Monitoring Food System Change in Dhaka: Evidence from Dhaka Food System Project

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WAGENINGEN UNIVERSITY & RESEARCH

Food and Agriculture Organization of the United Nations

Kingdom of the Netherlands

Monitoring Food System Change in Dhaka: Evidence from Dhaka Food System Project

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This report uses a food system monitoring approach to analyse the connection between the project "Modelling, planning, and improving Dhaka's food system" (DFS) initiatives and Dhaka's food system. The project followed a comprehensive approach that considered various aspects of the food system, including short-term challenges related to food security, availability, and consumption, as well as long-term challenges regarding urban food policy and planning. Our food system monitoring approach found that most of the DFS project initiatives in Dhaka are related to policies, governance, retail and market transformation, and food quality and safety. Some initiatives also focused on improving food processing, storage, and distribution, promoting sustainable fruit and vegetable production, and improving existing markets. The project also aimed to encourage behavioural change towards consuming nutritious and diverse food. Overall, the DFS project addressed various challenges related to food security, availability, consumption, urban food policy, and planning in Dhaka.

Keywords: food system, monitoring and evaluation, food environment

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Photo cover: Marion Herens, WCDI, Woman preparing school children's snacks, Gazipur

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List of abbreviations and acronyms

BDT	Bangladesh taka
BFSA	Bangladesh Food Safety Authority
BIP	Bangladesh Institute of Planners
BSF	Black Soldier Fly
CCs	City corporations
CEGIS	Center for Environmental and Geographic Information Services
CRFS	City Region Food System
CGUFSS	Consultative Group in Urban Food System Strategies
CWGs	City Working Groups
DAE	Department of Agricultural Extension
DAM	Department of Agricultural Marketing
DFA	Dhaka Food Agenda
DFS	Dhaka Food System
DLS	Department of Livestock Services
DMA	Dhaka metropolitan area
DNCC	Dhaka North city corporation
DoF	Department of Fisheries
DSCC	Dhaka South city corporation
FAO	Food and Agriculture Organization of the United Nations
FLW	Food loss and waste
FPMU	Food Planning and Monitoring Unit
GCC	Gazipur city corporation
GIS	Global information system
IPC	Integrated Food Security Phase Classification
IPTM	Institute of Professional Training & Management
LGD	Local Government Division
M&E	monitoring and evaluation
MMC	Market Management Committee
MoLGRD&C	Ministry of Local Government, Rural Development and Cooperatives
NCC	Narayanganj city corporation
NGO	non-governmental organisation
NLFSCs	Neighbourhood-Level Food Safety Committees
PSC	Project Steering Committee
TWG	Thematic Working Groups
WBB	Work for Better Bangladesh
WCDI	Wageningen Centre for Development Innovation, Wageningen University & Research
WUR	Wageningen University & Research

Summary

The project "Support for Modelling, planning, and Improving Dhaka's Food System" (DFS) project aimed to address Dhaka's challenges in providing affordable, accessible, safe, and nutritious food to its residents, using a comprehensive, gender-inclusive, and nutrition-sensitive approach. Dhaka is facing significant challenges to ensure affordability and accessibility of safe and nutritious food to its residents. DFS project aimed to find integrated solutions to address both present and future food needs in Dhaka. The project followed a comprehensive approach that considered various aspects of the food system, including short-term challenges related to food security, availability, and consumption, as well as long-term challenges regarding urban food policy and planning. A gender-inclusive and nutrition-sensitive approach was adopted throughout the project.

The report uses a food system monitoring approach to analyse how the DFS project initiatives connect with Dhaka's food system. DFS project initiatives target specific aspects and aim to bring transformative changes for improved food outcomes in the city while also being gender-sensitive, food safety and nutrition-focused. This report analyses the connection between the DFS project initiatives and Dhaka's food system using a food system monitoring approach. Most of the 21 DFS project initiatives are linked to specific aspects of Dhaka's food system, and three initiatives are expected to contribute to multiple aspects, aiming to bring about changes in the city's food system. The outputs generated by these initiatives are anticipated to transform the food system and improve food-related outcomes in Dhaka's four cities. The project initiatives were designed to be gender-sensitive and nutrition-focused, aligning with the project's overall approach.

Key findings

DFS project tackled long-term urban food policy challenges and short-term issues related to access to safe and nutritious food in Dhaka by connecting various initiatives to policies, governance, and retail and market transformation activities while emphasising food safety practices. Many DFS project initiatives were connected to policies, governance, and retail and market transformation activities related to the food environment in Dhaka. It addressed concerns about food safety through six initiatives that focused on monitoring and improving food safety practices. This ensured that the project could simultaneously address long-term challenges related to urban food policy design, structural change and short-term challenges concerning access to safe and nutritious food in Dhaka.

By implementing four initiatives focused on food loss and waste management, the DFS project aimed to contribute to the sustainable transformation of Dhaka's food system, leading to improved food utilisation and positive environmental outcomes. Efficient management of food loss and waste was identified as crucial for the sustainable transformation of Dhaka's food system. The DFS project implemented four initiatives targeting food loss and waste management to address this issue. The project aimed to improve food utilisation and environmental outcomes within the food system by improving these aspects.

Through its efforts in enhancing Dhaka's food system policies, practices and governance, the DFS project has played a role in striving for a more resilient, sustainable, and inclusive urban food system. To address food and nutrition security concerns in Dhaka, it is necessary to strengthen food policy and governance arrangements within the food system. The DFS project played a role in improving food system policies and governance in Dhaka, aiming to achieve a more resilient, sustainable, and inclusive urban food system. The initiatives enhanced food availability, accessibility, and utilisation and improved environmental and socioeconomic outcomes through various activities and outputs.

Through six initiatives geared towards enhancing food quality and safety in Dhaka, the DFS project actively worked to diminish the risks associated with poor hygiene practices in street food, restaurants, food processing, and selling platforms to boost food safety, availability, and accessibility, and reducing their vulnerability to foodborne illnesses. Poor hygiene practices in street food, restaurants, food processing, and selling platforms in Dhaka pose a risk to the safety and quality of meals, particularly for the urban poor, causing them to be vulnerable to foodborne diseases. The DFS project implemented six initiatives focused on improving the quality and safety of food in Dhaka through activities such as food quality assessment and monitoring. These initiatives aimed to improve food safety, availability, and accessibility through their respective activities.

The DFS project's three initiatives focused on improving Dhaka's food processing, storage, and distribution, organising various activities to enhance food safety, security, and socioeconomic outcomes. Ensuring safe processing, storage, and transport of agricultural products and awareness of wholesale prices is essential for waste reduction and improved food safety within the Dhaka food system. The DFS project included three initiatives to enhance food processing, storage, and distribution in Dhaka. Several activities were organised to improve food safety, security, and socioeconomic outcomes.

Urban agriculture and rooftop gardening activities were promoted to improve food safety, availability, and accessibility in Dhaka. Urban and rooftop gardening can provide fresh produce, reduce expenses, improve air quality, and mitigate the impact of climate change in Dhaka. The DFS project focused on promoting the safe and sustainable production of fruits and vegetables in Dhaka through two initiatives. Urban and rooftop gardening activities aimed to improve food safety, availability, and accessibility through training, input distribution, and the development of policy and technical guidelines.

The DFS project aimed to improve existing and establish new markets for fresh produce, benefiting the community. Dhaka residents express dissatisfaction with the poor quality of vegetables available in markets, which are often contaminated with chemicals, lack nutritional value, and pose health risks. Improving existing retailers and establishing modern markets can ensure the availability of fresh produce and bring community benefits. The DFS project aimed to improve existing markets and add new ones in proximity to the existing ones through four initiatives. These initiatives improved food availability, accessibility, utilisation, safety, and other environmental and socioeconomic outcomes.

1 Introduction: Dhaka Food System Project for affordable, safe, and nutritious food in Dhaka

1.1 Background

Dhaka faces significant challenges in guaranteeing the availability of affordable, safe, and nutritious food for its inhabitants. Dhaka, Bangladesh's capital, is one of Asia's largest megacities, with a population of over 22 million (World Bank, 2022). Studies reveal that the urban poor, such as waste collectors and day labourers, suffer from poor nutritional status (Banna et al., 2022; Biswas et al., 2020); 39.5 per cent of preschool children face stunting, and 73 per cent of street children suffer from chronic malnutrition (Hakim and Rahman, 2015b; Jesmin et al., 2011). Alongside malnutrition and stunting, wasting and micro nutrition deficiencies, increased prevalence of overweight and obesity are significant concerns (Bakket et al., 2022). Moreover, 16 per cent of the population is food insecure (Integrated Food Security Phase Classification [IPC], 2022). Research further indicates that foodborne diseases are prevalent all along the food value chain, starting at production sites up to consumers due to unhealthy food handling practices (Sarma et al., 2022).

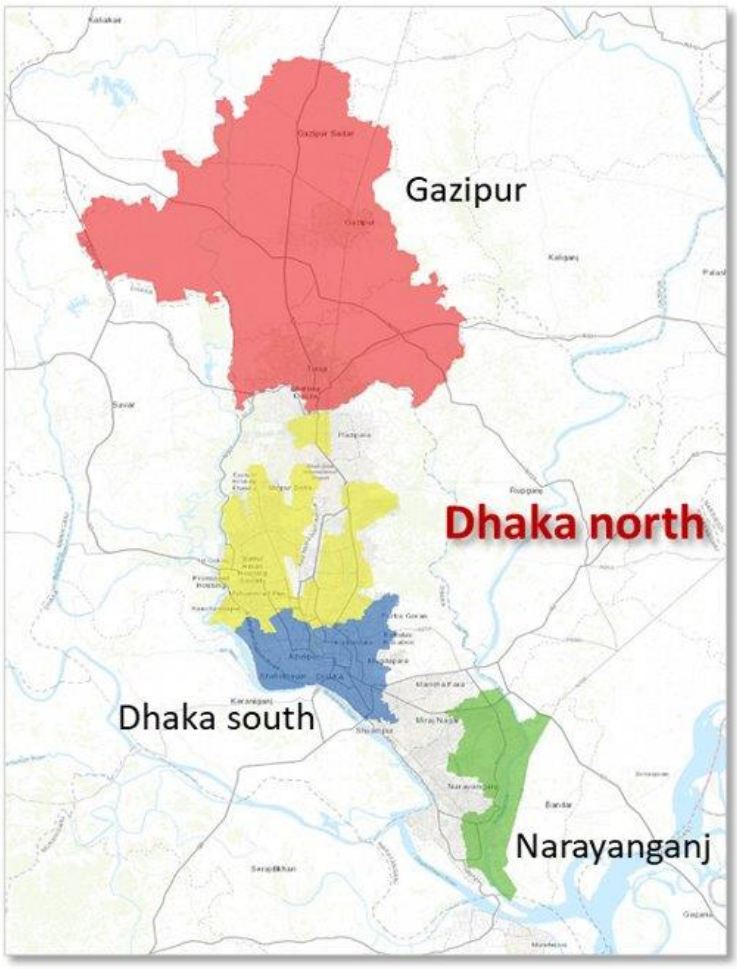

Figure 1 *The Map of Dhaka Metropolitan Area.*

In Dhaka, there needs to be more design and coordination for urban food policies. Even though food is consumed in urban areas, food security in Bangladesh is viewed as an agricultural issue under the jurisdiction of the Ministry of Agriculture, Ministry of Food, and Ministry of Fisheries and Livestock. City corporations need to incorporate food into their urban plans and need to gain knowledge and experience in managing the food system. Additionally, many government agencies are responsible for governing the urban food system, but clearer mandates and collaboration must be made, making coordination tricky.

The project Modelling, planning, and improving Dhaka's food system (DFS) found integrated solutions that can address Dhaka's present and future food needs. The DFS project aimed to improve the performance of the food system[1] in the Dhaka metropolitan area (DMA) and to ensure that all residents of Dhaka have access to sufficient safe, healthy and nutritious food. In 2019, the Food and Agricultural Organization of the United Nations (FAO), the local government division of the Ministry of Local Government, Rural Development, and Co-operatives (MoLGRD&C), and Wageningen University and Research (WUR) came together in this project.[2] The Embassy of the Kingdom of the Netherlands funds the project inplemented in the Dhaka Metropolitan Area, comprising Dhaka North, Dhaka South, Gazipur and Narayanganj City Corporations.

