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Food security and diets in urban Asia : How resilient are food systems in times of Covid 19 ?

An analysis and characterization
of 8 urban food systems in selected cities in Asia

Authorship

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Disclaimer

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About Dikoda

We provide nutrition focused impact solutions, technical support and actionable insight for the public and private sector. Our technical focus is addressing malnutrition in urban areas. Our geographical focus is in Asia and the Pacific.

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Abbreviations

FAO Food and Agriculture Organization of the United Nations

GAIN Global Alliance for Improved Nutrition

GHSL Global Human Settlements Layer

IPC Integrated Food Security Phase Classification

NGO Non-government organization

SDFU Status and Determinants of Food insecurity and Undernutrition

SME Small or medium-sized enterprise

UN United Nations

VAM Vulnerability Analysis and Mapping

WFP World Food Programme

WRA Women of Reproductive Age

Notes

This report provides an analysis and characterization of urban food system across 8 selected cities in Asia. This research is the Component 1 (C1) of a series of knowledge building products supported by Dikoda. Additional components include:

- Component 2 (C2) 4 deep dive case studies that aim to 1) provide rich in depth examples to feed into the evidence on nutrition-specific and sensitive interventions in poor urban areas to promote food security and prevent malnutrition, 2) provide an opportunity to evaluate urban interventions, learn from the process and offer collaboration opportunities for WFP to support upgrading and scaling up.

- Component 3 (C3) rapid market assessment in 3 selected cities that aim to 1) understand the market environment and stakeholders in the urban contexts, 2) specifically focusing on informal food sector actor, characterize their offer and their level of resilience during COVID-19.

The outputs from C1 to C3 can be shared upon request by WFP or Dikoda's team.

Executive summary

Vulnerable populations in urban areas globally have been among the worst hit by the global COVID-19 crisis. The pandemic has upended normal life and the food systems that support urban populations have been significantly disrupted. To date, insufficient evidence exists on the impact on availability, access and use of foods for vulnerable urban populations. The gaps in evidence of urban food system weaknesses during the COVID-19 crisis, and the likely consequences on food security and nutrition in poor urban populations, requires better understanding urban to shape potential interventions for WFP.

This research study conducted between January and April 2021, assessed the level of resilience of urban food systems in the face of the COVID-19 crisis in eight selected cities in the Asia/Pacific region. It used a range of methods and data sources to characterize urban food systems and explored external drivers, food supply chains, food environments, individual factors, consumer behaviour and diet outcomes. The Food Systems Dashboard Framework[1] developed by Johns Hopkins University, the Global Alliance for Improved Nutrition and other international collaborators was used as the conceptual framework to guide the analysis. Key data sources were:

1) **Primary quantitative data:** Surveys with urban food system stakeholders (n=2,528) including private sector, local government actors, UN agencies and NGOs.

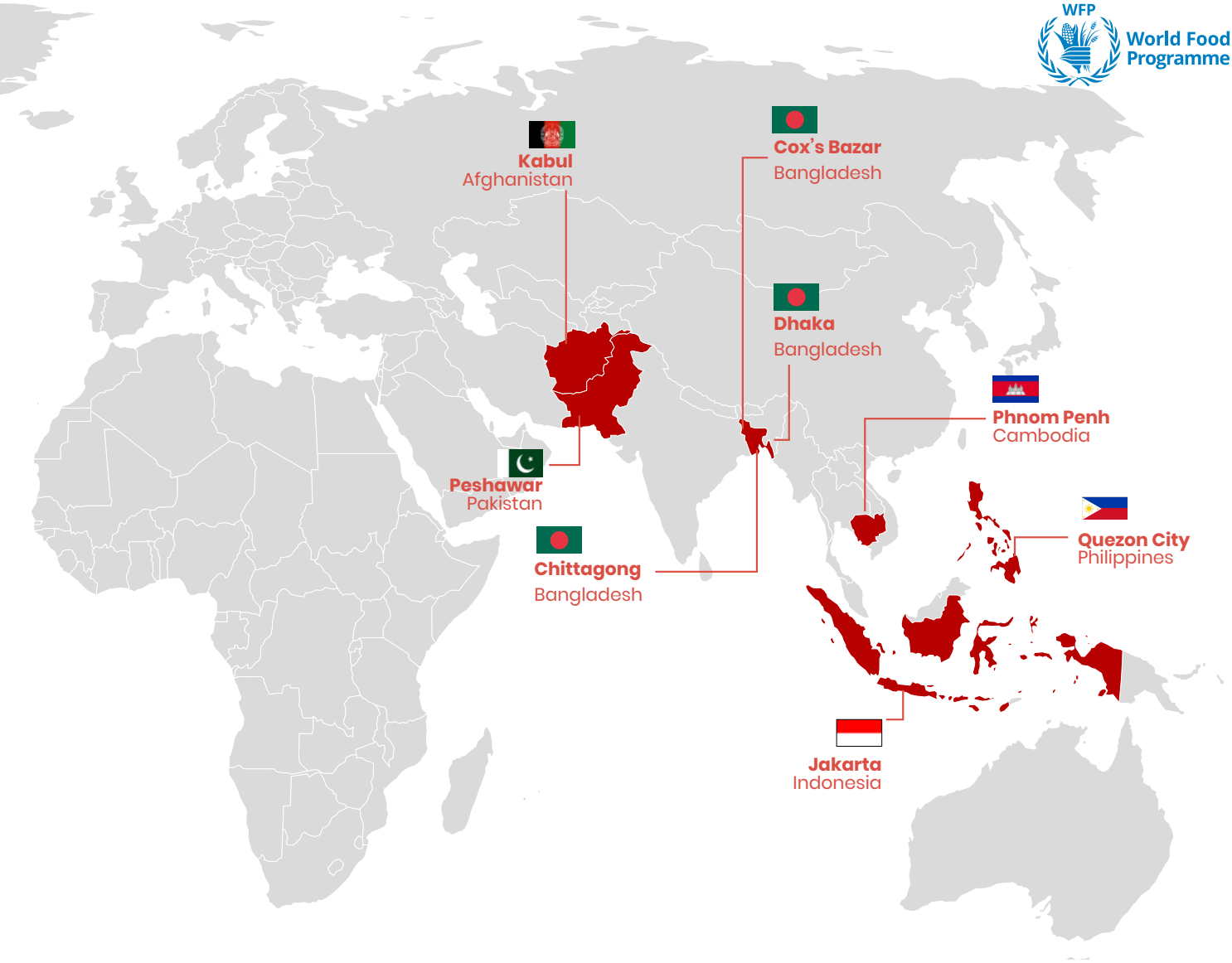
2) **Primary qualitative data:** Key informant interviews (n=30) with representatives from local government, UN agencies, national/international NGOs, Food Security and Nutrition Cluster Coordinators, private sector actors in the food industry and community-based organizations involved in supporting the food system during the pandemic.

3) **Secondary data analysis:** Analysis of reports and online databases for selected indicators of vulnerability relating to components/outcomes of food systems and national Demographic and Health Surveys (DHS) data to produce city-level indicators.

4) **Geospatial data:** Analysis of peer-reviewed urban datasets combined with primary data collection.

Eight cities were selected in collaboration with WFP Regional Bureau Bangkok and Country Offices in the region. Inclusion criteria were primarily based on where WFP Country Offices are located, to facilitate rapid data collection and networking

[1] The Food Systems Dashboard. Global Alliance for Improved Nutrition (GAIN) and Johns Hopkins University. 2020. Geneva, Switzerland. https://foodsystemsdashboard.org/



with relevant stakeholders. Using the materials collected, we developed eight city briefs to provide snapshots of the city-level food systems and COVID-19 related impacts and vulnerabilities in the following cities:

1. **Chittagong, Bangladesh**
2. **Cox's Bazar refugee camps and communities, Bangladesh**
3. **Dhaka, Bangladesh**
4. **Jakarta, Indonesia**
5. **Kabul, Afghanistan**
6. **Peshawar, Pakistan**
7. **Phnom Penh, Cambodia**
8. **Quezon City, Philippines**

Pre-COVID-19 data has been used to as a baseline to highlight vulnerability in the food system that existed before the crisis. The city briefs aim to provide meaningful comparison of data across cities, but some disparity in secondary data inevitably exists.

A typology of resilience in urban food systems has been developed, to show how different parts of the food system exhibit different capacities during the pandemic. Based upon the Food Systems Dashboard Framework, we selected one key indicator for each of the following dimensions: external drivers, food supply chains, food environments, individual factors, consumer behaviour and diets (outcomes). For each indicator, we developed cut-offs for absorptive capacity, adaptive capacity and transformative capacity. These capacities may also be interpreted as low, medium and high levels of resilience respectively.

This typology offers a simplified classification of resilience in urban food systems, which can be used to compare cities and identify priorities and opportunities to strengthen resilience. It is intended as an operational tool, which may be modified and adapted.

Main findings

The study findings are presented in the context of external drivers, the components of food systems (food supply chains, food environments, individual factors, consumer behaviors) and diet outcomes. The eight city briefs provide a visual representation of the available data and highlight areas of vulnerability and resilience in city food systems. The COVID-19 pandemic has increased levels of vulnerability and food insecurity in cities through three main mechanisms, which varied geographically between cities and temporally throughout the pandemic:

- **Disruptions to food supply chains**
- **Increased food prices**
- **Loss of income**

Food supply chains have been disrupted (in some cases for multiple, prolonged periods) due to transport and movement restrictions during the pandemic. Urban areas typically have longer and more complex supply chains than rural areas, which makes them more susceptible to disruption. A range of government and private sector interventions helped to protect supply chains and keep food moving from rural areas into major cities. Many food sector businesses lost a large proportion of their income, and some were forced to close, reduce costs, or adapt in other ways. We found that many SMEs were unable to access financial support and technical assistance they needed during the pandemic. Responses and adaptations developed by SMEs (often with no external support) may contribute to longer term resilience, such as diversification, online sales and home deliveries.

The combination of increased food prices and loss of income affected food affordability for the urban poor. Food prices increased during the pandemic in all eight cities, with considerable variations between cities and between food groups. Daily wage earners and informal sector workers were most affected by loss of income and their access to food was compromised when local markets and street food vendors were subject to restrictions. Many of these people were not registered for social protection programmes and had no financial buffer, making them highly susceptible to food insecurity.

Urban inequity has increased with wealthier households adopting coping strategies that may improve longer term resilience, while poorer households are adopting unsustainable negative strategies. Average household income declined by at least 40% in all cities, with the largest decline (75%) reported in urban slums in Bangladesh (from February to April 2020). Governments adapted, supplemented and scaled up their existing social protection programs in response to the pandemic to support people who became vulnerable in cities. Poor urban households reduced their food basket (diet diversity) and meal frequency, prioritized children over adults or begged for food. Wealthier households in cities adapted by engaging with online shopping using larger supermarkets.

The typology suggests that food systems in the eight cities did not show high levels of resilience (or transformative capacity) to respond effectively to the COVID-19 crisis. Individual factors, represented by reduced income, were particularly affected and remained at the absorptive level (i.e. lower level of resilience characterized by coping rather than adapting or transforming). Combined with even moderate rise in food prices, this loss of income raises concerns regarding the resilience of households and is eventually likely to reflect in diet and nutritional outcomes.

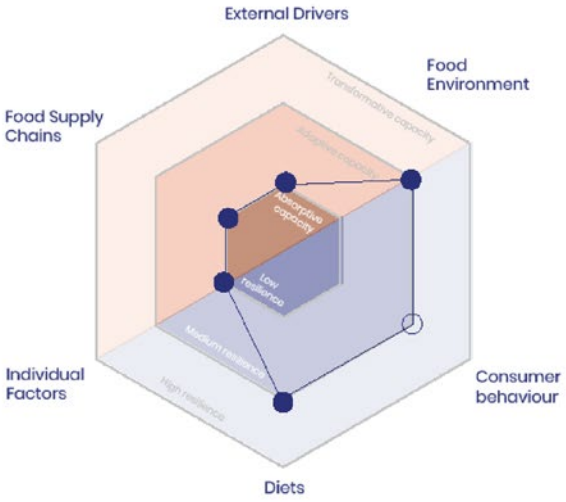
Comparison of the 8 city typologies: low level of resilience to cope with the COVD-19 Crisis

Absorptive | Adaptive | Transformative

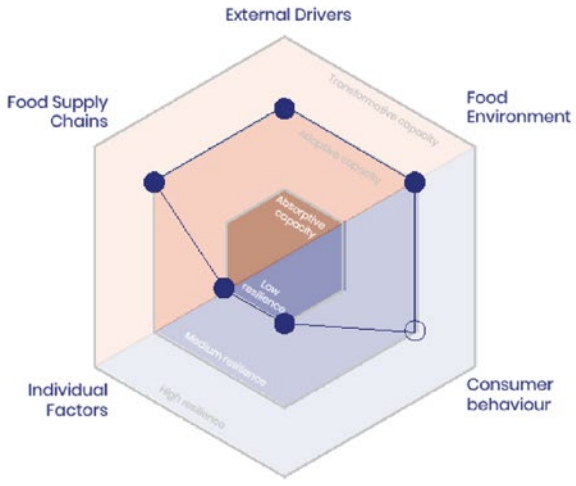
	External Drivers	Food supply chains	Food environments	Individual factors	Diets
Chittagong					
Cox's Bazar					
Dhaka					
Jakarta					
Kabul					
Peshawar					
Phnom Penh					
Quezon City					

The spider plots in the city briefs illustrate our assessment of urban food system resilience using the selected indicators. This enables comparisons between cities to identify strong or vulnerable parts of the food system. In the two examples below, Dhaka shows better availability of data (hollow circles indicate lack of data) and a higher level of resilience overall compared to Jakarta. However, Dhaka shows vulnerability in relation to food supply chains (indicated by proximity to cultivated land) and individual factors (indicated by reduction in average household income during the pandemic).

Example of typology for Jakarta



Example of typology for Dhaka



Positive opportunities for transformation of urban food systems exist. Innovative transformations represent an area that could be strengthened on the supply side to increase the resilience of the economy and the livelihoods of those working in the food system by protecting income and the access of vulnerable individuals to the food system. Interventions are needed to shorten food supply chains to make city food systems more sustainable and resilient.

The following recommendations are potential entry points for governments and development actors to consider in the response to COVID-19 and to strengthen the resilience of urban food systems against inevitable future shocks.
The targeted recommendations for WFP are listed below.
The full list of recommendations for other stakeholders are included in Section 6.

Program and policy recommendations:

Provide financial support through grants and technical assistance to SMEs in the food sector to protect the integrity of food supply chains:

- Use WFP's expertise in cash transfer to support e-voucher grants for SMEs to support a sustainable and resilient food systems. Business loans or grants to business with low or no interest (targeting could be done either based on location or products sold). Advertise existing support schemes more widely, especially those that are accessible to unregistered vendors.

- To increase street food vendors' resilience, provide skills development to street food vendors to make transformative changes to their business that allows greater resilience, notably through online sales, delivery platforms and marketing in general, or support to diversify their business. Skills training could be provided together with financial support.

- Support vendors to use technology to move to online

orders via collective channel (sales platform at low cost) or improve connections and communication with consumers. Support e-commerce that can reach poor urban-dwellers. Specifically for the case of Pasar Mitra Tani intervention in Jakarta, support targeted action to reach low-income residential areas and involve Jakarta's poor population more actively.

Support dynamic urban food supply chains:

- Supporting vendors to access wholesalers and pool resources to coordinate shared deliveries and negotiate better prices.

- Connect small urban vendors with small rural suppliers and bypassing the big operators.

- Set up COVID-19/pandemic safe logistics processes that put in place systems and safety to facilitate movement of goods while meeting safety requirements and tracking provenance.

- Support the development of communication platforms reaching poor urban dwellers. These platforms could support information sharing targeting por households on where food at most affordable price can be found in their community.

- Support government and municipalities initiatives during the crisis, such as the Ministry of Agriculture led intervention in Dhaka, to bring markets and foods closer to poor urban dwellers (refer to the deep dive case studies C2) and explore new approaches such as mobile markets. For these interventions, advocate to increase the nutrition-sensitivity of the project by promoting nutritionally higher quality foods. WFP supply chain could work with programme and relevant government counterparts to explore more effective supply chain and logistical solutions (e.g., for transporting goods to overcome difficulties encountered when using public transportation systems, liaising with Department of Agriculture Marketing about warehousing, cold chain, distribution mechanisms). This would however require broad-based consultation and intensive support from the different stakeholders (including, ministries, departments and NGOs). Mobile markets can support access of fresh products in poor urban areas during lockdowns and physical restrictions.

Social protection and safety net programs that are adaptive and responsive to shocks and support those worst affected, including the urban poor:

- Demonstrate the impact of cash transfers on food diversity for the current WFP led cash back intervention in Dhaka slums (refer to deep dive case studies C2) and promote the potential of cash incentives for Government and agencies to implement nutrition-sensitive social safety net programmes that have both food and nutrition security benefits for the target group.

- Increase the sustainability of cash transfer/assistance programmes by leveraging the potential of the programme to influence other components of the food system, including producers, retailers and consumers, as part of a systemic approach to food value chains. This can be achieved by ensuring that the cash is spent towards reinforcing the food supply chain (for example, via accredited street food vendors selling healthy foods).

- Promote the use of targeting and modalities that are urban and nutrition sensitive – recommend using Multi Dimensional Poverty Index (MDPI) for targeting, complement with SBCC tackling barriers of purchasing healthy foods, and include cash modality matching the cost of a healthy diet.

Urban agriculture programs to enable city residents and communities to grow their own food and generate extra income:

- Advocate for the inclusion of the urban poor and particularly families that are at risk of malnutrition (such as families with young children) into urban agriculture programmes (specifically in Quezon City where an urban agriculture programme is already operational – refer to the deep dive

case study C2).

- Provide technical guidance on increasing nutrition-sensitivity of the urban agriculture programmes.

- Provide strategic guidance on what foods make sense to do as urban agriculture and where things will not be competitive with rural suppliers, for example specialist foods that are highly nutritious and/or can be sold as specialist cash crops.

- Consider technical guidance on urban farming solutions (hydroponics, fertilizer) and provide specialist support lines and websites for problems solving and sale of cheap equipment. Create a city urban farming platform that links suppliers, transporters, equipment suppliers, consumers, technical experts, people providing loans/grants.

- Demonstrate the impact of the current urban agriculture programme in Quezon City on dietary diversity (Grow QC).

Methodological recommendations:

- **Standardised indicators of resilience and vulnerability are needed to facilitate comparisons between cities, especially for individual factors and consumer behaviour.** In future assessment, the indicators included in the urban analysis should be considered and can be adjusted depending on the type of shock in question or depending on local priorities. These include: Cultivated land within 50 km of city (km2 per 100,000 persons), proportion of food sector businesses with most suppliers located within the city, average change in food prices during a specific time frame based on 4 selected food items, reduction in average household income, Minimum Dietary Diversity for Women of Reproductive Age (MDD-W). For individual factors, child Food Insecurity Experience scale indicator should be used to capture the level of food insecurity experienced by children and adolescents, as research has shown that their experience is different to the household's head. More research should be undertaken to provide guidance on a standardized indicators relevant to consumer behaviour.

- **Further development and application of the typology of urban food systems resilience, which may be used as an operational tool to identify priorities and opportunities to strengthen resilience.**

- **Innovative approaches to defining urban areas and collecting city-specific data, such as combining local surveys with spatial, remotely sensed data that can bring unique insights:** Approaches that support and improve government's existing assessment, monitoring and surveillance tools and systems are recommended.

Section 1

Introduction

Introduction

Background on urban food systems in the Asia and Pacific region

Food systems should promote equitable and affordable access of safe, and nutritious food in adequate amounts. They are by nature at the confluence of many different sectors and areas of expertise, and need to be understood through comprehensive analytical frameworks that can holistically interpret complexities, such as sustainable use of natural resources, agriculture, food, nutrition and resilience. At the global level, initiatives from international declarations (such as the New Urban Agenda[2]), policies and conferences have contributed towards an increased focus on the role that urban food systems can play in enhancing nutrition, food security and promoting sustainable and resilient cities.

Before COVID-19, many countries in Asia and the Pacific region had faced sustained high malnutrition rates in urban areas despite significant reductions in poverty and a rise in per capita income. Calories have been made cheap and nutrients expensive due to a narrow focus on affordable grain production in these countries. Food systems have been focused on increasing food availability and often on facilitating the maintenance of rice self-sufficiency, but this has come at the expense of nutrient-dense diets. The focus on the grain production also contributed to degrading the environment and making food systems more susceptible to shocks.

Efforts to transform existing food systems that focus on the provision of affordable, nutritious and high-quality diets for all have remained insufficient. In Asia and Pacific countries, the urban poor spends most of its income on food, and poor families often cannot afford a nutritious diet. Street food[3] is a cheap and convenient source of food for millions of urban people[4], but it also contributes to the development of obesity and non-communicable diseases (NCDs) and may be lacking in food safety and hygiene. Additionally, poor regulation of the nutritional content of packaged foods, unfavourable taxes and tariffs8 imposed on healthier foods, and an abundance of junk food outlets, means that consumers are not informed or protected. Insufficient national policies aimed at eradicating malnutrition and transforming food systems have been implemented with the objective of making nutritious diets available and accessible to everyone[5]. At the individual level, food-related behavioursare influenced by socio-economic and cultural factors, including traditions and taboos, cost and purchasing power, gender inequality, education, the decision-making power of women at household level, and investment in women's nutrition.

[2] Stanley, J., 2016. The new urban agenda. Planning News, 42(4), p.29.
[3] Prepared or cooked food sold by vendors in a street or other public location
[4] FAO HLPE 2017. Nutrition and food systems. A report by the High-Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome.
[5] FAO HLPE 2017. Nutrition and food systems. A report by the High-Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome.
[6] IFPRI 2021. Impacts of COVID-19 on People's Food Security: Foundations for a more Resilient Food System. http://ebrary.ifpri.org/utils/getfile/collection/p15738coll2/id/134295/filename/134506.pdf

Overview of main impacts of COVID-19

The agriculture sector and key food supply chains actors under the food systems globally have been protected by governments during the crisis due to their role in delivering essential services. The dimension of food security that has been most affected is accessibility due the disruption in physical access to food outlets in urban areas, and affordability due to a decline in people's income.[6] Insufficient evidence exists on the impact on availability and use of foods. Issues around stability of food availability are reflective of resilience dimensions; although staple foods are mostly not affected, labour intensive/perishable crops and animal source foods are likely to experience more disruption. This is mainly due to a lack of manpower in farming and challenges taking produce to markets, leading to large scale food wastage. Big grocery stores and supermarket chains have been able to meet COVID-19 guidelines and remain open and have consequently survived and for some, benefited from the COVID-19 crisis, whereas small and informal food system actors often lacked support or social protection. These smaller providers are recognized as key suppliers of foods in poor urban areas of LMICs; they reportedly faced longer lead times in sourcing supplies, reduced labour capacity, greater challenges in meeting COVID-19 measures and overall increased running costs.[7]

Poor urban populations, particularly women, are likely to be the most vulnerable to the health and economic impacts of the COVID-19 crisis due to a decline in food security (UNHABITAT 2020).

Rationale for this study

Based on growing urban needs, WFP aims to support countries in achieving their vision and plans for 2030, as outlined in the WFP Strategic Plan (2017–2021). Urban programming can contribute to the achievement of SDG 2 (on zero hunger) and SDG 17 (on partnerships for the goals). WFP Regional Bureau Bangkok provides strategic guidance and technical support to WFP country operations in the region to support analysis, testing and the application of innovative programmatic approaches.

The gaps in evidence of urban food system weaknesses during the COVID-19 crisis and the likely consequences on food security and nutrition in poor urban population indicate a need to better understand urban food system dynamics and identify areas of interventions for WFP. Dikoda has been contracted by WFP to support urban food system analysis in its operational areas. Additional research will explore the effectiveness of interventions for strengthening nutrition-sensitive food systems and the development of mechanisms to enhance data collection from urban informal sectors.

[7] Carducci, B., Keats, E.C., Ruel, M., Haddad, L., Osendarp, S.J.M. and Bhutta, Z.A., 2021. Food systems, diets and nutrition in the wake of COVID-19. Nature Food, 2(2), pp.68-70.

Aims and objectives

The aim of this research is to assess the level of resilience of urban food systems in the face of the COVID-19 crisis in eight selected cities in the Asia and Pacific region. The geographic focus is in poor urban and peri-urban areas where vulnerable populations live.

The objectives are to:

1. Characterize the urban food systems by exploring external drivers, food supply chains, food environment, individual factors, consumer behaviour and dietary outcomes.

2. Assess the level of resilience using a typology of resilience.

3. Identify at-risk areas where populations are vulnerable and food systems weak.

4. Develop a food system data collection and analysis methodology that can evaluate change over time.

5. Consolidate WFP's programmatic work in urban areas and recent evidence collected during COVID-19 to contribute to the evidence base.

WFP World Food Programme

Section 2

Methodology

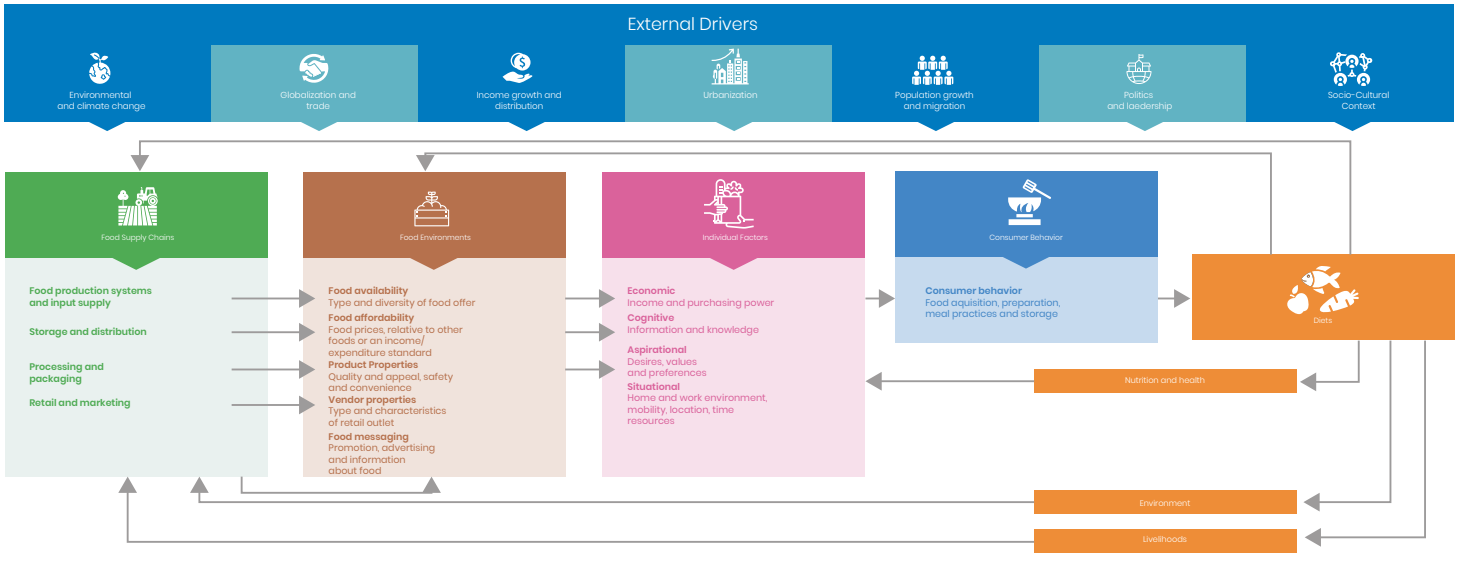
Methodology

This study was conducted between January 2021 and April 2021. All data collection and stakeholder engagement activities were conducted online due to global travel restrictions associated with the pandemic. The core research team was based in Europe and the Pacific, with support from national researchers in Bangladesh, Indonesia and the Philippines.

2.1 A conceptual framework for urban food systems

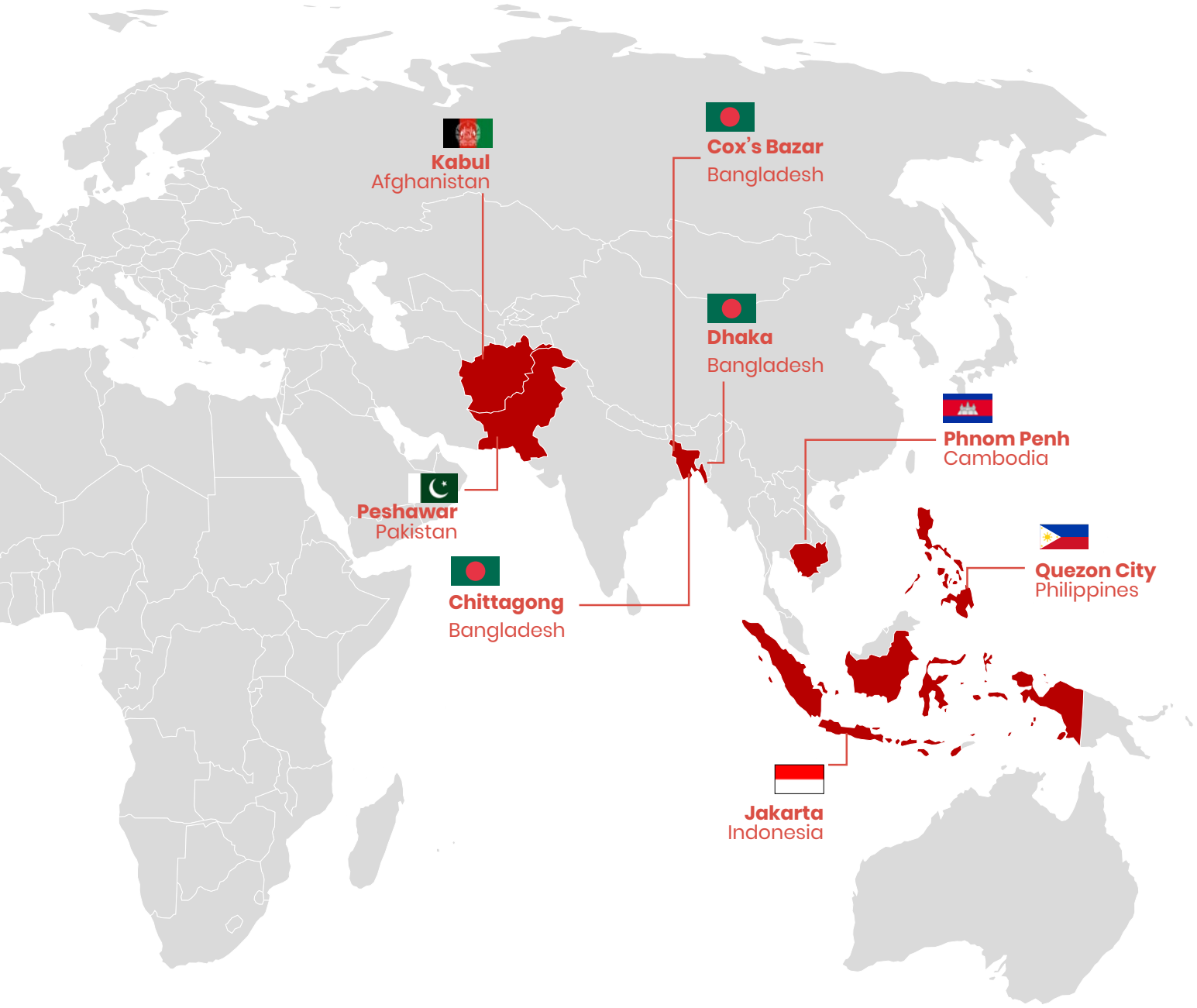
In this study, we used the Food Systems Dashboard Framework as the conceptual framework for our analysis of urban food systems (Figure 1). This framework depicts food systems in terms of external drivers (macro-level factors), four interrelated components of food systems (food supply chains, food environments, individual factors and consumer behaviour) and outcomes of food systems (including diet, nutrition and health). The dashboard was developed by Johns Hopkins University, the Global Alliance for Improved Nutrition and a range of international collaborators, as a tool for comparing country food systems; it is populated with country-level data for selected indicators. We applied the same conceptual framework to this study of urban food systems at city level. We used the framework to guide our analysis and examine the impacts of COVID-19 on urban food systems.

FIGURE 1.
FOOD SYSTEMS DASHBOARD FRAMEWORK



Adapted from: HLPE (2017). Nutrition and food systems. A report by the high level panel of experts on food security and nutrition of the committee on world food security, Rome, Italy

FIGURE 2.
MAP OF EIGHT CITIES INCLUDED IN THIS STUDY.



2.2 Selection of cities in partnership with WFP

A list of potential cities was developed in collaboration with WFP Regional Bureau Bangkok and Country Offices in the region. Inclusion criteria were primarily based on where WFP Country Offices are located, to facilitate rapid data collection and networking with relevant stakeholders.

The multi-agency SDFU (Status and Determinants of Food insecurity and Undernutrition) study was completed in the Philippines, Indonesia and Myanmar in 2020. Therefore, Quezon City (Metro Manila) and Jakarta were included in this study due to known data availability from SDFU. It was not possible to include Yangon after the military coup in February 2021.

Focus on poor urbans areas, slums, informal settlements

and peri-urban areas within these cities was prioritized in the selection and use of data through primary and secondary data collection efforts.
Consultation meetings were completed with each of the WFP Country Offices to explain the purpose of the study and what would be involved. This was an opportunity to assess levels of activity and engagement in relation to urban food systems, using an online questionnaire and an interactive online map to highlight areas of vulnerability.

After these meetings, the final list of eight cities was finalised (Figure 2):

1. **Chittagong, Bangladesh**
2. **Cox's Bazar refugee camps and communities, Bangladesh**
3. **Dhaka, Bangladesh**
4. **Jakarta, Indonesia**
5. **Kabul, Afghanistan**
6. **Peshawar, Pakistan**
7. **Phnom Penh, Cambodia**
8. **Quezon City, Philippines**

For Bangladesh, a decision was made in collaboration with the Country Office to include two cities and Cox's Bazar refugee camps (Kutapalong Mega Camp and host communities) for several reasons:

- Bangladesh has one of the highest rates of urbanization in the world and is experiencing rapid growth in its secondary cities
- A high level of experience of urban programming
- Cox's Bazar is the largest refugee operation worldwide with Kutapalong mega camp hosting close to 900,000 refugees.

2.3 Overview of study methods

A combination of primary data collection and secondary data analysis was used to assess the impacts of COVID-19 on urban food systems in the eight cities (Figure 3).

Primary data collection:
Surveys were conducted with three groups of stakeholders:

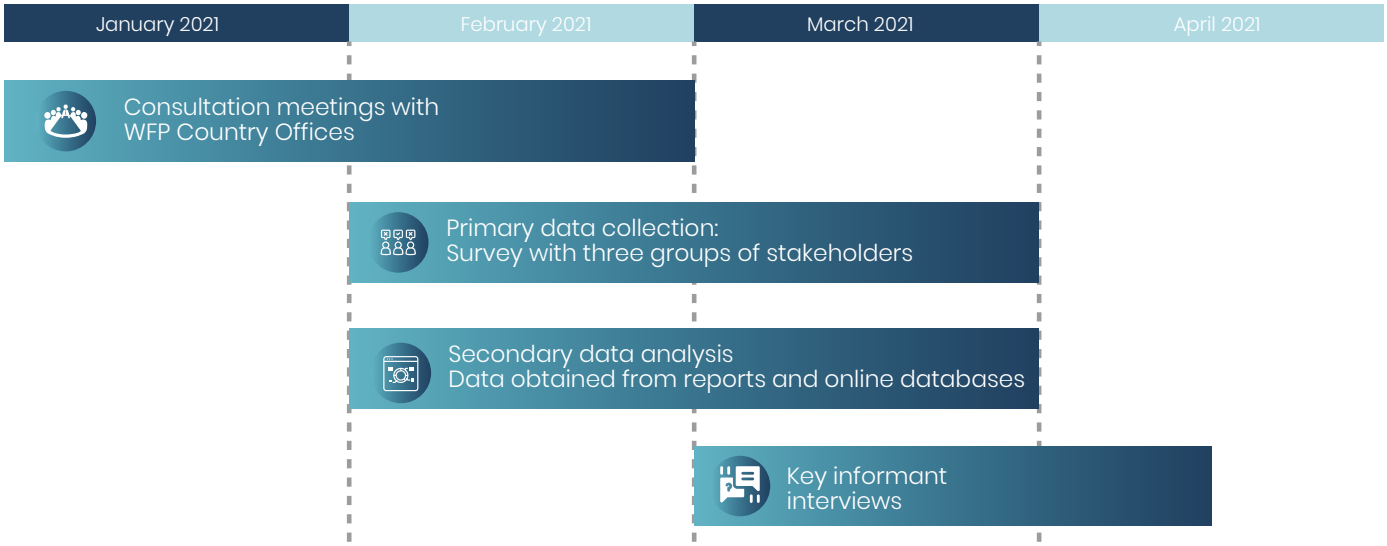
- Private sector – businesses in the food sector
- Local government actors
- UN agencies, NGOs, charities and other development actors

In total, 2,528 respondents were included.

TABLE 1.
SUMMARY OF SURVEYS CONDUCTED

Stakeholder group	Survey sample
Private sector Round 1	1,181
Private sector – Round 2	575
Local government actors	274
UN agencies, NGOs, charities and other development actors	498
Total	2,528

FIGURE 3.
TIMELINE FOR CONSULTATIONS AND DATA COLLECTION



Survey instruments were designed to investigate the impacts of COVID-19, strengths and vulnerabilities in the city food systems, and response priorities in each city. They were translated into local languages and administered by national call centres in local languages using an online data entry system. The contact lists were based on numbers from phone books, online searches and street maps, based on agreed criteria.

For the private sector, we conducted two survey rounds. The first was a short questionnaire to assess the impacts of the pandemic on SMEs, supply chains and business income. Respondents were asked if they would be willing to participate in a more detailed survey. In the second round, we used a modified version of the questionnaire developed by GAIN and WFP (as co-conveners of the SUN Business Network)[9] , which was used in 17 countries in May 2020. This included questions on business adaptations to mitigate the effects of the pandemic and ability to access financial and technical support.
The private sector surveys were complemented by a small number of interviews with market vendors and street vendors (in Dhaka, Jakarta and Quezon City) to capture their personal experiences during the pandemic.

Secondary data analysis:
Data were obtained from reports and online databases for selected indicators of vulnerability relating to components/outcomes of food systems (aligned to the Food Systems Dashboard Framework). WFP VAM staff assisted researchers to identify the most relevant and up-to-date sources of data.

The following types of data were prioritized:
- Standardized indicators to facilitate comparisons between cities
- Baseline (pre-COVID) and data collected during the COVID-19 pandemic (2020-21)
- City-level data (alternatively, district or regional data)

We used national Demographic and Health Surveys (DHS) data to produce city-level indicators for Chittagong, Dhaka, Jakarta, Kabul, Peshawar, Phnom Penh and Quezon City. We included the most recent surveys for each country (Table 2). We then selected the urban district (admin2) level data

[9] Nordhagen et al. (2021) COVID-19 and small enterprises in the food supply chain: Early impacts and implications for longer-term food system resilience in low- and middle-income countries. https://doi.org/10.1016/j.worlddev.2021.105405

corresponding to the city of interest. Many of the indicators selected were missing for Quezon City and data on anaemia was only collected in Phnom Penh. All analyses were performed in Stata version 16.1, using appropriate survey-weighting techniques with Stata's svyset command.
We recognize the limitations of using DHS data when conducting city-level analysis datasets used for this analysis because it was not designed for looking at urban district level data alone, but data availability with the granularity required is very limited. It was important to frame a discussion of food security and food system resilience around the best available information. We were hoping to compile urban district level data for populations from the lowest wealth quantile, but sample sizes were too small.