The project followed an approach, integrating diverse aspects of the food system to address both short-term challenges related to food security, food availability, and consumption and long term challenges concerning urban food policy and planning in Dhaka.[3] After the first phase of the project between 2019 and 2021, the project has implemented 21 initiatives clustered in six themes; five of those are oriented towards short term, and one is oriented towards long-term change in Dhaka's food system. Activities involved meetings and training of food system stakeholders, development of new products, tools, and service points and piloting them, preparing policy documents, etc. (Annex 1 for details of initiatives). In the short-term, the initiatives are expected to contribute to changes clustered under five themes addressing immediate challenges of food security, availability, and utilisation in Dhaka: upgrading fresh markets, reducing food loss and waste management, promoting nutrition and food security, improving food safety and consumer awareness, strengthening food value chains. In the long term, the project aims for one cluster of systematic change towards better urban food system governance and policy making capacity in Dhaka through enabling institutions for stronger (multi-actor and multisector) food governance and support multilevel adaptive urban planning capacity related to food (Figure 2: Theory of Change for the thematic cluster approach of Dhaka Food System project).

[1] Food system involve every step of food production and use, including growing, harvesting, packing, processing, transporting, marketing, consuming, and disposing of food waste (including fish). These activities require resources and lead to various outcomes such as food access, income, and environmental effects. Food systems are shaped by social, political, cultural, technological, economic, and natural factors. Please see van Berkum et al. (2018) and HLPE (2020) for more detailed information on food system approach.

[2] You can find more detailed information about the project on https://www.wur.nl/en/research-results/research-institutes/centre-for-development-innovation/show-cdi/improving-dhakas-food-system.htm and https://www.fao.org/urban-food-agenda/projects-dhaka/en/ websites.

[3] The project Support for Modelling, Planning and Improving Dhaka's Food System was designed along three output areas: [1] Modelling the food system of the Dhaka metropolitan area (by developing appropriate techniques and implement targeted studies); [2] Developing a strategic Dhaka Food Agenda 2041 (by establishing and strengthening the necessary governance arrangements) and [3] Develop and test selected interventions to improve the performance of Dhaka's food system (Project proposal, FAO, 2018).

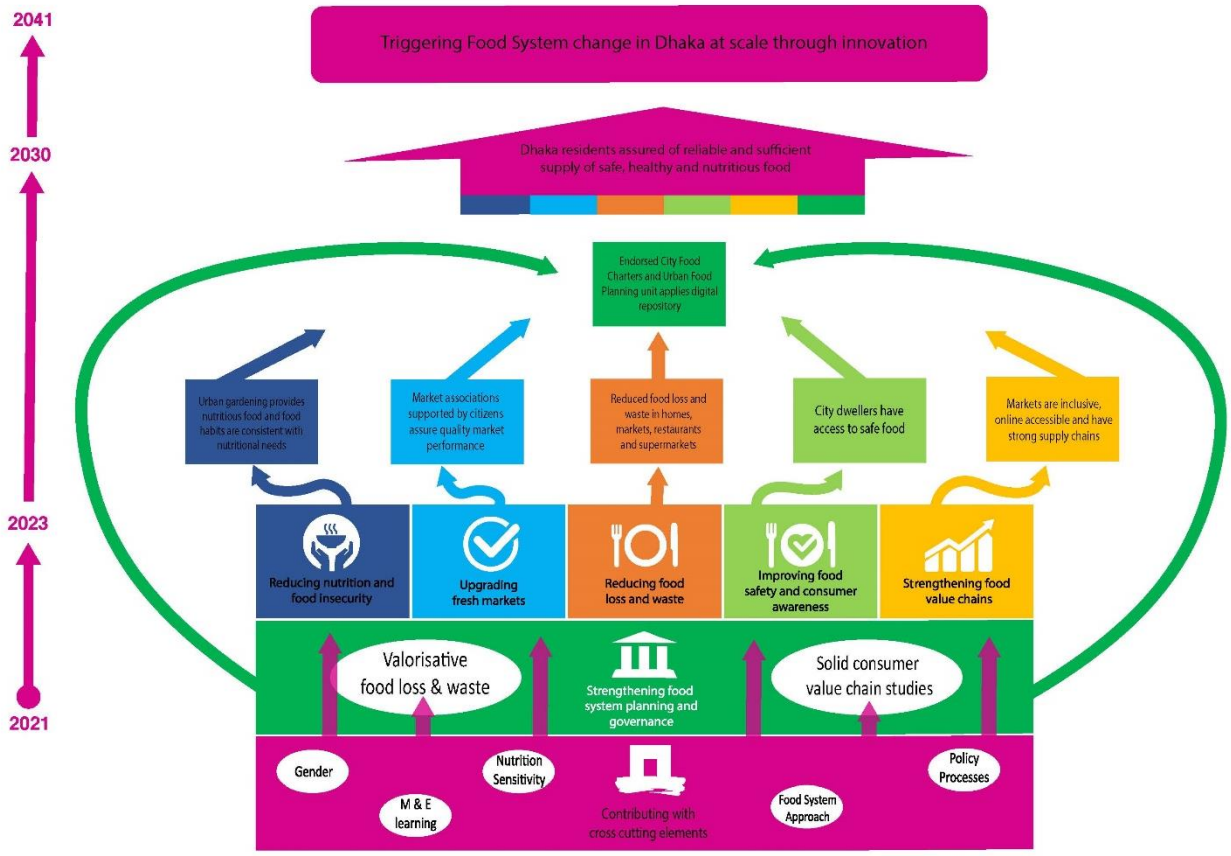

Figure 2 *Theory of change for the thematic cluster approach of Dhaka Food System Project.*

The project followed a gender inclusive and nutrition sensitive approach. Addressing gender issues and ensuring the participation of women in DFS project activities were embraced to deal with gender dynamics within the food system. The project sought to "promote and support gender equity by designing appropriate activities that deliver specific gender outcomes and pay careful attention to gender issues throughout the project's life cycle (WUR and FAO, 2020)". This intention was consolidated in a DFS project gender strategy (Naco et al., 2020). Similarly, the project developed a nutrition strategy (Bakker et al., 2022), analysing the current state of nutrition in urban Bangladesh, focusing on Dhaka's urban food system. These two strategies were combined in an implementation trajectory at the project level to monitor all initiatives for gender and nutrition-sensitive aspects, including monitoring indicators. (Please see further details on gender and nutrition sensitive approach in Box 1).

Box1: Nutrition and gender sensitive action in DFS project

The DFS project aims to improve access to healthy food and promote better eating habits by addressing issues such as inequality, gender dynamics, and malnutrition through various initiatives that highlight the connection between gender, nutrition, and the food industry. The project implements several activities that directly or indirectly contribute to improved and equitable access to nutritious food and encourage consumers in Dhaka to make healthier food choices. However, by adopting a food systems approach, the link between project activities, equitability and better nutrition are not always straightforward. Yet, several root causes of inequality, problematic gender dynamics, and malnutrition can be found throughout the food system at all levels. For this reason, the DFS project developed activities that aimed to make these links between gender, nutrition and the different parts of the food system explicit.

Dhaka's nutrition and gender strategies aim to improve nutrition and promote gender equality through analysing nutritional situations and gender dynamics in urban areas. Two strategies, one for gender (Naco et al, 2020) and the other for nutrition (Bakker et al., 2022), were developed at the beginning of the project. These strategies were to ensure the project components integrated approaches that contribute to improved nutrition and gender equity for Dhaka's population. The nutrition strategy provides a context analysis of the status of nutrition in urban Bangladesh and Dhaka in particular. The gender strategy analyses gender dynamics in Dhaka's food system and how these form the root causes of malnutrition and poverty. Both strategies offer frameworks that create gender, equity, and nutrition explicit links between the various parts of the food system (from production to consumption and waste). Both strategies also include strategic pathways and indicators that can be applied to the various project activities to ensure these activities are gender and nutrition sensitive. You can find more information about strategies in the documents on gender analysis and strategy and nutrition strategy.

Workshops were held by the WUR/FAO DFS team in Dhaka on gender, equity, and nutrition in the food system. Tools and training materials were created to promote nutrition and gender sensitivity in ongoing activities.

- Workshops were held to sensitize participants on gender dynamics, gender equity and nutrition in Dhaka's food system and the various project activities.
- Formulate gender and nutrition indicators monitoring and evaluation of existing project activities.
- Develop and monitor activities with the six thematic clusters to create links between the activity and nutrition explicit topics, select one or more strategies to pursue.
- Consultation between WUR and FAO to create nutrition and gender sensitive data collection tools and training materials.

These activities guided the design of various project activities and supported project staff in ensuring their work was nutrition and gender sensitive. This resulted in:

- Raising the awareness of the project team on gender dynamics and nutrition in Dhaka's food system.
- Improved the ability of project staff to formulate a coherent narrative on where their work takes place in the food system and how their work contributes to improving nutrition and gender equity.
- Integration of gender and nutrition objectives throughout the DFS activities.
- Participants becoming of nutrition, healthy food choices and practices and gender dynamics in their personal food environment and Dhaka's food system in general.

1.2 Objective of this report and approach

This report uses a food system monitoring approach to analyse the linkages between DFS project initiatives and Dhaka's food system. The approach utilises data from existing monitoring and evaluation (M&E) data collected by the DFS project. These include the project outputs such as a number of trainings, workshops, meetings, new products, tools, and service points, communication, knowledge, monitoring, and policy documents, new social groups formed, and the number of beneficiaries benefited from those, and monitoring reports. The project M&E team has collected data on project outputs during project activities and prepared monitoring reports using data from structured or semi-structured interviews with project beneficiaries.

Box 2: Food system monitoring approach in detail

To assess the linkage between the DFS project on food system activities, we use the food system monitoring approach, aligning all DFS project initiatives with a modified version of two conceptual food system frameworks, proposed by Siemen et al. (2018) and the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security (HLPE, 2020). The details of our approach is as follows.

The DFS project implements 21 initiatives (please see Annex 1 for details of each initiative). Details of each initiative included in several project documents prepared by the project staff (e.g., concept notes, documents containing initiative descriptions, slide deck containing information on the clusters, and the log-frame comprised of multiple outputs and outcome indicators to measure the performance of initiatives). We use information from these documents to match each initiative to main food system activities in Dhaka. Food system activities include all actors and their activities involved in producing, processing, distributing, consuming, and disposing of food products from agriculture, forestry, or fisheries, and their broader economic, societal, and natural environments. In our study, we classified food system activities into seven used seven food: production, retail and markets, consumption, processing, storage, and distribution, policies and governance, food safety promotion and monitoring, and food loss and waste management. Production, retail and markets, consumption, processing, storage, and distribution are classified under food supply chain activities; policies and governance, food safety promotion and monitoring, and food loss and waste management are classified under food environment which influence the functioning of all other food system activities. To match initiatives to food system activities we use planned initiative outputs. We use those outputs and definitions of food systems activities to identify whether a particular output of an initiative can change a certain food system activity (please see Annex 2 for the detailed matching) first. Then we examine whether those outputs can change a food system outcomes of food and nutrition security; environmental and socioeconomic outcomes. The outcome of food and nutrition security is further split into three sub outcomes of food availability and accessibility, food safety, and food utilization.

To assess and compare the contribution of initiatives to the activities, we classified related initiatives output indicators under six categories: number of beneficiaries participating in training; number of beneficiaries participating in workshops/meetings; new products, tools, and service points; communication, knowledge, monitoring, and policy documents; number of people reached through communication activities; number of new committees formed. For instance all training given under the urban gardening and roof-top gardening initiatives have been aggregated and presented as a contribution to production. Finally, we linked the planned outcomes of each initiative with the food system activities and food system outcomes were aggregated under five categories: food availability and access, food utilization, food safety, environmental outcomes and socioeconomic outcomes. Detailed definitions of DFS project outputs that have contributed to Dhaka food system activities are:

- **Training**: Beneficiaries participating in training include all men and women who participated in training for urban gardening, rooftop gardening, fresh market monitoring, food loss and waste reduction/management, food safety, hygiene, preservation and transportation in the context of street food vending, good hygiene practices in the slaughterhouse, food safety and hygiene in farmer's markets and restaurants, food safety and hygiene within the food value chain, and food systems planning and management.
- **Workshops/Meetings**: Beneficiaries participating in workshops/meetings include all men and women who participated in workshops/meetings on stakeholder linkages that promote nutrition and food security in urban areas, managing food loss and waste, coordination to build linkages between wholesale and retail markets, and food systems planning and management.
- **New products, tools, and services**: The numbers listed under the category of new products, tools, and services represent innovative pilot projects such as establishing rooftop demonstration plots to encourage rooftop gardening; implementing black soldier fly production to address food waste; inaugurating farmer's markets to ensure food safety; and installing android-based market monitoring applications.
- **Communication, knowledge and policy documents**: The number listed under the category of communication, knowledge, and policy documents represents communication materials developed to raise awareness about fresh market food safety and hygiene practices; knowledge products such as annual mission statements posted by market associations, city food charters, national level consultation reports, knowledge products to disseminate best food systems practices, ongoing food systems actions, and proposals to increase the sustainability of the food system, and policy papers, such as policies to promote rooftop gardening and the Dhaka Food Agenda 2041.
- **Communication activities**: Beneficiaries reached by communication activities involve engaging men and women in activities that include communication on the assessment of fresh markets for improvement, and information regarding GIS and the food system dashboard.
- **New committees formed**: This category lists new committees such as neighbourhood level food security committees that were formed during the DFS project and that regularly monitor fresh markets to ensure food safety.

In our food system monitoring approach, we first analysed the initiatives' outputs and narratives to link DFS project initiatives to seven food system activities derived from academic literature – governance, food safety promotion and monitoring, and food loss and waste management –. This includes all components of the food supply chain from food production to consumption and the food environment surrounding the food supply chain concerning the food system's governance, monitoring, and management.[4] Second, we examined which food system outcomes, including food availability and access, food utilisation, food safety, and environmental and social outcomes, that initiatives have aimed to contribute to. Please see Box 2 for the food system monitoring approach in detail.

1.3 Organization of the report and how to read it

This interactive report showcases the DFS project initiatives and the Dhaka food system. Furthermore, the report is organised as follows. The report begins by summarising the overall relationship between the DFS project and the changes in Dhaka's food system. It explains how the DFS project initiatives are connected to various food system activities and map them using an infographic – a food system map. The rest of the sub-sections explain the linkage of each project initiative with each of the seven food system activities considered in this report and the outputs of initiatives that concern that activity.

Readers can navigate the report using the interactive food system map. The food system map includes boxes for food system activities and clickable initiatives. Clicking on the boxes the reader can directly reach related sub-section for an activity or initiative.

[4] Our framework includes food quality promotion and monitoring, and food loss and waste management and food safety activities not covered by the food system framework developed by Siemen et al. (2018) and HLPE (2020). After reviewing project activities, and consulting local experts, we decided to use these two activities to better map the DFS initiatives to the food system.

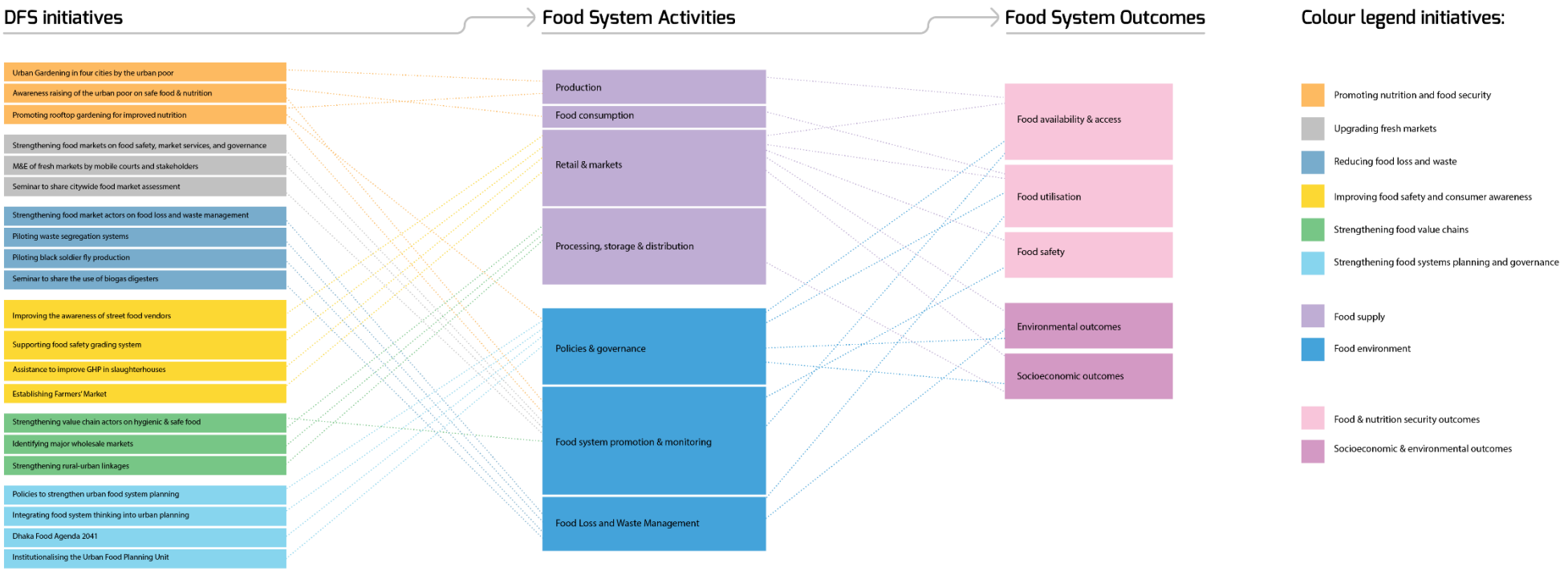

Figure 3 *DFS project food system map: The linkages between DFS Initiatives, food System Activities, and outcome.*

The interactive map shows how the expected DFS project initiatives contributed to food system activities and outcomes. The lines indicate the linkages between initiatives, food system activities, and outcomes identified for this report. We explain how we constructed this map in Box 2 above. You can click on the DFS initiative and food system activity boxes to go to the related pages and learn more about how DFS initiatives contributed to the activity; the map links each DFS initiative and the details. You can always return to this page by clicking.

2 Food system results of the DFS project

2.1 DFS Project Initiatives viewed through a food system's lens

2.1.1 Project outputs by food system activities

The food system monitoring map (Figure 3) links the 21 DFS project initiatives (introduced in detail in Annex 1), food system activities and system outcomes. Most initiatives (18) are linked to one food system activity. Three initiatives (e.g. raising the awareness of the urban poor on safe food and nutrition, promoting rooftop gardening in the DMA to improve nutrition, and strengthening the capacity of food market actors on food safety, market services, and governance) aimed contributed to multiple food system activities. The initiatives, through influencing food system activities, are expected to trigger a short-term change in the food environment and supply to Dhaka's food system.

The outputs produced by these initiatives are expected to contribute to improving the city's food system performance. Table 1 summarises the aggregated overall project outputs by food system activities based on the project's monitoring and evaluation (M&E) data. (Please see our food system monitoring approach in Box 2 for detailed definitions of outputs used to track how the DFS project aimed to contribute to food system activities). The project trained 28414 beneficiaries. Most (13497) were trained on food consumption to raise the awareness of the urban poor on safe food and nutrition; 2203 beneficiaries were trained on food loss and waste management. Many beneficiaries participated in workshops and meetings, most (1656) related to improving food system policies and governance. The project introduced 39 new products and services, including an interactive GIS tool that provides a holistic view of the food system. This food system dashboard contributes to food system policies and governance and 16 farmers' markets. The project used 220 communication, knowledge, and monitoring documents (for example, please see *Dhaka Food Agenda 2041 foresight and scenario development report* here). These documents, which mainly concern food safety in Dhaka, were distributed to about 286000 people. The project also formed 130 market monitoring committees to improve food safety in the city.

Table 1 *Overall project outputs by food system activities.*

	Beneficiaries participating in training	Number of workshops/ Meetings	New products, tools, and service points	Communication, knowledge, monitoring, and policy documents	People reached through communication activities	New committees formed
Food environment	7032	116	22	220	286688	130
Food Loss and Waste Management	2688	7	.	.	.	.
Policies and Governance	1656	95	1	210	41	.
Food Quality Promotion and Monitoring	2688	14	21	10	286647	130
Food supply system	21382	18	17	.	.	.
Production	7841	.	.	.	.	.
Processing, Storage, and Distribution	328	18	.	.	.	.
Retail & Markets	1258	17	16	.	.	.
Consumption	11982	.	.	.	.	.
Total number of outputs	28414	151	39	220	286688	130

Source: Authors' calculations using monitoring and evaluation data collected by DFS project. "." shows no reported output on the corresponding category of output and food system activity.

The project initiatives produced gendered and nutrition-sensitive outputs, in line with the gender-inclusive and nutrition-sensitive approach followed by the project. The project included a gendered analysis of Dhaka's urban food system, outlining how to take a nutrition and nutrition sensitive approach in all thematic clusters of the project (For details, please see nutrition and gender sensitive action in Box 1). Project initiatives under each cluster were designed by taking this approach into account. Share of female participants in the DFS projects, meetings, and training was highest in food production activities concerning food production (urban and rooftop gardening) and followed by policies and governance (Table 2). For instance, 5707 women participated in training regarding urban and rooftop gardening; 114 women participated in food safety and fresh market-related training; and 26 women participated in meetings held to build linkages between wholesale and retail markets. This is 5000 beneficiaries trained in urban gardening and 1515 in rooftop gardening to increase their access to safe food, focusing on nutrition. The project trained 11982 other beneficiaries in healthy nutrition behaviour, nutritious food preparation and appropriate storage. Fourteen learning and sharing workshops were organised to ensure multistakeholder linkages would promote nutrition and food security in urban areas. Finally, one policy guideline was developed to enhance rooftop gardening for better nutrition.

Table 2 *Percentage of female participants in DFS project meetings, workshops, and trainings by food system activity.*

Food system activity	% of women participants
Food environment	16%
Food Loss and Waste Management	4%
Policies and Governance	24%
Food Quality Promotion and Monitoring	17%
Food supply system	65%
Production	76%
Processing, Storage, and Distribution	9%
Retail & Markets	14%
Consumption	71%

Source: Author's own calculations using monitoring and evaluation data collected by DFS project. "." Shows there is no reported output on the corresponding category of output and food system activity.

2.1.2 Linkages of initiatives by food system activities

The project focused on the system's food environment and supply-related activities. Over the course of the project, the findings and concepts were on the physical, social, economic, cultural, and political factors that impact the accessibility, availability, and adequacy of food within a community or region. To change these factors, 13 out of 21 initiatives contributed to activities concerning the food environment – specifically six on the promotion and monitoring of food safety, five on policies and governance, and four on food loss and waste management (see the importance of food loss and waste management in Dhaka here). Ten initiatives were linked to food supply system activities, four to retail and markets, three to processing, storage and distribution, two to food production, and one to food consumption.

Emphasis on food safety as an entry point for action: The project addressed concerns about food safety through six initiatives on food safety and monitoring: promotion of nutrition and food security, upgrading of fresh markets, improving food safety and forming consumer awareness clusters, increasing food safety was achieved through food safety, promotion and monitoring activities in Dhaka. More specifically, the project provided training on food safety to strengthen the capacity of the food market and value chain actors, strengthened monitoring mechanisms monitoring of fresh markets, advised on addressing this topic in citywide initiatives, and increased the awareness of the urban poor on food safety.

Most DFS project initiatives are linked to policies, governance, and retail and market transformation activities. This ensures that the project could simultaneously address long-term challenges concerning urban food policy design and short-term challenges related to access to safe and nutritious food in Dhaka. For instance, five initiatives contributed to transforming policies and governance in developing the Dhaka Food Agenda 2041. This document is a stakeholder-created and evidence-informed long-term vision document (please also see this video of the Dhaka Food Agenda). The Agenda is expected to improve food availability and access, food utilisation, and environmental and socioeconomic outcomes in the midterm. The DFS project established four city working groups (please see Box 3 for details of city working groups) aiming to enhance food security and improve governance of the urban food system by developing a tailored food agenda and vision, together with a consultative group and technical working groups to connect national – city corporation level efforts to transform Dhaka's food system. These groups comprise active members whom city coordinators lead. They regularly discuss food-related issues, prioritise actions and bridge gaps between sectors and stakeholders. Five other initiatives are linked to retail and markets, which are expected to improve all food system outcomes.