Spatial data:
To complement data on vulnerability, a number of spatial datasets were used to provide context to the analysis on food security for each city. City-specific data is in general inadequate for cities in the region, however a number of global data products exist that help to describe the context in

TABLE 2. AVAILABLE INDICATORS FROM DHS DATA

DHS indicators	Chittagong	Dhaka	Jakarta	Kabul	Peshawar	Phnom Penh	Quezon City
Wasting in children <5 years	✓	✓			✓	✓	
Stunting in children <5 years	✓	✓			✓	✓	
Overweight in children <5 years	✓	✓			✓	✓	
Exclusive breastfeeding (0-5 months)	✓	✓	✓	✓	✓	✓	✓
Early initiation of breastfeeding within 1 hour	✓	✓	✓	✓	✓	✓	✓
Minimum diet diversity (MDD) 6-23 months	✓	✓	✓	✓	✓	✓	
Minimum meal frequency (MMF) 6-23 months	✓	✓	✓	✓	✓	✓	✓
Minimum acceptable diet (MAD) 6-23 months	✓	✓	✓	✓	✓	✓	
Different food groups consumed by breastfed 6-23 months old: Fruit and vegetable rich in vitamin A, other fruit and vegetable, meats, and eggs	✓	✓	✓	✓	✓	✓	
Anaemia in women (15-49 years)						✓	

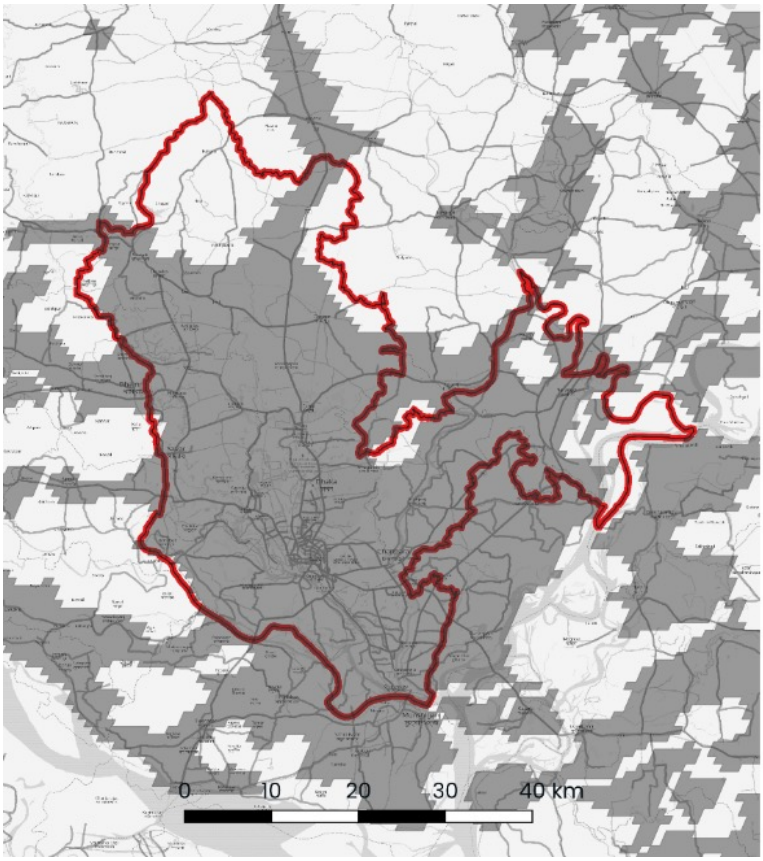
which food security issues can be considered. We have used a number of peer-reviewed datasets that provide data specific to towns and cities, based on the use of remotely sensed, satellite imagery. Specifically, data from the Global Human Settlements Layer (GHSL) project has been used to describe the extent built-form, and population density of the focal cities. This data is important as it grants an appreciation of cities that transcends a purely administrative definition of a city and the land that surrounds it – appropriate to the study of urban food systems.

Where DHS and other statistical data may be limited by its granularity and representation, GHSL and other types of spatial data provide location-based information relating to population trends and dynamics and in relation to land-use changes, the presence of infrastructure, natural hazards, and other external drivers that may influence food security and vulnerability. It is also possible to identify the location of specific components of the food system in relation to the population – for example, food markets, modern grocery outlets.

This can aid in identifying the location of more vulnerable populations both within and on the fringes/outside the official city limits. Clearly there are limits to defining the relationship between people and their susceptibility to food insecurity from satellite images – the goal here being to help WFP and its partners to contextualize how they think about urban food systems and more generally about targeting vulnerable urban populations.

This data is also important as it can facilitate regional-level comparisons providing common observations at both a spatial and temporal level. To allow for replicability open source data and tools have been used throughout, much of which was developed by the European Copernicus space program[10]. The focus here has also been on simple, rapid ways of assessing urban areas against factors that are likely to contribute to the resilience of the urban food system.

FIGURE 4. DEFINING CITIES



This map highlights one of the basic challneges of programming in urban settings - how to define the city. More often than not the functional urban area, or the population that is actively contributing to the economy of a city extends far beyond the administrative jurisdicaton of a city administration. The grey shaded area here shows the urban 'footprint' of Dhaka - and clearly the urban area extends outside of the formal boundary of Greater Dhaka. The implication here is that there are many 10s or 100s of thousands of people outside of the purview of city administraitons, and perhaps not benefitting from the services and support that urban local governments provide. In Dhaka this may amount to c. 6 million + persons.

Mapping the footprint of settlements using satellite data provides a objective way of identifying patterns of growth and location of potentially vulnerable populations i.e. with poorer access to quality urban infrastructure and services (WASH etc), insecurity of tenure etc.

Greater Dhaka Metropolitan Area
GHSL boundary (2015)

[10] See for more info: https://ghsl.jrc.ec.europa.eu/

Key informant interviews:
WFP Country Offices provided contact details or introductions to food systems stakeholders in each city. These included representatives from local government, UN agencies, national and international NGOs, SUN Business Networks and Food Security and Nutrition Cluster Coordinators. Additional stakeholders were identified by the research team, such as private sector actors in the food industry and community-based organizations involved in supporting the food system during the pandemic.

A topic guide was developed to explore the impacts of COVID-19 on urban food systems, the support provided to vulnerable groups during the pandemic, and priorities to improve the resilience of urban food systems. The research team completed key informant interviews with up to five stakeholders in each city (30 in total). Recordings of the interviews were used to make notes on key findings, data sources and any other relevant information.
We also conducted short, on-site interviews with small business owners in Quezon City (n=3), Dhaka (n=3) and Jakarta (n=2) to explore the impacts of COVID-19 on their businesses and livelihoods. They included food factory owners, marketplace vendors and street food vendors.

2.4 Purpose and development of the COVID-19 city briefs

The COVID-19 City Food System Briefs aim to provide snapshots of the city-level food systems and COVID-19 related impacts and vulnerabilities. The city briefs are based on the conceptual model of the Food Systems Framework (Figure 1) with focus on available data and components that are likely to be impacted by COVID-19. The city briefs are not trying to comprehensively describe the food systems; rather they are to highlight important aspects of urban food systems that have been, or risk being, negatively affected by COVID-19.
The city briefs source data from primary and secondary materials. The methods for primary data collection are detailed in the Overview of study methods (2.3). Secondary sources include WFP's food price monitoring and surveys on COVID-19 impacts carried out by development actors. Pre-COVID-19 data has been used to highlight vulnerabilities in the food system that existed before the crisis. Available data from secondary sources varies across cities as levels of analysis (city, district, urban, national) and metrics used differ. The city briefs aim to enable meaningful comparison of data across cities, but some variation in secondary data inevitably exists. Even within a city, pre-COVID and recent data may not have been collected using the same metric or level of analysis, but data has been contrasted with each other where reasonable. The nature of the pandemic has led to data collection often taking place over the phone and organizations using proxy indicators.

The indicators in the 'External drivers' section of the city briefs have been mostly derived and calculated from Global Human Settlements Layer (GHSL) data (as described above). The data source for each indicator is quoted at the end of the briefs. DHS data has been disaggregated to strata level to obtain figures specific to the city.

The development of the food system typology, presented in the briefs as a spider plot, is detailed below.

2.5 Purpose and development of typology

We used the data gathered in this study to develop a typology of resilience in urban food systems. We assessed resilience in relation to the COVID-19 pandemic, but the same typology could be adapted to assess resilience to other types of shocks and disasters.

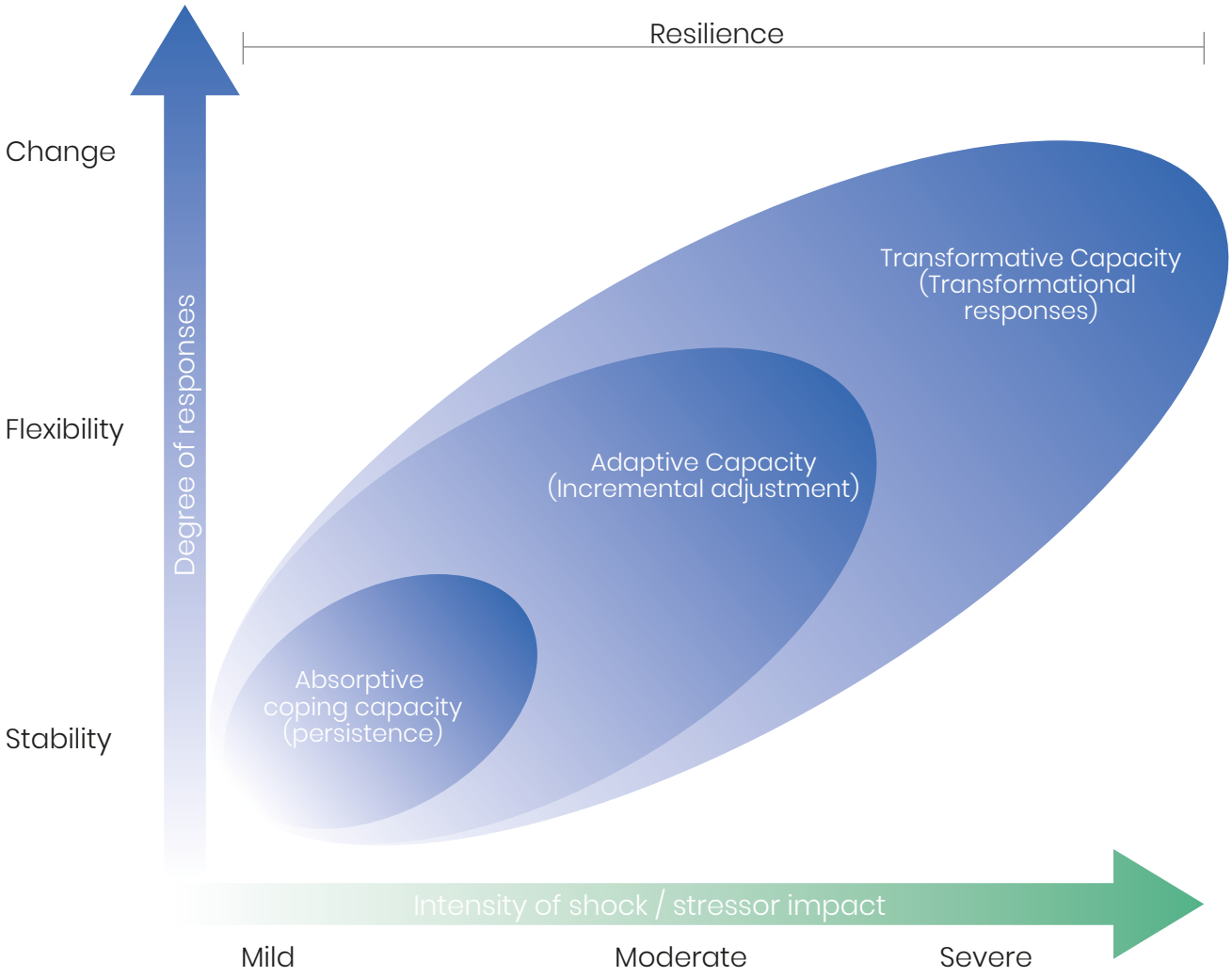
Resilience is the ability of a system to adapt and recover after a shock has occurred. This complex and dynamic process depends on the severity and intensity of the shock and the vulnerability of the system. We hypothesized that different parts of the food system may exhibit different levels of resilience and adapt and recover at different rates to the COVID-19 pandemic.

In the context of food security and nutrition, resilience has been described[11] as an emergent process resulting from a combination of three capacities and responses:

1. **Absorptive capacity –** leading to persistence (or coping with the shock)
2. **Adaptive capacity –** leading to incremental adjustments/ changes/adaptations
3. **Transformative capacity –** leading to transformational responses

Figure 5 illustrates that more intense or severe shocks demand a greater degree of flexibility and change to enable systems to adapt and transform – rather than merely cope with the shock. Therefore, resilience reflects the capacity to develop and implement strategies and responses to counter the conditions of vulnerability.[10]

FIGURE 5. RESILIENCE AS THE RESULT OF ABSORPTIVE, ADAPTIVE, AND TRANSFORMATIVE CAPACITIES10



[11] Béné et al. (2016) Is resilience a useful concept in the context of food security and nutrition programmes? Some conceptual and practical considerations. https://doi.org/10.1007/s12571-015-0526-x

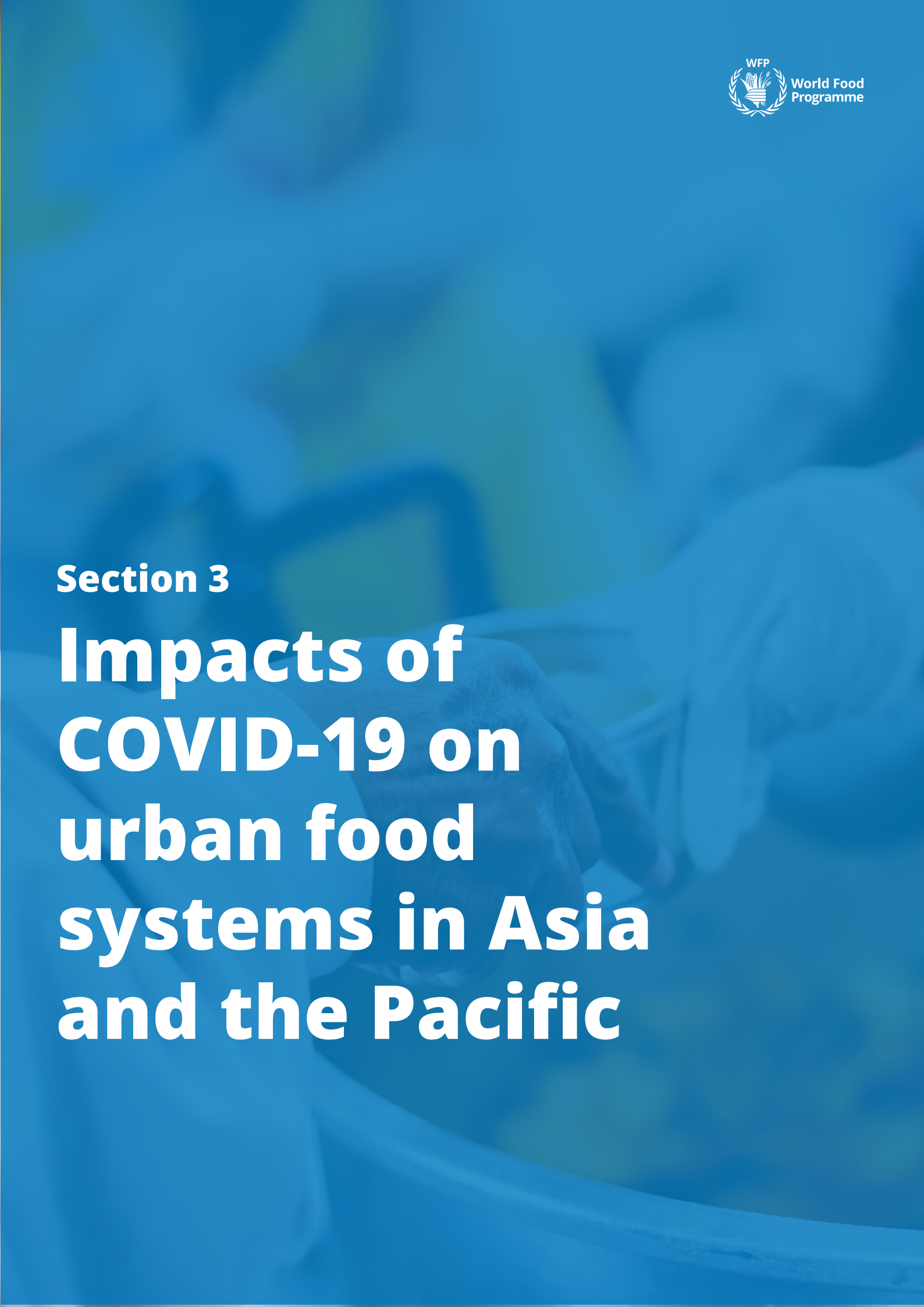
We combined this conceptualisation of resilience with the Food Systems Dashboard Framework to examine resilience in urban food systems (Figure 6). We selected one key indicator for each dimension of the Food Systems Dashboard Framework: external drivers, food supply chains, food environments, individual factors, consumer behaviour and diets (outcomes). For each indicator, we developed cut-offs for absorptive capacity, adaptive capacity and transformative capacity. These capacities may also be interpreted as low, medium and high levels of resilience respectively. This categorization is somewhat reductionist because the three types of capacity are interdependent, and a combination is needed for resilience. However, we felt that viewing them as levels of resilience, or steps on the pathway to resilience, would help to identify areas of urban food systems where adaptations may be happening – but transformation may be needed.

The indicators we selected were influenced by data availability. Nevertheless, there were still gaps in the typology due to heterogeneous data collection and reporting between cities and/or lack of 2020 data showing the impact of COVID-19.

The values and cut-offs for each indicator are presented in Section 5. These values were used to create a spider plot for each city, which are included in the city briefs (Section 4). This typology offers a simplified classification of resilience in urban food systems, which can be used to compare cities and identify priorities and opportunities to strengthen resilience. It is intended as an operational tool, which may be modified and adapted. For example, the selected indicators may be adjusted depending on the type of shock in question or depending on local priorities.

FIGURE 6. INDICATORS USED IN THE TYPOLOGY OF RESILIENCE

	External Drivers	Food supply chains	Food environments	Individual factors	Consumer Behaviour	Diet
Indicators used in this study	Cultivated land within 50 km of city (km2 per 100,000 persons)	Proportion of food sector businesses with most suppliers located within the city (%)	Average change in food prices (during pandemic) based on 4 selected food items (%)	Reduction in average household income (%)	NO INDICATOR FOR ALL CITIES** ** Data were available for consumer behaviour for only two cities.	Minimum Dietary Diversity for Women of Reproductive Age (MDD-W) (%)



WFP World Food Programme

Section 3

Impacts of COVID-19 on urban food systems in Asia and the Pacific

Our study findings are presented in the context of external drivers, the four components of food systems and diet outcomes (Figure 1). We applied this conceptual framework at city level to explore the impacts of the COVID-19 pandemic and implications for the resilience of urban food systems. These dimensions of food systems are multi-dimensional, overlapping and interrelated. This study is not a comprehensive analysis of the complexity of urban food systems. However, it provides a regional overview using available data and case studies from eight cities in the Asia and Pacific region. This section concludes with eight city briefs, which provide a visual representation of the available data and highlight areas of vulnerability and resilience in city food systems. They also enable comparisons between the eight cities and highlight data inconsistencies.

3.1 External drivers

External drivers are macro-level factors that 'push or pull' at the food system, including climate change, globalization and trade, income distribution and growth, urbanization, population growth and migration, politics and leadership, and socio-cultural context[12]. During Covid-19, migration or lack of movement due to COVID-19 lockdown and movement restrictions is also an important factor worth noting influencing food system form demand side.

These factors influenced how and why the coronavirus originated and spread around the world, how people and governments responded, and its impact on food systems. In-depth analysis and exploration of external drivers is beyond the scope of this study. However, some external drivers of urban food systems are represented in our city maps to provide context for our analysis (see Section 4).

We used proximity to cultivated land in our typology because we felt this was an important driver in relation to food supplies during the COVID-19 pandemic (see 3.2).

Historically, cities and city growth relied on a surplus from nearby food sources to feed their citizens. Many of the cities in this study and most cities in low and lower middle-income countries in Asia continue to enjoy a symbiotic relationship with the rural hinterlands that surround them – which provide, among other things, food, labor, and land, to satisfy demand in cities. There is somewhat of an inevitability that as urbanization proceeds and cities grow and incomes rise, there is likely to be a loss of cultivated land near cities.

The characteristics of urbanization – urban density and urban growth – are important determinants of the economic success of a city and the contribution cities make to a national economy. The interaction of households and firms, sharing costs, labor, and ideas, and engaging in increasingly higher value-added economic activities, and the conversion of rural/agricultural land to that with higher value uses. The economic pull of cities is generally what attracts migration from rural areas and the transition from farm-based to off-farm jobs.

Evidence from a global study of cities suggests though that as incomes rise, cities tend to expand outwards, in a fragmented manner, with average densities falling over time.[13] This suggests both an inefficiency in the way land is used and a likely growth in inequality, as those who can afford to consume more land do so, restricting supply for others, who must then live on smaller plots, often in marginal locations in overcrowded conditions.

Very high density living – that can be observed in many of the study cities – is also associated with overcrowding resulting in diseconomies of scale – congestion, contamination and contagion. COVID-19 has been an urban pandemic, with high density, overcrowded neighborhoods – more likely to be the home of the urban poor – disproportionately affected.[14] On the fringes of cities, in peri-urban areas, settlements may expand outside the formal administrative area, where residents may not benefit from formal urban services, despite contributing to the economy of the city. On average an additional 12% of each city's population live outside the formal city boundaries but within a contiguous urban area – that with urban form and characteristics.

[12] The Food Systems Dashboard. Global Alliance for Improved Nutrition (GAIN) and Johns Hopkins University. 2020. Geneva, Switzerland. https://foodsystemsdashboard.org/

Equally, as agricultural land on the fringes of cities is converted to higher-value urban uses, cities become more reliant on global food supply chains. With many millions of urbanites at the mercy of global food prices, the urban poor are likely to remain the most vulnerable, typically spending a higher proportion of earnings on food.

The eight cities included in this study are affected by a multitude of external drivers. Migration and extreme weather events caused by climate change are two examples that may have contributed to and/or compounded the effects of the COVID-19 pandemic in urban areas. For example, 30% of the urban study population is at risk from flooding (average across the eight cities). The city most susceptible to flooding is Phnom Penh, where around 90% of the population is increasingly affected by climate change. The city most recently experienced severe flooding in October 2020.[15]

Migration as external driver: the example of Cox's Bazar

Flows of refugees from conflict often strain food availability in host communities. Between August and October 2017, 671,000 Rohingya fled violence and persecution in Myanmar for the safety of Cox's Bazar District in the Chittagong region of southeastern Bangladesh. There, they joined Rohingya who had fled earlier violence during the previous 20 years.[16]

The impact of the sudden increase of refugees, from 169,000 to about 910,600, on the Bangladeshi host community has been immense. The overall population in Ukhia and Teknaf sub-districts has almost tripled and refugees outnumber local residents by a ratio of 3:1[17]. The crisis has affected the host community significantly, through loss of natural resources, increases in food, cooking fuel and transport costs, and a highly competitive labor market with greatly decreased wages[18].

The impact of COVID-19:

The economy in Bangladesh started experiencing the impacts of the COVID-19 crisis in early to mid-March 2020, with the first case reported on March 7. A full countrywide lockdown followed from March 26 to May 28. Cox's Bazar municipality, the urban center of the district, has a non-agricultural economy (97%). Trade and services comprise almost 70% of the local economy, followed by industrial and manufacturing jobs, such as in construction and miscellaneous non-agricultural labor . The increase in market prices observed as a result of lockdown movement restrictions had a huge impact as most people depend on day-to-day wage labor[19]. Lockdown meant no income for many and difficulty accessing markets to buy food. Before COVID-19, the food security and nutritional status of the poorest amongst the host community was already a growing concern. In November 2018, 39% of households were vulnerable to food insecurity, of whom 11% were highly vulnerable[20]. In late 2020, the number of households highly vulnerable to food insecurity had risen to 51%. The food consumption situation remained stable for the Rohingya community in camps as humanitarian aid adapted to the situation and continued providing assistance[21-22]but overall vulnerability increased in both the host community and the Rohingya community as a result of the COVID-19 crisis[23].

This example illustrates the complexity and influence of external drivers of urban food systems, which are unique to every context. The following sections consider the impacts of COVID-19 on the components of urban food systems, including three key factors introduced above: food supply chains, food prices and income.

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[13] T Angel (2012) Planet of Cities. Lincoln Institute of Land Policy.
[14] Sahasranaman and Jensen (2021) Spread of COVID-19 in Urban Neighbourhoods and Slums of the Developing World. https://doi.org/10.1098/rsif.2020.0599
[15] Analysis by Dikoda using data from Dottori et al. (2016) Flood hazard map of the World - 100-year return period. European Commission, Joint Research Centre (JRC) [Dataset] PID: http://data.europa.eu/89h/jrc-floods-floodmapgl_rp100y-tif
[16] IFPRI Global Food Policy Report 2020. Chapter 5 Refugees and Conflict-Affected People
Integrating Displaced Communities into Food System shttp://ebrary.ifpri.org/utils/getfile/collection/p15738coll2/id/133648/filename/133859.pdf
[17] IFPRI/BIDS, Economic Activities of the Forcibly Displaced Rohingya Population – An Analysis of Business Enterprises in Southeastern Bangladesh, September 2018
[18] http://www.fao.org/3/i8776en/I8776EN.pdf

[19] WFP Cox's Bazar Urban Vulnerability Assessment - 2020
[20] WFP Refugee influx Emergency Vulnerability Assessment (REVA 2) 2019
[21] WFP in Cox's Bazar | Information Booklet October 2020
[22] FEX 63 (ennonline.net)
[23] WFP Refugee influx Emergency Vulnerability Assessment (REVA 4) 2020

3.2 Food supply chains

Food supply chains refer to the steps involved in producing food and transporting it to where it is consumed, and include agricultural production, storage and distribution, processing and packaging, retail and marketing. [24]

During the COVID-19 pandemic, food supply chains around the world have been disrupted (in some cases for multiple, prolonged periods) by transport and movement restrictions imposed by governments. Urban food systems have been disproportionately affected by these restrictions because they rely on food brought into the city from rural areas, where most food production occurs.

Urban areas typically have longer and more complex supply chains than rural areas, which makes them more susceptible to disruptions during shocks. Specifically in poor urban and peri-urban areas, weak infrastructure and recurrent exposure to external shocks mean that food supply chains are likely to be less resilient compared to wealthier urban areas.

There are many factors that influence the complexity of food supply chains, including geographical or agri-environmental factors. As explained in the previous section, proximity to cultivated land is a key indicator of resilience in terms of whether a city will be able to feed its population when food supply chains are compromised.

Phnom Penh is surrounded by a much greater area of cultivated land than the other cities included in this study (7,212 km2 within 50 km of the city compared to 2,959 average for 7 cities)." Its relatively short supply chains proved to be an asset during the pandemic and food supplies remained relatively stable, with a diverse range of fresh and non-perishable goods available in most shops and markets. Many people in the c ity have connections to family members living in nearby rural areas. An NGO stakeholder witnessed

[24] The Food Systems Dashboard. Global Alliance for Improved Nutrition (GAIN) and Johns Hopkins University. 2020. Geneva, Switzerland. https://foodsystemsdashboard.org/

FIGURE 7A: AVAILABILITY OF CULTIVATED LAND IN CLOSE PROXIMITY TO PHNOM PENH

Phnom Penh is set within a fertile area of cultivable land. Of all the cities that were the focus of this study it has the best access to cultivated land in absolute terms and relative to its population. The city has around 193 km2 of cultivated land per 100,000 persons

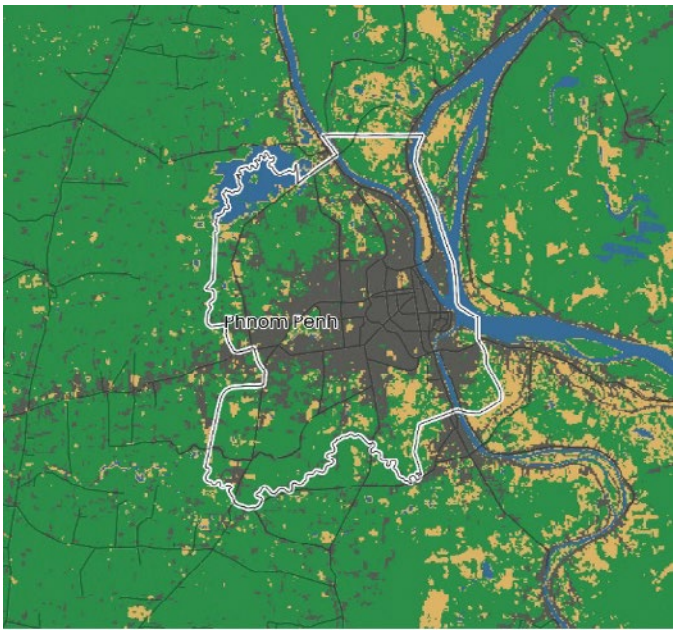
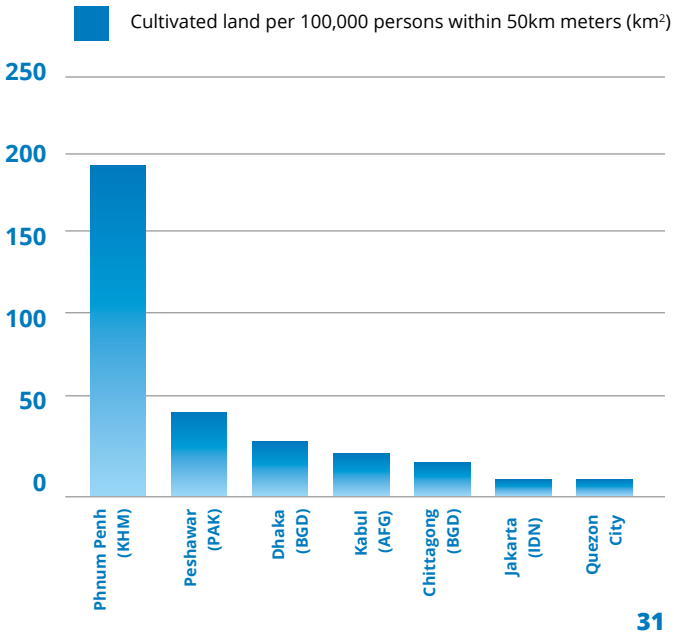


FIGURE 7B: AVAILABILITY OF CULTIVATED LAND IN CLOSE PROXIMITY TO PHNOM PENH



food exchanges between rural and urban households after movement restrictions were lifted, such as bags of rice brought into the city from rural areas where they are cheaper.

The other cities included in this study are more dependent on more distant food supplies. The COVID-19 pandemic exposed vulnerabilities in food supply chains and highlighted opportunities for strengthening the resilience of urban food systems. Examples from Peshawar, Jakarta and Quezon City will be considered later in this section.

The following selected survey findings offer insights into the extent and nature of disruption to food supply chains and the impact on businesses in the food sector. The city briefs include disaggregated data for each city (Section 4).

In the UN/NGO survey, 43% of respondents reported that food supply chains in their city were disrupted by the pandemic (n=469). Respondents said all major food groups were in short supply compared to normal times: fruit and vegetables (50%); animal source foods (38%); staple grains (42%); nuts and seeds (43%); manufactured, packaged or processed foods (62%).

The first round of our private sector survey included 1,181 businesses across the food sector including food production (17%), manufacturing and processing (11%), storage and suppliers (20%), retailers and caterers (21%) and other food-related businesses (31%). The survey respondents were mostly owners of small businesses (classified as SMEs); over half (57%) had fewer than 10 employees, and 93% had fewer than 50 employees. In this sample, 40% of SMEs reported that their suppliers are primarily located outside the city in which they are based (Figure 8).

As expected, food retailers and caterers primarily used suppliers located within the city (73%). This was true for about half of the agricultural producers, manufacturers and suppliers. Agricultural producers and food suppliers were each served by a fifth of suppliers from other regions in the country. Most business owners reported that supply chains were moderately (55%) or severely (24%) disrupted by the pandemic, and access to customers and markets was moderately (56%) or severely (27%) disrupted. Three quarters of

FIGURE 8. LOCATION OF SUPPLIERS FOR CITY-BASED SMES IN THE FOOD SECTOR

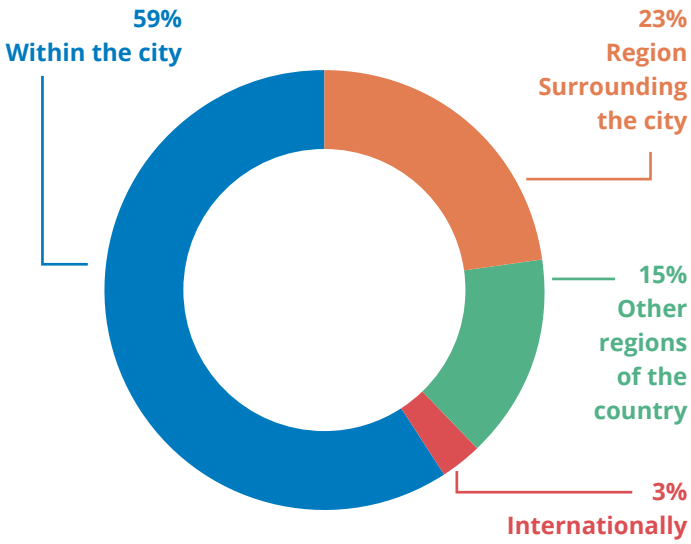


FIGURE 9. ACTIONS TAKEN TO REDUCE THE COST OF OPERATIONS IN % (N=561)

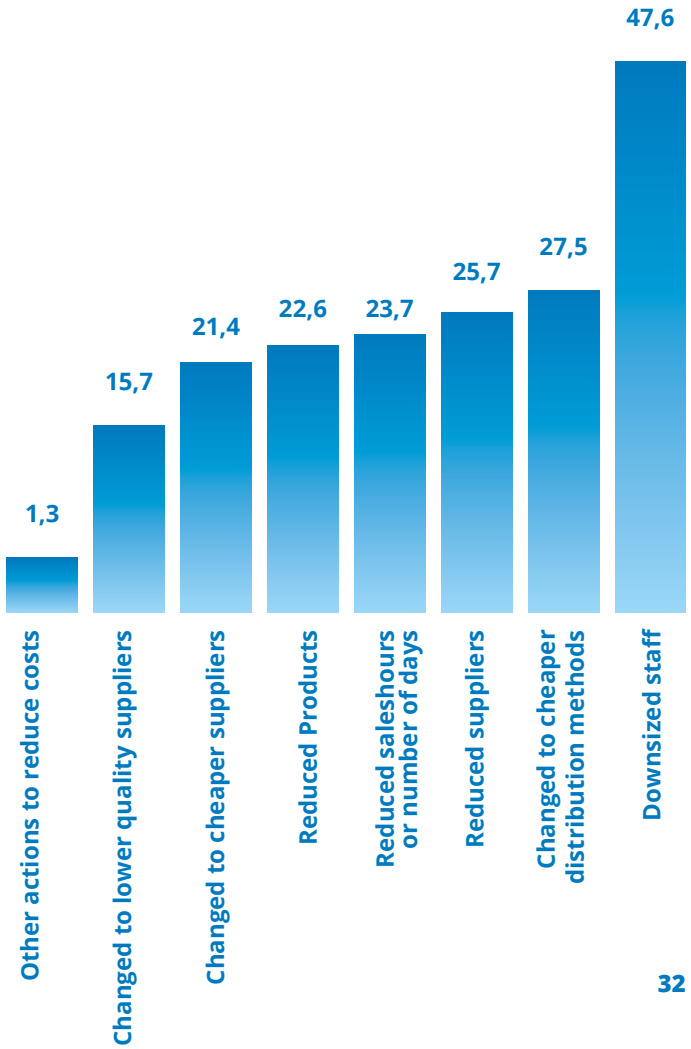
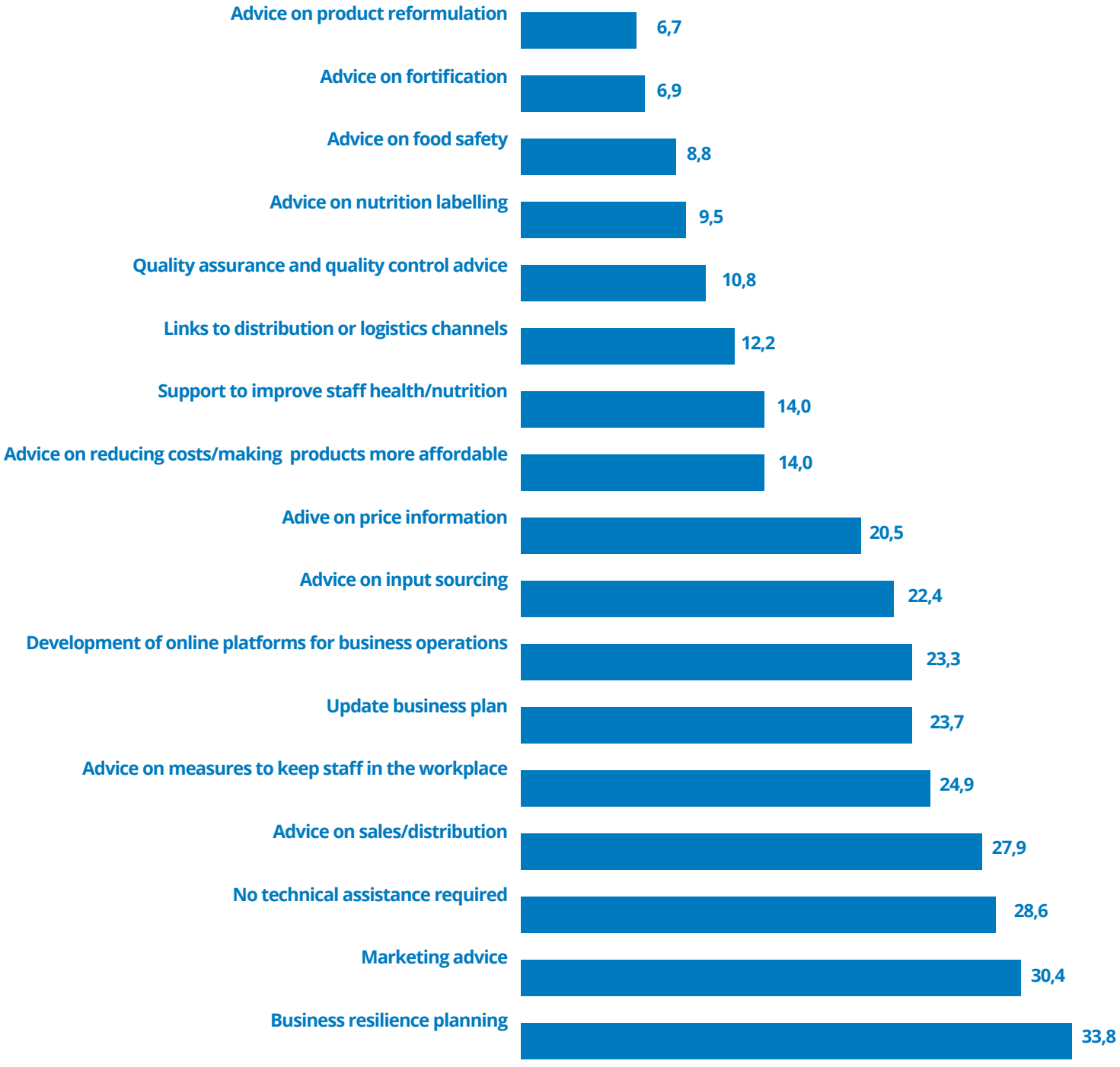


FIGURE 10. TYPES OF TECHNICAL ASSISTANCE REQUIRED TO COPE WITH THE IMPACT OF THE PANDEMIC (% OF RESPONDENTS WHO SAID YES TO EACH OPTION; N=566)



SMEs had experienced lower income during the pandemic. Business owners had to find ways to reduce operational costs, with downsizing staff the most common action taken (48%) (Figure 9). Over 80% of business owners said they were unable to access financial support during the pandemic (n=344).