Box 3: City working groups

City working groups (CWGs) in Dhaka aim to enhance food security and improve urban food system governance by developing a tailored food agenda and vision. In Dhaka, multiple institutions work on food and nutrition security and related issues, often they work in a way that is fragmented; there needs to be a policy or strategy dedicated to food and nutrition at the city-level. The DFS project established four CWGs in 2019 to strengthen urban food system governance. All four cities currently have an operational CWG, made up of 30 to 40 active members, with a defined city-specific food agenda and vision (City Food Charter).

The CWGs meet regularly to discuss food issues, led by city coordinators who engage stakeholders and follow protocols. The CWGs meet every 2 to 3 months. The purpose of the CWGs is to discuss food-specific issues in their cities and arrive at joint priorities and action. Each of the meetings is convened and facilitated by a city coordinator, a role that has proven crucial to the establishment and continuation of the CWGs. Key to the success of these coordinators is their contextual understanding, knowledge of protocols and procedures, and their ability to engage key stakeholders in the CWG learning process.

The established CWGs are in the process of reaching a state of self-management and governance:

- The CWGs have learned how to create better understanding of and address complex food issues in their cities through extensive exchanges on various issues in their food system. These exchanges help the CWGs create an overview of difficulties; to understand interconnectedness, and agree on responsibilities and actions. Prior to the project, this level of exchange and coordination of food and nutrition, from the viewpoint of food, did not exist at the city level.
- CWGs support bridging between different sectors and actors. This means that community representatives can speak directly to city councillors. Members of the CWGs feel they provide an important platform to raise a strong and unified voice on what is required to address food concerns in the city.
- CWGs increase adaptability in the city context. Because they operate at the city-level, the CWGs are able to develop their own focus; where one city may focus on the monitoring of food safety, another city focuses on urban gardening or strengthening the poultry sector.
- CWGs provide a platform for more inclusive decision-making. The CWGs provide a platform that can help amplify different voices that – outside the CWG – may not be as powerful.
- Potentially, CWGs can contribute to a long-lasting impact on the food system. The CWGs have been shown to function as a vehicle for prompt decision-making, partnering and action. Over time, and in close collaboration with the city corporations, the CWGs are increasingly showing their potential to contribute to decision-making regarding food in their cities.

You can find more detailed information in the case study paper on the CWGs.

However, the associated evolution of food consumption patterns can translate into the "triple burden" of overweight and obesity, under-nutrition and micronutrient deficiencies. Moreover, major uncertainties add complexity to the trajectories of change, such as climate change; natural disasters; environmental degradation; pollution; biodiversity loss; environmental footprint; unequal income growth; disease outbreaks; price volatilities, and unstable global food markets.

2.2 DFS Project and food environment in Dhaka

2.2.1 Food loss and waste management

Effective management of food loss and waste is crucial for the sustainable transformation of Dhaka's food system. Essentially, food loss and waste is the decrease in food quantity or quality along the supply chain. Food loss occurs along the food supply chain from harvest up to, but not including, the retail level. Food waste occurs at the retail and consumption levels (SOFA, 2019). In Bangladesh, 40 million people are food insecure, and 11 million suffer from acute hunger (World Food Programme, 2023). FAO estimates that 30 per cent of the total food produced is usually lost or wasted along the food supply chain (FAO, 2015). Specifically in Dhaka, 16% of the population is food insecure, and 70% of the waste is food-related (FAO, 2022). Despite having guidelines (National 3R strategy) to manage waste from households, businesses, and markets in Dhaka North City Corporation (DNCC) and Dhaka South City Corporation (DSCC) and promote waste recovery and reuse, these practices are not widely implemented. Recycling exists informally, and waste pickers work in unsanitary conditions without protective equipment to salvage recyclable goods. Furthermore, waste from fresh markets, which is predominantly biodegradable, is not being used productively (composting, energy recovery, etc.). This waste remains unsorted and ends in landfills, causing harmful environmental impacts.

The DFS project tackled challenges related to food loss and waste management through four initiatives:

- Strengthening the capacity of food market vendors, market management committees, and city corporations on food loss and waste reduction management.
- Piloting waste segregation systems in selected fresh markets in Dhaka South City Corporation.
- Piloting black soldier fly production to produce animal feed from fresh market organic waste to valorise the food loss and waste.
- Seminar to share the use of biogas digesters to manage waste from fresh markets case studies.

Through improving food loss and waste management, the project aimed to improve two food system outcomes: food utilisation and environmental outcomes. For this purpose, food loss and waste related initiatives organised learning and sharing workshops for market vendors, market management committees, and government officials on food loss and waste management and promoted waste segregation approaches among vendors. The project established a black soldier fly production unit to produce animal feed from food waste. Three private entrepreneurs have adopted a business model to produce Black Soldier Fly (BSF) based feed.

The endline assessment showed that after the project, stakeholders' knowledge, practices, and attitudes in fresh markets have improved regarding food loss and waste management. The monitoring reports show that, compared to the project baseline, 34 per cent of urban fresh markets targeted through the projects adopted techniques to manage and reduce food loss and waste (FLW). Market association members and city corporation representatives also needed to understand food waste management further. Thus, training regarding efficient food loss and waste methods helped enhance their knowledge. Stakeholders' testimonies reflect that:

> "The market management committee monitors the market regularly after the training. For example, whether the market is frequently cleaned and whether the waste is collected twice daily by waste collectors."

> "After the training, the vendors keep the waste in one place. From there, the waste collector takes the waste separately during collection. They have also talked to the city corporation about providing bins to their markets."

Additionally, 2688 project beneficiaries participated in related food and waste management training, and the project organised seven workshops related to this topic.

2.2.2 Food system policies and governance

Strengthening food policy and governance arrangements in the food system is necessary to address Dhaka's food and nutrition security concerns. Currently, 38.9 per cent of Bangladesh's population resides in urban areas, with an expected increase to 45.6 per cent in 2030 and 52.8 per cent in 2 041.[5] To address these concerns, the national government of Bangladesh prioritises food and nutrition security in urban areas, as outlined in the National Food and Nutrition Security Policy (NFNSP) 2020-2030 (Food Planning and Monitoring Unit [FPMU], 2021). There is an urban food policy to ensure food and nutrition security in Dhaka, a mega-city, or to ensure the food system becomes more inclusive, resilient and sustainable.

To close this gap in policy and action plan, the DFS project contributed to improving food system policies and governance in Dhaka so as to achieve a more resilient, sustainable and inclusive urban food system. Project activities included developing spatial and socio-economic planning tools for modelling and foresight development of the Dhaka food system, strengthening capacity through training sessions, workshops and lobbying efforts that involved professionals with expertise in food system governance, focussing on formulating effective policies.

Those activities were grouped under five initiatives:

- Policies formulated and endorsed to strengthen urban food system planning.
- Strengthening institutional capacity to integrate food system thinking into urban planning, including the establishment of four city working groups.
- Dhaka Food Agenda 2041.
- Institutionalizing the Urban Food Planning Unit (UFPU) in the local government division (LGD)[6]**.**

[5] United Nations Population Division, Department of Economic and Social Affairs, World Urbanization Prospects: The 2018 Revision.

[6] Initially, development and implementation of food system policy planning tools was a separate initiative. This report includes institutionalizing the Urban Food Planning Unit (UFPU) in the local government division as its initial form as a Desk is focal point for the tools.

Box 4: The Dhaka Food Agenda

Dhaka's rapid urbanization has led to unhealthy eating habits and malnutrition. The Dhaka Food Agenda 2041 aims to provide a solution to this challenge. Rapid urbanization of a growing population in the Dhaka metropolitan area challenges established efforts to ensure access to sufficient, affordable, nutritious, safe and sustainably sourced food. Improvements in income bring about transformational changes. However, the associated evolution of food consumption patterns can translate into the "triple burden" of overweight and obesity, under-nutrition and micronutrient deficiencies. Moreover, major uncertainties add complexity to the trajectories of change, such as climate change; natural disasters; environmental degradation; pollution; biodiversity loss; environmental footprint; unequal income growth; disease outbreaks; price volatilities, and unstable global food markets.

Responding to such a myriad of challenges and ambitions requires a holistic approach and cannot be addressed by single disciplines, institutions, departments or sectors. In response, the DFS project engaged in the development of the Dhaka Food Agenda 2041(DFA 2041). An urban food agenda that offers directions and pathways for the coordination, collaboration, collective vision, innovative policies, and leadership essential to transforming Dhaka's food system can be a leading example of a dynamic and sustainable metropolis.

The Dhaka Food Agenda 2041 is a stakeholder-created and evidence-informed long-term collective vision, a resource document that can support policymaking and urban planning. The document is a synthesis of key challenges and aspirations for meeting Dhaka's food needs and forward-looking pathways to accompany transformation, which complements Bangladesh's existing policies and development goals.

Over 100 stakeholder organizations collaborated in the creation of the Dhaka Food Agenda 2041 using data, projections and policies for future scenarios. The Dhaka Food Agenda 2041 was developed by engaging a wide range of stakeholder organizations who are active in Dhaka's food system through a participatory and consultative process. Development of Dhaka's Food Agenda has been driven by foresight and scenario analysis, considering the longer-term implications of current trends and potential consequences of future uncertainties. In this process, data and projections were employed to guide stakeholder discussions. In addition, existing policies, and examples from urban food agendas in other cities, were used to guide the thinking. This enabled the development of a set of possible future scenarios, their implications, and desirability and supported the formulation of strategy and planning. The process was guided by the Local Government Division at the Ministry of Local Government, Rural Development and Cooperatives (MoLGRD&C), and was supported by the four city corporations of Dhaka Division: Dhaka North, Dhaka South, Gazipur and Narayanganj. Project activities were facilitated by the FAO Representation in Bangladesh, Wageningen University and Research and Foresight4Food.

The vision detailed in the DFA 2041 document guides governments in addressing food and nutrition concerns, and suggests practical steps such as creating an urban food desk at the Ministry of LGD for planning assistance. The Agenda offers guidance at the city and national government level in taking up urban food and nutrition issues, in short and long-term planning processes, and supports planning with concrete steps. A few specific examples are reflected in the use of the DFA 2041 in the process of national policy development for urban nutrition, and in guidance of the process of anchoring urban food policy at the MoLGRD&C in the form of an urban food desk, which is back-to-back with the urban health desk.

Initiatives contributed to achieving better food availability, accessibility and utilisation; improved environmental and socioeconomic outcomes through several activities and outputs. The initiatives trained government, civil society, and the private sector stakeholders on food system planning and multistakeholder collaboration in food system policy development. The initiatives contributed to the development of guidelines for food vending, rooftop gardening, urban gardening, and farmers' gardening for food systems planning and governance. As a part of the project, city working groups and consultative groups in Urban Food System Strategies (CGUFSS) were formed to bridge the gap between the city corporation and national levels. Meetings were organised with city working groups, the consultative group in Urban Food System Strategies (CGUFSS), and other meetings where national-level stakeholders participated in food system planning and management. Finally the initiatives developed knowledge products to share with the relevant stakeholders to disseminate best practices, ongoing food system actions, and proposals for creating a sustainable food system. Examples include selecting and prioritising key issues and providing input in city food charters, outlining challenges, focus areas, and vision for each city by city working groups. The government has endorsed the Dhaka Food Agenda, which includes incentives to promote urban gardening, value chains, food loss and waste, and nutrition in urban areas for 2041(please see Dhaka Food Agenda in Box 4).

The initial work to create and institutionalize the Urban Food Planning Unit (UFPU) in the local government division (LGD) remains an ongoing process. As part of the institutionalization process, LGD formally designated a Desk responsible for the follow up of the Dhaka Food Agenda 2041 in its Urban Development Wing. This represents an important initial step towards a longer-term goal to create a larger unit dedicated to food as an Urban Food Planning.

Project initiatives related to policies and governance in Dhaka's food system organised training in food system management, which 1656 participants joined. Additionally, those initiatives organised 95 workshops/meetings and drafted 210 documents related to policy formation, which included annual mission statements by market associations, city food charters, policy guidelines and technical guidelines on rooftop gardening, and the Dhaka Food Agenda 2041. The project also supported national and local stakeholders by developing food system planning tools, including a socioeconomic modelling dashboard and Interactive global information system (GIS) website, to help policymakers design policy (please see Box 5 for those anchoring tools).

Box 5: Anchoring food system planning tools

The DFS project created food system analysis tools for Dhaka, with improvement plans. Multiple tools were developed during the DFS project to help us understand the characteristics of the current food system, analyse bottlenecks and casual relationships and assess the likely outputs of systemic changes (e.g. diet change, salinisation and droughts, food markets). These tools can help us anticipate change and plan for Dhaka's robust, improved (future) food system. To ensure the longevity of these tools, and promote continuous learning based on their outputs, tools were anchored in the local organisation of the Center for Environmental and Geographic Information Services (CEGIS), which has a long-standing history in collaboration with the government of Bangladesh on these topics.

A course was developed to anchor the tools in Bangladesh institutions. The objective of the course was to make participants from the institutions acquainted with the DFS foresight process and, specifically, the modelling of indicators that were used to measure the outcomes and model the food system. Within the DFS project, the following process steps for foresight were used (1) problem identification; 2) narrative development; 3) indicator selection; 4) indicator calculation and; 5) interpretation.

The integrated course focused on:

- Module A: Modelling for applied economic policy analysis (MAGNET/GTAP)

Introduction to CGE Modelling for agrifood system foresight and scenario analysis; The objective of this module was to engage participants in an active, team-based process of learning about the Computable General Equilibrium (CGE
  - Review core economic theories needed to be operationalised in an applied general equilibrium model;
  - Define model experiments that represent real-world issues and problems in agrifood systems;
  - Learn to prepare foresight scenarios set up for policy simulations;
  - Learn to interpret general equilibrium model results and visualise them using an R-based online dashboard, which is designed for Bangladesh food system foresight.) model and its use in applied agrifood system analysis

- Module B: Modelling of land use changes and land use change impacts

Interactive GIS, Dynamic Modelling (iCLUE) and QUICKScan. This course aims to learn future spatial modelling with the iCLUE model and to learn about participatory mapping tools in the form of QUICKScan to explain and communicate modelling outputs.

The integrated spatial modelling course covered:
  - *Interactive GIS:* catalogue of downloadable food system maps of Bangladesh. Including compelling narratives to trigger map exploration.
  - *ICLUE model:* projects showing where land-use changes are likely to occur based on population growth, economic development zones, road and port accessibility and climate change.
  - *LARCH model:* evaluates the potential for animal species based on landscape characteristics, such as habitat quality and the amount and configuration of habitat.
  - *QUICKScan modelling environment:* participatory modelling environment to link data, for example from interactiveGIS, to knowledge from workshop participants.

Additional information can be found in van Haren et al. (2022); van Haren et al. (2023); Verweij et al. (2016); Verweij et al. (2018).

These tools were transferred to the Center for Environmental and Geographic Information Services (CEGIS) to anchor their use through various training events and is expected to coordinate with the LDG Desk dedicated to the DFA 2041. Also, communication materials were distributed to 41 participants during this food system activity.

2.2.3 Food quality promotion and monitoring

Poor hygiene practices in street food, restaurants, food processing, and selling platforms in Dhaka jeopardise the safety and quality of meals for the urban poor, making them vulnerable to foodborne diseases. The urban poor in Dhaka rely largely on unsteady and informal jobs, facing multiple hindrances such as lack of time, money, cooking facilities and safe water, which makes food preparation challenging for them. These workers rely on street food for their daily consumption. Street food is readily available and cheap, and therefore it is an important part of their diet. As their lives are busy, restaurants and hotels are also becoming an increasingly popular choice for urban citizens. However, the quality of the food available on the street and in restaurants is not safe because of poor hygiene practices at street food vending stalls and restaurants, which means the urban poor are vulnerable to foodborne diseases.

Moreover, food quality in Dhaka is jeopardised, as safety and hygiene practices are not followed when food is processed, such as in slaughterhouses. In addition to food processing, food-selling platforms such as fresh markets, which are very popular among urban citizens for accessing fresh food and vegetables, fail to adhere to food safety and hygiene practices, causing buyers to become vulnerable to hazardous diseases.

The **DFS project has six initiatives that focus on improving the quality and safety of food in Dhaka through initiatives including food quality and the promotion of monitoring activities:**

- Raising the awareness of the urban poor on safe food and nutrition.
- Promoting rooftop gardening in the DMA for improved nutrition.
- Strengthening the capacity of food market actors on food safety, market services, and governance.
- Monitoring of fresh markets in DNCC enforced by mobile courts and stakeholders.
- Seminar to share citywide food market assessment on fresh markets.
- Strengthening the capacity of value chain actors in the supply of hygienic and safe food.

Those initiatives contributed to better food safety, availability and accessibility through several activities. The initiatives trained 20 out of over 200 hotel and restaurant owners in Narayanganj. Furthermore, the initiative trained street food vendors and butchers on food safety and hygienic practices. The project formed neighbourhood-level food safety committees to monitor fresh markets to ensure food safety. The project trained over 90 per cent of food vendors at fresh markets, who became aware of the importance of providing fresh and safe food to consumers and who started to practice food preservation. This fact was also noted by several vendors at fresh markets:

> "Fish and meat should be kept in the refrigerator. Meat should not be hung in the store for a long time. The rotten part should be cut off and discarded if any product rots. Rotten products and good products should be sorted and kept separately."

> "Food should not be adulterated and expired food should not be kept in the market, food should not be spoiled, and wastage should be stopped."

As part of the DFS project, FAO conducted a mobile court visit to Dhaka's Mohammadpur Krishi Market. Officials from various departments were present to raise their awareness of the mobile court and to provide both comprehensive law enforcement and improving understanding of food safety. The project distributed communication materials to raise awareness of fresh market food safety and hygiene practices.

In total, 2 688 project beneficiaries across different initiatives participated in food safety and hygiene related training. Additionally, the project organised 14 workshops/meetings and developed 21 new innovative products and services, which include monitoring applications and rooftop demo plots. Further, communication materials regarding food safety and hygiene practices were distributed to around 286 000 participants during this food system activity.

2.3 DFS project and food supply system in Dhaka

2.3.1 Food processing, storage and distribution in Dhaka

Safe processing, storage, and transport of agricultural products and awareness of wholesale prices are essential for fair prices reducing waste, and improving food safety in the Dhaka food system. When food products are transported from wholesale to retail markets, they undergo various stages of processing, storage and distribution. It is important to pay attention to these stages to ensure food safety measures are followed, and food waste is reduced. In addition to food safety in food value chains, retailers need information on the prices of different food items in wholesale markets so they can choose markets with lower rates.[7] Processing, storage, and distribution, including distribution points, not only impact food safety but also play a crucial role in maintaining fair food prices. Improving food processing, storage, and distribution activities within the food supply system is, therefore, crucial to enhancing the food system in Dhaka.

Three DFS project initiatives focussed on enhancing food processing, storage and distribution in Dhaka:

- Identifying major wholesale markets and foods that rely heavily on wholesale markets.
- Strengthening rural-urban linkages by connecting wholesale markets to production hubs.
- Strengthening the capacity of value chain actors in the supply of hygienic and safe food.

Several activities were organised to improve food safety and security, and socioeconomic outcomes. These activities included training food value chain actors such as poultry farmers and peripheral vegetable producers on supplying hygienic and safe food. Further, the activities also include organising coordination meetings/workshops to build linkages between wholesale and retail markets, improving the incomes from retailing and wholesalers. In order to facilitate better coordination, a printed directory was also developed containing the contact of all the wholesalers according to area, product type and market, and distributing the aforementioned directory to relevant retail markets, developing and distributing communication materials to promote safe food and hygiene practices. In total, 328 project beneficiaries participated in related food processing, storage, and distribution related training, and the project organised 18 meetings/workshops regarding safe and hygienic food processing, storage and distribution.

2.3.2 Food production

Urban and rooftop gardening can provide fresh produce while reducing expenses, improving air quality, and lessening the impact of climate change in Dhaka. The food system activity of production refers to safe and sustainable food production within the Dhaka food supply system. The consumption of vegetables, fruits, and medicinal plants in Dhaka is still below the World Health Organization and FAO's recommended level for consumption of fruits and vegetables (Pamuk et al., 2021). Households purchase these items from wet markets and street vendors, followed by farmers' markets, small and large supermarkets.[8] A part of the demand can be met by producing fruits and vegetables in cities.

Urban and rooftop gardening can help meet food demand by supplying fresh, safe and hygienic food products and by reducing household expenditure for buying vegetables and fruit. Urban gardening involves growing plants in both public and private areas within the city limits (Kim et al., 2018), and rooftop gardening is the process of growing plants on building roofs (Manrique-Alba et al., 2019). These urban and rooftop gardens create a healthier atmosphere by improving air quality, absorbing carbon from the air, and mitigating the impact of climate change. Particularly, improvement of air quality is critical in Dhaka because air quality is chronically low compared to international standards.

[7] Please also note that information about the best prices from wholesale markets only ensures that retailers can purchase food products from the cheapest markets. Because their choice also depend on distance and the organization of the logistics. If a market with cheap prices is far away and the roads include huge traffic, it might not be the best option to go to a market with the lowest prices.

[8] Please see a more detailed discussion in Snoek et al. (2021).

The DFS project focussed on improving the safe and sustainable production of fruits and vegetables in Dhaka city through two initiatives:

- Urban gardening by the urban poor in four cities.
- Promoting rooftop gardening in all four cities for improved nutrition.

Urban and rooftop gardening activities improved food safety, availability and accessibility through the activities of training and input distribution and through the development of policy and technical guidelines. The initiatives trained 7841 urban citizens on urban and rooftop gardening to increase their access to nutritious and safe food; distributed inputs for urban and rooftop gardening; and developed two policy and technical guidelines on rooftop gardening to enhance rooftop gardening for better nutrition. A woman participant stated how training in urban gardening helped to increase the availability of fresh vegetables in Dhaka:

> "I learnt new techniques of cultivation, preparing beds, use of fertiliser, when and how to use fertiliser, which pest to harm and which pest not to harm, how to control the pest and how we can manage the pest without using chemical pesticides. After receiving the training, I produced more than previously, which led to increased vegetable consumption. The training helped to reduce food waste during harvesting. Now I can contribute to my family by providing fresh vegetables every day and by reducing the cost to my family. When I start to cook, I just go to the yard and collect fresh vegetables to be cooked for my family. On the other hand, I have given vegetables to my relatives and neighbours who do not have vegetable gardens. They are interested in seeing my garden and learning from my experience. Through this process, relations with neighbours have become stronger. Now I am taking part in family decisions related to food consumption. In fact, I have been empowered by becoming involved in the process of growing food."

2.3.3 Food retail and marketing

Dhaka residents are unhappy with poor quality vegetables in the markets because of chemicals, low nutritional value, and risk of illness. Improving existing retailers and markets by establishing modern markets will ensure fresh produce and community benefits. The residents of Dhaka were not satisfied with the quality of vegetables in local markets because of concerns regarding the presence of harmful chemicals, pesticides and formalin (Pamuk et al., 2021). Additionally, the nutritional value of the products sold in local markets may not meet desired standards, and food handled by vendors may pose a risk of foodborne diseases that can affect financially stressed urban customers (Khairuzzaman et al., 2014). Improving the existing farmers' markets, and establishing new and modern markets that prioritise the provision of fresh produce, are key to addressing these concerns and benefiting the community.

The DFS project aimed to improve existing markets and add new ones near the existing ones through four initiatives:

- Improving the awareness of street food vendors on food hygiene, preservation and transportation.
- Supporting the implementation of a food safety grading system in selected hotels and restaurants in Narayanganj City Corporation (NCC) and Gazipur City Corporation (GCC).
- Providing technical assistance to improve good handling practices (GHP) in slaughterhouses in (GCC, NCC, DSCC and DNCC).
- Establishing farmers' markets in the DMA (DNCC, DSCC GCC and NCC).

Those initiatives contributed to improved food availability, accessibility, utilisation, safety, personal hygiene and other environmental and socioeconomic outcomes. The initiatives established 16 farmers' markets in four city corporations in Dhaka to ensure food safety; trained 507 farmers on food safety, hygiene, and safe food management in farmers' markets; trained 751 food value chain actors, hotel and restaurant owners, street food vendors, and butchers on food safety and hygiene practices. According to project monitoring reports, 130 fresh markets have started to implement food safety and hygiene practices. Two existing established fresh markets were partially refurbished in their infrastructure as well as supported in their management, becoming reference model markets.