Marketplace vendors in Quezon City explained how their businesses were affected by supply chain disruptions and loss of customers/revenue. They survived by adapting and diversifying their businesses to attract new customers.

"The COVID greatly affects us because our income and sales went down. The decrease was more than half. Ever since COVID, there were lots of restaurants that closed. These restaurants are major customers of our products – fruits. When they closed, our sales also went down ... The adjustments we made, we first looked and identified what people need. When our sales of fruits went down, we diverted into selling other products like fruit shake ... We have not received any financial assistance. We were able to survive in our own ways since we do not have any other source of income, that's why we need to adapt with the situation in this time of COVID. What people need, that's what we will sell."

Elpedio Serapion (aged 45)

"The effect on us was more negative since our patron customers were gone. Our income really went down, meaning our income from what we sell now is only a quarter [of our usual income]. It is now more difficult to get products from our suppliers. There were times that prices are high, other times, prices are low ... Currently, what we do is posting [our products] on Facebook so that people will order only from us then we deliver to them door-to-door. At least with the delivery, we are getting 5 pesos since we are using motorbike."

Melissa C. Baluyot (aged 28)

"We experience a lot of income loss. We have a lot of loans. We greatly loss our income … Since we need [extra income], I added this small canteen [street food]. There is additional income because price is low. Our usual customers are also the vendors from the stalls inside as well as the soldiers who are guarding this place."

Rosalyn de Paz (aged 30)

Transport restrictions threatened food supply chains serving urban areas, especially during the early stages of the pandemic. A range of government and private sector interventions helped to protect supply chains and keep food moving from rural areas into major cities.

Peshawar is one of the largest cities (population wise) in Pakistan's Khyber Pakhtunkhwa (KP) Province, with a population of 4,267,198, almost two times higher than the second largest city. It is surrounded by mountain ranges on three sides and food production is seasonal (due to cold winters) including wheat, potatoes and a small variety of fruits and vegetables. Peshawar relies on food supplies from more productive agricultural areas such as Punjab Province, especially for wheat (the staple grain) and fresh fruits and vegetables.

Food supply chains were initially disrupted during the first wave of the COVID-19 pandemic, however, the Government of Pakistan responded by relaxing transport restrictions to keep food supplies moving around the country. The situation stabilized and supply chain disruptions were minimal thereafter. In April 2020, UN agencies reported no major food supply or availability concerns in most parts of the country.[25] In Peshawar, food markets remained open and well supplied.

[25] WFP and FAO. Rapid Assessment: Possible Impact of COVID-19 on Livelihoods, Food Security, Nutrition and Agricultural Supply Chain in Pakistan. April 2020.

The Government of Pakistan and other food system stakeholders recognize the need to protect food supply chains from future shocks and emergencies. One stakeholder in Peshawar referred to 'supply chain smoothening' to improve the resilience of the food system. Improved storage facilities are needed to reduce post-harvest losses from local produce (during the short growing season) andpreserve food transported from Punjab Province. Investments have been made in grain storage facilities and seed silos, to support wheat supply chains. Further investment is needed in affordable cold storage solutions.

Jakarta is a megacity with a population of more than 10 million, and over 30 million in the Greater Jakarta area. It is highly dependent on food imported from rural areas of Java, other islands/regions of Indonesia and other countries. Jakarta experienced a high burden of COVID-19 cases (described as the red zone) and transportation of food into the city was disrupted at the beginning of movement restrictions[26] in 2020.

The Government of Indonesia identified a range of challenges impacting food supply chains, such as poor post-harvest handling, lack of cold storage facilities and high logistics costs for inter-island trade – all of which were exacerbated by movement restrictions. In the city of Jakarta, priority access was granted for trucks delivering nutritious and perishable foods such as fruits and vegetables. Food trucks were marked with stickers to indicate which commodities they were transporting and what level of access they were permitted. These drivers were also exempt from isolation requirements.

Online marketplaces are helping to improve food supply chain logistics in Indonesia. An example is TaniHub, an e-commerce platform established in late 2015 to enable consumers and businesses to buy fresh produce directly from farmers at fair prices and sustainable quantities. The company experienced six-fold growth in 2020 as the demand for online marketplaces increased during the pandemic. When Jakarta implemented large-scale social restrictions, TaniHub collaborated intensively with the local government at the supply and demand side of food and agricultural products. The company aims to complete and deliver all orders within 48 hours. Packages are placed in front of the customer's house to minimize contact between customers and couriers. TaniHub has also established a warehouse near Jakarta to ensure food supply and delivery speed to Jakarta and its satellite cities are not disrupted[27]. In the forthcoming deep dive case study on TaniHub, the access and its use by poor urban populations is questioned and recommendations are proposed to overcome barriers identified.

Similarly, the National and Provincial Food Security Agency, under the Ministry of Agriculture, established an online food market, Pasar Mitra Tani (Farmers Partner Market) in two Jakarta sub-districts, targeting public and low-income families. The market connects farmers directly with customers, so that food commodities can be sold at affordable prices and delivered by local taxi motorbikes.
The trend of urban farming has increased since Jakarta implemented a work-from-home policy. Many people have started to grow their own vegetables, fruits and traditional medicinal plants such as ginger and turmeric, since their prices spiked in the markets. The government responded positively and supported this community-based initiative by providing seeds and growing media, which can be ordered online and delivered. The government aims to expand this initiative to dedicate 30% of the available open space in the city, including the rooftops of several mosques, to horticulture crops.[28-29]

In October 2020, the Government of Indonesia passed a new Omnibus Law, which aims to create jobs and stimulate domestic and foreign investment. It includes measures to simplify the importation and distribution of food products and agricultural inputs coming into the capital, while supporting local food production and diversification, to reduce overall dependence on imported goods. It is hoped that this new law will help to strengthen food supply chains and stabilize food prices, thereby improving food availability and affordability.

[26] World Food Programme. Indonesia COVID-19: Economic and Food Security Implications (4th Edition).

[27] Sari, F 2020, 'TaniHub sediakan bahan pangan selama PSBB,' accessed 18 April 2021 <https://www.validnews.id/TaniHub-Sediakan-Bahan-Pangan-Selama-PSBB-kxK>

Interventions are needed to shorten food supply chains to make city food systems more sustainable and resilient. Urban agriculture is one solution that is gaining popularity and delivers a host of other sustainable urbanization benefits, such as increasing access to recreational spaces, greening neighborhoods, and influencing microclimates through urban cooling.

Quezon City is the gateway of food from rural provinces to the whole of Metro Manila. When travel restrictions were imposed in March 2020 to control the spread of coronavirus, the flow of food commodities from agricultural production areas to urban markets was significantly disrupted. This affected the supply of vegetables, fruits, meats, and other agricultural produce into Quezon City and Metro Manila.

This disruption to food supply chains resulted in unstable food prices, reduced food availability and concerns about food quality and safety. Combined with the impact of the pandemic on food access (due to movement restrictions) and affordability, this situation increased the risk of food insecurity especially among vulnerable population groups. In response, the Quezon City Government established a Food Security Task Force (QC-FSTF) in May 2020. This is part of the city's economic recovery plan from the COVID-19 pandemic. The task force aims to mitigate the impact of the pandemic through initiatives on food security and self-sufficiency by promoting urban agriculture, the development of agricultural zones and food zones, and through overall improvements to the city's food systems.

The QC-FSTF's objective is to ensure that food in Quezon City is always available, accessible, and used for better health and nutrition among its citizens. A key part of its strategy is the Urban Agriculture Program, which builds on an existing initiative – the Joy of Urban Farming. This initiative started 10 years ago to help low-income households grow their own food, reduce their household expenses and serve as source of livelihood and extra income.

Throughout the pandemic, the QC-FSTF's Urban Agriculture Program has supported households and communities to cultivate their own vegetable gardens and urban farms. It has distributed over 42,000 seed starter kits – containing seeds, seedlings, and garden tools. The program also provides training and seminars to households and communities to build their capacities in establishing and sustaining household gardens and urban farms. Produce from the household gardens and community farms are used by the families for their consumption and for generating income.

The QC-FSTF is developing four models of urban agriculture: a) household gardens, b) community gardens and farms, c) institutional gardens, and d) commercial farms. Other key projects and The QC-FSTF is developing four models of urban agriculture: a) household gardens, b) community gardens and farms, c) institutional gardens, and d) commercial farms. Other key projects and activities are also planned, such as Community Kitchens, which would help to raise demand for produce from urban farms, and the development of Agri Zones and Food Zones in the city.

Garden of ASF Victims, Brgy. Bagong Silangan, Quezon City .
Photo Credit: Rowena Campo.

[28-29] The Food Security Agency & the Food Security Agency of Jakarta, 2021, personal discussion, 12 April 2021.

3.3 Food environments

The food environment is where consumers interact with the food system to acquire food, including physical locations where food is bought (such as markets, shops and restaurants) and factors that influence the way people access foods. [30]

In this section we focus on food availability and food affordability – two important aspects of urban food environments that were affected by COVID-19.

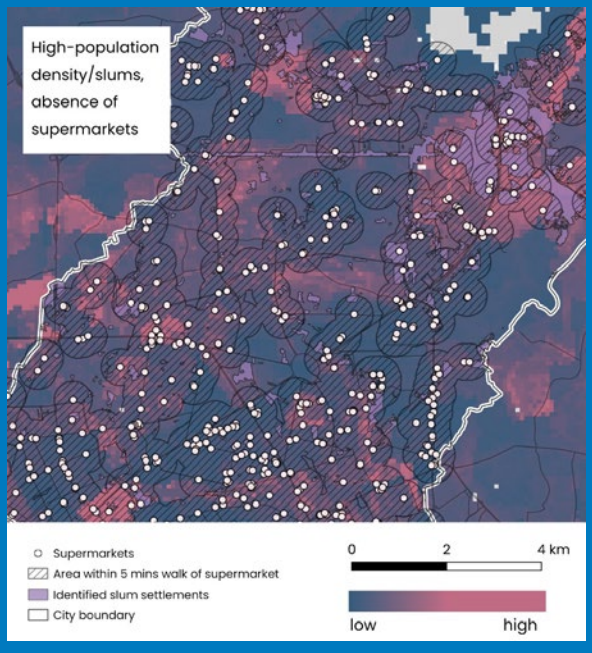
Food availability refers to the sufficiency of food (quantity and quality) supplied to the population, including domestic food production and imports. Food availability was affected by disruption to food supply chains during the pandemic (as described in 3.2). In most cities, food supplies stabilized after the initial shock and sufficient food was available for those who could afford it. However, food availability was also affected by market closures and this has fundamentally altered the way people interact with the food system.

Food affordability refers to the cost of food and whether people can afford an adequate and nutritious diet. Even before COVID-19, affordability of healthy diets was a significant constraint; it is well known that healthy diets cost more than basic staples and energy sufficient diets.[31-32] In the State of Food Security and Nutrition in the World (SOFI) 2020 report using 2017 price data from 170 countries, showed that a healthy diet cost 60 percent more than a diet which only met essential nutrients, and five times more than a diet which only satisfied energy needs via a starchy staple. [33]

Availability of modern food retail outlets, Quezon City.

Urban food systems provide a range of access points for food from local productions sites, street food vendors, wet/local markets, food vendors, cafés, restaurants, and modern, convenience shopping in supermarkets or other food outlets. Analyzing the prevalence and distribution of modern food shopping outlets can provide some insight into the resilience of the food system (particularly where a city is reliant on food imports); and also useful in beginning to identify how access to food varies, spatially. Modern food retail in cities in lower and lower middle-income countries are unlikely to provide an affordable food environment for most poor urban residents who are more likely to rely on the informal food sector. However, the location choices of these outlets or rather the absence of these outlets may identify areas of interest from a programming perspective. For example, combining population density maps with the location of modern food retail outlets may highlight where there are large numbers of people with specific types of access to food i.e. street vendors, wet markets etc. Although an absence of modern food retail in no way implies no access to food, it may help highlight areas or neighborhoods with specific characteristics in terms of access to food.

The map below shows the location of supermarkets in Quezon City in relation to the population density of the city. One can see large, densely populated areas with no modern supermarkets within 5-10 minutes' walk. This signposts areas that may warrant further investigation in terms the resident population and local food outlets.

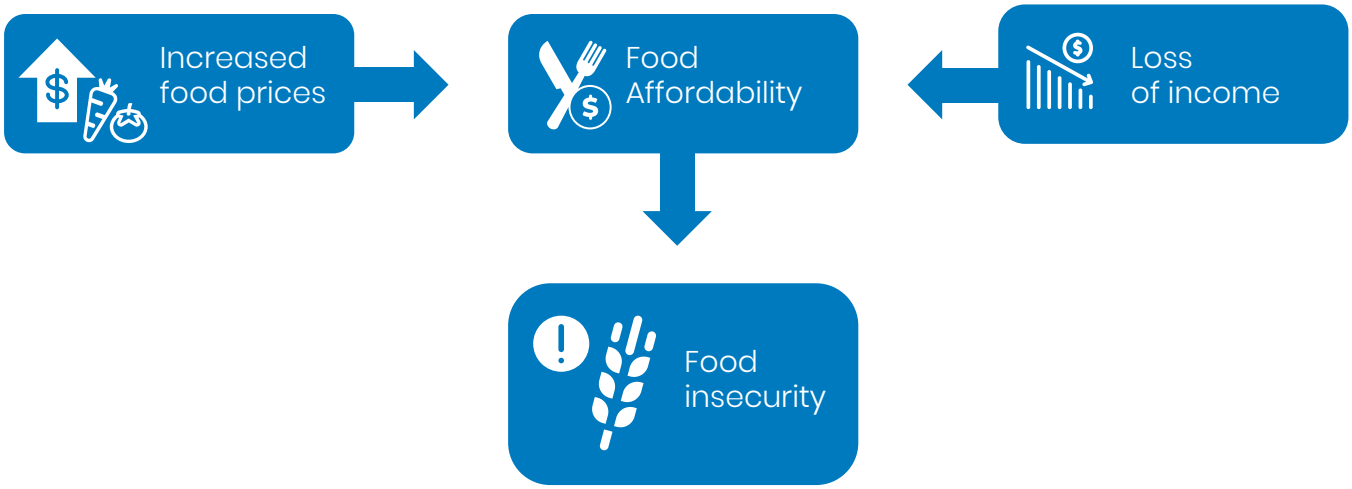


[30]The Food Systems Dashboard. Global Alliance for Improved Nutrition (GAIN) and Johns Hopkins University. 2020. Geneva, Switzerland. https://foodsystemsdashboard.org/

[31]Drewnowski A, Darmon N. Symposium: Modifying the Food Environment: Energy Density, Food Costs, and Portion Size Food Choices and Diet Costs: an Economic Analysis. 2005.

[32]Chastre C, Duffield A, Kindness H, Lejeune S, Taylor A. The Minimum Cost of a Healthy Diet. 2007.

FIGURE 11. THE DUAL IMPACTS OF COVID-19 ON FOOD AFFORDABILITY AND FOOD INSECURITY



The affordability of a nutritious diet may be limited by high food prices or low household income or a combination of both. In our UN/NGO survey, 65% of respondents reported that food affordability was disrupted by the COVID-19 pandemic (n=469). The urban poor were affected by the dual impacts of increased food prices and loss of income (Figure 11). This made food less affordable and contributed to food and nutrition insecurity among groups of people that were not previously vulnerable.

Food prices increased during the pandemic in all eight cities, with considerable variations between cities and between food groups.

Food commodity prices are influenced by a multitude of macro-level factors (external drivers of the food system) including currency fluctuations, energy prices, inflation, government subsidies, food production shortfalls, seasonal variations, and natural disasters, to name but a few. It is beyond the scope of this study to assess how all these factors came into play during 2020-21.

National statistics authorities and WFP VAM teams have monitored retail and wholesale food prices of key commodities in urban markets throughout the pandemic. These data have been summarized in the city briefs (Section 4), showing the year-on-year price change for selected food items in each city.

We also used these data to calculate the average price change between January 2020 and December 2020 (based on four commonly consumed food items). This was our selected indicator for food environments in our typology of resilience in urban food systems.
All eight cities showed an average increase in food prices in 2020, but there was considerable variation between the food groups used in the calculation (Figure 12). It is important to acknowledge that the average value used in the typology is an oversimplification of a complex situation.

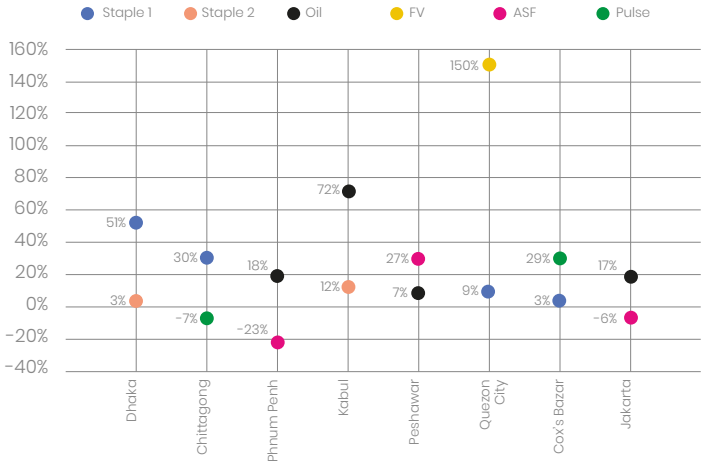
There was also considerable variation between cities. The lowest average increase in food prices was in Phnom Penh

[33] Schmidhuber J, Shetty P. The nutrition transition to 2030 Why developing countries are likely to bear the major burden. 2005.

(+2% based on four selected food items: rice, vegetable oil, morning glory and snakehead fish). This may be in some part attributable to its shorter supply chains and relatively stable food supplies during the pandemic (as discussed in 3.2). The greatest average increase in food prices was in Quezon City (+47% based on four selected food items: rice, oil, tomatoes and fish).

Figure 13 shows the monthly price fluctuations for these and other food items in Quezon City in 2020. All vegetables increased in price (ranging from +25% for carrots to +250% for cabbage). Animal source foods varied with some increasing in price (fish +18% and pork belly +42%) and others stable (eggs 0%) or declining in price (chicken -6%). Other key commodities also varied with some increasing in price (rice +9% and cooking oil +9%) and others declining in price (sugar -9%).

FIGURE 12. FOOD PRICE CHANGES IN 2020 (%) SHOWING HIGHEST AND LOWEST VALUES FOR FOODS INCLUDED IN OUR AVERAGE CALCULATION IN THE TYPOLOGY (SEE TABLE 4).



We cannot explain these food price fluctuations, but such differences are likely to undermine diet diversity by making some foods less affordable than others. This has been observed in Quezon City. Minimum Diet Diversity in children (aged 6-23 months) was 7.7% in 2020 (SDFU Philippines Urban Survey) compared to 25.1% in 2018 (Expanded National Nutrition Survey data for Quezon City). Pre-COVID data were not available for women's diet diversity (MDD-W) in Quezon City. However, the SDFU 2020 survey conducted in urban slums reported that only 16% of women achieved the minimum diet diversity of 5/10 food groups (see 3.5).

Loss of income during the pandemic meant that food was unaffordable for many people in cities who were not previously considered vulnerable.

Peshawar was initially affected by supply chain disruptions (as described in 3.2) but the situation quickly stabilized, and food markets were well stocked after they reopened. Food affordability has been a much greater challenge than food availability in Peshawar during the pandemic. The average food price increase in Peshawar from January 2020 to December 2020 was 17% (calculated from WFP VAM data using four key commodities).

In addition to food price increases, many people lost their incomes, making a diverse and nutritious diet unaffordable. This affected daily wage earners and people working in the informal sector, such as street vendors, construction workers and taxi drivers. However, it also affected some private sector employees who were not paid for several months. A report by the Pakistan Bureau of Statistics found that 55% of the working age population in KP Province were either affected by job losses or reduced income during the pandemic.[34] The financial implication at household level was 67% reduced household income in urban areas (compared to 63% in rural areas) in KP.

A new category of urban poor emerged in the city – households that were not previously considered vulnerable were suddenly experiencinvtg food insecurity. A UN stakeholder in the city observed increased numbers of men and women (including some well-dressed people) begging on the streets because they could not afford to buy food. Data are not yet available showing the impact on diet quality in Peshawar. However, a nutrition cluster stakeholder reported that families were coping by reducing diet diversity and consuming staple foods to meet energy needs. Essential items were distributed, including wheat flour, ghee, lentils and other dry rations.

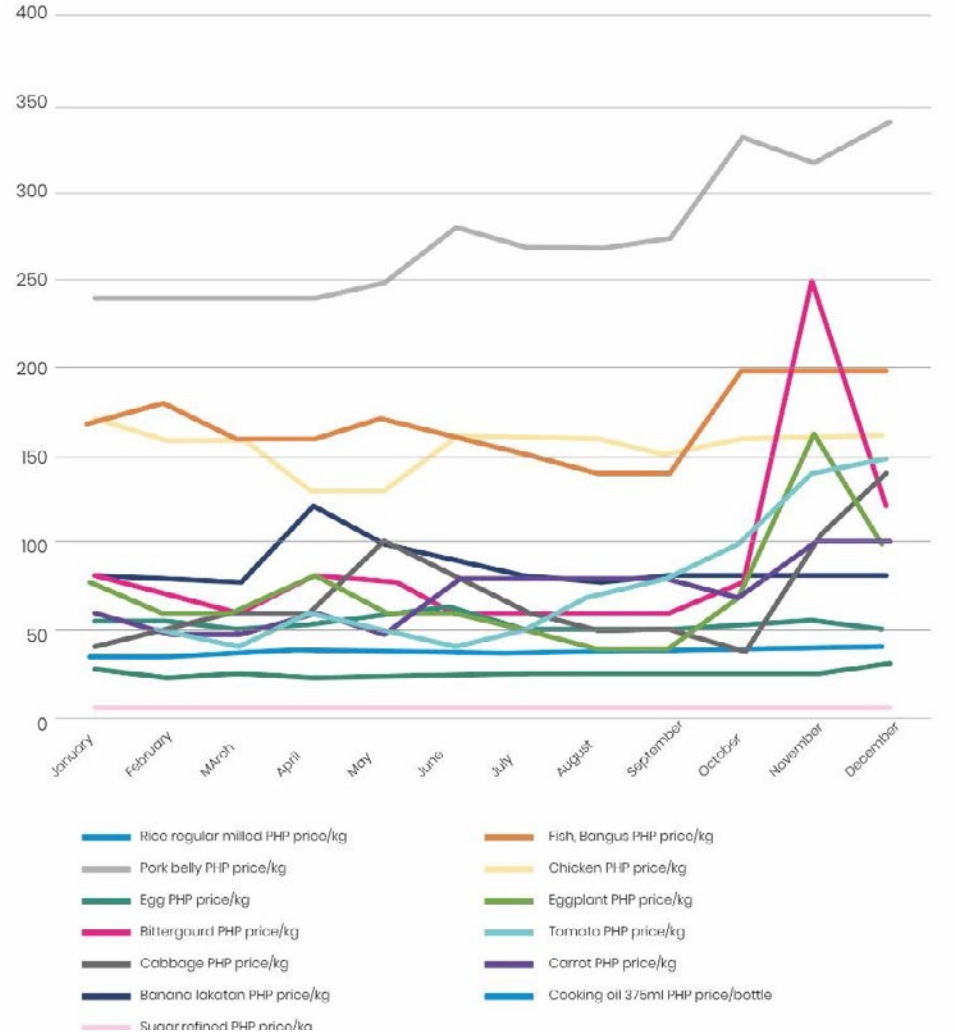


FIGURE 13. MONTHLY FOOD PRICE FLUCTUATIONS FOR KEY COMMODITIES IN QUEZON CITY IN 2020 (DATA SOURCE: PHILIPPINE STATISTICS AUTHORITY)

The Government of Pakistan responded to this crisis by launching the Ehsaas Emergency Cash Programme in April 2020. This reinforced the Benazir Income Support Programme (BISP) with more inclusive eligibility criteria to account for increasing vulnerability in urban areas. A web-portal and SMS service were launched so that people could check their eligibility and register for the benefits using their national identity number.

The next section of this report highlights the role of social protection to support people affected by loss of income (3.4).

Daily wage earners have experienced loss of income, indebtedness and food insecurity – many are struggling to rebuild their livelihoods.

Dhaka residents have endured two months of lockdown and prolonged restrictions since the start of the COVID-19 pandemic. Many people lost their incomes and livelihoods, with informal sector workers and daily wage earners among the hardest hit. Loss of income was greater for men (76%) than women (69%) reported in the rapid response research [35]. Garment factories were closed. Street vending was not permitted. Marketplaces were initially closed, then later re-opened with reduced opening hours and fewer customers. The following direct quotes illustrate the impacts of the pandemic on street vendors and market vendors.

[34] Government of Pakistan. Special survey for evaluating socio-economic impact of COVID-19 on wellbeing of people. December 2020.
[35] https://www.pprc-bd.org/debt-burden-doubles-urban-and-new-poor-struggle-to-recover-pprc-bigd-study/
Microsoft Word - 20 May_PPRC-BIGD Final April Survey Report.docx (bracu.ac.bd)

Zakir Hossain, 37, is a street food vendor in the Amtali, Mohakhali area of Dhaka city. He has survived the financial hardship of the pandemic by borrowing money, reducing his own food consumption, and accepting food from neighbors for his children. He faces new challenges as some customers have changed their behavior and purchasing patterns.

"Lockdown became a severe burden for me and left no option for generating income nor even any savings to survive. Before pandemic, I used to earn 800-1000 BDT daily which [was] enough to survive my business with meeting daily necessities. To combat economic crisis, in the first week of this restriction, I borrowed money as there was a hope that everything will be normal in the coming week. However, the restriction was extended, leaving me in uncertainty. To survive, I coped with different mechanisms including selling vegetables in residential areas to keep my business viable, but the affluent [were] more dependent on online shopping or super shops. Poor people were not able to spend money on vegetables or fresh items and they depended on rice and potatoes. I had no money to send my family back to [my] hometown, so I borrowed money from my father, and am also eating less and sometimes neighbors share food with my children. When government lifted the lockdown, I returned to street vending, but the revenue was down three-fold despite doubling my business time. I am not looking for any financial assistance but hope that to avoid more suffering and hunger the government will not impose any further restrictions."

Md. Riaz Mia, 29, is a market vendor in Mohammadpur Kacha Bazar. His shop was relocated due to lack of space for social distancing in the bazaar. He also borrowed money to survive and his earnings remain over 50% lower than before the pandemic.

"Before the pandemic my shop was in the market area but after the lockdown started, the shop shifted to nearest playground. We faced lots of difficulties because of this change. My revenue dropped to 3,000 BDT instead of 7,000-8,000 BDT daily before pandemic. We didn't have as many customers as before. I borrowed money with interest and survived during that time. Still I have debt of 50,000 BDT. I don't know how I will cope if there is another lockdown. I am not asking for any financial assistance, but proper market planning is required so people could easily access the market."

Samar Chandra, 32, is a market vendor in Banani Kacha Bazar. He said fewer people were visiting the market because they believe that supermarkets offer a safer environment. He has adapted by offering home deliveries, but he faces competition from larger online retailers. He hopes that markets will be improved to encourage more customers to return safely.

"This sudden lockdown severely affected revenue, which dropped to a third of what it was before the pandemic. The marketplace is not clean and safe and due to fear of infection, customers are starting to visit supermarkets. The markets are almost closed down. The city government relocated the perishable goods shops in the market to the nearest park. Only the grocery shops stayed at the market. The number of customers increased slowly but not same as before. We established an alternate home delivery service for people who call, but it is not as convenient as the service offered by supermarkets or online grocery businesses. As the park is an open place, when there are two customers at the same time and I suggest that one keeps their distance and waits, they go to another vendor and I lose customers. It will take time to recover. To tackle the next pandemic, I recommend that markets be renovated to provide customers with a good environment."

In Jakarta, we spoke to two small business owners who have survived by adjusting and adapting to the situation. Financial and technical support are needed to help these and other businesses to diversify and develop new opportunities.

Mrs Lilis, 66, runs a tofu factory and distribution company in East Jakarta. Her business sells fresh tofu directly to individuals and markets, and raw soybeans to the tempe processing industry. Her business has been affected by the increased cost of raw materials (soybeans) and reduced turnover when the markets were closed. She stayed in business by reducing the number of employees (from 30 to 15) and taking a loan from the bank. She has also started supplying directly to catering companies, but this comes with additional requirements to meet hygiene and health standards. Her son helped her to set up an online delivery service using local motorbike couriers.

Mrs Elda, 45, runs a small Padang food restaurant in one of the slums in West Jakarta. It has been established for decades but she does not have an official business license. Before the pandemic, she usually sold out of food by 2 pm. Now there are always leftovers. Many of her customers were people working nearby who have lost their jobs. The cost of raw ingredients (such as chilies and meat) has increased, and her business income has halved. She would like to develop an online delivery service, but she does not have the knowledge or expertise and would like to receive technical assistance with marketing.

"Although the cooking ingredients are not as expensive as before, the price is still higher than before the pandemic. We cannot increase the price or reduce the food's size because we do not want to lose more of our customers. Now, more customers choose to cook at home ... We did not do much, only open the food stall longer until 5pm, where the leftovers will be sold for the next day. Fewer customers mean less revenue. What we do is to cut the salary of our employees."

3.4 Individual factors & consumer behavior

These two components of the food system have been combined into one section of this report, partly because they are closely related. Individual factors influence what foods a person buys and eats, such as income and purchasing power (economic factors), information and knowledge (cognitive factors), values and preferences (aspirational factors), home and work environment (situational factors).[36] Consumer behavior includes people's food decisions related to buying, preparing, storing and consuming food.

Data availability limits national and sub-national comparisons for individual factors and consumer behavior – except for economic factors (such as income and expenditure). The Food Systems Dashboard highlights the need for more high-quality data and key indicators, which would strengthen understanding of the relationship between food systems and diets. [37]

The COVID-19 pandemic has limited opportunities for data collection at individual and household level. Household income was the only indicator for which we found comparable data (for 7/8 cities) showing change before/during the pandemic. We selected this as our key indicator for individual factors in our typology of resilience in urban food systems.

We did not identify an appropriate indicator for consumer behaviour for all eight cities. Only for two cities, Jakarta and Quezon City, data **on consumer behaviour showed that households dramatically altered the way they purchased food due to COVID-19 – including by reducing purchases of nutritious foods** (SDFU P and I 2021). During the pandemic, many households in Jakarta reduced the purchase of nutritious foods such as meat, poultry and fish (62 per cent), eggs (47 per cent), fruit (49 per cent) vegetables (28 per cent) and beans pulses and tofu (30 per cent) due to limited purchasing power. In Quezon City, among the food items that households stopped buying because of lack of money were: meat (16 per cent) and meat organs (23 per cent); seafood (40 per cent); and corn (33 per cent). The households also resorted to buying cheaper foods as substitute; however, this was only practised by a few households and was most noticeable for rice, breastmilk substitutes, dairy milk and fish, for which cheaper replacements were used.

Average household income declined by at least 40% in all cities, with the largest decline (75%) reported in urban slums in Bangladesh (from February to April 2020).[38] (Refer to Table 4 under Typology)

The previous section highlighted the dual impacts of loss of income and increased food prices on food affordability in urban areas (Figure 11). Food system stakeholders in all eight cities emphasized the vulnerability of daily wage earners and informal sector workers, who were unable to generate income during the pandemic. Household capacity to access markets has been a major influence in reduced economic activity in Jakarta. Lower income, rather than food unavailability or inability to physically access markets, has been driving lower consumption. Fear of COVID-19 is also influencing consumer purchasing behaviour (SDFU I 2021). In Quezon City, both economic and physical access factors were associated with low dietary diversity, consumption of unhealthy foods and consumption of zero fruits and vegetables (SDFU P 2021).

Governments adapted, supplemented and scaled up their existing social protection programs in response to the pandemic to support people who became vulnerable in cities. Phnom Penh has a large workforce of daily wage earners, including garment factory workers and construction

36 The Food Systems Dashboard. Global Alliance for Improved Nutrition (GAIN) and Johns Hopkins University. 2020. Geneva, Switzerland. https://foodsystemsdashboard.org/

37 Fanzo et al. (2020) The Food Systems Dashboard is a new tool to inform better food policy. https://doi.org/10.1038/s43016-020-0077-y

38 PPRC-BIGD Rapid Response Research: Livelihoods, coping and support during COVID-19 crisis. April 2020.

workers, who lost their jobs in 2020 when these industries were forced to close. Many of these workers are young men and women who migrated from rural areas to find work in the city. During the pandemic, some of these migrant workers returned to their home villages, while others remained in the city hoping to find alternative employment.

An economic impact survey conducted in four provinces in Phnom Penh municipality (n=1,087) found that average household income decreased by 40% between January 2020 and April 2020. [39] The main reasons reported by workers were temporary closure of businesses/factories (34%), reduced working hours (26%) and lack of overtime (19%).

The Cambodian government's main strategy to support poor and vulnerable households during the pandemic was to expand its poverty identification and social protection program. The Identification of Poor Households (IDPoor) program was launched in 2007, with support from the German and Australian governments, and has made a significant contribution to poverty reduction in Cambodia.

IDPoor benefits include conditional cash transfers for pregnant women and children, school meals and scholarships. It was originally designed for rural areas, using a community-based participatory process to identify very poor (IDPoor1) and poor (IDPoor2) households. The IDPoor On-Demand system was piloted in 2018, with a new mobile interface to directly input household data for quicker turnaround. Implementation in urban areas began in 2019.

During the first phase of the COVID-19 pandemic, the government recognized the extent of the impact in urban areas. The implementation of the IDPoor On-Demand system was rapidly scaled up to improve coverage in urban areas. In June 2020, the government launched a relief cash transfer program for poor and vulnerable households. IDPoor households received an extra $30 a month, with supplementary payments for vulnerable household members such as the elderly, people with disabilities and people living with HIV (World Bank 2020).

A High-Frequency Phone Survey of households in Cambodia (including 1,184 IDPoor households) found that the proportion of IDPoor households receiving social assistance increased from 50% in June 2020 to 92% in October 2020. [40] This was mostly in the form of direct cash transfers. Survey respondents reported spending the money they received on food (100%) as well as other essential items (58%) and loan repayments (15%).

The cash transfer relief program has helped to alleviate food insecurity in Cambodia during the pandemic. Prevalence of moderate or severe food insecurity in IDPoor households declined from 67% in August 2020 to 39% in October 2020.

Kabul has experienced a similar income crisis among its informal sector workforce due to restrictions imposed during the COVID-19 pandemic. This has been compounded by returning migrants (mainly from Iran) who also lost their jobs and incomes. IPC projections suggested that 30% of Kabul's population would experience crisis or emergency levels of food insecurity from November 2020 to March 2021.

The Government's Dastarkhwan-e Meli [41] program (roughly translated as National Food Table) supports households with incomes of $2 a day or less, or twice the national poverty line. This equates to over 90% of the population of Afghanistan.

During the pandemic, this program has been supplemented by the COVID Relief Effort for Afghan Communities and Households, which aims to help households to withstand the economic impacts of the pandemic and encourage them to follow social distancing guidelines. This project has been implemented through grants to Community Development Councils, to provide food and sanitation packages for

[39] Agkor Research Cambodia and Future Forum. The Effect of Covid-19 on Wage Workers. The Headline Results Series 1. Round 1 Data Collection. May 2020. https://www.futureforum.asia/publications/covid-19-economic-impact-study/

[40] World Bank 2021. Socioeconomic impacts of COVID-19 on households in Cambodia.

[41] Dastarkhwan-e Meli https://dastarkhanmili.org/

[42] Citizens' Charter Afghanistan Project: http://www.ccnpp.org/Page.aspx?PageID=1043

households in their communities. These packages contain items procured from local wholesalers and retailers, thereby supporting local businesses as well.

In Kabul Municipality, about 630,000 households have received relief packages worth 8000 AFN (about US$100 equivalent) during the pandemic.[42] It is not known to what extent this additional support has helped to alleviate food insecurity in the city.

WFP Bangladesh with the Government of Bangladesh has recently piloted a new cash assistance program in the Dhaka slums, using a digital cash back system to incentivize healthier choices.

During the COVID-19 pandemic, WFP piloted a 10-month program in Dhaka slums, in partnership with BRAC (Building Resources Across Communities) and financially assisted by USAID. This innovative program combines cash assistance with cash incentives and nutrition behaviour change communication to promote health diets through enhanced dietary diversity.
A total of 7,607 households in low-income urban areas of Kalyanpur and Sattala Bosti (Mohakhali) received 3,000 BDT (35 USD) monthly cash assistance, which has the potential to meet up to 60% of daily calorie intake needs.

Thirty local vendors agreed to provide a stable supply of food items in seven selected food groups: 1. fortified rice, 2. green leafy vegetables, 3. fortified oil, 4. eggs, 5. pulses, 6. orange flesh fruits (vitamin A rich foods) and 7. other fruits and vegetables.
A digital system monitors how beneficiaries spend their cash assistance (using individual IDs). If beneficiaries spend a minimum of 150 BDT (1.8 USD) per food group for at least five out of the seven selected food groups (750 BDT in total), a cash bonus, or cashback, is received the following month along with the regularly-scheduled cash incentive.

The maximum amount of cashback available per month is 750 BDT in both slums. However, recognizing that beneficiaries have a number of non-food needs, WFP decided to test out two different thresholds for the maximum cashback to assess if they resulted in different purchase patterns. Therefore, the amount that beneficiaries need to spend on the healthy food groups to receive the maximum amount of cashback is 3,000 BDT in Sattala Bosti and 2,000 BDT in Kalyanpur.

The cashback amount is calculated as a percentage of the money a beneficiary spends on the designated healthy foods, which is 25% in Sattala Bosti and 37.5% in Kalyanpur.

Limits were placed on the amount of cashback available for buying fortified rice and fortified oil to mitigate overconsumption and promote dietary diversity and particularly consumption of fresh foods.