The first piloted farmers' market and street food vendors demonstrated the potential to enhance food availability, accessibility, utilisation and safety. The rapid assessment of the first pilot market showed that approximately 50 per cent of consumers visited the market because of better access to fresh and organic food. Furthermore, 78 per cent of customers reported increased vegetable consumption thanks to the farmers' market. The testimony of consumers at the pilot farmers' market clearly emphasises the positive impact of the market on food availability, accessibility, utilisation and safety:

> "I am a low income person. Usually, I buy my daily vegetable from a nearby fresh market or mobile vegetable vendor (mobile van). However, I rarely buy fresh vegetables from the mobile vendor also because of the high prices. Therefore, I generally purchase a very tiny amount of vegetables for my household. Even the vegetables I purchase from the van are not good quality. A few weeks ago, I came to know about the farmers' market where fresh, organic and safe vegetables are sold by the farmers who usually cultivate and sell their products. I felt I could trust them and found a very good quality of fresh food. Generally, I bought 1 kg per day, but as I found cheap and fresh vegetables in the market, now I buy 2 to 3 kg per week." (Testimony of a consumer at a farmers' market during the rapid assessment).

Endline assessments of the 16 markets later established that about 800 consumers purchased safe vegetables from each farmers market every week, with 12800 consumers are getting direct benefits from farmers' market. Weekly sales are oscillated around 400 Eur in each market. More than 90% of the consumers were found to be satisfied even asking for markets to open twice a week. This is especially true for women as they can easily purchase vegetables of their own choice and in a good atmosphere.

2.3.4 Food Consumption in Dhaka

Motivating urban poor communities to actively participate in tackling malnutrition and consuming nutritious, diverse diet is essential and in high demand. Despite significant progress, challenges remain to improve the health and nutritional status of the population in Bangladesh (Fahim et al., 2021). Urban dwellers, as opposed to those living in the countryside, have to buy most of their food. So their food security depends on the ability of households to buy sufficient and nutritious food. The awareness campaigns and projects focused on health and nutrition and are designed as a top down approach, which should have taken into account the limited income of the urban poor. Therefore, the urban poor community continued to rely on energy-dense, cheap, readily available, convenient food such as samosa, chicken balls and parties. However, these foods contain starch, added sugar and vegetable fat.

The DFS project aimed to contribute to the behavioural change of the urban poor towards consuming nutritious and diverse food through an inclusive approach. The project achieved this through a mass campaign: "Nutrition for all: eat, save, reduce your footprint", which inspired the urban poor to produce vegetables and fruits in their home yard, thus addressing the inaccessibility to nutritious food because of lack of income. Further, the campaign encouraged participants to make healthy diet choices at home and to follow cooking guidelines that reduce nutrient loss during food preparation and storage.

The initiative further contributed to a better understanding of the importance of consuming fruits and vegetables, as noted by a training participant:

> "... training helped me understand the nutritional value of fruits and vegetables. Now I know that an adult must consume at least 400 g of fruits and vegetables daily."

Furthermore, this initiative trained 11 982 urban poor on healthy nutrition behaviour, nutritious food preparation and appropriate storage

3 Key takeaways

Enhancing Urban Food Security and Sustainability through the long and short-term intervention of the DFS Project. The DFS project in Dhaka, Bangladesh, was developed to address both long-term urban food policy challenges and short-term issues related to safe and nutritious food accessibility. The project emphasised food safety practices by linking various initiatives to policies, governance, and retail and market transformation activities to ensure a comprehensive approach. The project successfully addressed concerns about food safety through six initiatives that focused on monitoring and improving food safety practices, effectively tackling both long-term policy design challenges and short-term food access issues.

The project aimed to strengthen food policy and governance for a resilient and inclusive urban food system. The DFS project played a vital role in enhancing Dhaka's food system policies and governance. By striving for a more resilient, sustainable, and inclusive urban food system, the project aimed to address food and nutrition security concerns effectively. Recognising the need for strengthened food policy and governance arrangements within the food system, the DFS project worked towards achieving these objectives through various activities and outputs, including Dhaka Food Agenda 2041, that are associated with food availability, accessibility, and utilisation while enhancing environmental and socioeconomic outcomes.

Improving food quality and safety to reduce vulnerability to foodborne illnesses was a short-term objective of the project. To address the risks associated with poor hygiene practices in street food, restaurants, food processing, and selling platforms in Dhaka, the DFS project implemented pilot initiatives focused on enhancing food quality and safety. By promoting safer practices and diminishing vulnerability to foodborne illnesses, the project contributed to improved food safety, availability, and accessibility for all, mainly benefiting the urban poor.

The project had the pilot initiative to enhance food processing, storage, and distribution for greater food safety and security. The DFS project organised various activities to improve food safety, security, and socioeconomic outcomes by focusing on Dhaka's food processing, storage, and distribution. Recognising the importance of safe processing, storage, and transportation of agricultural products and awareness of wholesale prices, the project implemented initiatives to address these crucial aspects and reduce waste while ensuring food safety within the Dhaka food system.

The project promoted urban and rooftop gardening for safe and sustainable produce. Urban and rooftop gardening activities were actively promoted by the DFS project to improve food safety, availability, and accessibility in Dhaka. These activities aimed to offer fresh produce, reduced expenses, improved air quality, and mitigate the impact of climate change. The project concentrated on safe and sustainable fruit and vegetable production through two initiatives, providing training, input distribution, and the development of policy and technical guidelines.

The project revamped markets for fresh produce, benefiting communities. The DFS project aimed to improve the management of existing markets (2 also benefitting from infrastructure refurbishment as model markets) and establish new ones for fresh produce, benefiting the community. Addressing concerns raised by Dhaka residents about poor-quality vegetables contaminated with chemicals and lacking nutritional value, the project focused on enhancing existing retailers and establishing new farmers' markets. These efforts aimed to ensure the availability of fresh produce and bring numerous benefits to the community, including improved food availability, accessibility, safety, and other environmental and socioeconomic outcomes.

Amongst others, a focus point of the project was food loss and waste management in Dhaka for the sustainable transformation of Dhaka's food system. An essential aspect of the DFS project was its focus on food loss and waste management. The project aimed to contribute to the sustainable transformation of Dhaka's food system by implementing specific initiatives, leading to improved food utilisation and positive environmental outcomes. Recognising the significance of efficient food loss and waste management, the project targeted this issue to enhance food utilisation and promote better environmental practices within the food system.

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Annex 1 DFS project initiatives

Theme	Initiative name	Initiative content
Promoting nutrition and food security	Urban Gardening in four cities by the urban poor	An extensive research initiative was carried out during the Project's first phase to better understand the challenges faced by the poor to access adequate food and nutrition, and their mechanisms to cope with them. Food price monitoring was also done during the pandemic. The urban poor households also gave their ideas and made requests as to how DFS could support them. Unanimously there was interest in learning how they could grow their own food, supplement their dietary intake, and if possible, even supplement their livelihoods. During phase one, DFS worked in three cities to train households (designing six training modules), build gardening capacity, distributing seeds, and inputs, and mobilise support. The results were very positive and indicated potential, especially in peri urban areas, but also potential in dense urban communities too. In the second phase, a scale-up of this initiative was planned, focusing on building capacity of poor urban households – reaching 5000 participants, but also the urban poor organisations that organize them. There were training-of-trainers to build a technical resource for these organisations, agricultural inputs distribution and also advocacy to push Ward Councillors to continue the distribution of seeds and inputs beyond the life of the Project. In addition, FAO worked with other implementing partners to reach more urban poor communities through various inventions, such as training on urban gardening, creating demonstration plots, and linkage workshops with other key stakeholders. The expected outcome was the widespread practice of gardening, providing the poor with the capacity to grow their own food, supplement their dietary intake with nutritious food, and develop organisational capacity to spread knowledge, leading to a more resilient food system.
	Raising the awareness of the urban poor on safe food and nutrition	Another finding from the research on the urban poor and their food security situation was that despite numerous NGOs and public programs promoting better nutrition, there was still inadequate *know how* on how the poor can eat better that meets their nutrient needs with the available resources they have. This pointed to practical knowledge gaps on how to select and purchase the right food, clean it, cook it, and store it, all things that could help ensure that food is more nutritious and healthy when consumed. Working through urban poor federations, which have their own extension outreach channels, regular campaigns were launched by community leaders and federation members to reach and impact tens of thousands of families having better and healthier food habits and practices on safe and sufficient food. During the first phase of the project, four campaigns were designed, and posters and training materials were developed, but due to the adverse situation of the pandemic and delays in procuring the campaign tools, the campaigns were never launched. During the second phase the Project connected with, and collaborated with a number of institutional partners to implement the campaigns, and institutionalise food campaigns at the city level. The initiative organised a nutrition campaign at the community and institutional level aiming to provide practical and accessible information on good nutrition to as many urban poor households as possible, with the help of master trainers who disseminated the relevant knowledge and expertise to individuals in the four cities of Dhaka. The campaign trained 218 master trainers and 2 161 cascade trainers and reached 8 720 family members. The campaign at the institutional level had the theme "Nutrition for all: eat, save, reduce your footprint". The initiative trained 320 students to be "Nutrition Ambassadors" at eight schools in Dhaka North and South, Gazipur and Naryanganj city corporations and brought 3200 students into the campaign programme to benefit at least 10000 family members in 3200 families. The initiative also International Education Centre (IEC) materials created, such as food plates, posters, festoons, flipcharts, and calendars to deliver nutrition-related messages to different communities, stakeholders, and slum dwellers to promote understanding of the important issues related to nutrition, food safety and more. Therefore, the nutrition communication messages shared information on tips for healthy diets and making healthy and sustainable food choices; ensuring food safety; cooking food efficiently and properly storing food; choosing healthy food options and effective and efficient purchasing strategies. Under this initiative, also 100 000 voice SMS were sent to the poor who are involved in the DFS project.
	Promoting rooftop gardening in DMA for improved nutrition	A surprising late addition to the list of strategic activities of the first phase was rooftop gardening for improved nutrition. Initially, it came as a request from the Joint Secretary of DNCC, and we discovered that it was an initiative by the Mayor in collaboration with the Ministry of Finance. A recently passed law provides financial incentives to homeowners and landowners to grow their own rooftop gardens. In the same spirit as promoting urban gardening for the poor, there is certainly potential to increase the intake of nutritious food for renters and owners of apartments, as well as employees of institutions and school children too. During the second phase, FAO responded to the DNCC government's request with technical guidance on how to implement their initiative, create technical handbooks, and also contribute to the promotion of the activity and policy advocacy efforts.