Beneficiaries were also invited to participate in interactive sessions to improve their knowledge about the importance of a healthy diet.
The pilot is now in a process of data analysis to generate evidence for potential replication and scaling up. More information can be found in the deep dive case study on this intervention.
Although social protection programs have been a lifeline for millions of households during the pandemic, for many the loss of income exceeded the amount of financial support received. Therefore, individuals and households (or consumers) have also used coping strategies and changed their food acquisition and consumption behaviours in response to the pandemic.

The Coping Strategies Index (CSI) is an indicator of how people respond and how their behaviour changes when they cannot access enough food. It can be used for rapid assessment and monitoring during emergencies when collecting data on food consumption is not practical.
The Livelihood Coping Strategies Index (LCSI) was reported by 5/8 cities included in this study. However, the data suggest that this indicator may have been applied and reported inconsistently between cities (Table 3). Other cities used different indicators to assess coping strategies and food security – as shown in the city briefs (Section 4).

TABLE 3. HOUSEHOLDS USING CRISIS (IN BLUE) AND EMERGENCY (IN RED) COPING STRATEGIES BASED ON LCSI DATA COLLECTED BEFORE AND DURING THE PANDEMIC

	LCSI 2019	LCSI 2020	LCSI 2021
Cox's Bazar*	50% 5%	45% 2.5%	58% 4%
Chittagong	NO DATA	NO DATA	NO DATA
Dhaka	NO DATA	NO DATA	NO DATA
Kabul	9.0%	20.0%	51.2%
Jakarta**	NO DATA	6.8% 6.9%	NO DATA
Peshawar	NO DATA	NO DATA	NO DATA
Phnom Penh	NO DATA	30.3% 5.3%	NO DATA
Quezon City**	NO DATA	42.1% 3.2%	NO DATA

*Rohingya refugee population
**Households with child aged 0-59 months

Food system stakeholders from a range of government and non-government organizations provided additional insights into how consumer behaviour has changed in urban areas. They observed that consumer behaviour adaptations to the pandemic were dependent on the extent to which household income was affected and opportunities to access alternatives.

Wealthier urban households whose incomes were minimally or not affected:

- Avoided wet markets due to concerns about safety and risk of infection
- Shopped in supermarkets because they can afford higher prices
- Switched to online shopping and/or home delivery
- Dietary diversity not affected (other than times when certain foods were not available)

Poor urban households who lost some/all their income:

- Some people returned to rural areas (family networks and lower cost of living)
- Reduced non-food spending, sold assets, borrowed money
- Shared food with neighbours
- Reduced food basket – focus on staple foods (less protein, fruits and vegetables)
- Reduced meal frequency
- Prioritized children over adults
- Begged for food

Food safety and hygiene in wet markets must be improved to reduce the risk of transmission of COVID-19, encourage customers to return safely and protect food access for the urban poor.

Wet markets in Dhaka were once the heart of the city but have become much quieter. Many of their previous customers have avoided using them during the pandemic due to concerns about safety and risk of infection. Wealthier households may have opted to buy food in different ways, but these options are unlikely to be accessible to poor urban households who depend on wet markets and street food vendors for daily food needs.

The Global Alliance for Improved Nutrition (GAIN) has implemented a pilot project in Dhaka's wet markets, under its Keeping Food Markets Working workstream. The COVID-19 pandemic has highlighted the issue of food safety in wet markets around the world. Dhaka's wet markets are no exception with overcrowding, poor draining and ventilation, and lack of appropriate hygiene and sanitation. It is essential to improve food safety in this environment to enable wet markets to survive and recover from the pandemic.

GAIN has worked in partnership with Dhaka South City Corporation to implement this pilot project in two wet markets: New Market Bazar and Islambagh Bazar. A COVID-19 response unit was formed from members of the bazar committee in each market. They consulted with customers and vendors to understand the challenges. They requested better safety equipment, social distancing systems, hand washing facilities, drinking water supply and proper drainage. In response, the project has taken steps to restructure the markets and improve safety for vendors and customers. A total of 500 vendors have been provided with sets of face masks. Hand washing points and access to drinking water have been installed. Drainage systems have been renovated and improved. Separate washrooms for women and areas for breastfeeding have been added. FAO has provided training sessions for vendors on food safety and hygiene. This project will be completed in December 2021 and the lessons learned will be implemented in other wet markets.

3.5 Diet and Food Security Outcomes

The outcomes of food systems include diet outcomes, nutrition and health outcomes, environmental impacts, economic impacts and social impacts. [43]
In this study we focused primarily on diet and nutrition outcomes, as they are the focus of WFP. In the preceding sections of this report, we considered the impacts of the COVID-19 on food security, food-related behaviors, diet diversity and how the pandemic has altered the dynamics of urban vulnerability in relation to diets and nutrition outcomes.
The city briefs provide details for each city and highlight differences in data quality and availability. In many cases, we were unable to obtain data to compare key indicators before and during the COVID-19 pandemic. Here we summarize what is known from our analysis.

The impact of COVID-19 on key indicators

Food consumption score and livelihood-based coping strategies:
The proportion of households with a poor food consumption score doubled between 2019 and 2020/21 in Kabul province (from 14% in 2019 to 19% in May 2020 just as the COVID crises started, and 29% in January 2021; city level data not available). In Cox's Bazar, the proportion of households with poor or borderline food consumption score increased from 31% in 2019 to 41% in 2020.

In May 2020, 20% of the population used livelihood-based coping strategies in Kabul province, compared to 9% in 2019. In June 2020, 2.5% households used emergency coping strategies versus 5% in 2019 in Cox's Bazar. The number of households having only two meals a day increased from 8% in pre-COVID times to 38% June 2020. After a peak in market prices in April, they returned to normal in June, corresponding to the lift in movement restrictions (the weekly cost of

[43] The Food Systems Dashboard. Global Alliance for Improved Nutrition (GAIN) and Johns Hopkins University. 2020. Geneva, Switzerland. https://foodsystemsdashboard.org/
[44] Source for Kabul province: Pre-Lean Season Assessment 2021, Pre-Lean Season Assessment 2020 and Seasonal Food Security Assessment 2019; for Cox's Bazar: Cox's Bazar Urban Vulnerability Assessment July 2020 and Refugee influx emergency vulnerability assessment 2020

a food basket increased from 922 BDT in January 2020 to 1,062 BDT in April 2020 and went back down to 974 BDT in June 2020 in Cox's Bazar). [44]

Infant and young child feeding practices:
Availability of data on breastfeeding practices, minimum diet diversity (MDD), minimum meal frequency (MMF) and minimum acceptable diet (MAD) only allowed the comparison pre-COVID/COVID in Jakarta and Quezon city slums where the situation worsened for all indicators.

Early breastfeeding initiation fell slightly from 72% in 2018 to 67% in 2020 in Jakarta slums, while exclusive breastfeeding prevalence remained the same (36%). The proportion of children 6-23 months old receiving MDD and MAD fell sharply from 2018 (pre-COVID) to 2020 (COVID) with a decline from 81% to 31% and from 76% to 28%, respectively. The proportion with MMF also declined from 94% to 84%.

In Quezon City slums, the proportion of children 6-23 months old receiving MDD and MAD estimated in urban areas of the Philippines in 2020 was extremely low (7.7% and 6.6% respectively) down from 25% and 15% respectively measured for Quezon City in 2018.

Women's diet diversity:
Data (pre-COVID and COVID) on women's diet was available in Jakarta slums, where the proportion of women who consumed at least five out of ten defined food groups the previous day or night (MDD-W) declined from 79% in 2018 to 64% in 2020.
Although pre-COVID data were not available for Quezon City, slum areas in Quezon City (SDFU Philippines Urban Survey) in 2020 showed an alarmingly low prevalence of MDD-W (16%).

Food insecurity:
The SDFU Philippines Urban Survey in 2020 reported that 71% of households with moderate or severe food insecurity were severely impacted by COVID-19. Similarly, the prevalence of households in Jakarta slums with severe food insecurity increased greatly from 2% in 2018 to 23% 2020.

Nutritional status:
With the COVID-19 crisis, many nutrition surveys were cancelled or postponed due to difficulties with anthropometric measurements.

WFP World Food Programme

Section 4

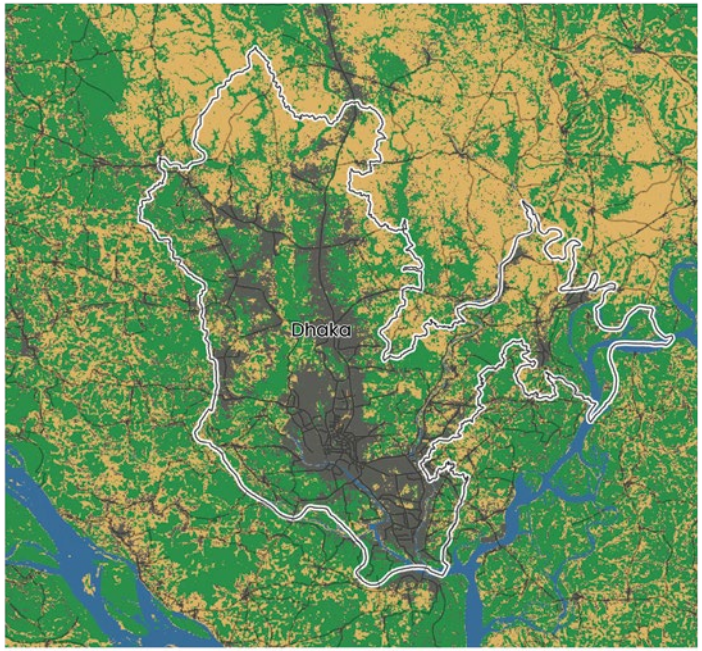
City Briefs

1. Chittagong, Bangladesh
2. Cox's Bazar, Bangladesh
3. Dhaka, Bangladesh
4. Jakarta, Indonesia
5. Kabul, Afghanistan
6. Peshawar, Pakistan
7. Phnom Penh, Cambodia
8. Quezon City, Philippines

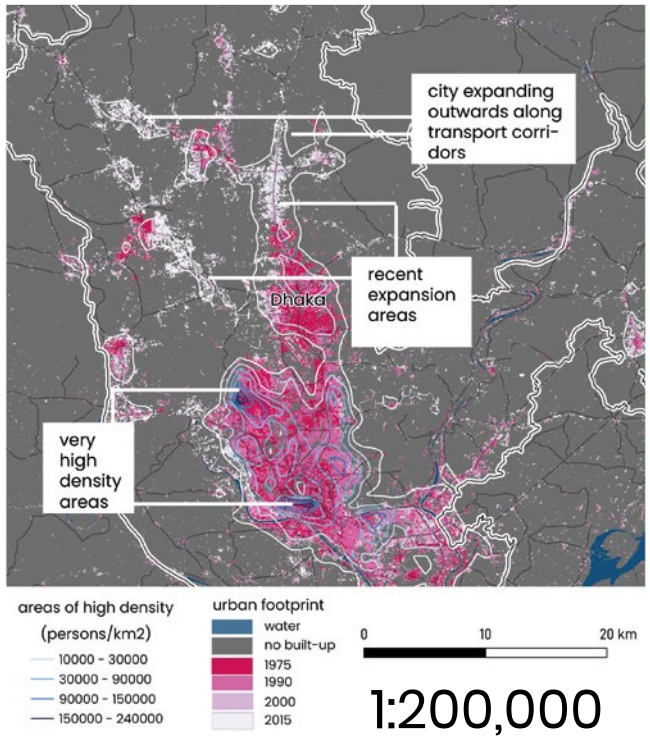
External drivers

The landcover and urbanisation maps illustrate some key external drivers that shape the food system in Dhaka. These include the use of land and indications of where population density and growth are most intense, highlighting the relationship cities have with food production, and suggesting areas of higher vulnerability during crises that affect the food system.

Landcover 2015



Urbanisation trends



Greater Dhaka is surrounded by fertile, agricultural land which covers around 35% of the land within 50km of the city. The city is expanding northward along main roads, though the wider urban agglomeration expands well beyond the formal administrative boundary adding another 40% to the city population, c. 6.5 million people in 2015. Dhaka is one of the most densely population cities on earth, with population densities reaching approaching 250,000 persons/km2 in some of the central thanas (districts). Urban growth continues along the main transport corridors, extending the reach of the city into its rural hinterland.

Key spatial indicators

Indicator	Dhaka	Average, 7 cities (excl. CXB)	Average, similar size LMIC cities in the region
Population density, persons per km2	7,371	9,468	11,677
Slum population	874,039		
Total built-up area in 2015, km2	867.5	471.01	776.0
Total resident population in 2015	23,942,350	1,002,460	
Surface of the built-up area per person in 2015, m2	36.2	37.3	37.5
Proportion of total resident population potentially exposed to floods in 2015 (%)	64%	38%	
Proportion of cultivated land in 50km radius	34.5%	33.3%	
Cultivated land in 50km radius per 100,000 persons, km²	23.0	44.0	
Number of supermarkets per 100,000 persons	0.8	4.8	
GDP per capita	4,124.1	4,200.4	
Growth rate	3.2	2.4	2.2
Proportion of population of the urban agglomeration living outside the formal boundaries of the city	40%	37%	

Food supply chains

The following table illustrates the location of the suppliers and customers of surveyed private sector entities, giving an indication of the proximity of food supply chains to the city.

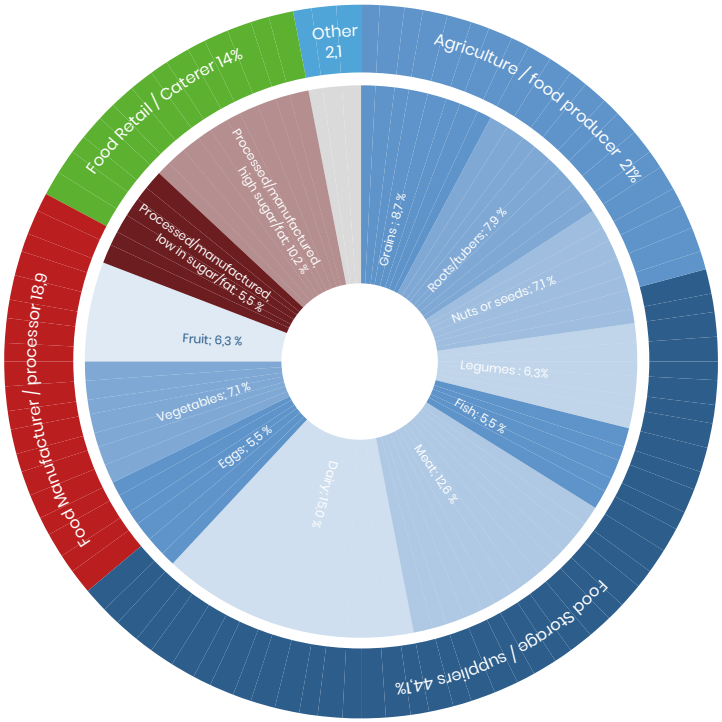
The proximity of food supply chains to the city

	Markets/ Customer locations	Supplier locations
Within the city	92.4 %	61.1 %
Surrounding region	2.1 %	8.3 %
Other regions of the country	2.1 %	27.1 %
Internationally	3.5 %	3.5 %

Food environment

The local food system actors and the types of food available in the local market are shown in the below figure. The inner circle consists of the types of food businesses while the outer circle shows the types of food the system produces, processes or sells.

Food system actors & foods available in the local market



4. Outcomes & Pre-COVID-19 vulnerability

Nutritional status, dietary diversity and consumption of unhealthy foods

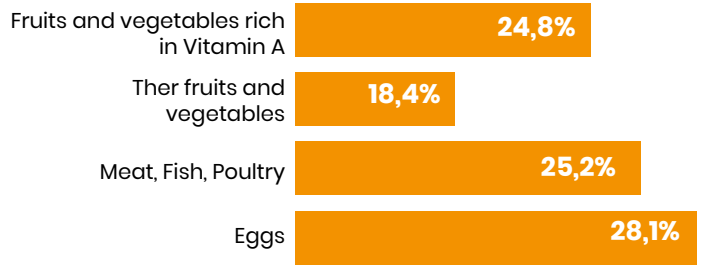
The following figures date from pre-COVID-19 and indicate vulnerabilities before the crisis, unless recent figures are available in which case a comparison between pre-COVID-19 and recent data is presented.

Women

Prevalence of minimum dietary diversity (MDD-W) among women and adolescents, Dhaka division

Children, 6-23 months

Food Consumed by breastfeeding children (6-23 month), Dhaka city



Children under 5 years

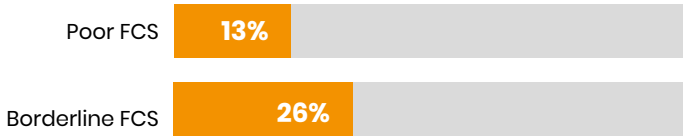
Portion of wasted and stunted children, Dhaka City

Food security

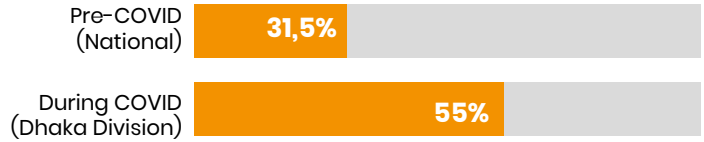
Changes in the food security levels of Dhaka's population before and during COVID-19 is presented based on the available data, using the Food Consumption Score (FCS) and the Food Insecurity Experience Scale (FIES). Data using the Livelihood Coping Strategy Index (LCSI) was not available.

Minimum acceptable diet (Dhaka Division)

Poor to borderline Food Consumption Score (FCS), Dhaka division

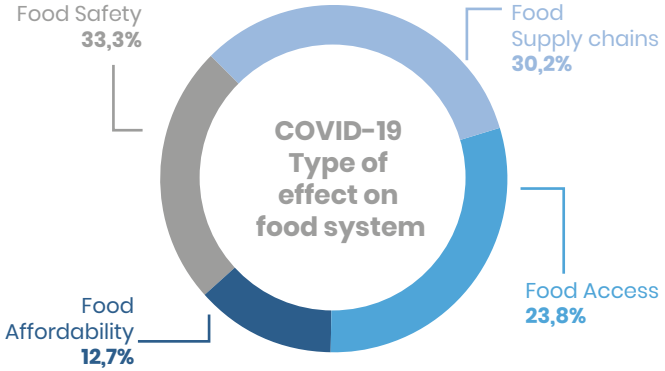


Prevalence of moderate or severe food insecurity (Food Insecurity Experience Scale) in adolescents



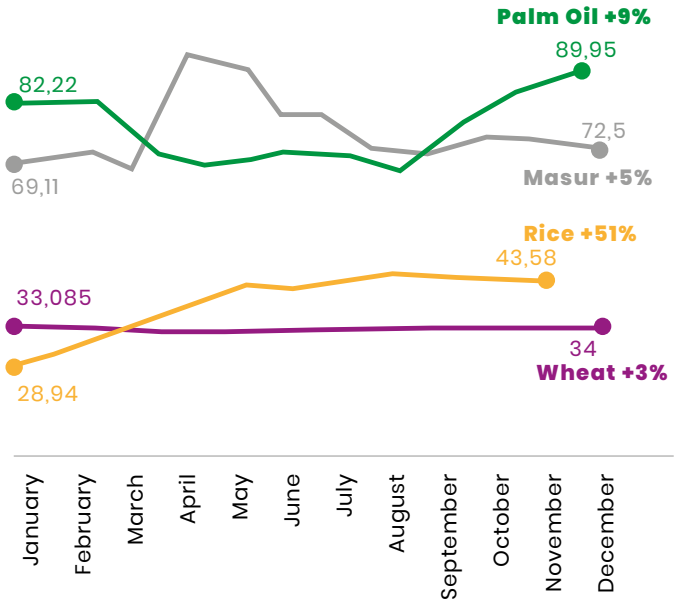
5. COVID-19 impact & response

This section explores the effects of COVID-19 on Dhaka's food system, examining supply chains, food prices and responses.

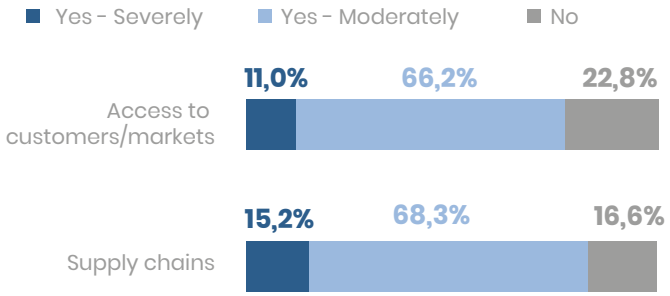


Change in food prices since COVID-19

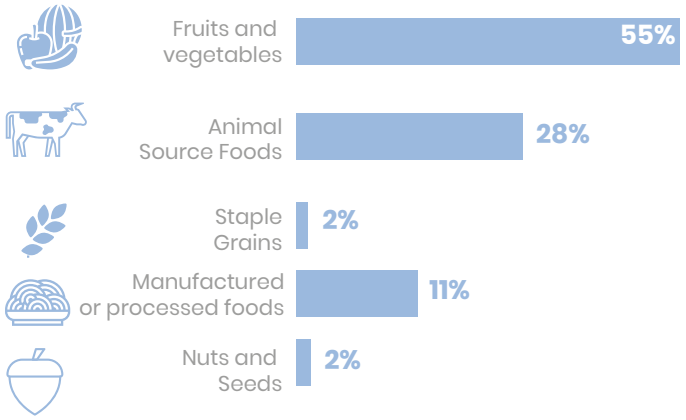
Change in food prices from January to December 2020 on four selected food items, BDT



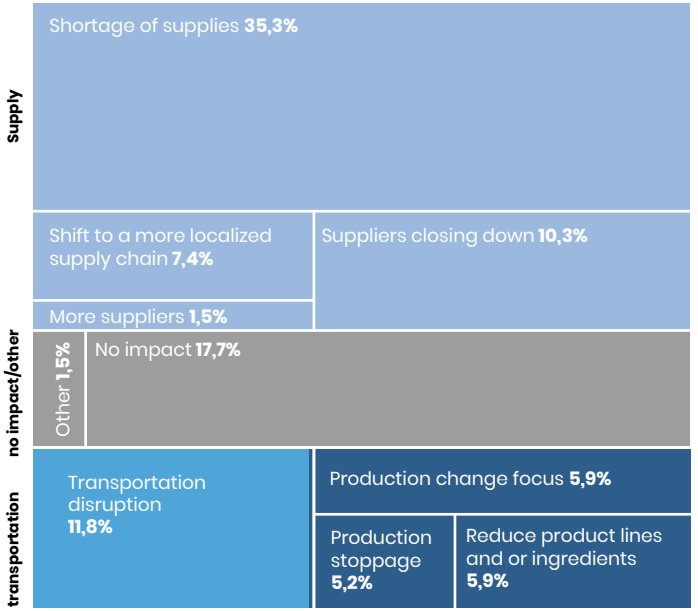
Extent of disruption of the COVID-19 pandemic on markets and supply chains



Foods that were short in supply



Effects of COVID-19 on company supply chains



Proportion of surveyed businesses whose income decreased between 25% and 50%

Data Sources

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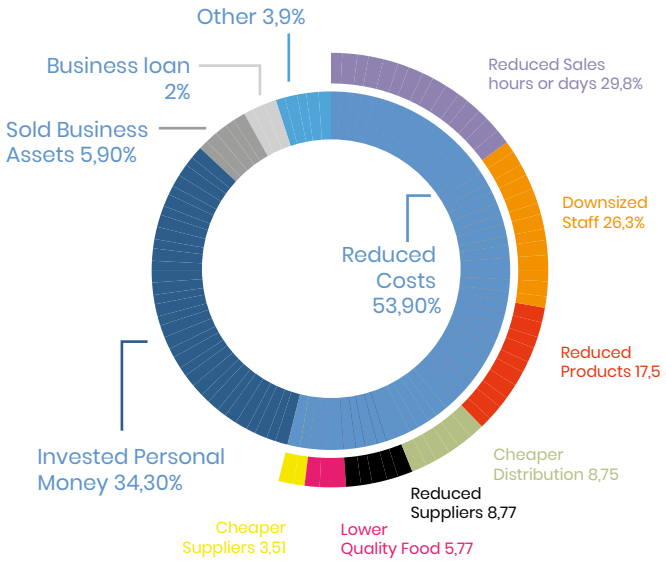
Food Consumption Score (FCS), Dhaka division Analysis of Food Security and Vulnerability in the Urban and Rural Areas in Bangladesh, WFP
Prevalence of moderate or severe food insecurity (Food Insecurity Experience Scale) in adolescents Second rapid assessment of food and nutrition security in the context of COVID-19 in Bangladesh: May – July 2020, FAO
Monthly food prices, Dhaka division WFP VAM
Sections Food supply chains, Food environment, COVID-19 impact and response Dikoda 2021

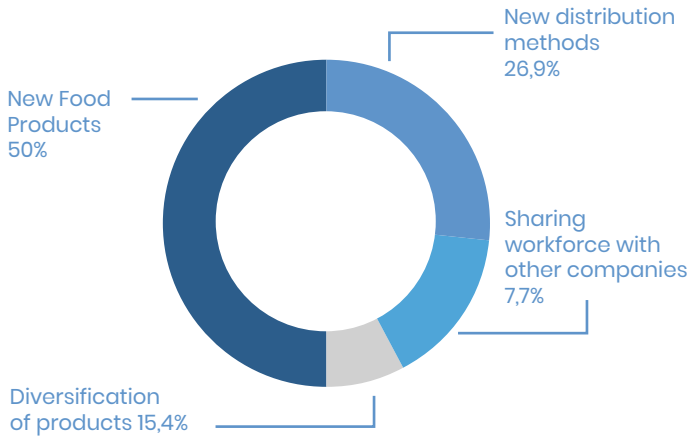
Responses and coping mechanisms

Impacts of COVID-19 on the food system are mitigated by responses by development partners and the government and by adaptations taken by food companies to changing conditions. This section illustrates some of these adaptations and responses, highlighting possible vulnerabilities and opportunities presented by the crisis

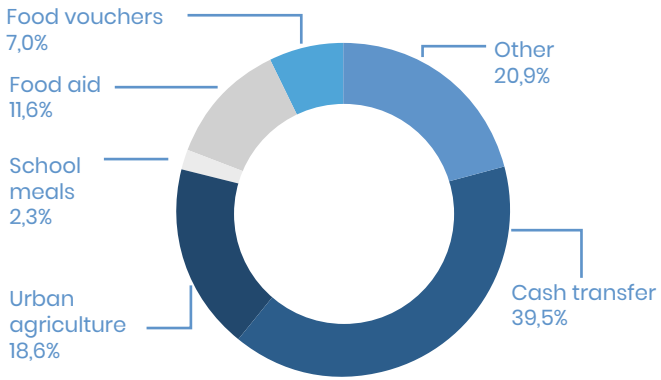
Private sector's methods to cope with lower income with breakdown of reduced costs



Other Methods of Adaptation by companies during COVID-19

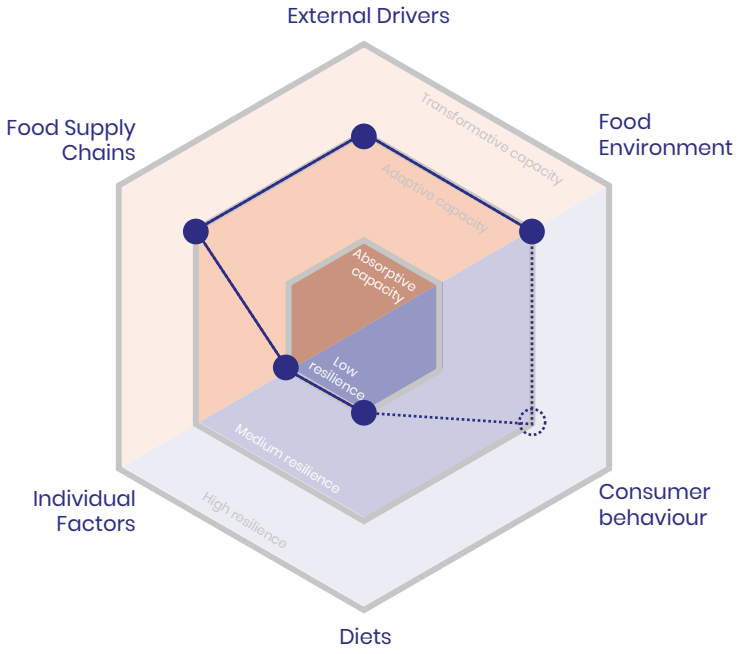


Response by Development Partners to food Insecurity



Typology

The typology contains one core indicator for each dimension, giving an indication to the food system's vulnerability and resilience in the face of COVID-19. No indicator was chosen for consumer behaviour.



Methods and data sources

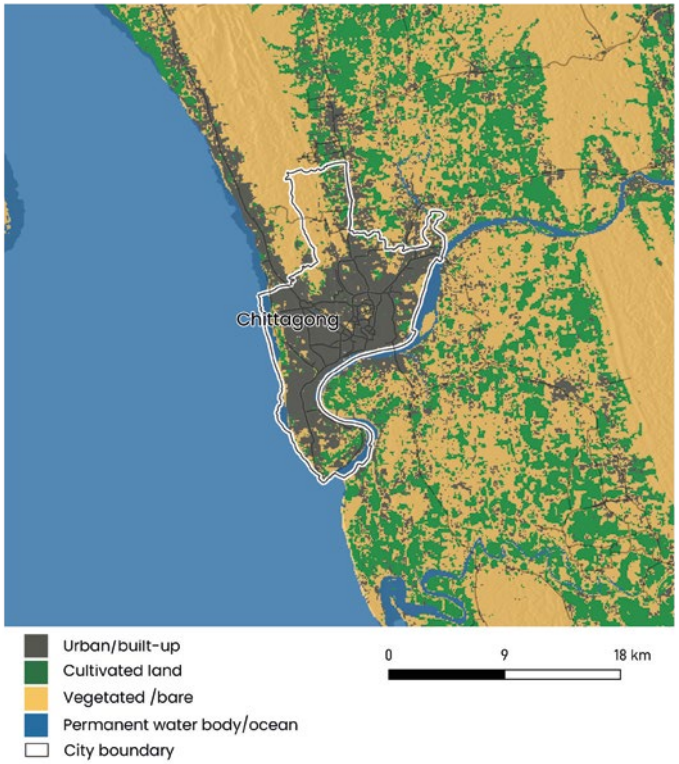
The brief describes the city's food system based on the Food Systems Framework presented in the report, with focus on available data and components that are likely to be impacted by COVID-19. All data is on city level unless indicated otherwise. Sources for the city brief include primary and secondary data and are listed after each figure or table. DHS data has been disaggregated to strata level to obtain figures specific to the city. Dikoda surveys took place in March 2021 and were carried out on governance, NGO and private sector stakeholders. : The development of the typology and the full survey methodology is detailed in the report. Key spatial indicators apart from slum population are from 2015 because data was consistently available across cities.

Population density, persons per km2	Calculated from GHSL data. Florczyk, A et al. (2019): GHS Urban Centre Database 2015, multitemporal and multidimensional attributes, R2019A. European Commission, Joint Research Centre (JRC) PID: https://data.jrc.ec.europa.eu/dataset/53473144-b88c-44bc-b4a3-4583ed1f547e
Slum population	Slum census 2014
Cultivated land in 50km radius, km2	Calculated using GIS spatial analysis techniques by Dikoda using Copernicus Global Land Service data (2019) Buchhorn, M. et al. Copernicus Global Land Service: Land Cover 100m: collection 3: epoch 2019: Globe 2020. Accessed Feb 2020
Cultivated land in 50km radius per capita, km2	Copernicus as above
Number of markets/supermarkets per 100,000 persons	Calculated using GIS and OPenStreetMap data for each city

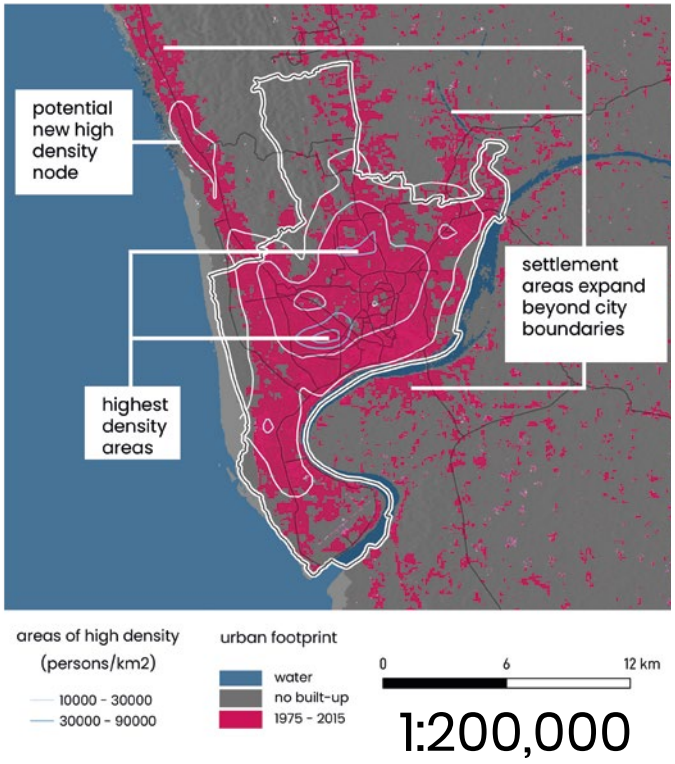
External drivers

The landcover and urbanisation maps illustrate some key external drivers that shape the food system in Chittagong. These include the use of land and indications of where population density and growth are most intense, highlighting the relationship cities have with food production, and suggesting areas of higher vulnerability during crises that affect the food system

Landcover 2015



Urbanisation trends



Chittagong (or Chattogram) is the second-largest city in Bangladesh and the location of the country's busiest international port – one of the world's oldest and largest in south-east Asia. The city is located on the Bay of Bengal and banks of the Karnaphuli River which have constrained growth of the city to the west and the south. However, urban development has extended along major transport routes north of the city and across the river to the south. More than half of the population of this urban agglomeration live outside the formal, Chattogram City Corporation area.

Key spatial indicators

Indicator	Dhaka	Average, 7 cities (excl. CXB)	Average, similar size LMIC cities in the region
Population density, persons per km2	6,626	9,468	9493
Slum population	493,441		
Total built-up area in 2015, km2	157.8	471.0	304.6
Total resident population in 2015	5,293,804	11,002,460	
Surface of the built-up area per person in 2015, m2	29.8	37.3	45.6
Proportion of total resident population potentially exposed to floods in 2015 (%)	65%	38%	
Proportion of cultivated land in 50km radius	15.4%	33.3%	
Cultivated land in 50km radius per 100,000 persons, km²	18.0	44.0	
Number of supermarkets per 100,000 persons	0.7	4.8	
GDP per capita	3,932.2	4,200.4	
Growth rate	1.3	2.4	1.8
Proportion of population of the urban agglomeration living outside the formal boundaries of the city	129%	37%	

Food supply chains

The following table illustrates the location of the suppliers and customers of surveyed private sector entities, giving an indication of the proximity of food supply chains to the city.

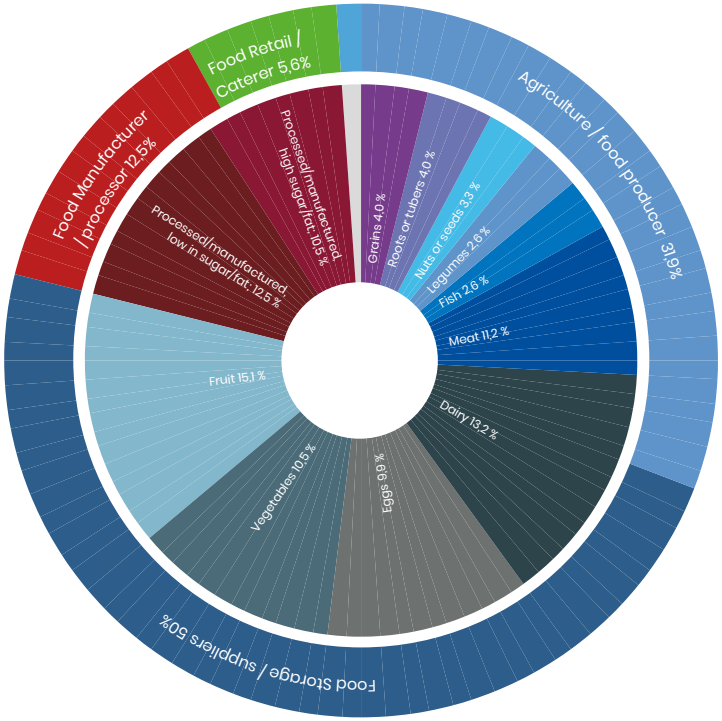
The proximity of food supply chains to the city

	Markets/ Customer locations	Supplier locations
Within the city	72.5%	46.5%
Surrounding region	17.6%	26.8%
Other regions of the country	8.5%	26.1%
Internationally	1.4%	0.7%

Food environment

The local food system actors and the types of food available in the local market are shown in the below figure. The inner circle consists of the types of food businesses while the outer circle shows the types of food the system produces, processes or sells.

Food system actors & foods available in the local market



4. Outcomes & Pre-COVID-19 vulnerability

Nutritional status, dietary diversity and consumption of unhealthy foods

The following figures date from pre-COVID-19 and indicate vulnerabilities before the crisis, unless recent figures are available in which case a comparison between pre-COVID-19 and recent data is presented.

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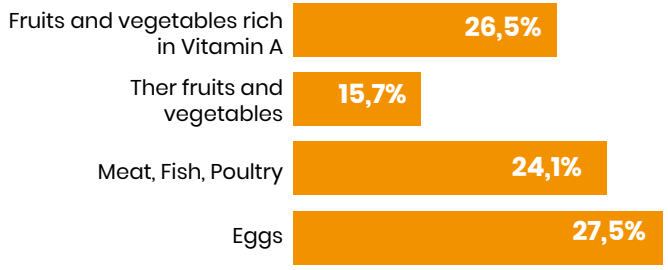
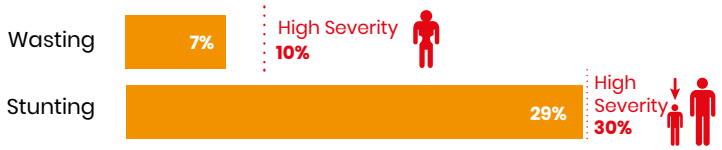
Foods consumed by breastfeeding children (6-23 months), Chittagong city

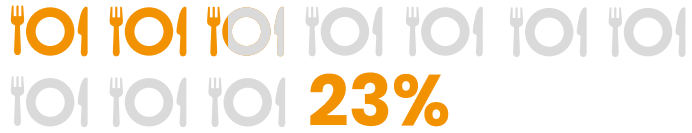


Children under 5 years

Proportion of wasted and stunted children, Chittagong city



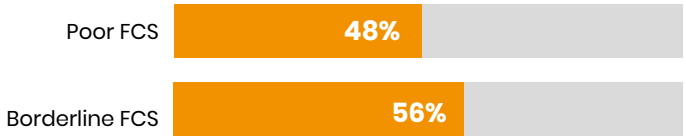
Minimum acceptable diet (Chittagong Division)



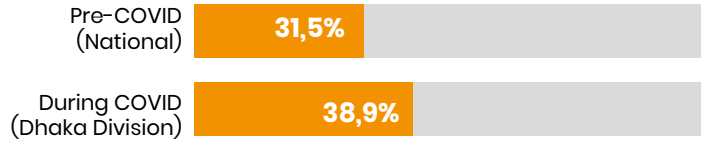
Food security

Changes in the food security levels of Dhaka's population before and during COVID-19 is presented based on the available data, using the Food Consumption Score (FCS) and the Food Insecurity Experience Scale (FIES). Data using the Livelihood Coping Strategy Index (LCSI) was not available.

Poor to borderline Food Consumption Score among urban casual day labourers in Bangladesh



Prevalence of moderate or severe food insecurity (Food Insecurity Experience Scale) in adolescents



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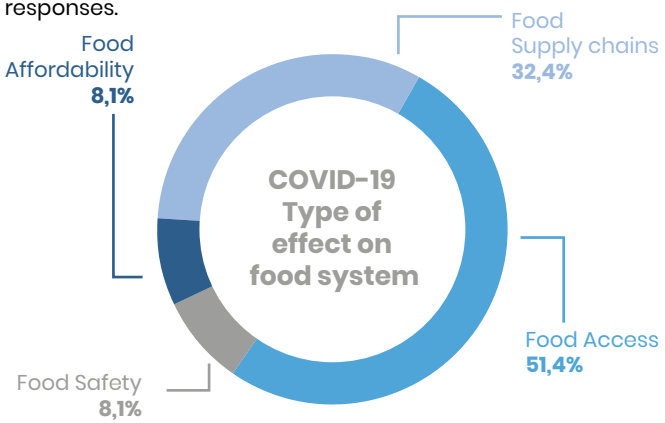
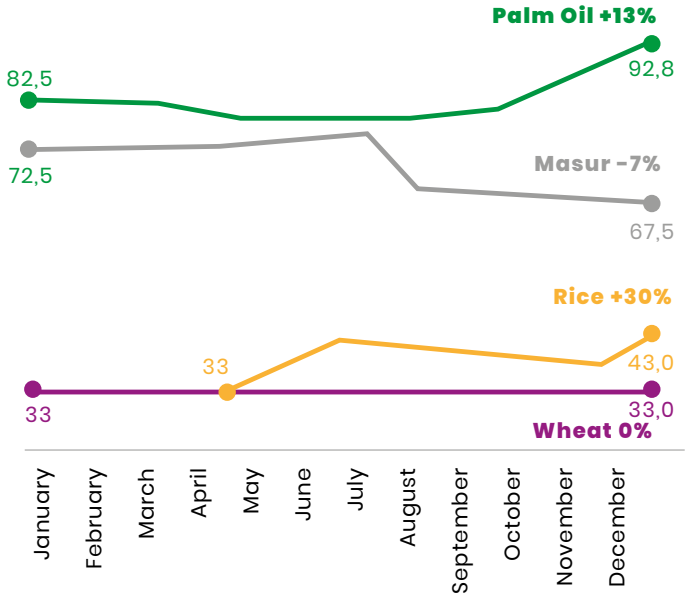
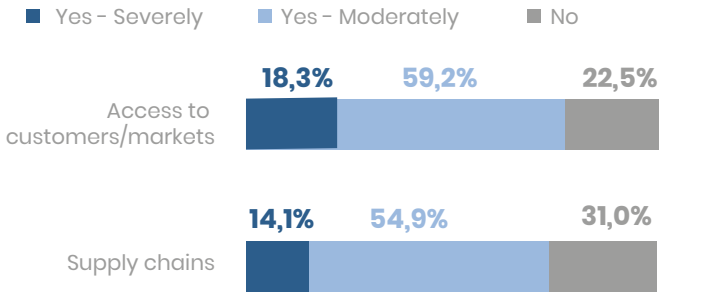


Change in food prices since COVID-19

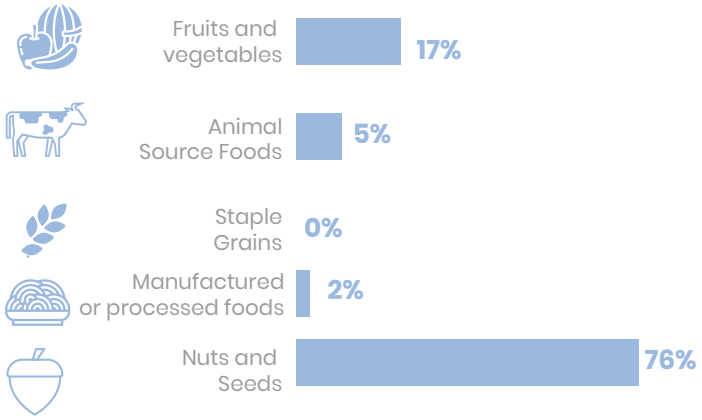
Change in food prices from January to December 2020 on four selected food items, BDT



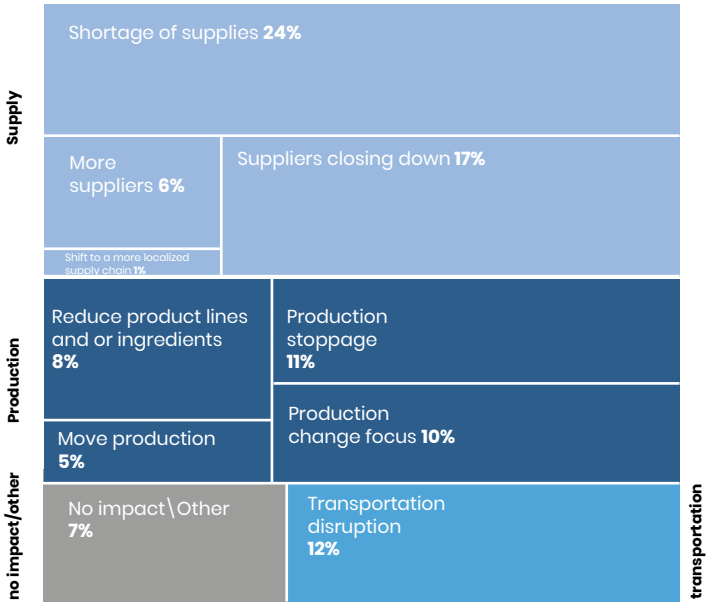
Extent of disruption of the COVID-19 pandemic on markets and supply chains



Foods that were short in supply



Effects of COVID-19 on company supply chains



Proportion of surveyed businesses whose income decreased between 25% and 50%

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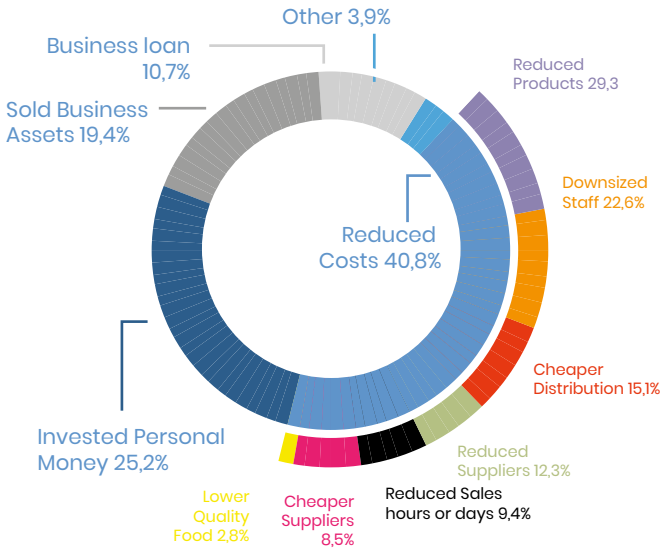
Food Consumption Score (FCS) Analysis of Food Security and Vulnerability in the Urban and Rural Areas in Bangladesh, WFP
Prevalence of moderate or severe food insecurity
(Food Insecurity Experience Scale) in adolescents Second rapid assessment of food and nutrition security in the context of COVID-19 in Bangladesh: May – July 2020, FAO
Monthly food prices WFP VAM
Sections Food supply chains, Food environment, COVID-19 impact and response Dikoda 2021

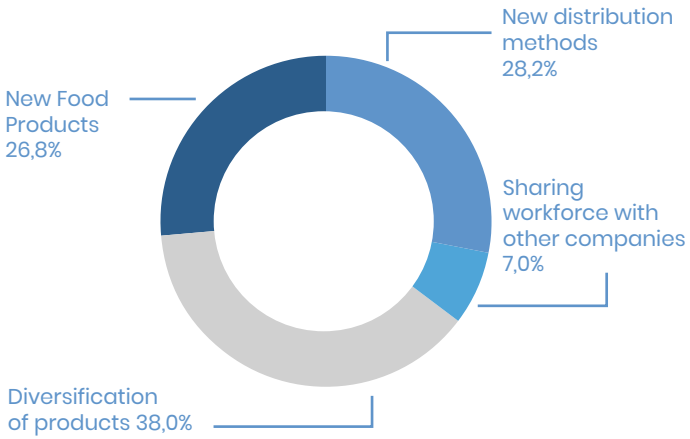
Responses and coping mechanisms

Impacts of COVID-19 on the food system are mitigated by responses by development partners and the government and by adaptations taken by food companies to changing conditions. This section illustrates some of these adaptations and responses, highlighting possible vulnerabilities and opportunities presented by the crisis

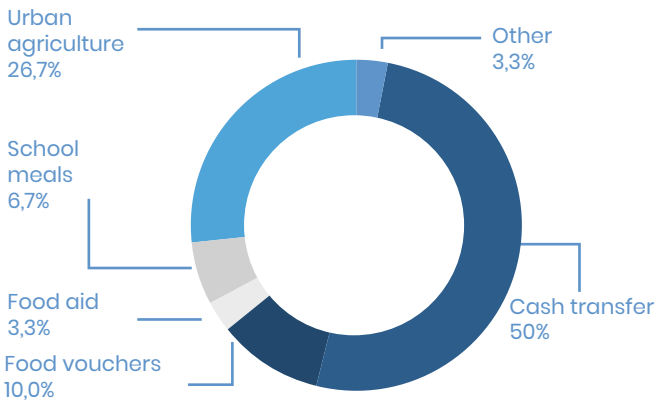
Private sector's methods to cope with lower income with breakdown of reduced costs



Other methods of adaptation by companies during COVID-19



Response by Development Partners to food insecurity



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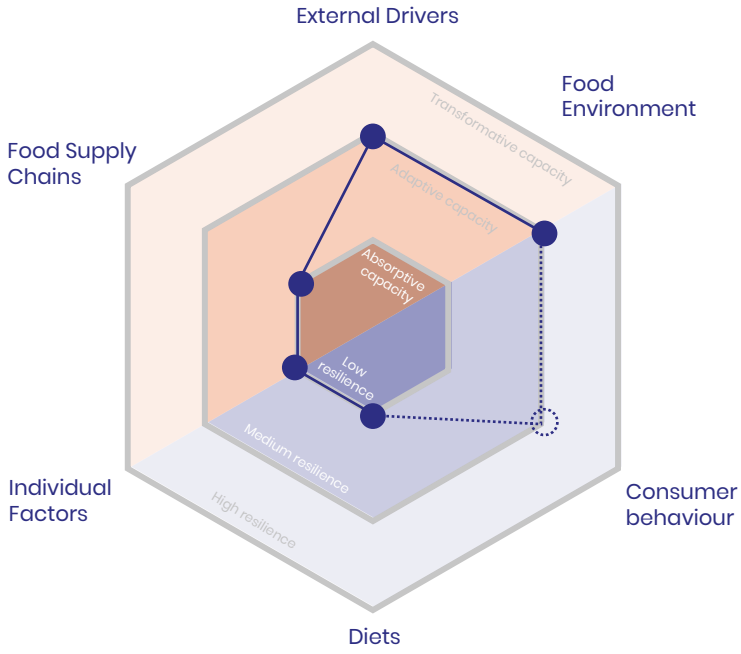
The typology contains one core indicator for each dimension, giving an indication to the food system's vulnerability and resilience in the face of COVID-19. No indicator was chosen for consumer behaviour.



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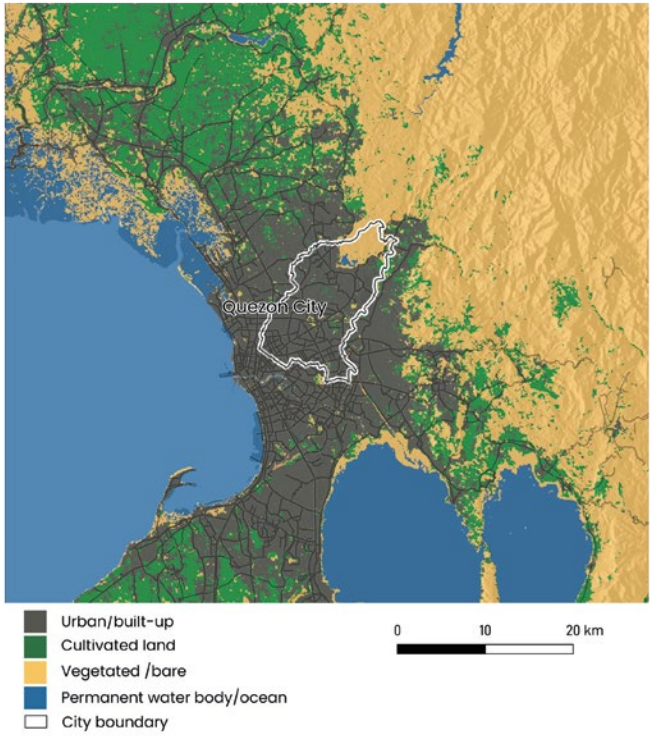
The brief describes the city's food system based on the Food Systems Framework presented in the report, with focus on available data and components that are likely to be impacted by COVID-19. All data is on city level unless indicated otherwise. Sources for the city brief include primary and secondary data and are listed after each figure or table. DHS data has been disaggregated to strata level to obtain figures specific to the city. Dikoda surveys took place in March 2021 and were carried out on governance, NGO and private sector stakeholders. : The development of the typology and the full survey methodology is detailed in the report.
Key spatial indicators apart from slum population are from 2015 because data was consistently available across cities.

Population density, persons per km2	Calculated from GHSL data. Florczyk, A et al. (2019): GHS Urban Centre Database 2015, multitemporal and multidimensional attributes, R2019A. European Commission, Joint Research Centre (JRC) PID: https://data.jrc.ec.europa.eu/dataset/53473144-b88c-44bc-b4a3-4583ed1f547e
Slum population	Slum census 2014
Cultivated land in 50km radius, km2	Calculated using GIS spatial analysis techniques by Dikoda using Copernicus Global Land Service data (2019) Buchhorn, M. et al. Copernicus Global Land Service: Land Cover 100m: collection 3: epoch 2019: Globe 2020. Accessed Feb 2020
Cultivated land in 50km radius per capita, km2	Copernicus as above
Number of markets/supermarkets per 100,000 persons	Calculated using GIS and OPenStreetMap data for each city

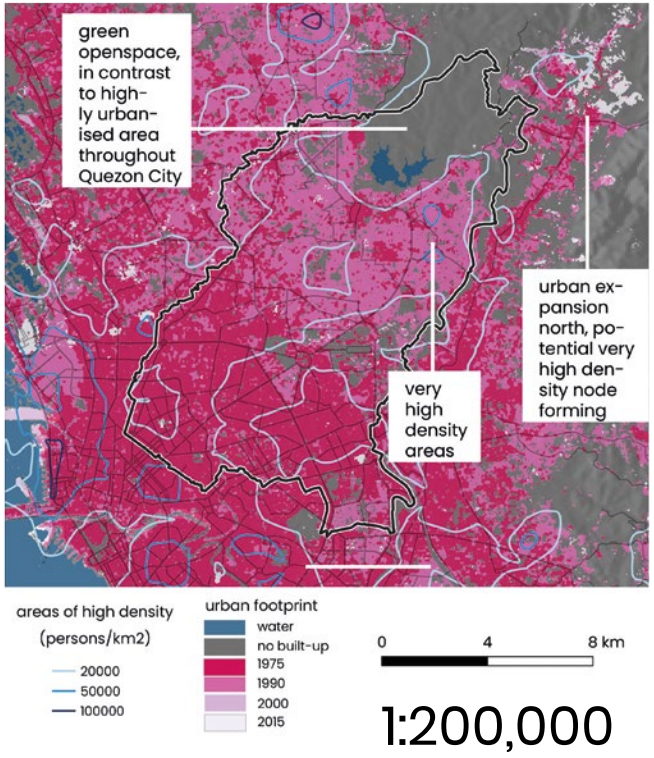
External drivers

The landcover and urbanisation maps illustrate some key external drivers that shape the food system in Quezon City. These include the use of land and indications of where population density and growth are most intense, highlighting the relationship cities have with food production, and suggesting areas of higher vulnerability during crises that affect the food system

Landcover 2015



Urbanisation trends



Quezon City is the largest city in the Philippines by population though sits within the Manila Metropolitan Area. The city is highly urbanised with c. 85% urban land cover, very little cultivated land (<3%) and the remaining land area mainly open water and forest, in the northern most corner of the city. Much of the urban fabric was built during the period between 1975 and 2000, with the city densifying as population has grown at around 1.4% per annum. The city is inextricably linked to the wider Metropolitan area, representing around 17% of the contiguous area of the Manila urban agglomeration which covers around 650km2.

Key spatial indicators

Indicator	Quezon City	Average, 7 cities (excl. CXB)	Average, similar size LMIC cities in the region
Population density, persons per km2	16,943	9,468	11,677
Slum population	appr. 810 760		
Total built-up area in 2015, km2	115	471.0	776.0
Total resident population in 2015	2,505,917	11,002,460	
Surface of the built-up area per person in 2015, m2	45.9	37.3	37.5
Proportion of total resident population potentially exposed to floods in 2015 (%)	31%	38%	
Proportion of cultivated land in 50km radius	15.8%	33.3%	
Cultivated land in 50km radius per 100,000 persons, km²	6.0	44.0	
Number of supermarkets per 100,000 persons	25.7	4.8	
GDP per capita	3,607.6	4,200.4	
Growth rate	1.4	2.4	1.8
Proportion of population of the urban agglomeration living outside the formal boundaries of the city	0%	37%	

Food supply chains

The following table illustrates the location of the suppliers and customers of surveyed private sector entities, giving an indication of the proximity of food supply chains to the city.

The proximity of food supply chains to the city

	Markets/ Customer locations	Supplier locations
Within the city	25.9%	37.0%
Surrounding region	59.3%	37.0%
Other regions of the country	14.8%	25.9%
Internationally	0%	0%

Food environment

The local food system actors and the types of food available in the local market are shown in the below figure. The inner circle consists of the types of food businesses while the outer circle shows the types of food the system produces, processes or sells.

Food system actors & foods available in the local market

4. Outcomes & Pre-COVID-19 vulnerability

Nutritional status, dietary diversity and consumption of unhealthy foods

The following figures date from pre-COVID-19 and indicate vulnerabilities before the crisis, unless recent figures are available in which case a comparison between pre-COVID-19 and recent data is presented.

Women

Prevalence of minimum dietary diversity (MDD-W) during COVID-19, Quezon City slums

During-COVID 15,7%

Children, 6-23 months

Foods consumed by breastfeeding children (6-23 months) during COVID-19, Quezon City slums

Fruits and vegetables rich in Vitamin A	22,2%
Egg or Flash Foods	38,2%

Change in minimum acceptable diet (6-23 months), Quezon City and slums

Pre-Covid Quezon City Slums 2020 14,6%

During Covid Quezon City 2018 6,6%

Consumption of unhealthy foods by children, Quezon City slums

Children 0-23m	63%
Children 24-59m	56%

Children under 5 years

Proportion of wasted and stunted children, Quezon City

Wasting	7%	10% High Severity
Stunting	30%	30% High Severity

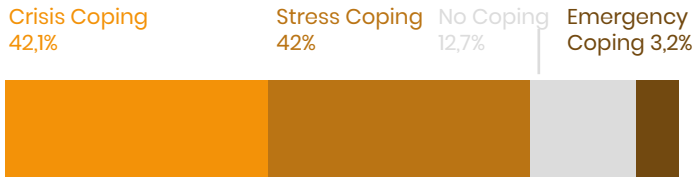
Food security

Changes in the food security levels of Quezon City's population before and during COVID-19 is presented based on the avail able data, using the Food Insecurity Experience Scale (FIES) and the Livelihood Coping Strategy Index (LCSI). The Food Consumption Score (FCS) was not available.

Prevalence of moderate or severe food insecurity (Food Insecurity Experience Scale), Quezon City slums

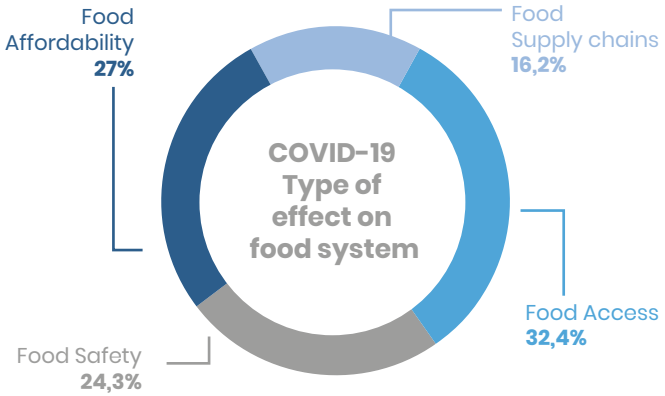
During COVID	63,0%

Livelihoods coping strategy index (LCSI) in households with children 0-59m, Quezon City slums, 2020



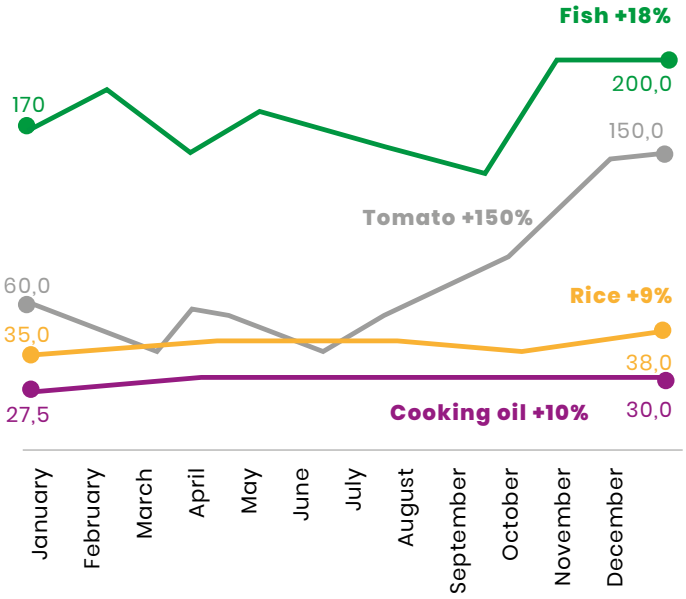
5. COVID-19 impact & response

This section explores the effects of COVID-19 on Dhaka's food system, examining supply chains, food prices and responses.

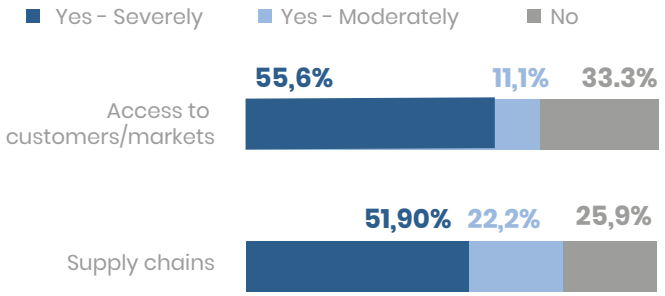


Change in food prices since COVID-19

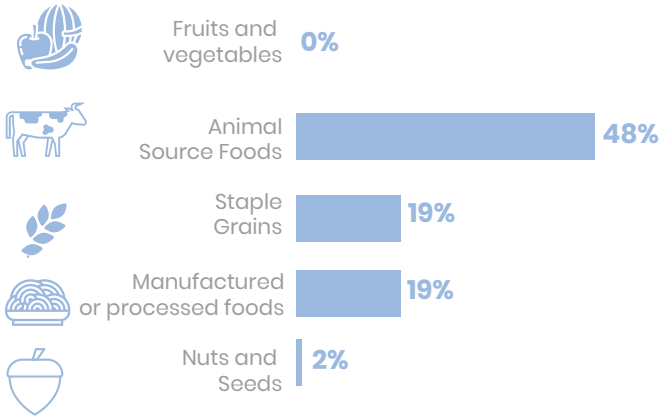
Change in food prices from January to December 2020 on four selected food items, PHP



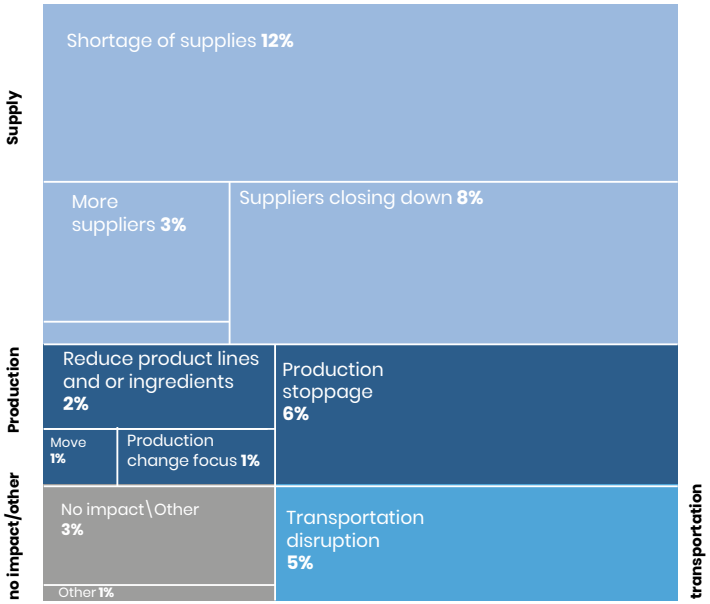
Extent of disruption of the COVID-19 pandemic on markets and supply chains



Foods that were short in supply



Effects of COVID-19 on company supply chains



Proportion of surveyed businesses whose income decreased between 25% and 50%

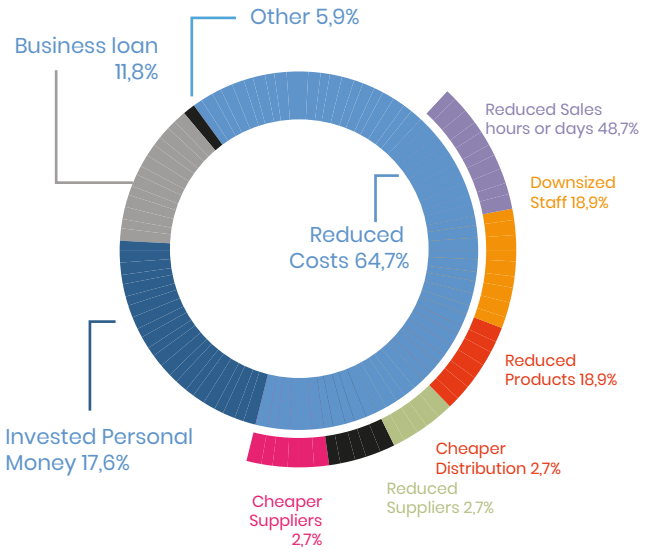
Data Sources

MDD-W Philippines Urban Survey (SDFU) 2020
Foods consumed by breastfeeding children (6-23 months) Philippines Urban Survey (SDFU) 2020
Minimum acceptable diet ENNS 2018, Philippines Urban Survey (SDFU) 2020
Consumption of unhealthy foods by children Philippines Urban Survey (SDFU) 2020
Proportion of wasted and stunted children ENNS 2018. Stunting prevalence is classified as high and wasting prevalence as medium by WHO standards.
Prevalence of moderate or severe food insecurity (Food Insecurity Experience Scale) Philippines Urban Survey (SDFU) 2020
Livelihoods coping strategy index (LCSI) Philippines Urban Survey (SDFU) 2020
Monthly food prices Philippine Statistics Authority. Retail prices for National Capital Region.
Sections Food supply chains, Food environment, COVID-19 impact and response Dikoda 2021

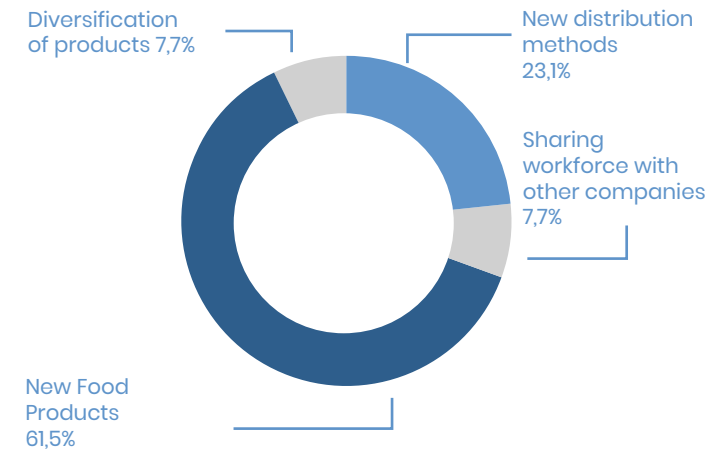
Responses and coping mechanisms

Impacts of COVID-19 on the food system are mitigated by responses by development partners and the government and by adaptations taken by food companies to changing conditions. This section illustrates some of these adaptations and responses, highlighting possible vulnerabilities and opportunities presented by the crisis

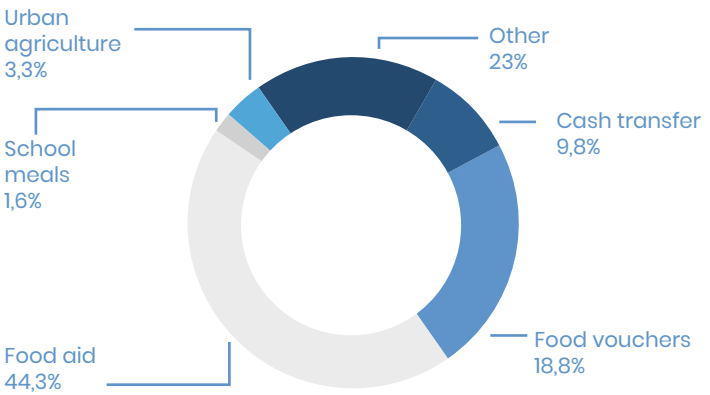
Private sector's methods to cope with lower income with breakdown of reduced costs



Other methods of adaptation by companies during COVID-19

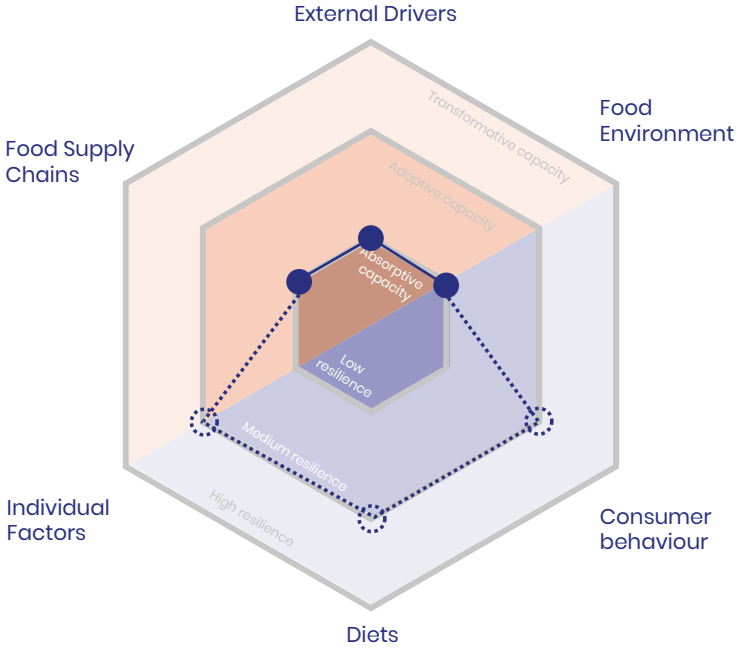


Response by Development Partners to food insecurity



Typology

The typology contains one core indicator for each dimension, giving an indication to the food system's vulnerability and resilience in the face of COVID-19. No indicator was chosen for consumer behaviour.



Methods and data sources

The brief describes the city's food system based on the Food Systems Framework presented in the report, with focus on available data and components that are likely to be impacted by COVID-19. All data is on city level unless indicated otherwise. Sources for the city brief include primary and secondary data and are listed after each figure or table. DHS data has been disaggregated to strata level to obtain figures specific to the city. Dikoda surveys took place in March 2021 and were carried out on governance, NGO and private sector stakeholders. : The development of the typology and the full survey methodology is detailed in the report.

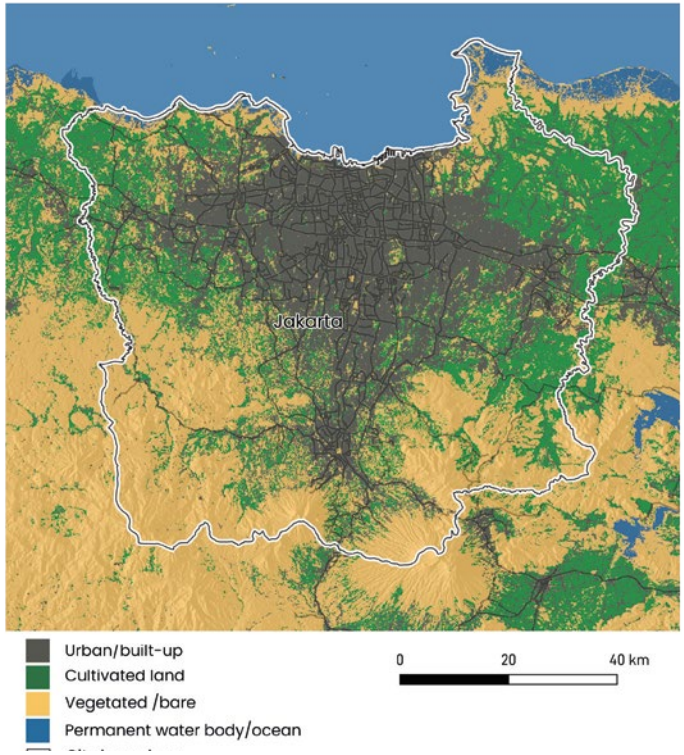
Key spatial indicators apart from slum population are from 2015 because data was consistently available across cities.

Population density, persons per km2	Calculated from GHSL data. Florczyk, A et al. (2019): GHS Urban Centre Database 2015, multitemporal and multidimensional attributes, R2019A. European Commission, Joint Research Centre (JRC) PID: https://data.jrc.ec.europa.eu/dataset/53473144-b88c-44bc-b4a3-4583ed1f547e
Slum population	Calculated using number of informal settlement households in Quezon city (188,549) and average HH size in Quezon City in 2015 (4.3). Source: CHAPTER 3: Demographic Profile and Social Development Quezon City, 2018. https://quezoncity.gov.ph/wp-content/uploads/2021/01/Eco_Profile_2018_Chapter-3.pdf
Cultivated land in 50km radius, km2	Calculated using GIS spatial analysis techniques by Dikoda using Copernicus Global Land Service data (2019) Buchhorn, M. et al. Copernicus Global Land Service: Land Cover 100m: collection 3: epoch 2019: Globe 2020. Accessed Feb 2020
Cultivated land in 50km radius per capita, km2	Copernicus as above
Number of markets/supermarkets per 100,000 persons	Calculated using GIS and OPenStreetMap data for each city

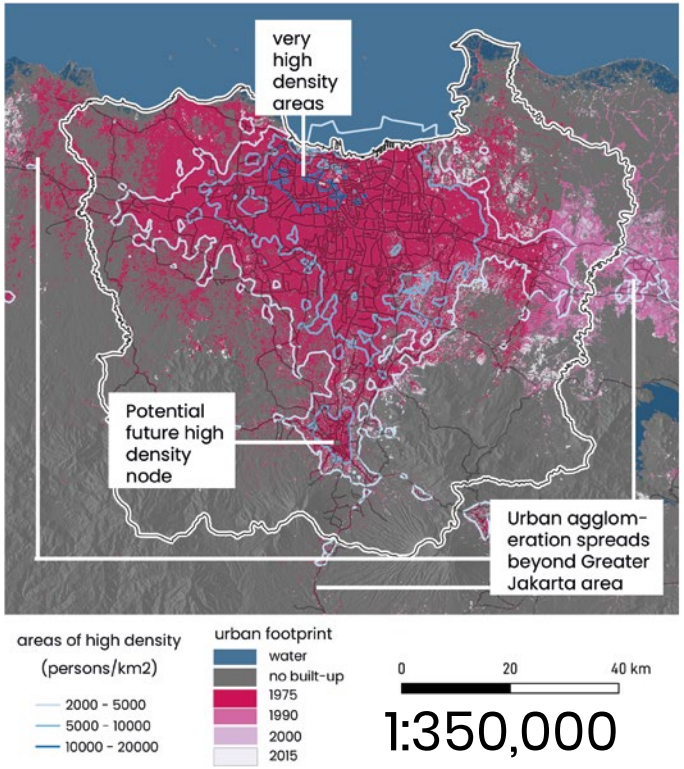
External drivers

The landcover and urbanisation maps illustrate some key external drivers that shape the food system in Jakarta. These include the use of land and indications of where population density and growth are most intense, highlighting the relationship cities have with food production, and suggesting areas of higher vulnerability during crises that affect the food system

Landcover 2015



Urbanisation trends



Jakarta is Indonesia's largest city, the nation's capital, and one of the world's largest metropolitan areas by population. Around a third of the population, c. 9 million people, live outside the formal, Greater Jakarta Metropolitan area. The city is located on Jakarta Bay, the Java Sea, to the north and the city has sprawled east and west along the coast, as well as south into West Java. The city is under threat from the sea a combination of subsidence and storm surges with around a quarter of the population affected by the latter. Population densities reach up to 21-25,000 persons per square kilometre in the some central parts of the city.

Key spatial indicators

Indicator	Jakarta	Average, 7 cities (excl. CXB)	Average, similar size LMIC cities in the region
Population density, persons per km2	7,249	9,468	11,677
Slum population	approx. 791,613		
Total built-up area in 2015, km2	1,889.1	471.0	776.0
Total resident population in 2015	36,312,539	11,002,460	
Surface of the built-up area per person in 2015, m2	52.0	37.3	37.5
Proportion of total resident population potentially exposed to floods in 2015 (%)	2%	38%	
Proportion of cultivated land in 50km radius	28.7%	33.3%	
Cultivated land in 50km radius per 100,000 persons, km²	7.9	44	
Number of supermarkets per 100,000 persons	1.1	4.8	
GDP per capita	11,766.8	4,200.4	
Growth rate	2.2	2.4	
Proportion of population of the urban agglomeration living outside the formal boundaries of the city	33%	37%	

Food supply chains

The following table illustrates the location of the suppliers and customers of surveyed private sector entities, giving an indication of the proximity of food supply chains to the city.