Theme	Initiative name	Initiative content
		The DFS project started rooftop gardening in four cities: 550 in DSCC, 550 in DNCC, 200 in GCC and 200 in NCC. A total of 1 500 participants, primarily women, were selected, and technical training was arranged to build capacity for rooftop gardening. A total of 20 demonstration gardens were established on the rooftops of buildings. The inputs distributed to selected beneficiaries included vegetable seeds, fruit tree saplings, fertilisers, geo-bags, agricultural tools and demonstration gardens. Project participants established gardens on rooftops. PROSHIKA implemented rooftop gardening as a partner NGO.
Upgrading fresh markets	Strengthening the capacity of food market actors on food safety, market services, and governance	During the first phase, DFS created, trialled, and tested diagnostic tools in around ten markets to assess market conditions (including a set of market indicators) and training modules to address critical areas. In addition, we piloted the creation of citizen-led, neighbourhood-level food safety committees that would work with the market associations to survey the markets and provide them feedback. The results point to the importance of providing market associations with a thorough evaluation of market conditions and the value of skills and know how on how to improve in these areas. DFS also conducted a widespread survey covering 388 markets in all four city corporations, and this helps to indicate the scale of the effort needed to impact fresh markets as a system. The second phase initiative worked with a national-level organisation to massively scale up these market training efforts, targeting building the capacity of 130 markets market associations in four city corporations through a comprehensive training module covering hygiene, public safety, food safety, food waste and loss reduction, waste management and market management, food safety and hygienic practices, the operation of toilets, and cleaning and maintenance. Together with an institutionalised monitoring approach that involved local stakeholders, there was the potential for a qualitative improvement in the quality of service, hygienic conditions, and overall food safety for markets and consumers who shop there.
	Monitoring of fresh markets in DNCC enforced by mobile courts and stakeholders	While training and raising awareness of vendors and market associations were essential, the enforcement of rules and regulations must also go hand in hand with these efforts. During the first phase, the CEO of the DNCC commented that training alone wasn't enough to improve fresh markets and that punitive measures were also necessary to send a strong message as to the City Government's commitment to improving food safety and hygiene in markets. DFS created a multi-stakeholder based multi-party task force jointly with the DNCC magistrate and technical representatives from the BSFA, DAE, DoF, and DLS. This multi-party approach helped build the capacity of mobile courts to adjudicate problematic food safety issues in markets with the technical know-how of national government departments and agencies, together with their local government counterparts.
	Seminar to share citywide food market assessment on fresh markets Initiative	One of the most ambitious activities that took place during the first phase of the Project (and during the pandemic) was the city-scale mapping of all the fresh markets of all four of Dhaka's cities. In total, there were over 350 markets, from temporary outdoor markets to large indoor structures, all serving millions of transactions to deliver food to the residents of Dhaka every day. By analysing the collected data from the mapping and the survey of the markets, a citywide view of the market system was possible. The DFS team reviewed the maps and identified a set of findings that could lead to a more informed understanding of how the market system worked and what the primary needs were. For example, understanding the proportion and location of markets without adequate drainage, water, lighting, or ventilation or evaluating the seriousness of safety concerns related to food safety practices and the threat of fires. The seminar brought together relevant institutions and City Governments and served as an opportunity to initiate a larger conversation about fresh markets in the city, highlighting their importance and needs and triggering deliberation on what changes were needed.
Reducing food loss and waste	Strengthening the capacity of food market vendors, market management committees and city corporations on food loss and waste reduction /management	There were a number of ways that market associations, vendors, and market workers could help ensure that food was not lost in markets before consumers purchased them. Better loading, storage, handling and hygienic practices, such as washing and maintaining clean market environments, were a must, but these kinds of practices were often not carried out effectively by markets. Training for market associations and vendors would help to address their knowledge gaps, and for district health officials would help to better identify problems and address them. DFS project selected the Institute of Professional Training and Management [IPTM] to implement all project activities under this initiative. One hundred thirty fresh markets were selected for intervention and to identify skill development needs through a baseline survey. The training materials (module) were developed in Bangla, and participants came from 130 market management committees and from poultry, meat, fish, and vegetable sectors. The training was completed between October 2022 to February 2023, including the dissemination on baseline survey findings and promotional activities in the Dhaka Food System. Following the training, the initiative worked on monitoring to improve production, waste segregation, and delivering quality products to consumers. In addition, end-line survey results, feedback, and recommendations were disseminated at four city-level workshops and one national-level seminar with the relevant stakeholders.
	Piloting waste segregation systems in selected fresh markets in DSCC	One of the first impressions that one received on entering fresh markets was the strong smells, often of rotting food and animal parts that were not properly disposed of. This was due largely to an inadequate approach to waste management by the City Government and market committees, lacking overall strategy, technical competencies, and even necessary infrastructure and tools. IPTM was chosen to carry out all target activities for waste segregation in 10 fresh markets located in Dhaka South City Corporation areas. Members of the Market Management Committee were trained to properly segregate waste, with 370 waste bins provided in two colours (322 green for biodegradable waste and 48 greys for non-biodegradable waste).

Theme	Initiative name	Initiative content
		The MMC members handed over the waste bins to the local authority after an assessment of the waste bin requirements at the ten pilot markets. A waste segregation report was generated based on the prevailing situation and bin requirement data. Scrap dealers were identified to link local waste collectors and vendors with MMC for financial benefit. A waste management strategic plan was initiated, and lessons learned from the ten pilot markets will be shared at four city-level workshops and one national-level workshop.
	Piloting black soldier fly production to produce animal feed from fresh market organic waste.	Given just how much food waste was produced by fresh markets every day across the city, DFS explored several promising ideas during the first phase on how to make better use of this overlooked resource. The need for innovative, cutting-edge technology to help make the case for new approaches was also understood. For this reason, the initiative to convert organic waste to animal feed (for livestock and aquaculture) using black soldier fly larvae that feed on organic waste and are used as a protein rich feed ingredient was developed. This technology was becoming extremely popular in other countries around the world, and DFS wanted to explore the feasibility and profitability of a BSF based feed production unit. Unfortunately, despite having a USAID-funded partner committed and private sector firms identified, it was impossible to identify partners in the project's first phase. In the project established a demonstration pilot, run by a university, and organised four promotional workshops and a seminar to disseminate the results of the pilot initiative.
	Seminar to share the use of biogas digesters to manage waste from fresh markets case study	One of the areas of exploration during the project's first stage was how the high quantities of food waste produced in individual markets could be made better use of, potentially as a source of energy, within markets. A considerable amount of work went into exploring various design options for a decentralised biogas conversion plant that could be operated within markets, and a feasibility study was conducted to analyse costs and the availability of inputs. Sadly, such decentralised plants, while relatively smaller and cheaper than large-scale plants, require more land than was available. But this did not rule out their viability in the future, with the potential there for private sector entrepreneurs investing in the transportation of food waste and construction of biogas plants to create much-needed alternative energy sources for the city. The seminar shared the findings of the DFS feasibility study and the plans and designs of the biogas plants so that they could inform ongoing discussions of the viability of biogas conversion as a source of energy. Key partners were the Asian Development Bank, who were already promoting clean energy approaches and had already invested in several biogas plants in cities throughout the country, but as yet had not thought about markets as a privileged source for inputs.
Improving food safety and consumer awareness	Improving the awareness of street food vendors on food hygiene, preservation, and transportation	Despite the ubiquity of street food vendors and their popularity as a source of food, there are hardly any policies that effectively influence how they prepare food and where they operate. As a result, street vendors are known to be a nuisance for city governments, motorists, and businesses, and are likely to pass food-borne diseases to many unwitting consumers. The second phase initiative arises from the requests of the city working groups to improve food safety while also finding more effective (and less punitive) ways to manage vendors effectively. One hundred fifty-two street food vendors (27 of whom were women) received training on food hygiene, preservation, transportation, and safe food practices. The training was organised by DNCC, GCC, and NCC, with the BFSA providing the training manual and conducting the sessions. During the training, the attendees pledged to follow specific hygienic practices. These included washing their hands thoroughly before starting work, using tissues to clean a runny nose and washing hands with soap afterwards, keeping fingernails short and clean, maintaining a safe distance from others when sneezing and coughing, and using a mask or tissue. They were also instructed to wear an apron and hand gloves when preparing and serving food, use clean water for food preparation and cleaning utensils, store raw and cooked food separately in the refrigerator, and ensure that unsafe food is not sold.
	Supporting the implementation of a food safety grading system in selected hotels and restaurants in NCC and GCC	During the first phase of the Project, the city working groups in Narayanganj and Gazipur indicated that food safety was a priority issue and that they wanted to start by improving food quality in hotels and restaurants. By collaborating with the local NGO IDG (supported by USAID), the DFS team has been able to work with a technical partner to give trainings to restaurant owners while also involving city officials and stakeholders (for example, the hotel and restaurant owners' association) to support these efforts. DFS was able to reach out and mobilise restaurants and owners in Narayanganj and successfully train them while also emphasising the role of district health officials and city leadership to ensure that all restaurants were to participate in the grading system.
	Providing technical assistance to improve GHP in slaughterhouses in GCC	The supply of meat to consumers is an important responsibility that meat sellers fulfil. However, there are concerns regarding the quality of the meat and its safety for consumption. The quality of meat depends on how butchers handle it during transportation, at the slaughterhouse, and in the butcher shops. Unfortunately, many butchers are not knowledgeable about safe handling practices that prevent contamination. As a result, they often slaughter animals in unhygienic conditions in open fields or by the roadside. In all four cities, the subject of safe meat handling was discussed with members of the CWG. The DLS emphasised the need to increase awareness among butchers about safe handling practices and hygienic practices to improve meat quality and food safety in the marketplace, which would have a positive impact on public health. In preparation for the CWG meeting and to address concerns related to DLS ownership, a two-day training course was conducted in 2022 to educate 129 butchers on good hygiene practices in the marketplace, with six of them being women. Additionally, a national-level workshop was organised with nine participants, and one woman attended to promote the establishment of consumer-friendly meat shops.

Theme	Initiative name	Initiative content
		The training aimed to enhance the knowledge and skills of the chosen butchers regarding safe meat handling and hygiene practices. It also aimed to promote and spread meat safety practices among the butchers and improve the quality and safety of the meat offered to urban residents. Participants shared that the training increased their awareness of meat safety and essential measures to maintain its quality for consumers. They also expressed their commitment to applying what they learned in the field through hands-on training demonstrations. Shere Bangla Agriculture University organised a visit to a meat processing factory in the Pabna district for learning purposes. The learning team consisted of meat sellers, members of the Market Management Committee, city officials, and DSCC ward councillors.
	Establishing Farmers' Market at DMA (DNCC, DSCC GCC and NCC)	Another initiative during the first phase that responded to a Mayor's specific request and consequently became very popular as an example of a food system intervention was the pilot establishment of a farmers' market in the Mirpur 6 neighborhood. The pilot, which worked closely with residents, farmers, and the Ward Councilor's office, was able to establish a weekly market that has been operating for six weeks now, generating strong returns for farmers, and also satisfying the food needs of local residents. The pilot helped to develop a workable methodology that links farmers in the city's periphery with urban consumers at the neighborhood-level, and this can be scaled up, focusing on neighbourhoods that have limited access to established fresh markets. In the second phase of the project, this initiative established farmers' markets in Dhaka. These markets allow farmers to sell their safe produce directly to consumers, ensuring that consumers have access to safe and healthy food. Additionally, this system eliminates any middlemen who may have compromised the safety and quality of the produce. In a partnership with Wok for Better Bangladesh, 16 farmers' markets were established in DNCC, DSCC GCC, and NCC. Every week, ten farmers from the outskirts of the city corporation bring fresh vegetables validated by the Agriculture Department of Bangladesh. Each of the 16 markets has market committees consisting of female consumers, ward councillors, civil society, and others who maintain food quality and handle management issues. There are 30 agriculture producers in each of the 16 groups who have been trained in good agriculture practices by the subdistrict level Department of Agriculture Extension office. During city level learning-sharing workshops held in January 2023, consumers expressed satisfaction with the farmers' markets.
Strengthening food value chains	Strengthening the capacity of value chain actors in the supply of hygienic and safe food	As mentioned previously, one of the most well-recognized imperatives is to improve food safety, and this can easily be seen in terms of interventions along entire 'food value chains', where different actors and different stages require information, training, and enforcement. Working with the local poultry association, the local district livestock department, and other development partners, DFS organised a training session on biosecure and safe poultry farming in peripheral Dhaka, and developed and distributed communication materials on safe food and hygiene practices. The goal was to raise awareness of food safety among poultry farmers and their association's leadership.
	Identifying major wholesale markets and foods that rely heavily on those wholesale markets	The existence of middlemen who serve as intermediaries between wholesale marketers and retailers, as well as the lack of communication linkages between them on the supply and prices of food, mean that retailers overall are deprived of a significant share of profits. In order to address these information asymmetries, the phase two initiative will seek to connect wholesale market associations with retail market associations in each of the four cities to create communication channels for the free flow of information on supply and prices. This will allow retail marketers more autonomy in deciding from where they will purchase food and allow them to seek the lowest possible prices for the best foods. This intervention will enable sustainability once the connections are made as there will be an incentive for the information linkages to be appropriated beyond the Project cycle and endure, as long as marketers are able to use that information to attain profits for themselves.
	Strengthening rural urban linkages by linking wholesale markets with production hubs	Information asymmetries also exist between regional growers' markets, such as those in Bogra, Jashore, Rangpur, and Satkhira, and wholesale markets serving the capital, and this means that retailers are not always able to get the best prices and thereby lose profitability. It also means that farmers lose out on profits, and this threatens the equitable distribution of profits throughout the entire value chain. To address this, the DFS project will work with FAO's Missing Middle Initiative Project (MMI) to connect regional markets with urban markets in Dhaka and establish communication channels for the free flow of information on prices and product availability. The initiative will work in the same way as the previous initiative and lead to the retailers being more empowered to decide upon which markets to source their food products from, and ultimately improved decision-making and lower prices.
Strengthening food system planning and governance (FSPG)	Policies formulated and endorsed to strengthen urban food system planning	Given the relative novelty of 'food system management and planning' by city governments, the DFS project piloted a number of innovative yet important projects together with city officials. These included creating designated areas for street food vendors in strategic parts of the city, setting up farmers' markets in neighbourhoods, and establishing City Food Charters to bring together a shared vision for a city's food system. The project also encouraged rooftop agriculture on both public and private buildings. The goal here is to develop successful policies recognised by cities and endorsed nationally. So far, these initiatives have been well-received, and there is a strong desire to continue, particularly in advocating for policy changes to increase the recognition and institutionalisation of these programs.