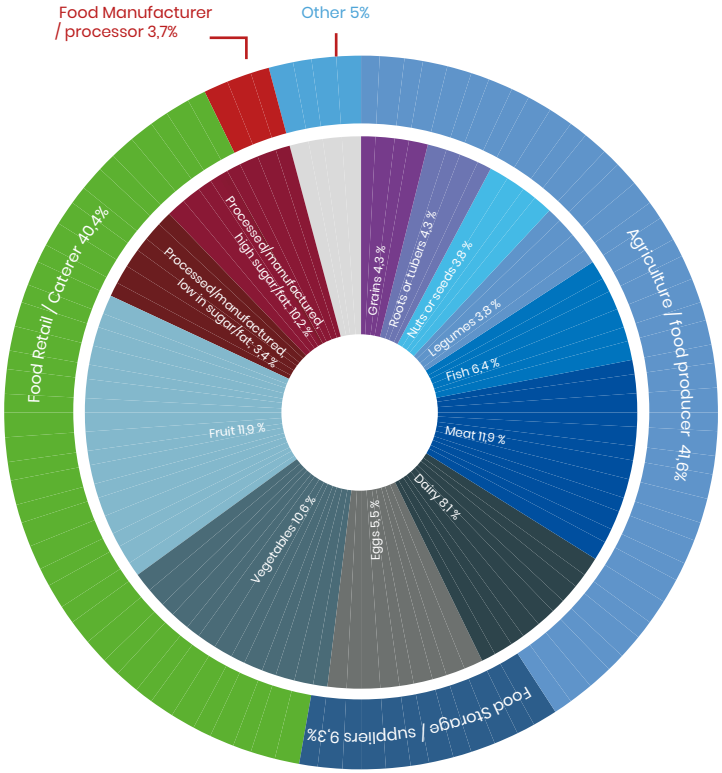
The proximity of food supply chains to the city

	Markets/ Customer locations	Supplier locations
Within the city	52.2%	46.6%
Surrounding region	22.4%	36,0 %
Other regions of the country	23.6%	15.5%
Internationally	1.9%	1.9%

Food environment

The local food system actors and the types of food available in the local market are shown in the below figure. The inner circle consists of the types of food businesses while the outer circle shows the types of food the system produces, processes or sells.

Food system actors & foods available in the local market



4. Outcomes & Pre-COVID-19 vulnerability

Nutritional status, dietary diversity and consumption of unhealthy foods

The following figures date from pre-COVID-19 and indicate vulnerabilities before the crisis, unless recent figures are available in which case a comparison between pre-COVID-19 and recent data is presented.

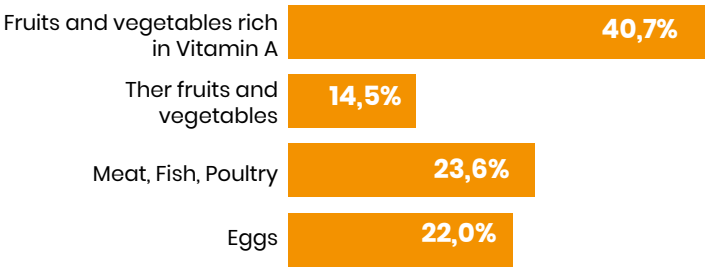
Women

Prevalence of minimum dietary diversity (MDD-W), Jakarta slums

* only data for either mother of or children 12-23 months

Children, 6-23 months

Foods consumed by breastfeeding children (6-23 months), Jakarta



Prevalence of minimum acceptable diet in Jakarta slums, children 6-23m

Children under 5 years

Proportion of wasted and stunted children, Jakarta city.

Consumption of unhealthy foods by children, Jakarta slums

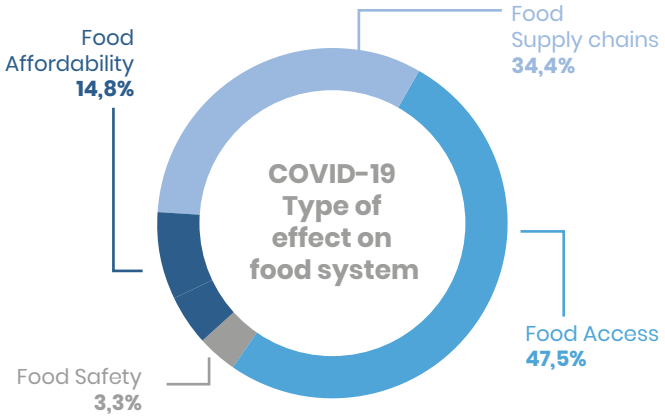
Food security

Changes in the food security levels of Jakarta's population before and during COVID-19 is presented based on the available data, using the Food Insecurity Experience Scale (FIES) and the Livelihood Coping Strategy Index (LCSI). Data using the Food Consumption Score (FCS) was not available.

Prevalence of minimum dietary diversity (MDD-W), Jakarta slums

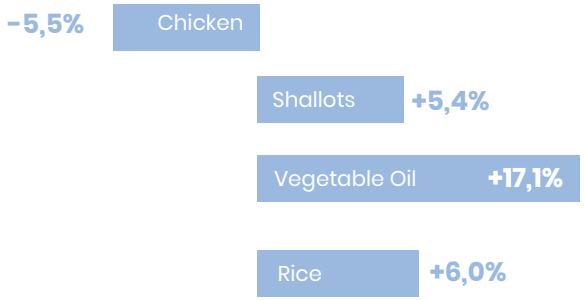
5. COVID-19 impact & response

This section explores the effects of COVID-19 on Jakarta's food system, examining supply chains, food prices and responses.

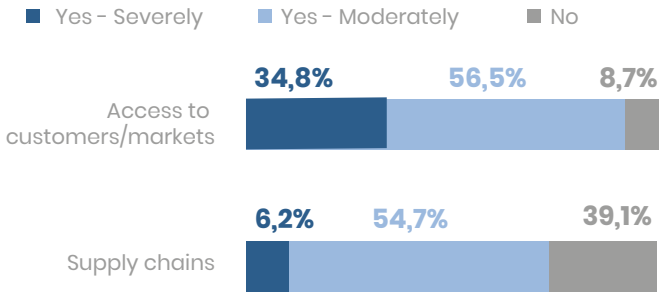


Change in food prices since COVID-19

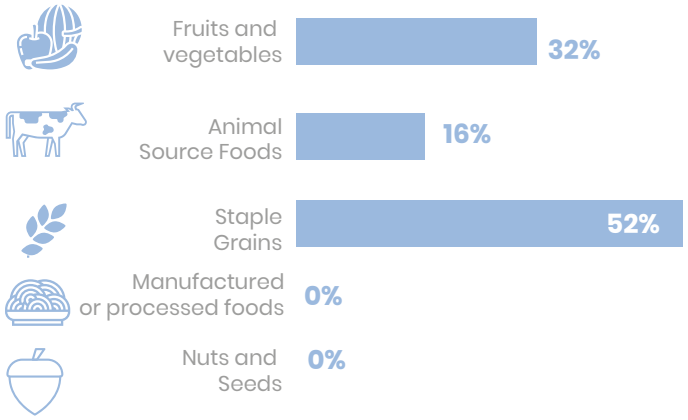
Change in food prices from November 2019 to November 2020 on four selected food items



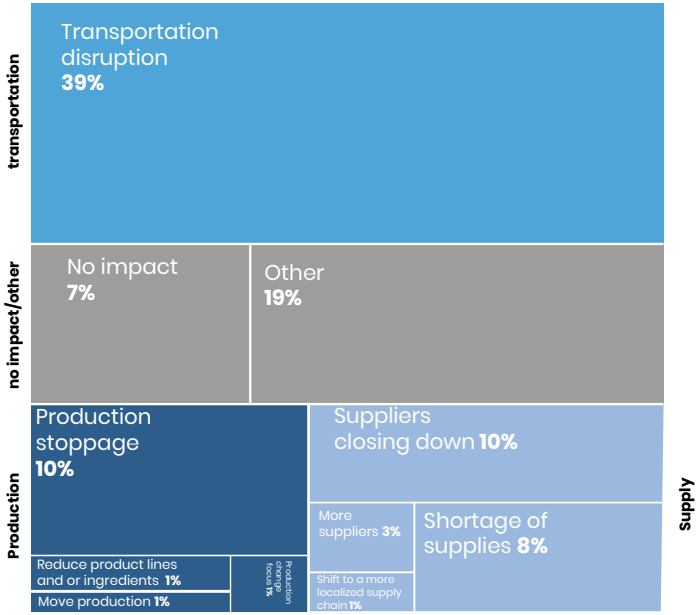
Extent of disruption of the COVID-19 pandemic on markets and supply chains



Foods that were short in supply



Effects of COVID-19 on company supply chains



Proportion of surveyed businesses whose income decreased between 25% and 50%

Data Sources

MDD-W REC UNICEF 2018 for Pre-COVID-19; Indonesia Urban Survey (SDFU) 2020 for during COVID-19.
Foods consumed by breastfeeding children (6-23 months) Secondary analysis of the DHS 2017
Minimum acceptable diet REC UNICEF 2018 for Pre-COVID-19; SDFU 2020 for during COVID-19.
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Proportion of wasted and stunted children Food Systems Dashboard, 2018. Stunting prevalence is classified as low and wasting prevalence as high by WHO standards.
Prevalence of moderate or severe food insecurity (Food Insecurity Experience Scale) REC UNICEF 2018 for pre-COVID; SDFU 2020 for during COVID
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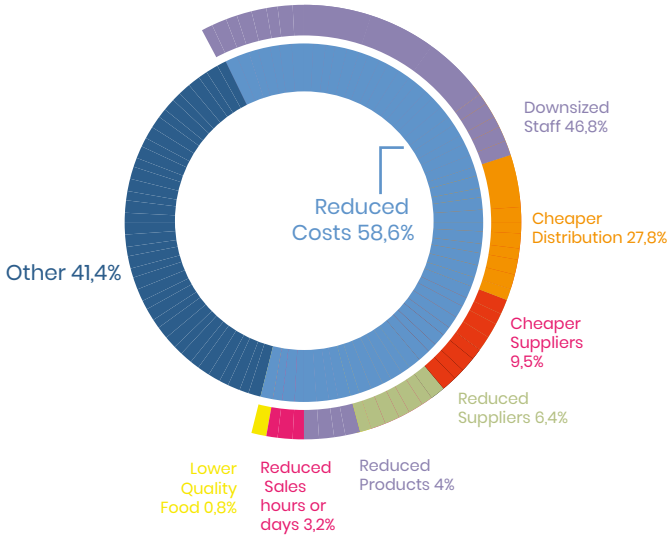
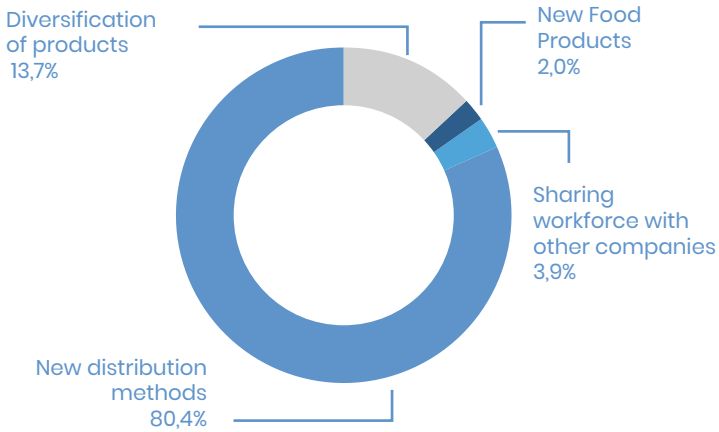
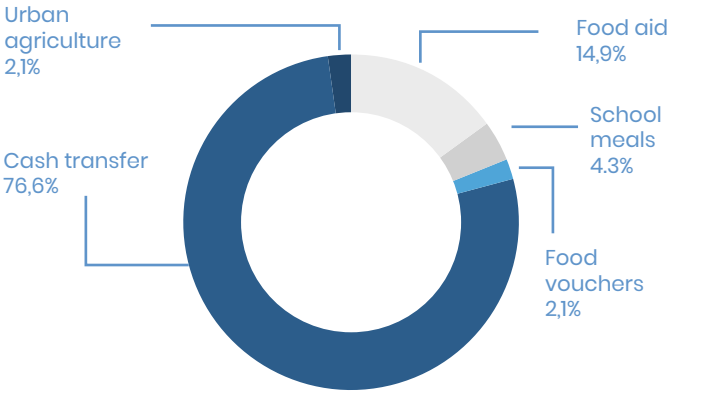


Other Methods of Adaptation by companies during COVID-19

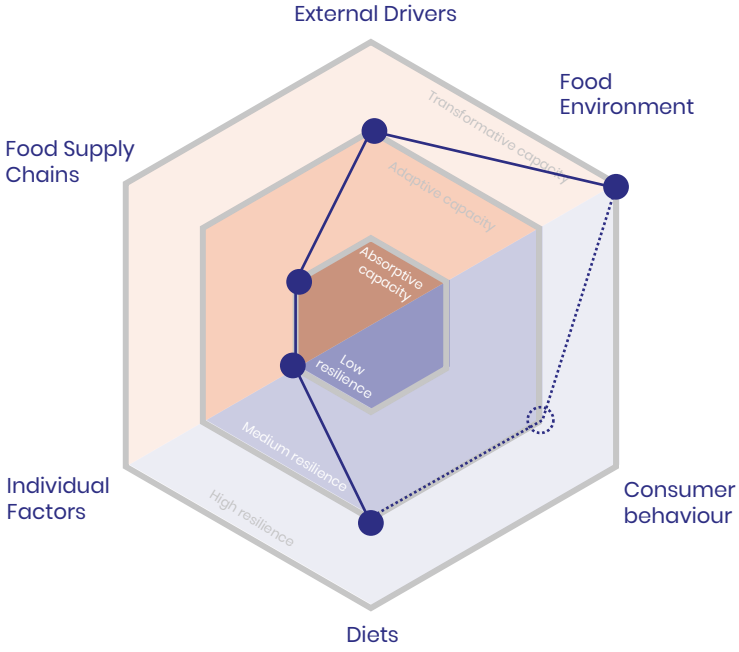


Response by Development Partners to food Insecurity



Typology

The typology contains one core indicator for each dimension, giving an indication to the food system's vulnerability and resilience in the face of COVID-19. No indicator was chosen for consumer behaviour.



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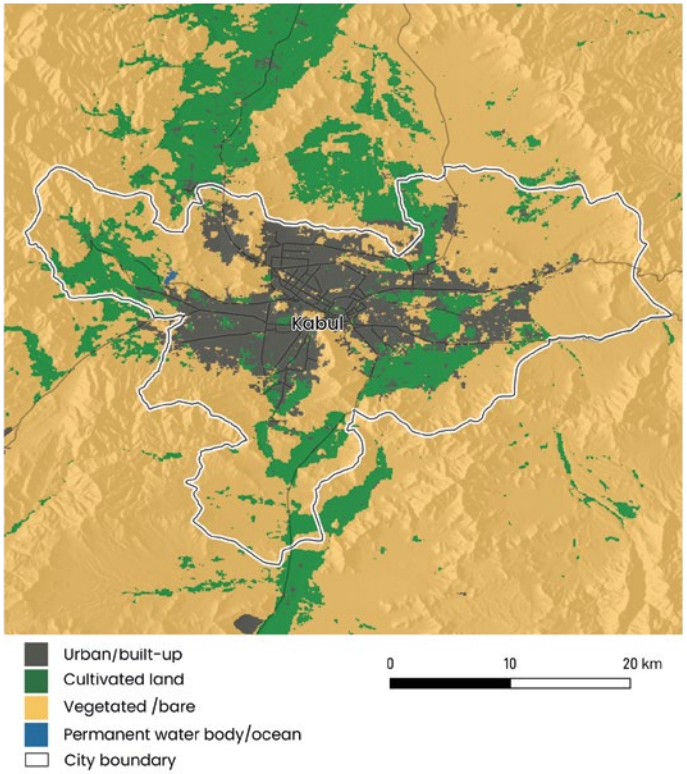
Key spatial indicators apart from slum population are from 2015 because data was consistently available across cities.

Population density, persons per km2	Calculated using 21.8% as a proportion of the urban population in Indonesia (SDFU 2020) of total population
Slum population	Slum census 2014
Cultivated land in 50km radius, km2	Calculated using GIS spatial analysis techniques by Dikoda using Copernicus Global Land Service data (2019) Buchhorn, M. et al. Copernicus Global Land Service: Land Cover 100m: collection 3: epoch 2019: Globe 2020. Accessed Feb 2020
Cultivated land in 50km radius per capita, km2	Copernicus as above
Number of markets/supermarkets per 100,000 persons	Calculated using GIS and OPenStreetMap data for each city

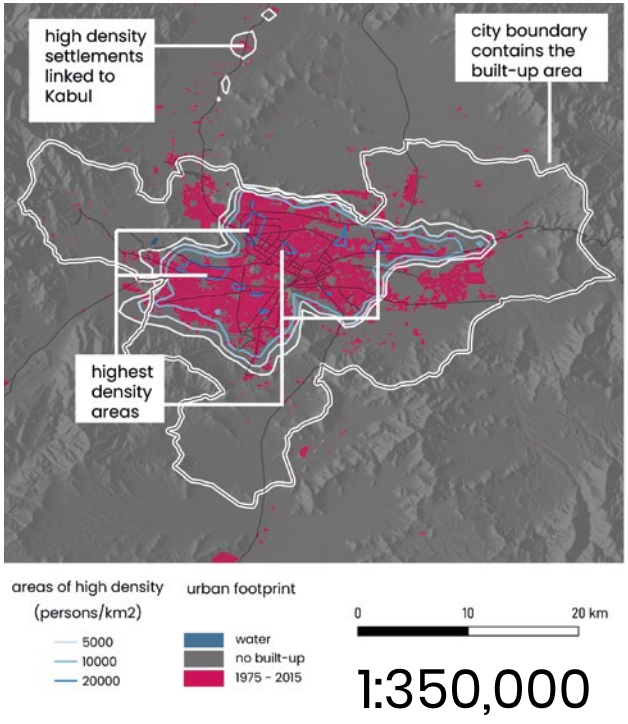
External drivers

The landcover and urbanisation maps illustrate some key external drivers that shape the food system in Kabul. These include the use of land and indications of where population density and growth are most intense, highlighting the relationship cities have with food production, and suggesting areas of higher vulnerability during crises that affect the food system

Landcover 2015



Urbanisation trends



Kabul is Afghanistan's largest city and the nation's capital. The city population has expanded considerably over the last two decades with population growing at on average 4% per annum, with the footprint of the city almost trebling in size since 1975. The amount of cultivated land in close proximity to the city is constrained by terrain and geography – rocky, with sparse vegetation. The majority of the urban population live within the official, city limits, with a handful of high density settlements existing to the north of the city.

Key spatial indicators

Indicator	Kabul	Average, 7 cities (excl. CXB)	Average, similar size LMIC cities in the region
Population density, persons per km2	13,651	9,468	13,337
Slum population	86% *		
Total built-up area in 2015, km2	108.7	471.0	82.1
Total resident population in 2015	4,381,842	11,002,460	
Surface of the built-up area per person in 2015, m2	24.8	37.3	20.3
Proportion of total resident population potentially exposed to floods in 2015 (%)	10%	38%	
Proportion of cultivated land in 50km radius	9.9%	33.3%	
Cultivated land in 50km radius per 100,000 persons, km²	19.4	44.0	
Number of supermarkets per 100,000 persons	0.5	4.8	
GDP per capita	1,314.5	4,200.4	
Growth rate	4	2.4	7.2
Proportion of population of the urban agglomeration living outside the formal boundaries of the city	24%	37%	

*of the urban housing stock nationally

Food supply chains

The following table illustrates the location of the suppliers and customers of surveyed private sector entities, giving an indication of the proximity of food supply chains to the city.

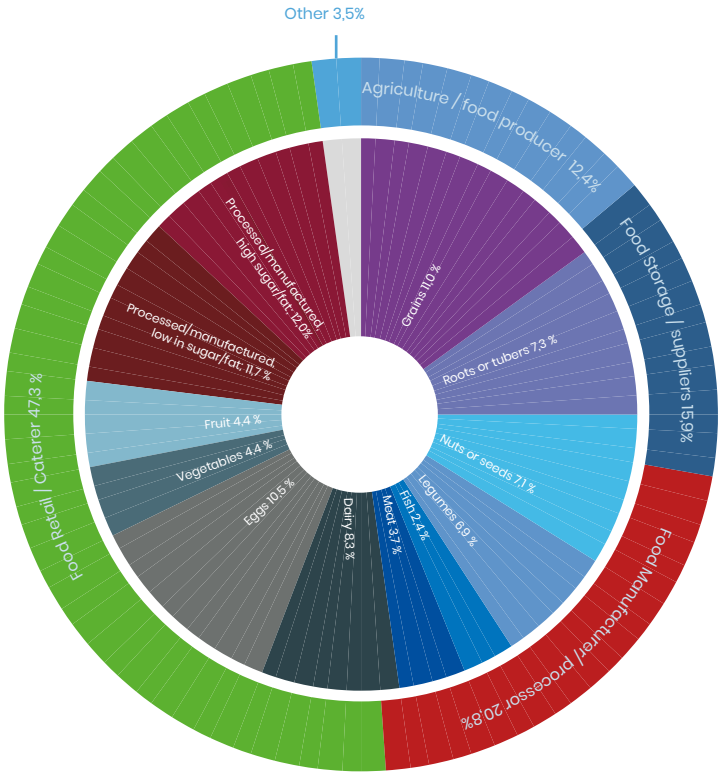
The proximity of food supply chains to the city

	Markets/ Customer locations	Supplier locations
Within the city	57.60%	69.30%
Surrounding region	35.70%	20.00%
Other regions of the country	4.90%	5.30%
Internationally	1.80%	5.30%

Food environment

The local food system actors and the types of food available in the local market are shown in the below figure. The inner circle consists of the types of food businesses while the outer circle shows the types of food the system produces, processes or sells.

Food system actors & foods available in the local market



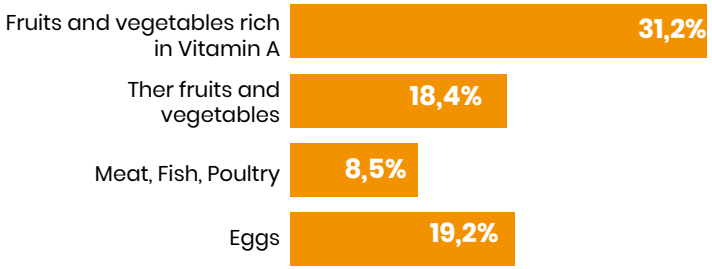
4. Outcomes & Pre-COVID-19 vulnerability

Nutritional status, dietary diversity and consumption of unhealthy foods

The following figures date from pre-COVID-19 and indicate vulnerabilities before the crisis, unless recent figures are available in which case a comparison between pre-COVID-19 and recent data is presented.

Children, 6-23 months

Foods consumed by breastfeeding children (6-23 months), Kabul



Minimum acceptable diet, children (6-23 months), Kabul

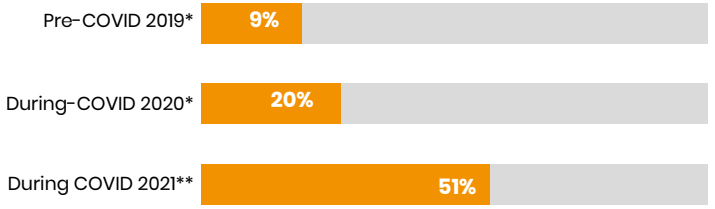
Children under 5 years

Proportion of wasted and stunted children, Kabul Province

Food security

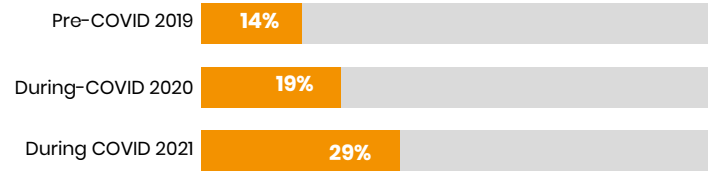
Changes in the food security levels of Kabul's population before and during COVID-19 is presented based on the available data, using the Food Consumption Score (FCS) and the Livelihood Coping Strategy Index (LCSI). Recent data using the Food Insecurity Experience Scale (FIES) was not available.

Change in the prevalence of emergency coping strategies (LCSI), Kabul province and Kabul city



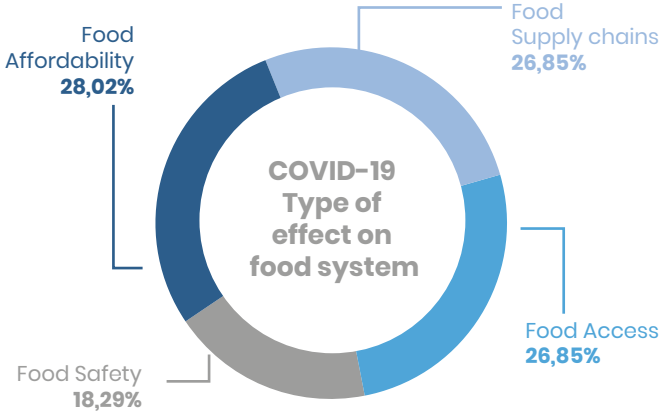
*Kabul province
**Kabul city

Change in the prevalence of households with a poor food consumption score, Kabul division



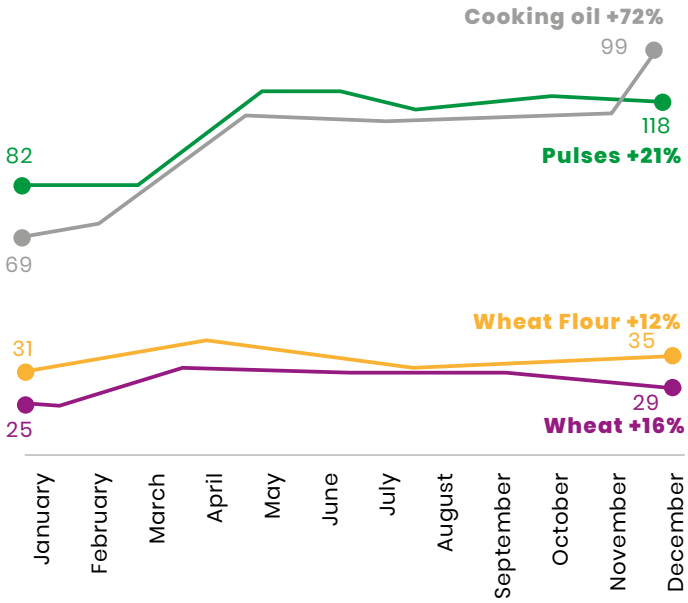
5. COVID-19 impact & response

This section explores the effects of COVID-19 on Kabul's food system, examining supply chains, food prices and responses.

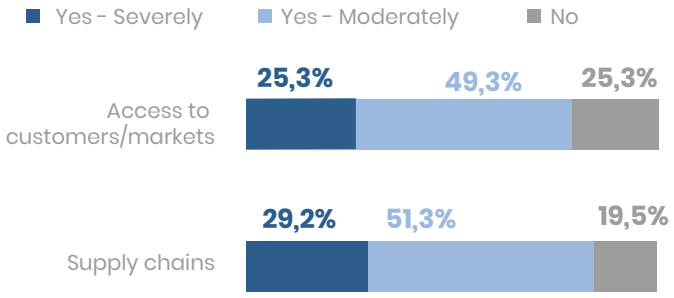


Change in food prices since COVID-19

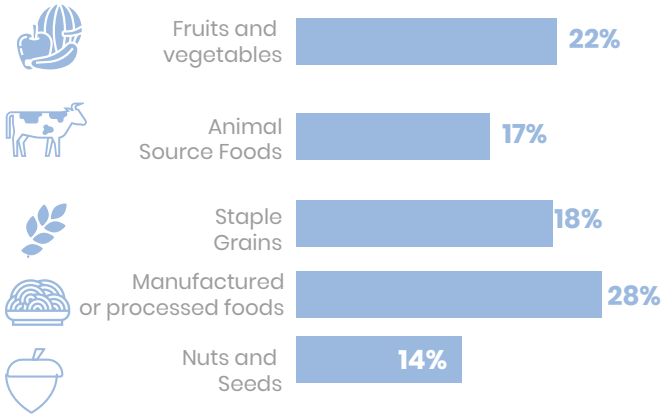
Change in food prices from January to December 2020 on four selected food items, AFN



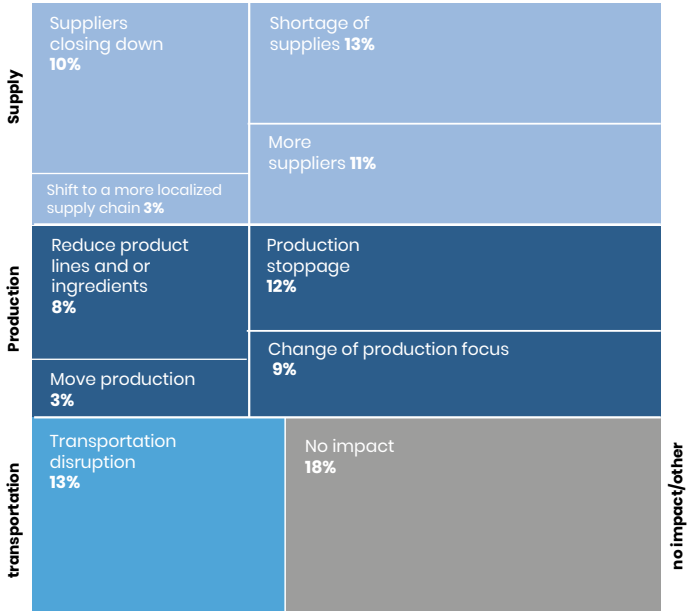
Extent of disruption of the COVID-19 pandemic on markets and supply chains



Foods that were short in supply



Effects of COVID-19 on company supply chains



Proportion of surveyed businesses whose income decreased between 25% and 50%

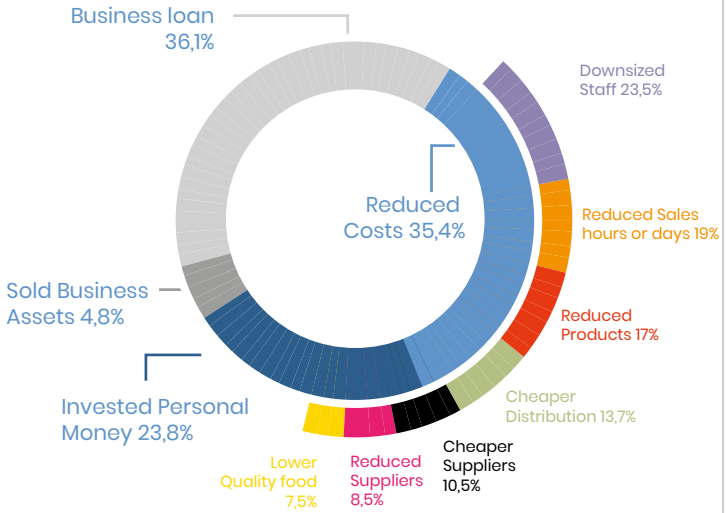
Data Sources

Foods consumed by breastfeeding children (6-23 months) Secondary analysis of the DHS 2015
Minimum acceptable diet Secondary analysis of the DHS 2015
Proportion of wasted and stunted children Afghanistan NNS 2013. Stunting prevalence is classified as high and wasting prevalence as medium by WHO standards.
Food Consumption Score (FCS) Seasonal Food Security Assessment (SFSA) 2019; Pre-Lean Season Assessment 2020; Pre-Lean Season Assessment 2021.
Livelihoods coping strategy index (LCSI) Seasonal Food Security Assessment (SFSA) 2019; Pre-Lean Season Assessment 2020; Pre-Lean Season Assessment 2021.
Monthly food prices WFP VAM
Sections Food supply chains, Food environment, COVID-19 impact and response Dikoda 2021

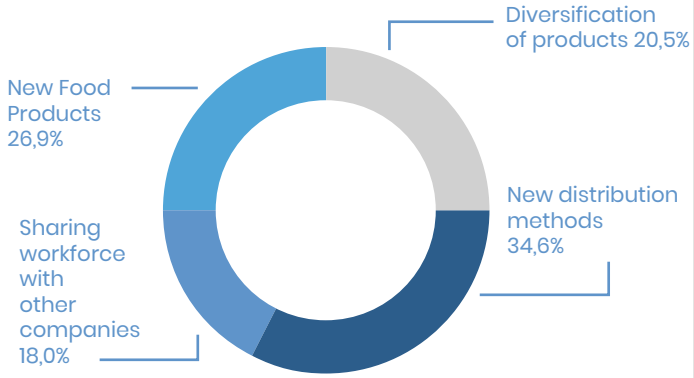
Responses and coping mechanisms

Impacts of COVID-19 on the food system are mitigated by responses by development partners and the government and by adaptations taken by food companies to changing conditions. This section illustrates some of these adaptations and responses, highlighting possible vulnerabilities and opportunities presented by the crisis

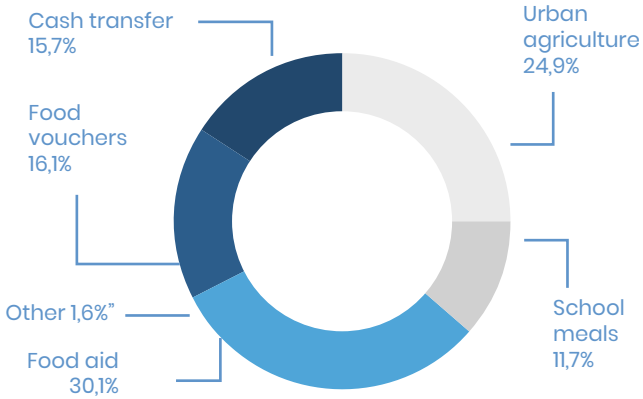
Private sector's methods to cope with lower income with breakdown of reduced costs



Other methods of adaptation by companies during COVID-19

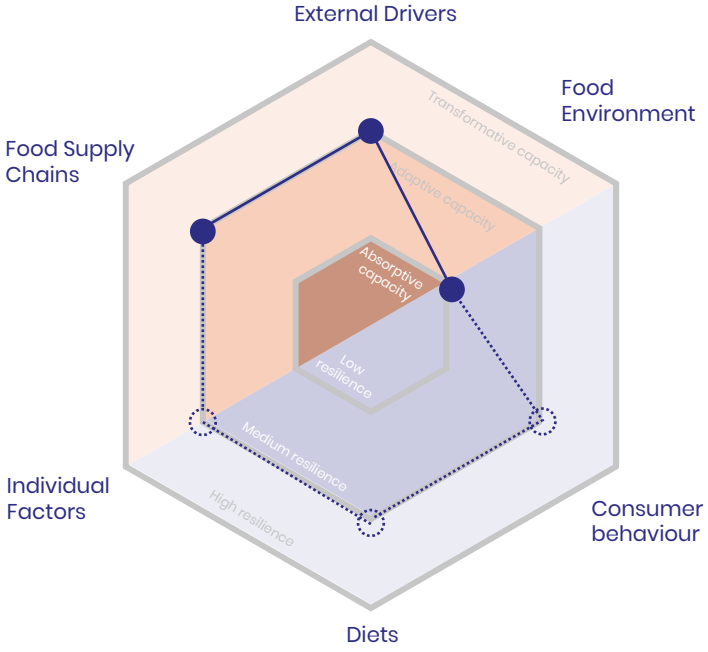


Response by Development Partners to food insecurity



Typology

The typology contains one core indicator for each dimension, giving an indication to the food system's vulnerability and resilience in the face of COVID-19. No indicator was chosen for consumer behaviour.



Methods and data sources

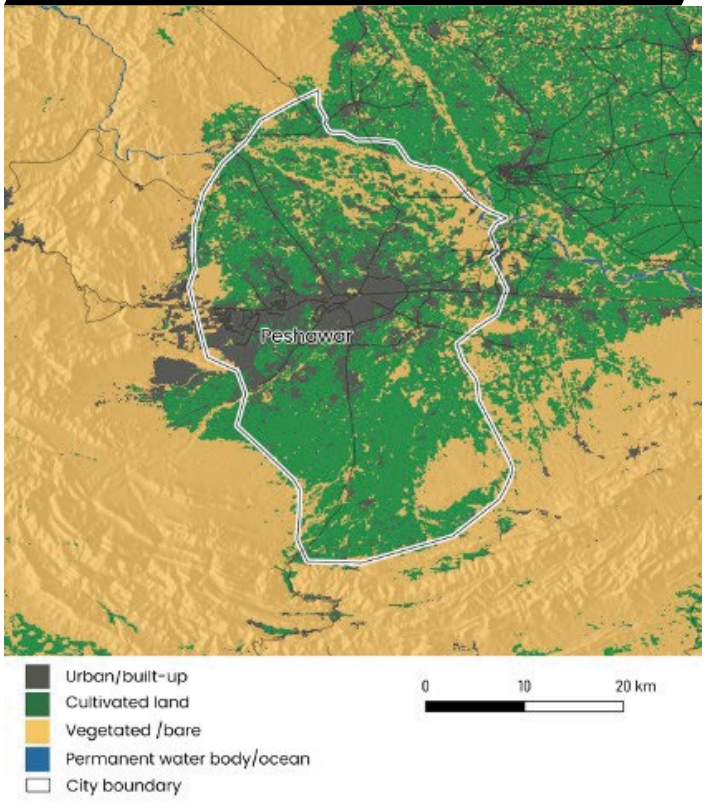
The brief describes the city's food system based on the Food Systems Framework presented in the report, with focus on available data and components that are likely to be impacted by COVID-19. All data is on city level unless indicated otherwise. Sources for the city brief include primary and secondary data and are listed after each figure or table. DHS data has been disaggregated to strata level to obtain figures specific to the city. Dikoda surveys took place in March 2021 and were carried out on governance, NGO and private sector stakeholders. The development of the typology and the full survey methodology is detailed in the report.
Key spatial indicators apart from slum population are from 2015 because data was consistently available across cities.

Population density, persons per km2	Government of the Islamic Republic of Afghanistan (2015). State of Afghan cities 2015. GoIRA: Kabul.
Slum population	Government of the Islamic Republic of Afghanistan (2015). State of Afghan cities 2015. GoIRA: Kabul.
Cultivated land in 50km radius, km2	Calculated using GIS spatial analysis techniques by Dikoda using Copernicus Global Land Service data (2019) Buchhorn, M. et al. Copernicus Global Land Service: Land Cover 100m: collection 3: epoch 2019: Globe 2020. Accessed Feb 2020
Cultivated land in 50km radius per capita, km2	Copernicus as above
Number of markets/supermarkets per 100,000 persons	Calculated using GIS and OPenStreetMap data for each city

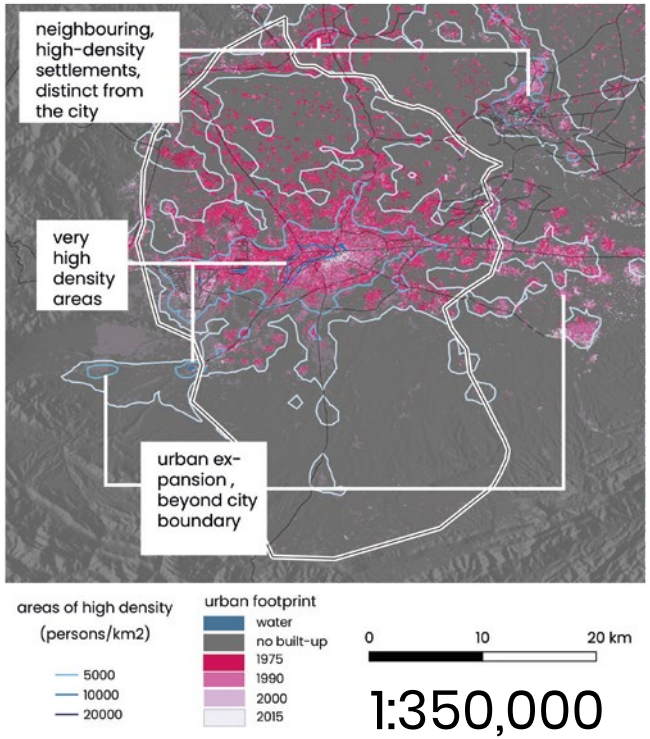
External drivers

The landcover and urbanisation maps illustrate some key external drivers that shape the food system in Peshawar. These include the use of land and indications of where population density and growth are most intense, highlighting the relationship cities have with food production, and suggesting areas of higher vulnerability during crises that affect the food system

Landcover 2015



Urbanisation trends



1:350,000

Peshawar is the sixth largest city in Pakistan and capital of the Khyber Pakhtunkhwa province (formerly North West Province), around 50km from the border with Afghanistan. The city has grown broadly east-west along the Peshawar Valley, and several high-density suburbs have grown up including Hayatabad to the west of the city. Around 20% of the population of the urban agglomeration living outside the formal, Peshawar Municipal Corporation area. The neighbouring city of Charsadda lies around 15km away across the Kabul River, where a further 100,000+ persons live.