Theme	Initiative name	Initiative content
	Strengthening institutional capacity to integrate food system thinking into urban planning	In Bangladesh, considerations about food are not part of the urban planning education curriculum, nor is it in any of the City Governments' guidelines regarding master planning or local urban planning. To address this gap, one of the promising initiatives of the first phase was working with the Bangladesh Institute of Planners (BIP) to promote the inclusion of food in urban planning and to promote food system thinking with existing professionals in the field (many who work for city governments). During the first webinar event, there were over 70 participants from around the country and also prominent members of the planning community. The second phase included urban planners and city corporation officials receiving training on urban food planning, as well as access to valuable knowledge products. The DFS and BIP collaborated to provide selected participants with training, while the DFS created a digital library on urban food planning. This library included policies, laws, regulations, situation reports, case studies, and documentaries. These resources are initially uploaded to the FAO website and then handed over to a designated Desk (Urban Development - 1 Branch under the Urban Development Wing) under the LGD. CEGIS, as a resource partner it to hosts an interactive GIS model and web map. Additionally, four case studies were prepared, highlighting successful food planning initiatives from around the world that could be considered for implementation in Dhaka.
	Dhaka Food Agenda	One of the overall objectives of the DFS Project is the formulation, validation, and national level adoption of the Dhaka Food Agenda 2041, covering the metropolitan region. The Dhaka Food Agenda 2041 is the final output of a lengthy technical and participatory process that evaluates existing knowledge on various thematic issues related to the present and future food system (at the moment, the most relevant are nutrition and food insecurity, food safety, fresh markets, and food loss and waste), through deliberation by technical working groups of experts and practitioners. These working groups are guided by WUR and FAO colleagues to evaluate policies, acts, plans, trends, and potential scenarios so that a set of proposed plans can be put forward. The overall decision-making body will be called the Consultative Group for Urban Food System Strategies (CGUFSS), and this will convene political leaders (including from different National Ministries, Mayors, and government departments), together with the private sector, think tanks, civil society and development organisations, and other entities related to the food system. The overall food agenda drew from technical proposals but be decided upon through reflection, consultation, and ultimately decided upon collectively, with the consensus being sought to arrive at the final version. Through the process, foresight and scenario mappings have been developed for Dhaka, and more than twelve consultations and working sessions have been conducted with the TWGs and CGUFSS, including a national seminar and four city-level seminars. Furthermore, the CGUFSS members and TWG conveners have had three training sessions to strengthen their capacity to plan the urban food system. Regional and international actors in the urban food system are engaged with the Government of Bangladesh's initiatives to improve Dhaka's food system through the launching and international conference on DFA 2041.
	Institutionalising the Urban Food Planning Unit in the local government division	The overall aim of the DFS Project is to formulate and implement a Food Agenda 2041 by bringing together key players representing Government Ministries, city corporations, utility and waste management agencies, the private sector, consumers, and civil society. In order to substantiate these consultative processes underpinning the formulation of the Food Agenda, this initiative drives the development of a range of potential food system scenarios. These scenarios are developed and projected towards 2041 by WUR using an interactive food system scenario tool that contains a macroeconomic model. The scenarios will include a contextual component on i) socio-economic conditions such as population growth, rates of urbanisation, income and employment growth and (inter)national trade; and ii) climate change options, incl. salinisation and land loss due to sea level rise. And a set of specific measures, targets and interventions based on the Strategic Food Agenda 2041, which will result from the engagement with CCs and LGD and a selection of interventions to improve the performance of the food system for the DMA. In the second phase of the project, this material, together with stakeholder consultations, is used to assess potential food system policy options for both national and local government. Particular attention is to strategies for improving food system efficiency, food system effectiveness and food system resilience in consultation with stakeholders. The scenario tool also accounts for data and findings gathered in the food value chain studies and consumer behaviour studies. The results of the food system scenario options are made available through two interactive websites: the DMA food system dashboard and the interactive GIS. In addition, a trajectory is put in place to build the capacity to use and maintain the interactive web-based planning tools, which ultimately will be handed over to GoB and end-users. An important contribution to the long-term food planning enabling environment of the project is that LGD assigned a Desk, located in the Urban Development - 1 Branch under the Urban Development Wing. Currently the desk is following urban primary health care and its designation as responsible for the DFA 2041 is a significant step for the governance of food systems. This is an initial step for a future establishment of a fully-fledged Urban Food Planning Unit.

Annex 2 Match between DFS project initiatives, food system activities and outcomes

DFS initiatives	Initiative outputs	Food systems activities	Food system outcomes
Urban Gardening in four cities by the urban poor	OP 1.1. # of urban poor received training on urban gardening to increase their access to safe food.	Food production	Food availability & access
Raising the awareness of the urban poor on safe food and nutrition	OP 1.2. # of community people are trained on healthy nutrition behaviour, nutritious food preparation and appropriate storage.	Food consumption	Food utilisation
	OP 1.3. # of learning sharing workshops have been organised to ensure multi-stakeholder linkages that promote nutrition and food security in urban areas.	Food quality promotion & monitoring	Food safety
Promoting rooftop gardening in DMA for improved nutrition	OP 1.4. # of policy guidelines and technical guidelines on rooftop gardening have been developed to enhance rooftop gardening for better nutrition.	Policies & Governance	Environmental outcomes
	OP 1.5. # of urban people received training on rooftop gardening practices for better nutrition.	Food production	Food availability & accessibility
	OP 1.6. # of rooftop demo plots have been established in public places to raise public awareness.	Food quality promotion & monitoring	Food availability & accessibility
Strengthening the capacity of food market actors on food safety, market services, and governance	OP 2.1 # of web and android based market monitoring applications have been uploaded.	Food quality promotion & monitoring	Food safety
	OP 2.2. # Neighborhood Level Food Safety Committees (NLFSCs) have been formed to regularly monitor neighbourhood fresh markets to ensure food safety.	Promotion, advertising and information	Food safety
	OP 2.3 # of Neighborhood Level Food Safety Committee (NLFSC) members received training on fresh market monitoring to ensure food safety.	Food quality promotion & monitoring	food safety
	OP 2.5 # of relevant stakeholders received information about fresh market assessment for fresh market improvement.	Food quality promotion & monitoring	Food safety
Monitoring of fresh markets in DNCC enforced by mobile courts and stakeholders	OP 2.6 # of monitoring activities have been conducted by the mobile court and multi-stakeholder committee.	Food quality promotion & monitoring	Food safety
	OP 2.7 # of people have been reached by communication materials and messages on fresh market food safety and hygiene practices.	Food quality promotion & monitoring	Food safety
Seminar to share citywide food market assessment on fresh markets Initiative		Food quality promotion & monitoring	Food availability & accessibility and food safety
Strengthening the capacity of food market vendors, market management committees and city corporations on food loss and waste reduction /management	OP 3.1 # of food market vendors, market management committees and City Corporation officials received training on food loss and waste reduction /management.	Food Loss & Waste Management	Food utilisation and environmental outcomes
Piloting waste segregation systems in selected fresh markets in DSCC	OP 3.2 # of vendors are using tools to segregate waste at source.	Food Loss & Waste Management	Environmental outcomes

DFS initiatives	Initiative outputs	Food systems activities	Food system outcomes
Piloting black soldier fly production to produce animal feed from fresh market organic waste	OP 3.3 # of black soldier fly (BSF) production units have been established to produce animal feed from the fresh market's organic waste.	Food Loss & Waste Management	Environmental outcomes
Seminar to share the use of biogas digesters to manage waste from fresh markets case study	OP 3.4 # of learning sharing workshops have been organised on food loss and waste management.	Food Loss & Waste Management	Food utilisation and environmental outcomes
Improving the awareness of street food vendors on food hygiene, preservation, and transportation	OP 4.1 # of street food vendors received training on food safety, hygiene, preservation, and transportation.	Processing, Storage & Distribution	Food safety
Supporting the implementation of a food safety grading system in selected hotels and restaurants in NCC and GCC	OP 4.2 # of hotel and restaurant owners received training on food safety and hygiene practices.	Retails & Market	Food safety
Providing technical assistance to improve GHP in slaughterhouses in GCC	OP 4.3 # of butchers received training to improve Good Hygiene Practice (GHP) in slaughterhouses.	Retail & markets	Food safety
Establishing Farmers' Market at DMA (DNCC, DSCC GCC and NCC)	OP 4.4 # of farmers' markets have been established in four cities to ensure food safety.	Retail & markets	Food availability & accessibility
	OP 4.5 # of farmers received training on food safety, hygiene and safe food management in farmers' markets.	Retail & markets	Food safety
Strengthening the capacity of value chain actors in the supply of hygienic and safe food	OP 5.1 # of communication materials have been developed and distributed for safe food and hygiene practices.	Food quality promotion & monitoring	Food safety
	OP 5.2 # of food value chain actors received training on the supply of hygienic and safe food.	Processing, Storage & Distribution	Food safety
Identifying major wholesale markets and foods that rely heavily on those wholesale markets		Processing, Storage & Distribution	Food security & food safety+socio-economic outcome
Strengthening rural urban linkages by linking wholesale markets with production hubs	OP 5.3 # of coordination meetings/workshops have been held to build linkages between wholesale and retail markets.	Processing, Storage & Distribution	food security & food safety+socio-economic outcome
Policies formulated and endorsed to strengthen urban food system planning	OP 6.1 # of guidelines on street food vending, rooftop gardening, urban gardening, and farmers' market operation have been developed for food system planning and governance.	Policies & governance	Food and nutrition security+Food availability and access+food utilisation+environmental outcomes+socio-economic outcomes.
	OP 6.2 # of city food charters developed and endorsed.	Policies & governance	Food and nutrition security+Food availability and access+food utilisation+environmental outcomes+socio-economic outcomes
Strengthening institutional capacity to integrate food system thinking into urban planning	OP 6.3 # of government, civil society, and private sector stakeholders received training on food system planning and management.	Policies & governance	
	OP 6.6 A electronic repository has been created in the Urban Food Planning Unit (UFPU).	Policies & governance	
	OP 6.8 # of knowledge products have been developed and shared amongst the relevant stakeholders to disseminate best practices, ongoing food system actions, and proposals to make the food system more sustainable.	Policies & governance	Food and nutrition security+Food availability and access+food utilisation+environmental outcomes+socio-economic outcomes.

DFS initiatives	Initiative outputs	Food systems activities	Food system outcomes
Dhaka Food Agenda		policies & governance	Food and nutrition security+Food availability and access+food utilisation+environmental outcomes+socio-economic outcomes.
Institutionalising the Urban Food Planning Unit in LGD	OP 6.7 # of participants have been introduced to the interactive GIS & Food System dashboard to raise awareness and capacity of resource persons.	policies & governance	Food and nutrition security+Food availability and access+food utilisation+environmental outcomes+socio-economic outcomes.
	OP 6.4.1 # of participants of city working group meetings, Consultative Group in Urban Food System Strategies (CGUFSS) meetings, Project Steering Committee (PSC) meetings, and other meetings organised where national-level stakeholders participated in food system planning and management.	policies & governance	Food and nutrition security+Food availability and access+food utilisation+environmental outcomes+socio-economic outcomes
	OP 6.4 # of city working group meetings, Consultative Group in Urban Food System Strategies (CGUFSS) meetings, Project Steering Committee (PSC) meetings, and other meetings have been organised where national-level stakeholders have participated in food system planning and management.	policies & governance	Food and nutrition security+Food availability and access+food utilisation+environmental outcomes+socio-economic outcomes

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The mission of Wageningen University & Research is "To explore the potential of nature to improve the quality of life". Under the banner Wageningen University & Research, Wageningen University and the specialised research institutes of the Wageningen Research Foundation have joined forces in contributing to finding solutions to important questions in the domain of healthy food and living environment. With its roughly 30 branches, 7,600 employees (6,700 fte) and 13,100 students and over 150,000 participants to WUR's Life Long Learning, Wageningen University & Research is one of the leading organisations in its domain. The unique Wageningen approach lies in its integrated approach to issues and the collaboration between different disciplines.