Key spatial indicators

Indicator	Peshawar	Average, 7 cities (excl. CXB)	Average, similar size LMIC cities in the region
Population density, persons per km2	7,533	9,468	9,107
Slum population	+ 250,000		
Total built-up area in 2015, km2	81.2	471.0	76
Total resident population in 2015	2,764,734	11,002,460	
Surface of the built-up area per person in 2015, m2	29.4	37.3	20.3
Proportion of total resident population potentially exposed to floods in 2015 (%)	7%	38%	
Proportion of cultivated land in 50km radius	35.8%	33.3%	
Cultivated land in 50km radius per 100,000 persons, km²	40.3	44.0	
Number of supermarkets per 100,000 persons	0.7	4.8	
GDP per capita	2,014.1	4,200.4	
Growth rate	2.0	2.4	1.3
Proportion of population of the urban agglomeration living outside the formal boundaries of the city	19%	37%	

Food supply chains

The following table illustrates the location of the suppliers and customers of surveyed private sector entities, giving an indication of the proximity of food supply chains to the city.

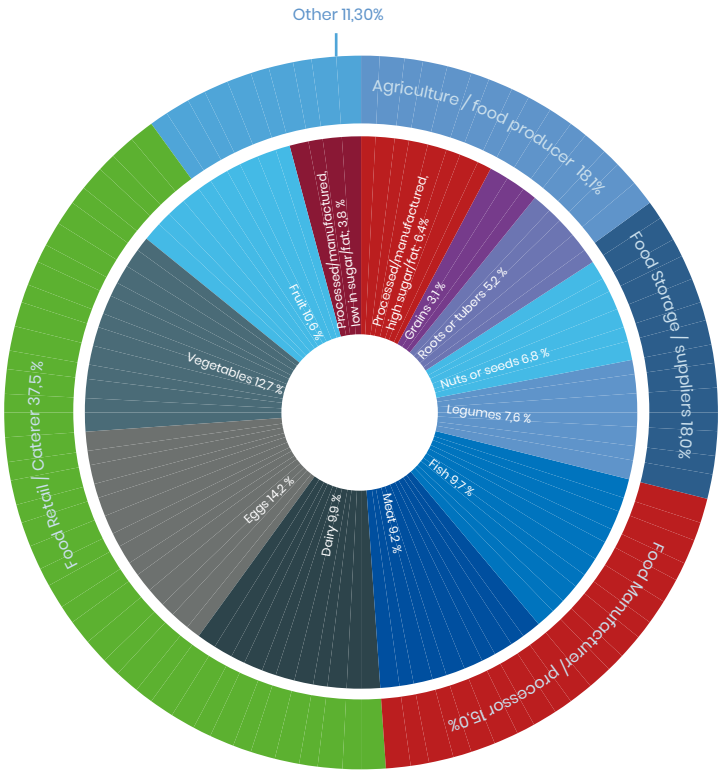
The proximity of food supply chains to the city

	Markets/ Customer locations	Supplier locations
Within the city	48.80%	34.40%
Surrounding region	41.30%	43.10%
Other regions of the country	9.40%	21.30%
Internationally	0.60%	1.30%

Food environment

The local food system actors and the types of food available in the local market are shown in the below figure. The inner circle consists of the types of food businesses while the outer circle shows the types of food the system produces, processes or sells.

Food system actors & foods available in the local market



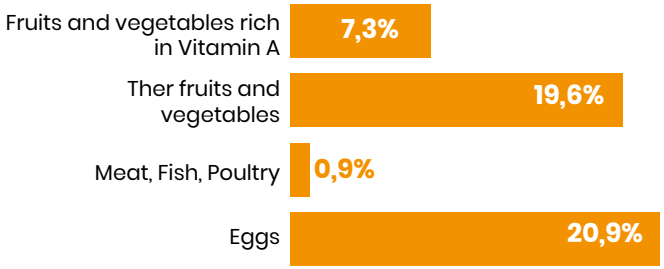
4. Outcomes & Pre-COVID-19 vulnerability

Nutritional status, dietary diversity and consumption of unhealthy foods

The following figures date from pre-COVID-19 and indicate vulnerabilities before the crisis, unless recent figures are available in which case a comparison between pre-COVID-19 and recent data is presented.

Children, 6-23 months

Foods consumed by breastfeeding children (6-23 months), Peshawar



Minimum diet diversity (6-23 months), Peshawar

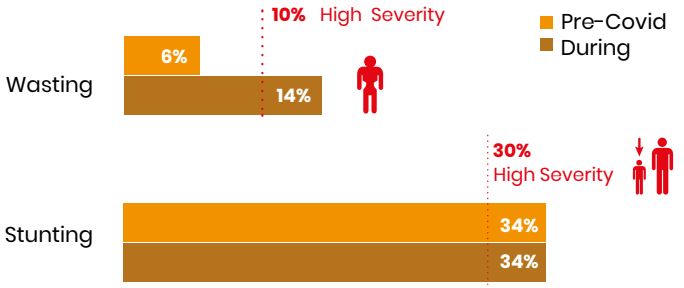
11,1%

Minimum acceptable diet (6-23 months), Peshawar

7,9%

Children under 5 years

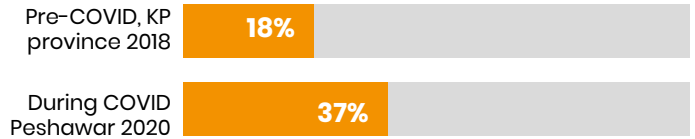
Proportion of wasted and stunted children before and during COVID-19, Peshawar



Food security

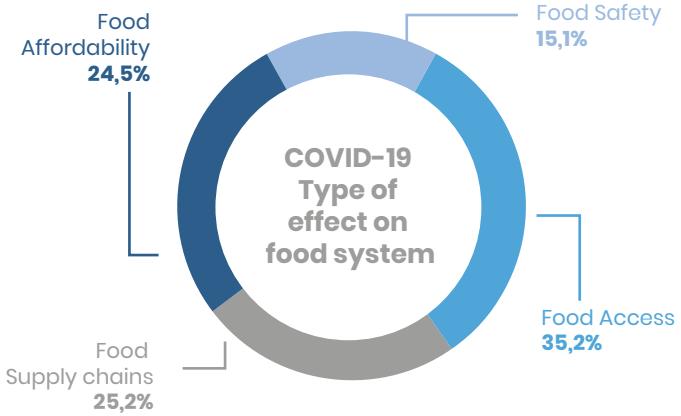
Changes in the food security levels of Peshawar's population before and during COVID-19 is presented based on the available data, using the Food Insecurity Experience Scale (FIES). Recent data using the Food Consumption Score (FCS) or the Livelihood Coping Strategy Index (LCSI) were not available.

Change in the prevalence of moderate or severe food insecurity (Food Insecurity Experience Scale)



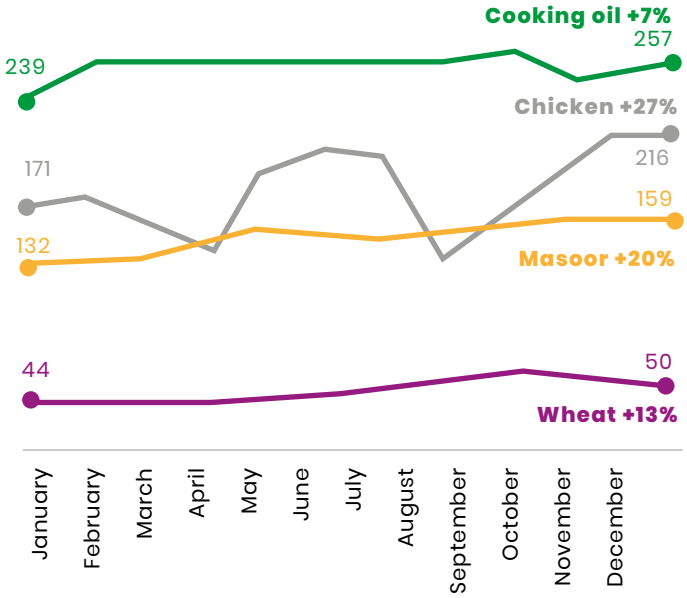
5. COVID-19 impact & response

This section explores the effects of COVID-19 on Peshawar's food system, examining supply chains, food prices and responses.

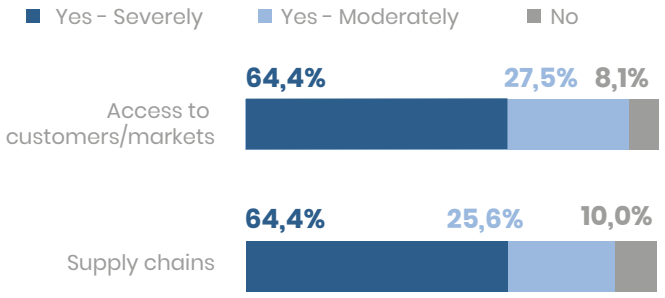


Change in food prices since COVID-19

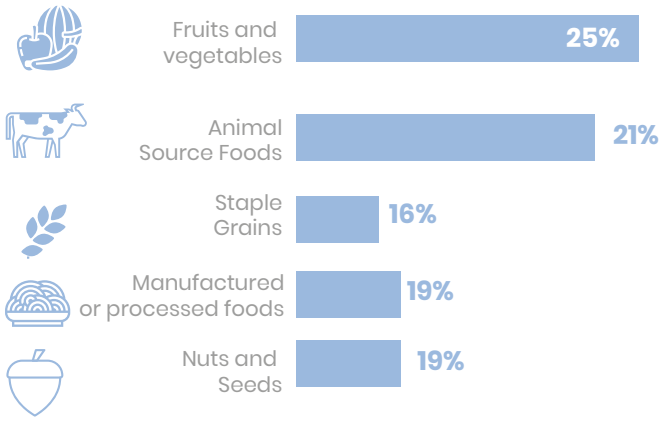
Change in food prices from January to December 2020 on four selected food items, PKR



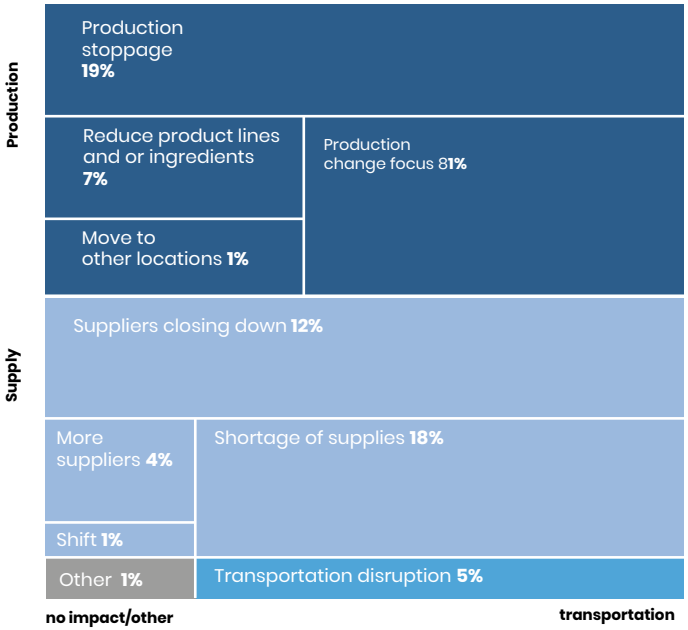
Extent of disruption of the COVID-19 pandemic on markets and supply chains



Foods that were short in supply



Effects of COVID-19 on company supply chains



Proportion of surveyed businesses whose income decreased between 25% and 50%

Data Sources

Foods consumed by breastfeeding children (6-23 months) Secondary analysis of the DHS 2017-18
Minimum acceptable diet Secondary analysis of the DHS 2017-18
Proportion of wasted and stunted children Secondary analysis of the DHS 2017-18; FAO Rapid assessment 2020. Stunting prevalence is classified as high and wasting prevalence as medium by WHO standards.
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Sections Food supply chains, Food environment, COVID-19 impact and response Dikoda 2021

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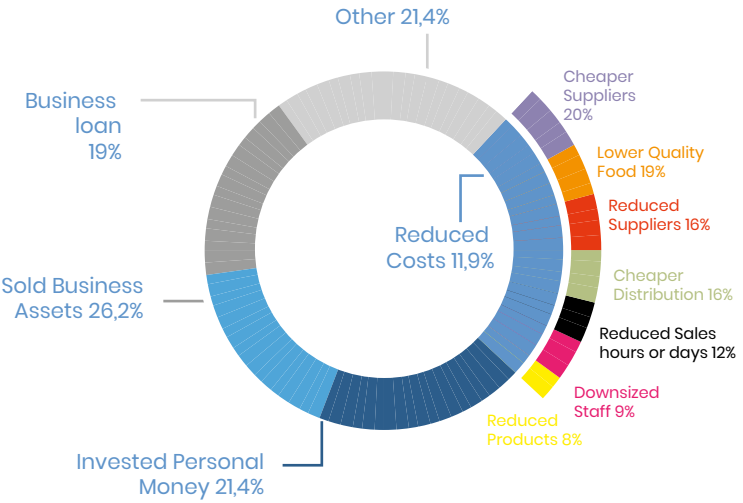
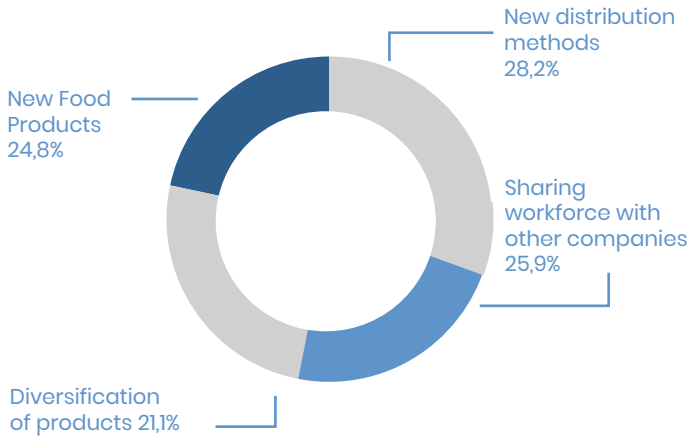
Impacts of COVID-19 on the food system are mitigated by responses by development partners and the government and by adaptations taken by food companies to changing conditions. This section illustrates some of these adaptations and responses, highlighting possible vulnerabilities and opportunities presented by the crisis

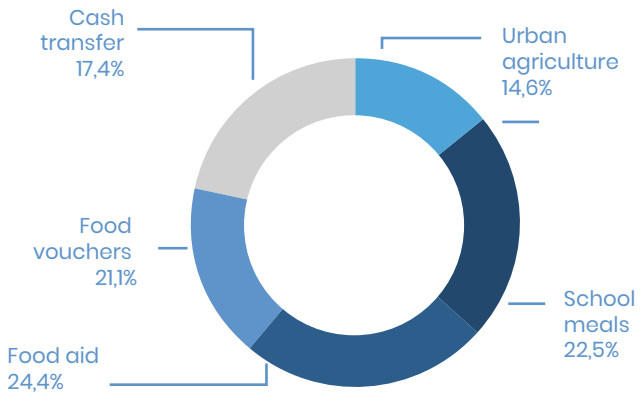
Private sector's methods to cope with lower income with breakdown of reduced costs



Other methods of adaptation by companies during COVID-19

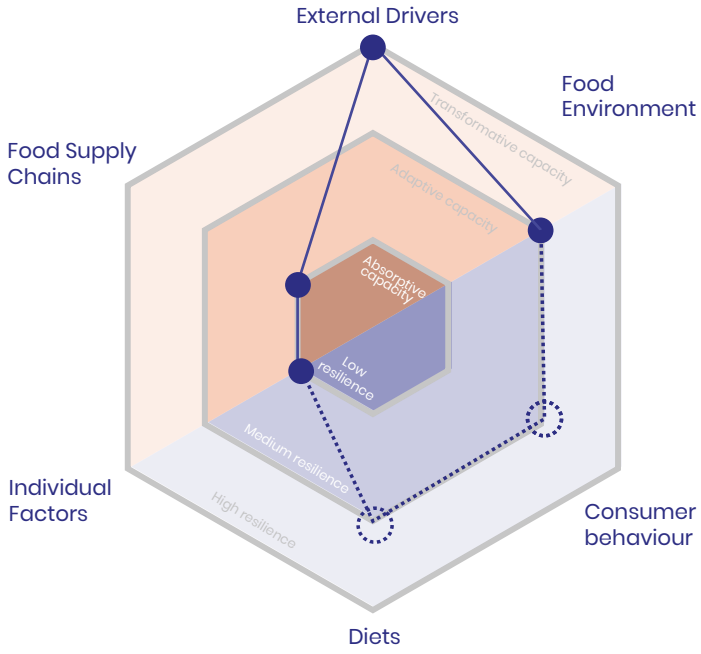


Response by Development Partners to food insecurity



Typology

The typology contains one core indicator for each dimension, giving an indication to the food system's vulnerability and resilience in the face of COVID-19. No indicator was chosen for consumer behaviour.



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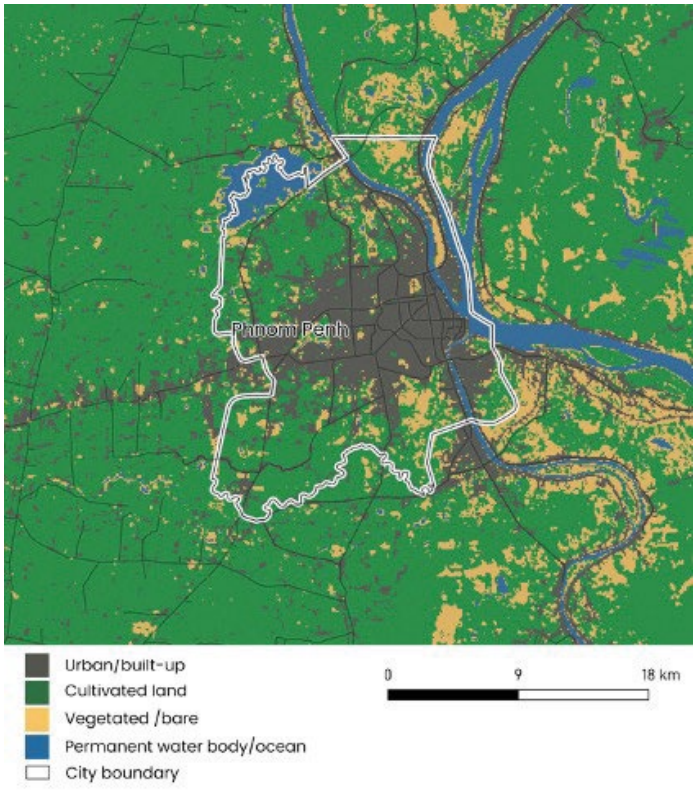
The brief describes the city's food system based on the Food Systems Framework presented in the report, with focus on available data and components that are likely to be impacted by COVID-19. All data is on city level unless indicated otherwise. Sources for the city brief include primary and secondary data and are listed after each figure or table. DHS data has been disaggregated to strata level to obtain figures specific to the city. Dikoda surveys took place in March 2021 and were carried out on governance, NGO and private sector stakeholders. : The development of the typology and the full survey methodology is detailed in the report.
Key spatial indicators apart from slum population are from 2015 because data was consistently available across cities.

Population density, persons per km2	Calculated from GHSL data. Florczyk, A et al. (2019): GHS Urban Centre Database 2015, multitemporal and multidimensional attributes, R2019A. European Commission, Joint Research Centre (JRC) PID: https://data.jrc.ec.europa.eu/dataset/53473144-b88c-44bc-b4a3-4583ed1f547e
Slum population	UNICEF 2020. Profiling of Slums and Underserved Areas of Peshawar City of Khyber Pakhtunkhwa Province of Pakistan.
Cultivated land in 50km radius, km2	Calculated using GIS spatial analysis techniques by Dikoda using Copernicus Global Land Service data (2019) Buchhorn, M. et al. Copernicus Global Land Service: Land Cover 100m: collection 3: epoch 2019: Globe 2020. Accessed Feb 2020
Cultivated land in 50km radius per capita, km2	Copernicus as above
Number of markets/supermarkets per 100,000 persons	Calculated using GIS and OPenStreetMap data for each city

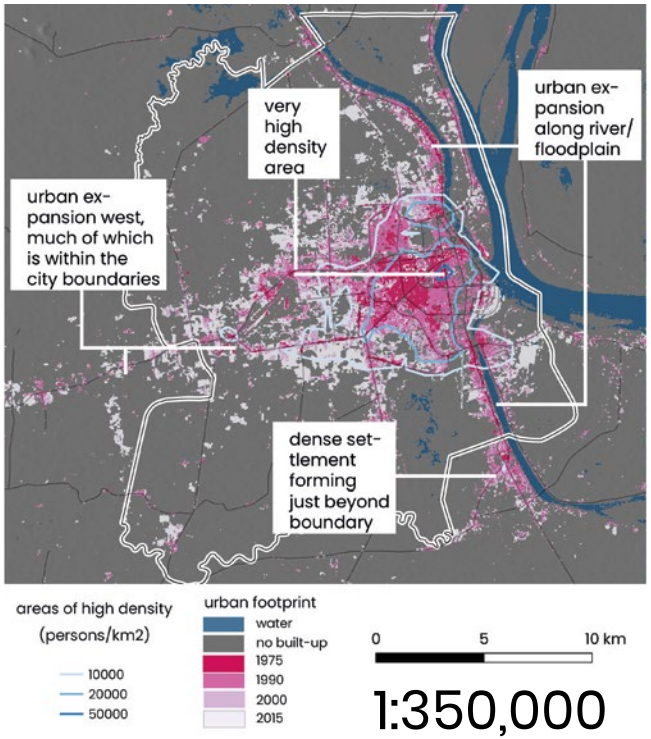
External drivers

The landcover and urbanisation maps illustrate some key external drivers that shape the food system in Phnom Penh. These include the use of land and indications of where population density and growth are most intense, highlighting the relationship cities have with food production, and suggesting areas of higher vulnerability during crises that affect the food system

Landcover 2015



Urbanisation trends



Phnom Penh is the largest city and capital of Cambodia. It is built on the banks of the Tonlé Sap, Mekong, and Bassac Rivers in low-lying, fertile agricultural land. Around 90% of the city's population is at risk from annual flooding. The city has expanded north-south along the river banks and also in a westerly direction, with the urban footprint growing at around 1.15% per annum. Population growth rates are c. 3% per annum.

Key spatial indicators

Indicator	Phnom Penh	Average, 7 cities (excl. CXB)	Average, similar size LMIC cities in the region
Population density, persons per km2	6,905	9,468	9107
Slum population	approx. 25%		
Total built-up area in 2015, km2	77.4	471.0	76.0
Total resident population in 2015	1,816,032	11,002,460	
Surface of the built-up area per person in 2015, m2	42.6	37.3	40.7
Proportion of total resident population potentially exposed to floods in 2015 (%)	90%	38%	
Proportion of cultivated land in 50km radius	93.4%	33.3%	
Cultivated land in 50km radius per 100,000 persons, km²	193.5	44.0	
Number of supermarkets per 100,000 persons	4.3	4.8	
GDP per capita	2,643.7	4,200.4	
Growth rate	3.0	2.4	13.0
Proportion of population of the urban agglomeration living outside the formal boundaries of the city	13%	37%	

Food supply chains

The following table illustrates the location of the suppliers and customers of surveyed private sector entities, giving an indication of the proximity of food supply chains to the city.

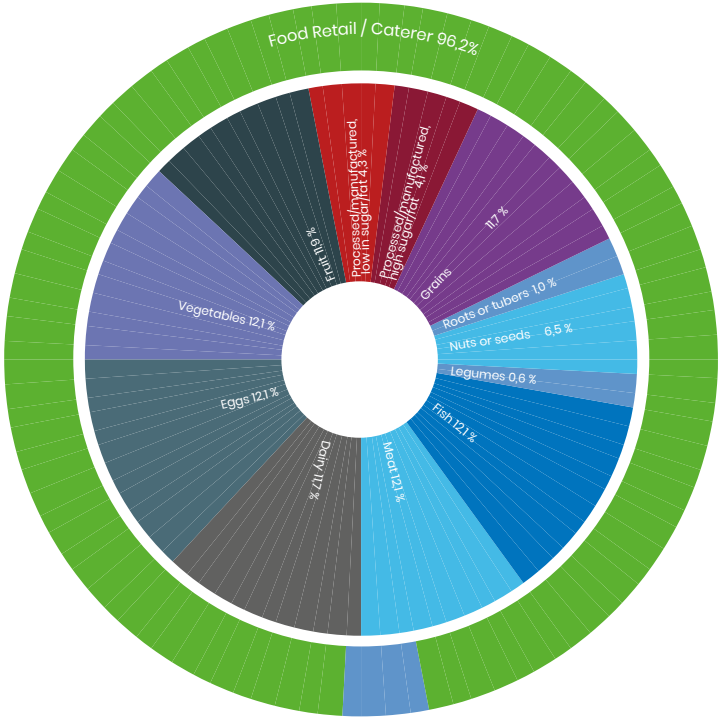
The proximity of food supply chains to the city

	Markets/ Customer locations	Supplier locations
Within the city	92.3%	91.8%
Surrounding region	7.7%	8.2%
Other regions of the country	-	-
Internationally	-	-

Food environment

The local food system actors and the types of food available in the local market are shown in the below figure. The inner circle consists of the types of food businesses while the outer circle shows the types of food the system produces, processes or sells.

Food system actors & foods available in the local market



4. Outcomes & Pre-COVID-19 vulnerability

Nutritional status, dietary diversity and consumption of unhealthy foods

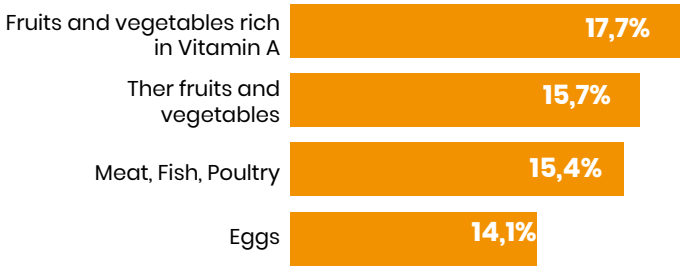
The following figures date from pre-COVID-19 and indicate vulnerabilities before the crisis, unless recent figures are available in which case a comparison between pre-COVID-19 and recent data is presented.

Women

Average minimum dietary diversity score for women (MDD-W), Phnom Penh Province

Children, 6-23 months

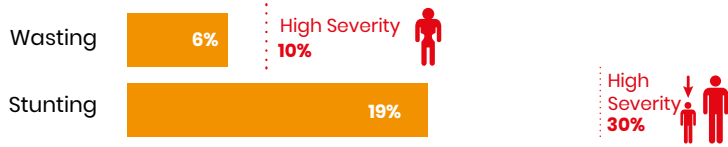
Foods consumed by breastfeeding children (6-23 months), Phnom Penh



Minimum acceptable diet, (6-23 months), urban Cambodia

Children under 5 years

Proportion of wasted and stunted children, Phnom Penh

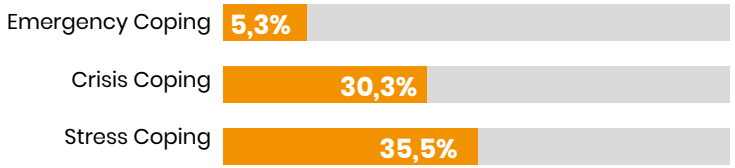


Food security

Changes in the food security levels of Phnom Penh's population before and during COVID-19 is presented based on the available data, using the Food Consumption Score (FCS) and the Livelihood Coping Strategy Index (LCSI). Data using the Food Insecurity Experience Scale (FIES) was not available.

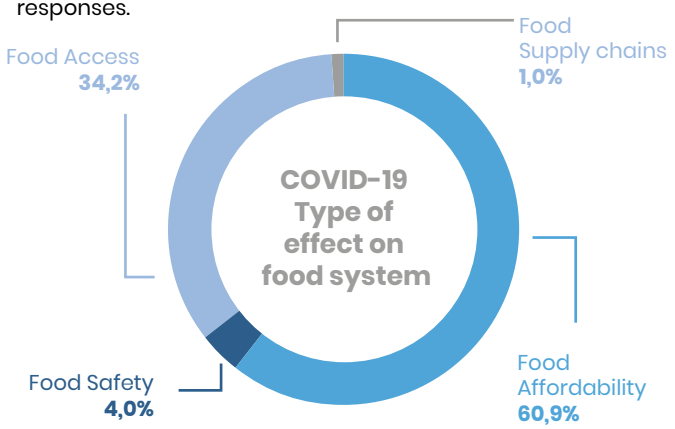
Prevalence of poor to borderline food consumption score in Phnom Penh

Livelihoods coping strategy index (LCSI) in households with children 0-59m, Phnom Penh province during COVID



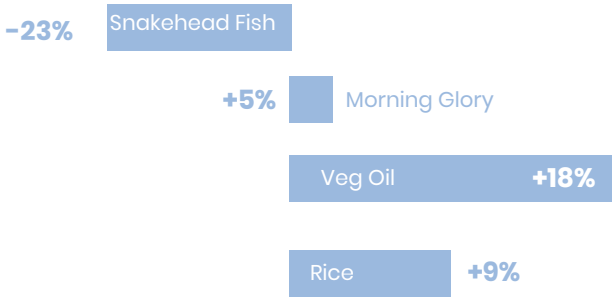
5. COVID-19 impact & response

This section explores the effects of COVID-19 on Phnom Penh's food system, examining supply chains, food prices and responses.

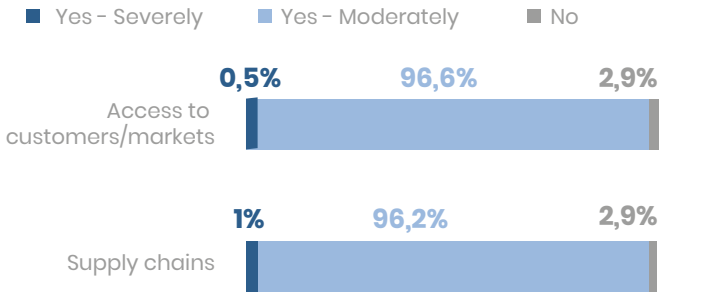


Change in food prices since COVID-19

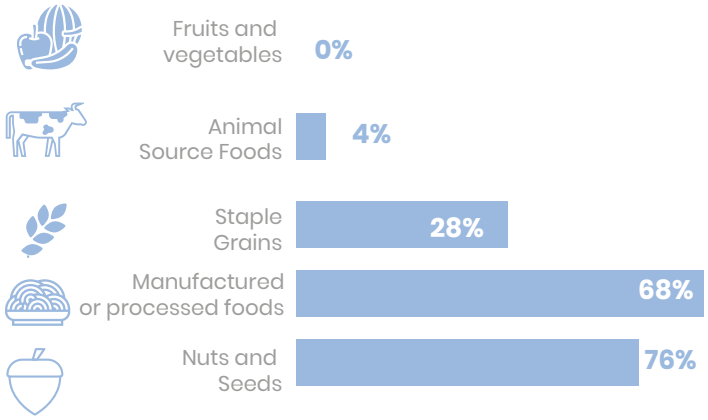
Change in food prices from May 2020 to March 2021 on four selected food items



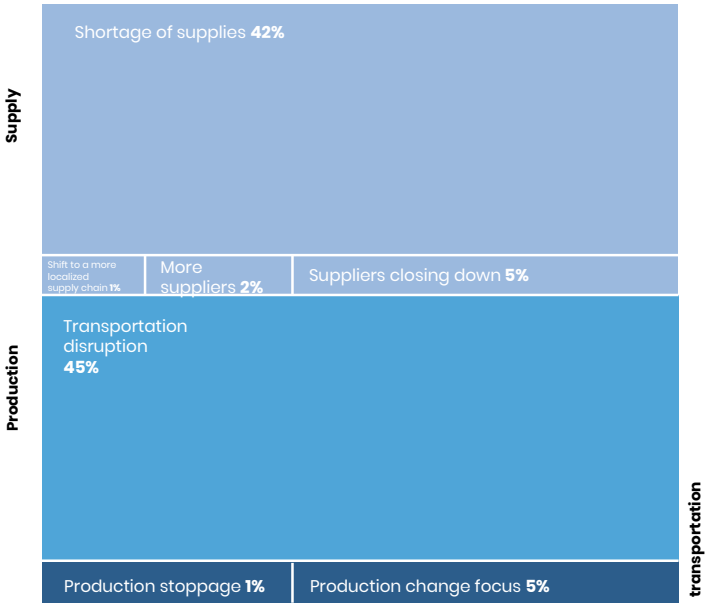
Extent of disruption of the COVID-19 pandemic on markets and supply chains



Foods that were short in supply



Effects of COVID-19 on company supply chains



Proportion of surveyed businesses whose income decreased between 25% and 50%

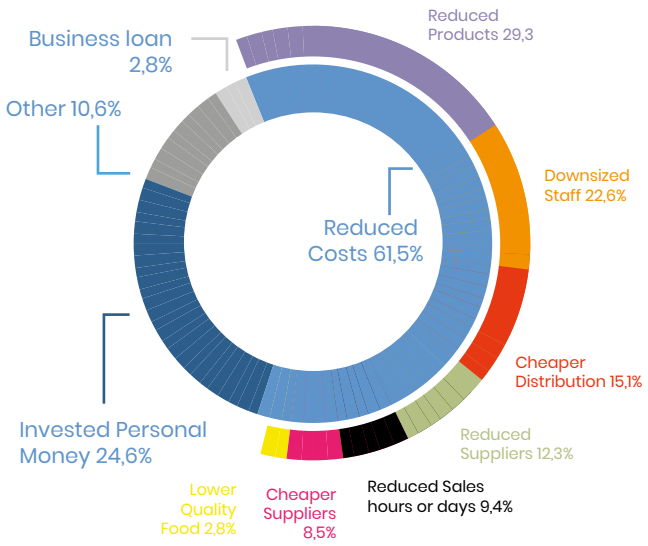
Data Sources

MDD-W Socioeconomic impacts of COVID-19 on households in Cambodia, Round 3, 2020
Foods consumed by breastfeeding children (6-23 months) Secondary analysis of the DHS 2014
Minimum acceptable diet Food systems dashboard, 2013-2018
Proportion of wasted and stunted children Secondary analysis of the DHS 2014. Stunting prevalence is classified as low and wasting prevalence as medium by WHO standards.
Food Consumption Score (FCS) CSES 2017; COVID19 Social Impact Study.
Livelihoods coping strategy index (LCSI) Socioeconomic impacts of COVID-19 on households in Cambodia, October 2020
Monthly food prices WFP VAM
Sections Food supply chains, Food environment, COVID-19 impact and response Dikoda 2021

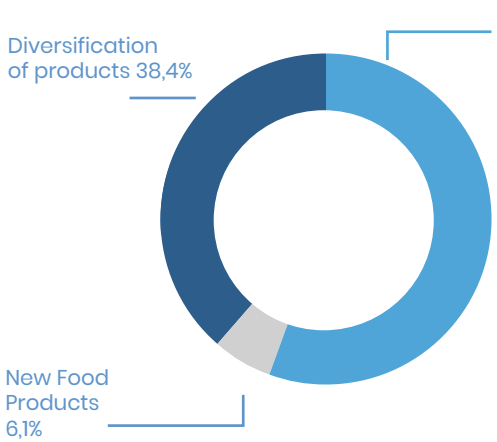
Responses and coping mechanisms

Impacts of COVID-19 on the food system are mitigated by responses by development partners and the government and by adaptations taken by food companies to changing conditions. This section illustrates some of these adaptations and responses, highlighting possible vulnerabilities and opportunities presented by the crisis

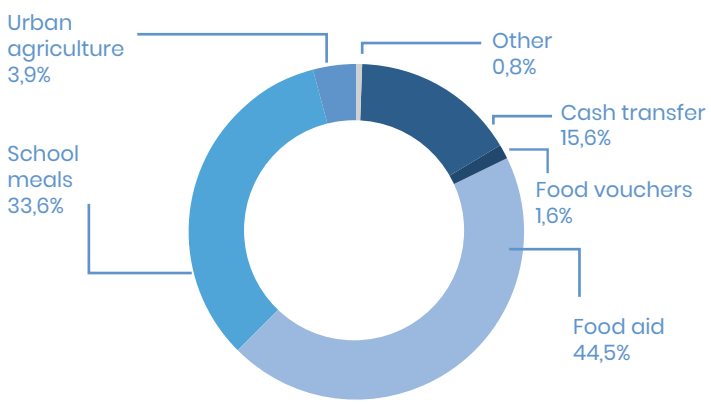
Private sector's methods to cope with lower income with breakdown of reduced costs



Other methods of adaptation by companies during COVID-19

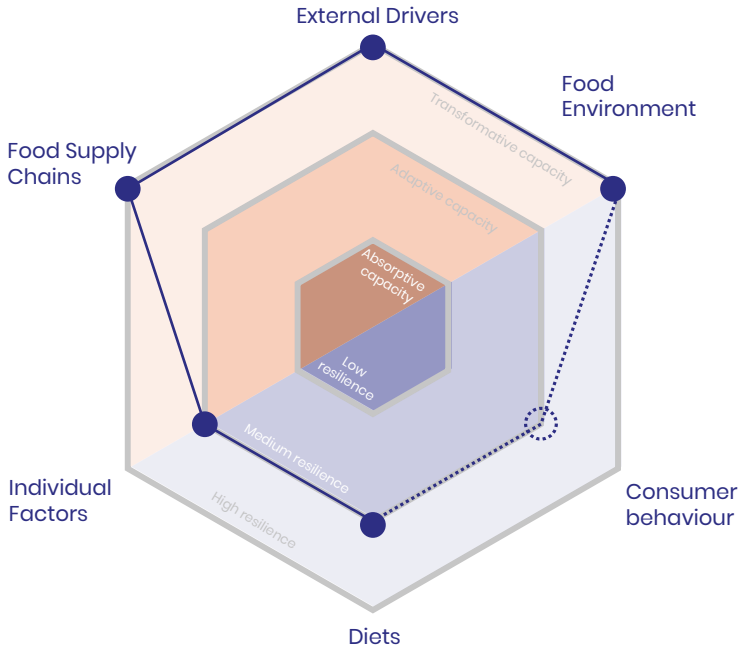


Response by Development Partners to food insecurity



Typology

The typology contains one core indicator for each dimension, giving an indication to the food system's vulnerability and resilience in the face of COVID-19. No indicator was chosen for consumer behaviour.



Methods and data sources

The brief describes the city's food system based on the Food Systems Framework presented in the report, with focus on available data and components that are likely to be impacted by COVID-19. All data is on city level unless indicated otherwise. Sources for the city brief include primary and secondary data and are listed after each figure or table. DHS data has been disaggregated to strata level to obtain figures specific to the city. Dikoda surveys took place in March 2021 and were carried out on governance, NGO and private sector stakeholders. : The development of the typology and the full survey methodology is detailed in the report.
Key spatial indicators apart from slum population are from 2015 because data was consistently available across cities.

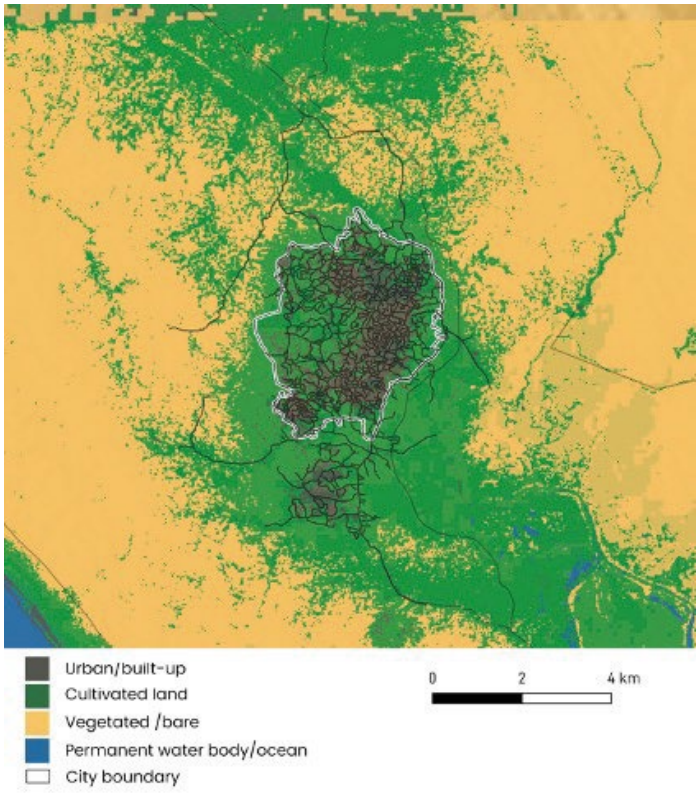
Data table source:

Population density, persons per km2	Calculated from GHSL data. Florczyk, A et al. (2019): GHS Urban Centre Database 2015, multitemporal and multidimensional attributes, R2019A. European Commission, Joint Research Centre (JRC) PID: https://data.jrc.ec.europa.eu/dataset/53473144-b88c-44bc-b4a3-4583ed1f547e
Slum population	UNDERSTANDING SLUMS: Case Studies for the Global Report on Human Settlements 2013. Fallavier P. The Case of Phnom Penh. MIT.
Cultivated land in 50km radius, km2	Calculated using GIS spatial analysis techniques by Dikoda using Copernicus Global Land Service data (2019) Buchhorn, M. et al. Copernicus Global Land Service: Land Cover 100m: collection 3: epoch 2019: Globe 2020. Accessed Feb 2020
Cultivated land in 50km radius per capita, km2	Copernicus as above
Number of markets/supermarkets per 100,000 persons	Calculated using GIS and OPenStreetMap data for each city

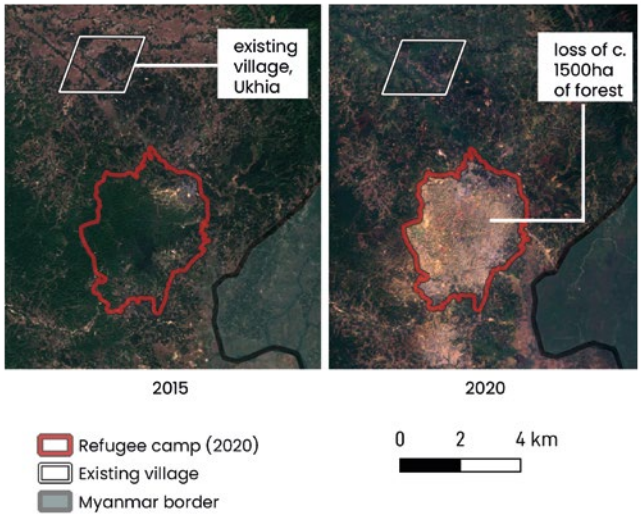
External drivers

The landcover and urbanisation maps illustrate some key external drivers that shape the food system in Cox's Bazar refugee camp. These include the use of land and indications of where population density and growth are most intense, highlighting the relationship cities have with food production, and suggesting areas of higher vulnerability during crises that affect the food system

Landcover 2015



Urbanisation trends



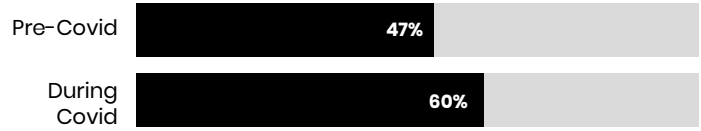
The refugee camp has grown very rapidly from virtually nothing to a settlement with urbanised characteristics over around 5 years, from 2017 to present. Since this time around 900,000 people have settled in this camp, constructing housing, buildings, shops, market places and a network of roads and footpaths. An estimated 1500ha of land has been cleared, 20% of which to house the camp and 80% deforested.1

Key spatial indicators

Key indicators were not available for Cox's Bazar from the GHSL database as for the other cities. Other indicators describing the external drivers have been used.

Indicator	Cox's Bazar	Average, 7 cities (excl. CXB)
Total refugee population in 2021	871,924	11,002,460

Change in prevalence of households that are multi-dimensionally poor (Rohingya)



Food supply chains

The following table illustrates the location of the suppliers and customers of surveyed private sector entities, giving an indication of the proximity of food supply chains to the city.

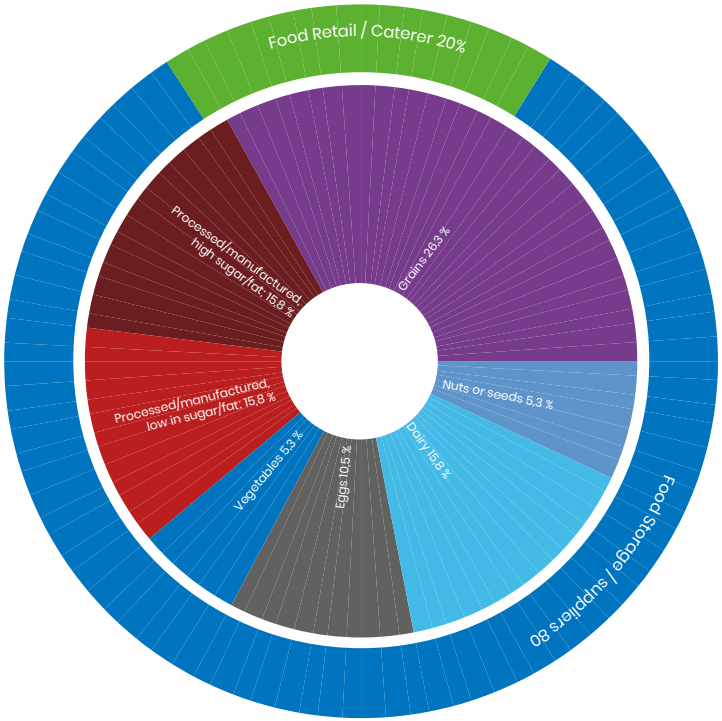
The proximity of food supply chains to the city

	Markets/ Customer locations	Supplier locations
Within the city	40%	60%
Surrounding region	40%	20%
Other regions of the country	0%	0%
Internationally	20%	20%

Food environment

The local food system actors and the types of food available in the local market are shown in the below figure. The inner circle consists of the types of food businesses while the outer circle shows the types of food the system produces, processes or sells.

Food system actors & foods available in the local market



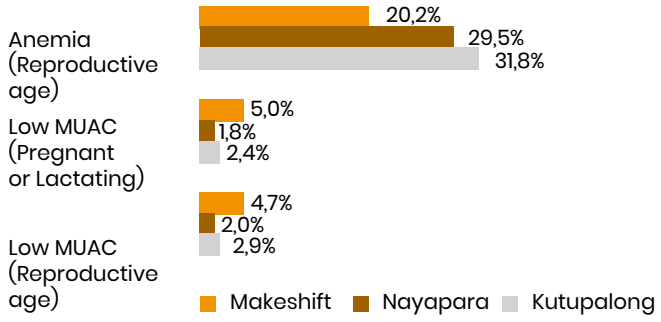
4. Outcomes & Pre-COVID-19 vulnerability

Nutritional status, dietary diversity and consumption of unhealthy foods

The following figures date from pre-COVID-19 and indicate vulnerabilities before the crisis, unless recent figures are available in which case a comparison between pre-COVID-19 and recent data is presented.

Women

Pre-COVID anemia and MUAC of women of reproductive age

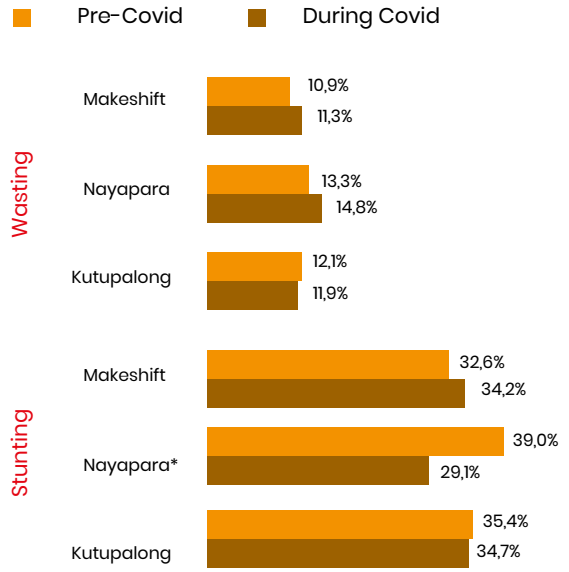


Children, 6-23 months

Minimum accepta ble diet

Children under 5 years

Change in the proportion of wasted (WHZ) and stunted (HAZ) children in Cox's Bazar

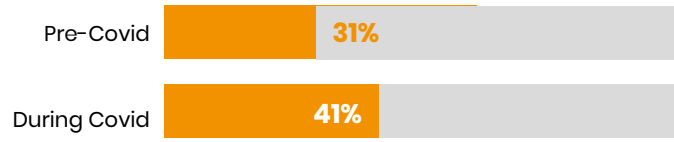


*Only change which is statistically significant.

Food security

Changes in the food security levels of Cox's Bazar's population before and during COVID-19 is presented based on the available data, using the Food Consumption Score (FCS) and the Livelihood Coping Strategy Index (LCSI). Data using the Food Insecurity Experience Scale (FIES) was not available.

Change in poor to borderline food consumption score, mean of Rohingya and host community



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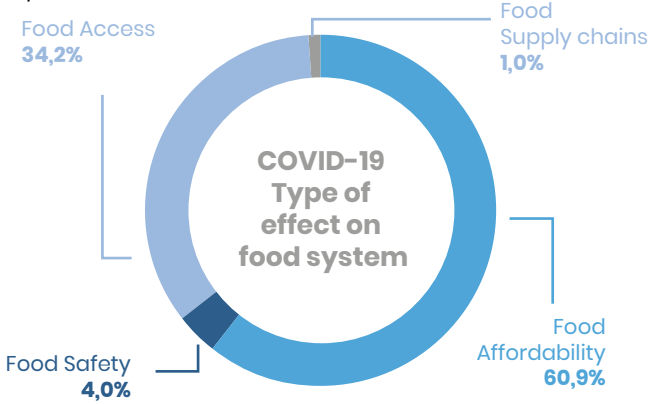
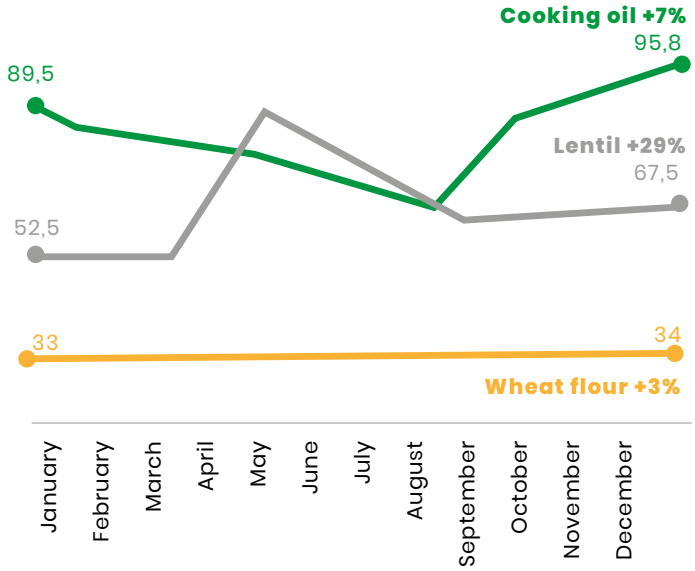
This section explores the effects of COVID-19 on Cox's Bazar's food system, examining supply chains, food prices and responses.

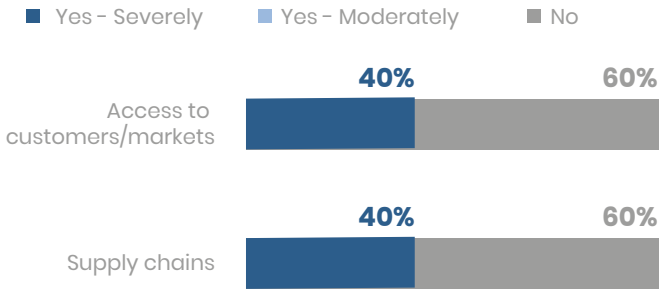


Change in food prices since COVID-19

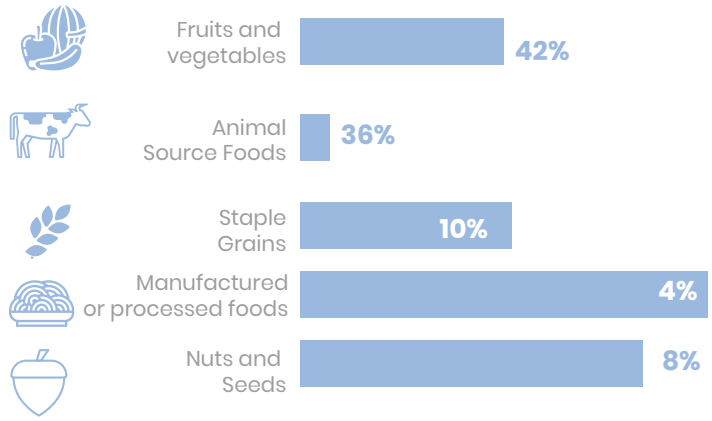
Change in food prices from May 2020 to March 2021 on four selected food items, BDT



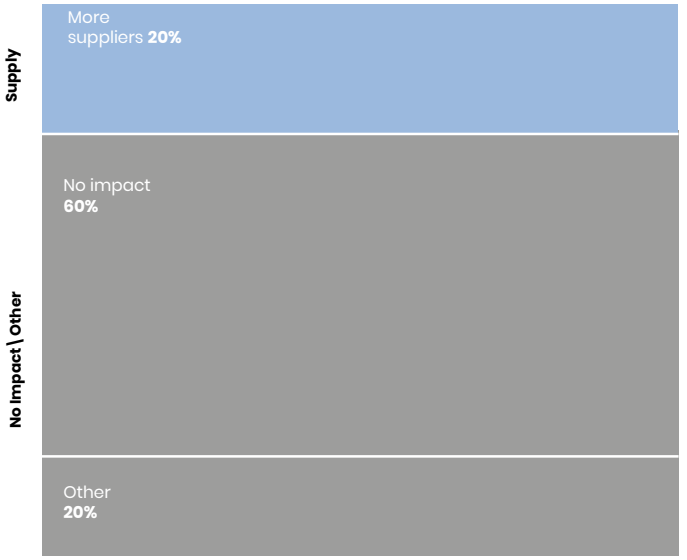
Extent of disruption of the COVID-19 pandemic on markets and supply chains



Foods that were short in supply



Effects of COVID-19 on company supply chains



Proportion of surveyed businesses whose income decreased between 25% and 50%

0%

Business income: there was no business whose income had decreased between 25% and 50 since the start of the pandemic; businesses had not experienced a change in income. Source: Dikoda 2021.

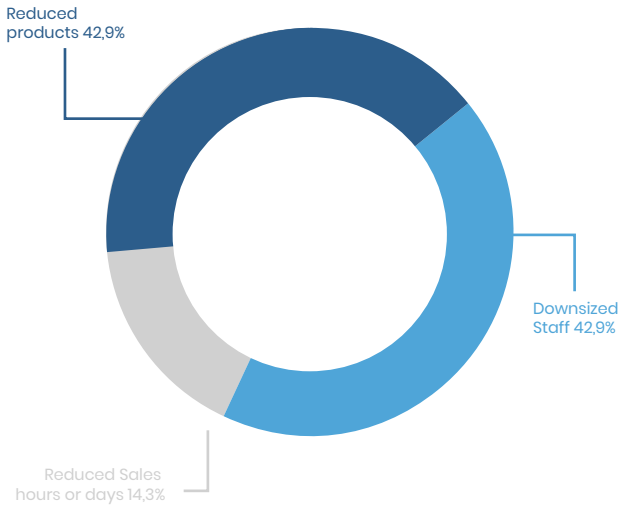
Data Sources

Total refugee population in 2021 Inter Sector Coordination Group ISCG: Cox's Bazar Refugee Population as of 31 January 2021
Households that are multi-dimensionally poor REVA 4
Women's anemia and MUAC Action Against Hunger. Emergency nutrition and health assessment round 2, May 2018
Minimum acceptable diet Action Against Hunger. Emergency nutrition and health assessment round 2, May 2018. Kutupalong: 2017
Proportion of wasted and stunted children Action Against Hunger, Emergency nutrition and health assessment Round 4 Oct 2019; Action Against Hunger, Emergency Nutrition assessment Nov 2020. Stunting and wasting prevalence are each classified as high by WHO standards.
Food Consumption Score (FCS) Reva
Livelihoods coping strategy index (LCSI) Reva 1 and Reva 4
Monthly food prices WFP VAM
Assistance received in the past 30 days Reva 4
Sections Food supply chains, Food environment, COVID-19 impact and response Dikoda 2021

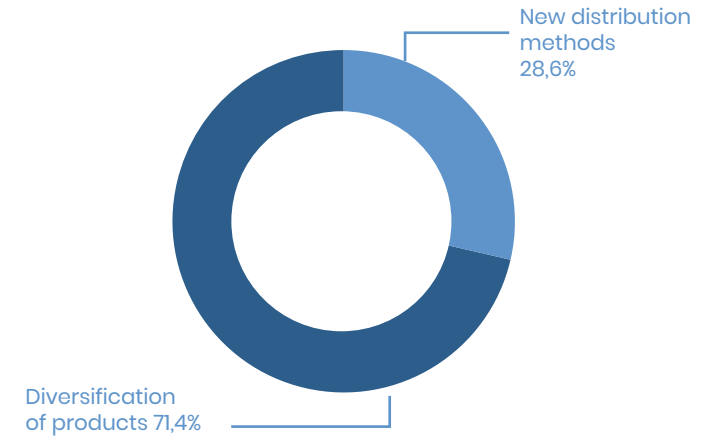
Responses and coping mechanisms

Impacts of COVID-19 on the food system are mitigated by responses by development partners and the government and by adaptations taken by food companies to changing conditions. This section illustrates some of these adaptations and responses, highlighting possible vulnerabilities and opportunities presented by the crisis

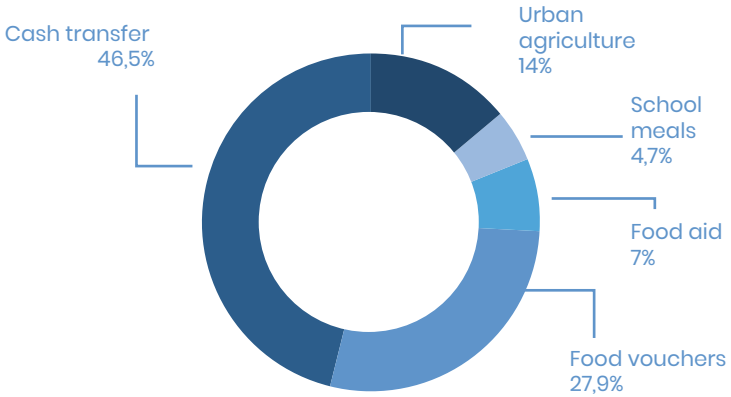
Actions taken by businesses to reduce costs around the pandemic (n=7)



Other methods of adaptation by companies during COVID-19

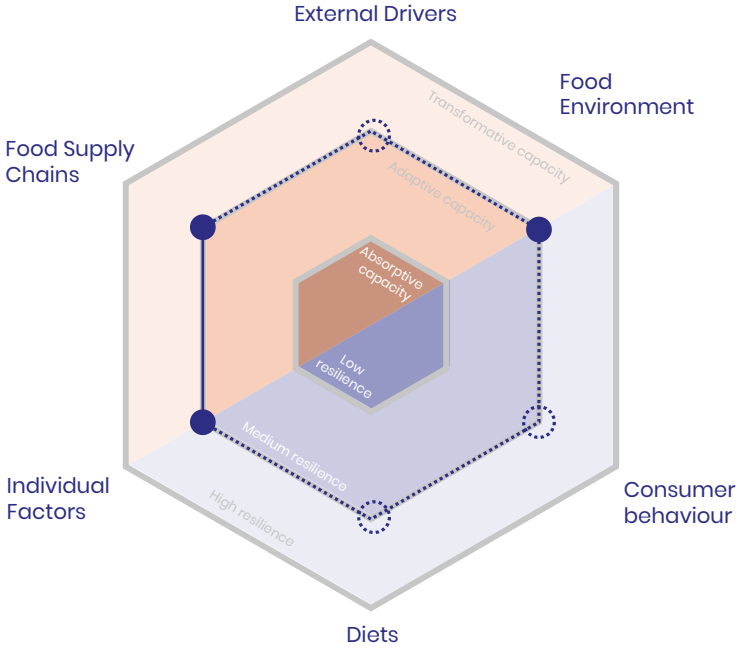


Response by Development Partners to food insecurity



Typology

The typology contains one core indicator for each dimension, giving an indication to the food system's vulnerability and resilience in the face of COVID-19. No indicator was chosen for consumer behaviour.



Methods and data sources

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Section 5

Resilience

The typology based on selected key indicators suggests that food systems in the study cities did not show high levels of resilience (or transformative capacity) to respond effectively to the COVID-19 crisis. There are differences in indicators and across cities as to particularly strong or vulnerable parts of the food system (as displayed in the spider plots in the city briefs).

Individual factors, represented by reduced income, were particularly affected in most cities where the average household income declined significantly (by at least 40%) and remained at the absorptive level (i.e. lower level of resilience characterized by coping rather than adapting or transforming). Combined with even moderate rise in food prices, this loss of income raises concerns regarding the resilience of households with already low incomes and is eventually likely to reflect in diet and nutritional outcomes.

As shown in the city of Phnom Penh, greater proximity to cultivated land is likely to contribute to the resilience of an urban food system by reducing the length and complexity of food supply chains. This may also have a bearing on food prices and indeed Phnom Penh's food prices remained relatively stable during the pandemic. However, the population was still affected by loss of household income.

While the COVID-19 pandemic provides opportunities for positive transformation of food systems, of which our research has found evidence, such as retailers moving to new distribution methods, this is not reflected by the key indicators used in the typology. Yet these innovative transformations represent an area that could be strengthened on the supply side to increase the resilience of the economy and the livelihoods of those working in the food system by protecting income and the access of vulnerable individuals to the food system. We recommend that an innovative dimension is included in future food system evaluation to reflect a government or municipalities capacity to change, rethink, or innovate in times of crisis.

TABLE 4. SCORING MATRIX FOR THE TYPOLOGY OF URBAN FOOD SYSTEMS RESILIENCE

Selected indicators Data Sources	External drivers Cultivated land within 50 km of city (km2 per 100,000 persons) Source: See Appendix 2	Food supply chains Proportion of food sector businesses with most suppliers located within the city (%) Source: Dikoda / 2021	Food environments Average change in food prices (during pandemic) based on 4 selected food items (%) * Source: WFP / 2020-21	Individual factors Reduction in average household income (%) Various / 2020-21	Consumer Behavior No indicator	Diets Minimum Dietary Diversity for Women of Reproductive Age (MDD-W) (%) Various / 2020-21
Chittagong	Adaptive (18.0)	Absorptive (46.5%)	Adaptive (9%)	Absorptive (75%)	N/A	Absorptive (35%)
Cox's	NO DATA	Adaptive (60.0%)	Adaptive (13%)	Adaptive (44%)	N/A	NO DATA
Dhaka	Adaptive (23.0)	Adaptive (61.1%)	Adaptive (17%)	Absorptive (75%)	N/A	Absorptive (30%)
Jakarta	Absorptive (7.9)	Absorptive (46.6%)	Adaptive (6%)	Absorptive (59%)	N/A	Adaptive (63.9%)
Kabul	Adaptive (19.4)	Adaptive (69.3%)	Absorptive (30%)	NO DATA	N/A	NO DATA
Peshawar	Transformative (40.3)	Absorptive (34.4%)	Adaptive (17%)	Absorptive (67%)	N/A	NO DATA
Phnom Penh	Transformative (193.5)	Transformative (91.8%)	Transformative (2%)	Adaptive (40%)	N/A	NO DATA
Quezon City	Absorptive (6.0)	Absorptive (37.0%)	Absorptive (47%)	NO DATA	N/A	Absorptive (15.7%)

Cut-offs used to categorise the above values in relation to levels of resilience and capacity:

Absorptive capacity	<8.6 km2	0-49%	≥30%	≥50%	N/A	0-49%
Adaptive capacity	8.6-25.3 km2	50-74%	5-29%	25-49%	N/A	50-74%
Transformative capacity	≥25.3 km2	75-100%	<5%			

* Four food items including a staple and vegetable oil and two other food items (according to availability an animal sourced food, a pulse, a vegetable, or another staple). Results for Cox's Bazar are based on three food items.

FIGURE 14. COMPARISON OF EIGHT CITY TYPOLOGIES SHOWING LEVELS OF RESILIENCE (OR CAPACITY) TO RESPOND TO THE COVID-19 CRISIS.

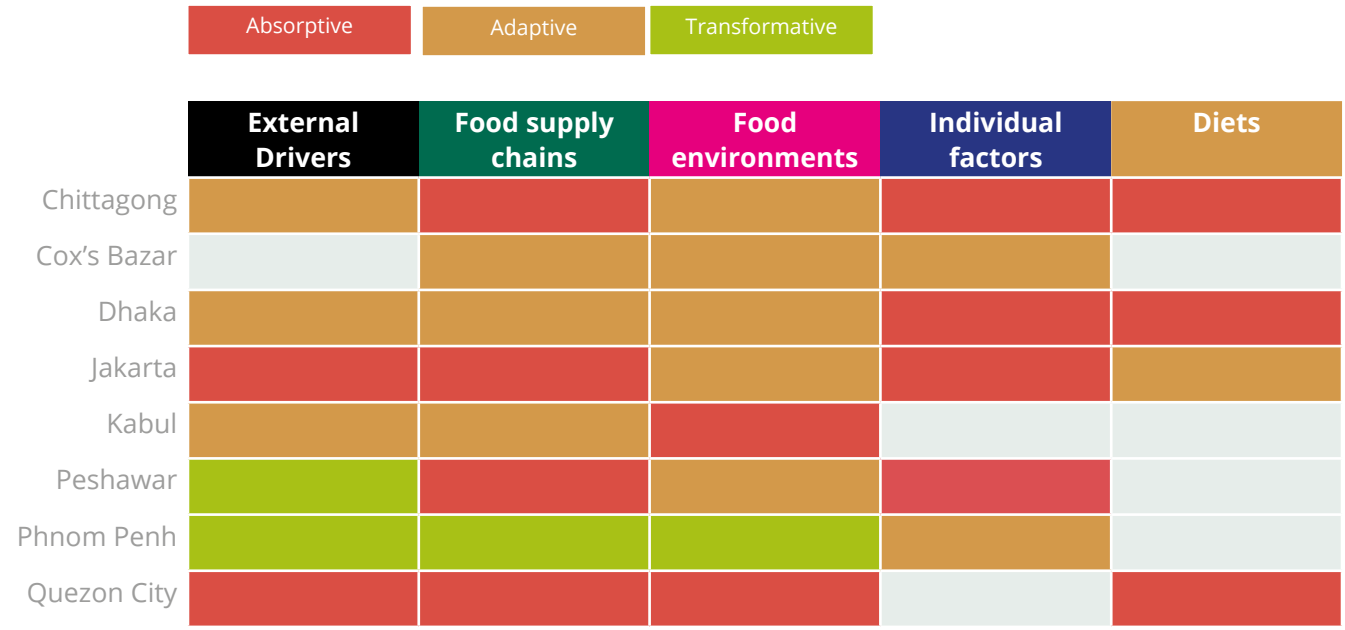
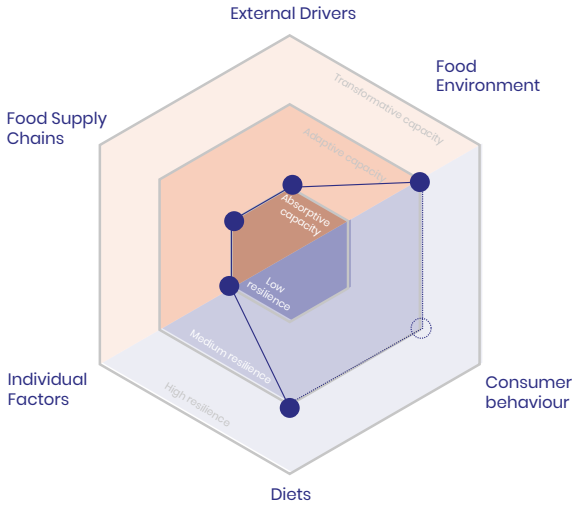
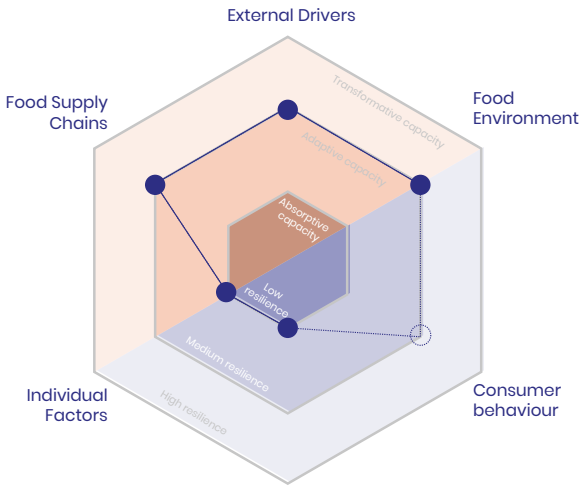


FIGURE 15. EXAMPLE SPIDER PLOTS FOR TWO CITIES.

Example of typology for Jakarta



Example of typology for Dhaka



The spider plots in the city briefs illustrate our assessment of urban food system resilience using the selected indicators. This enables comparisons between cities to identify strong or vulnerable parts of the food system. In the two examples below, Dhaka shows better availability of data (hollow circles indicate lack of data) and a higher level of resilience overall compared to Jakarta. However, Dhaka shows vulnerability in relation to food supply chains (indicated by proximity to cultivated land) and individual factors (indicated by reduction in average household income during the pandemic).

In summary, this analysis demonstrates:

Level of resilience vary widely across cities, with Quezon City demonstrating the lowest level of resilience and Phnom Penh the highest. In terms of food system dimensions, there is less variability for the dimension external drivers and lower level for individual factors and diets. Below we present a summary of evidence per food system dimension.

- External drivers:

Proximity to cultivated land is an important driver in relation to food supplies during the COVID-19 pandemic. The availability of cultivated land in close proximity (within 50km) of select cities in the Asia-Pacific region varies significantly. Some of the largest cities in this study Jakarta, Quezon City have reasonably limited access to cultivated land. On the other hand, Phnom Penh, surrounded by a much greater area of cultivated land than the other cities, has a relatively short supply chains proved to be an asset during the pandemic and food supplies remained relatively stable. This might be due partially to the smaller size of the city but also hypothetically to policies protecting peri-urban agriculture. High prices of agricultural land on the fringe of the city or restrictive land-use policies designed to curb urban sprawl may be a deterrent to converting land to urban uses, resulting in more compact, denser cities surrounded by abundant farmland.

- Food supply chains:

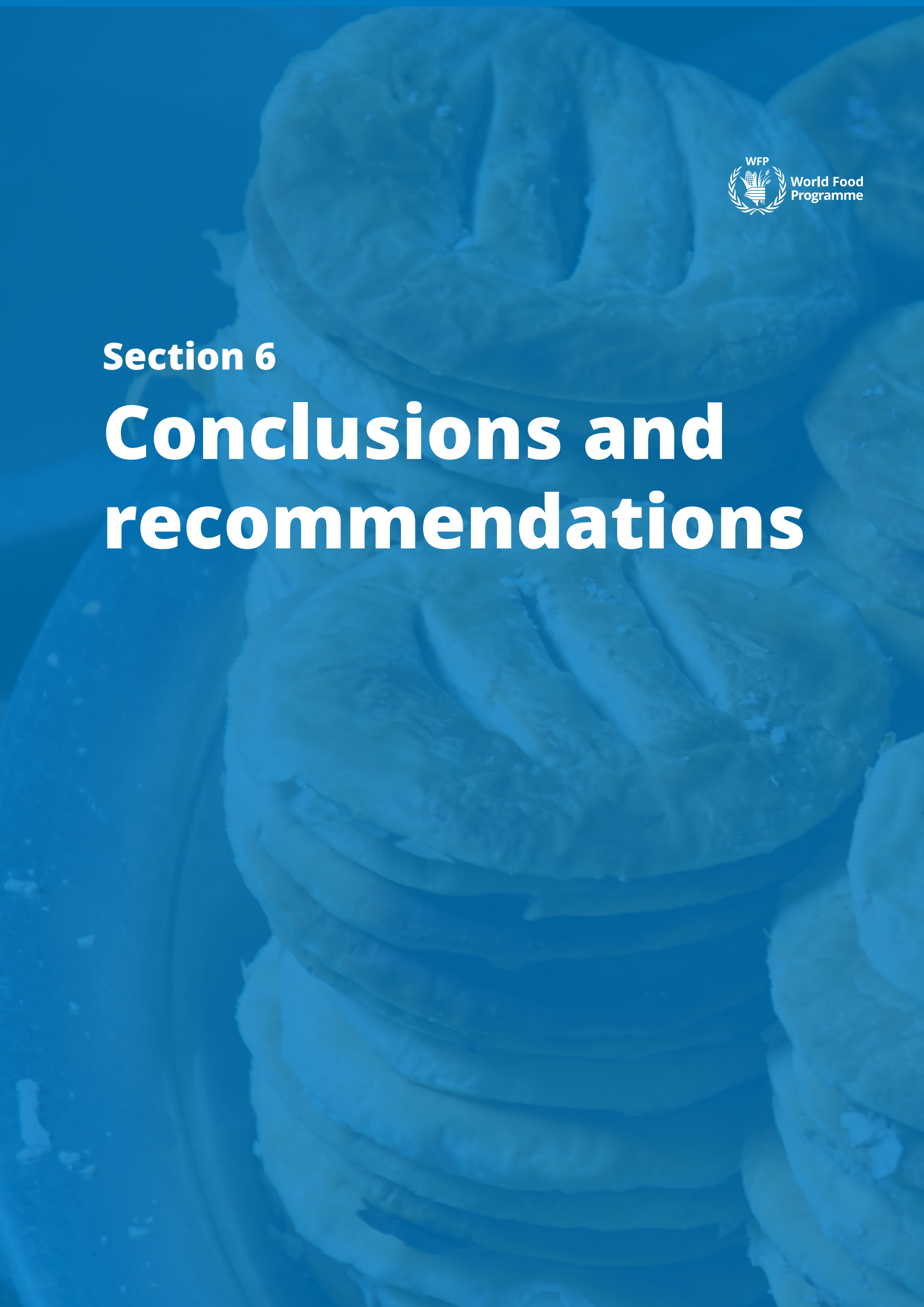
Proportion of food sector businesses with most suppliers located within the city was selected as an indicator of the resilience of food supply chains during the pandemic. Urban food systems have been disproportionately affected by COVID-19 restrictions because they rely on food brought

into the city from rural areas, where most food production occurs. All cities except Phnom Penh are more dependent on more distant food supplies from more productive agricultural areas. In Jakarta and Dhaka, successful supply chain interventions by government involved a high level of coordination between government departments that facilitated permissions for the movement of goods across districts, where cross-district movement was otherwise restricted and exemption from quarantine requirements by lorry drivers transporting essential food items.

- Food environments:
Food prices increased during the pandemic in all eight cities, with considerable variations between cities and between food groups. The lowest average increase in food prices was in Phnom Penh, while the greatest average increase in food prices was in Quezon City. The reduced financial capacity due to the drop in purchasing power by poor dwellers mean that women and children faced higher risks of lower dietary diversity. This also had a ripple effect on street food and informal food actors. These stakeholders faced acute challenges associated with the drop in business due to their limited capital and financial resilience. Nutrition sensitive and urban specific safety net for both poor urban dwellers and SMEs / informal food actors are important in this context. As the COVID-19 pandemic unfolded, many existing social protection programmes were not fit for purpose to provide an adequate response, due to inaccurate targeting and lack of access for workers in the informal economy.

- Individual factors:
Household income changes during crisis indicates changes in food purchasing power for urban poor and they spent most of their income on food. Household income dropped significantly for all cities by more than 50% compared to pre-COVID-19 except Cox's Bazaar and Phnom Penh where the drop was less. In Quezon City and Jakarta Consumer, behaviour showed that households dramatically altered the way they purchased food due to COVID-19 – including by reducing purchases of nutritious foods.

- Diets:
The proportion of women with a minimum diet diversity is a proxy for women's quality of diet. It is a key indicator that reflects hardship experienced by women and their household during crisis. For 4 out of 8 cities, the proportion of women eating at least 5 different food groups in the previous day fluctuate a lot between Jakarta (64 percent), Chittagong (35 percent), Dhaka (30 percent) and Quezon City (16 percent). Jakarta is the only city with comparable pre-COVID19 data; the proportion of women in Jakarta who consumed at least five out of ten food groups, unhealthy foods, any meat source and SSBs were all higher before COVID-19. In Quezon City, women reduced their consumption of both nutritious and unhealthy foods, which increased the risk of micronutrient deficiencies



Section 6

Conclusions and recommendations

This study provides a regional overview of the impacts of COVID-19 on urban food systems based on evidence from eight cities in the Asia and Pacific region. We examined urban food systems using the conceptual framework underpinning the Food Systems Dashboard, which enabled us to explore the influence of external drivers, and the impacts of the pandemic on components of food systems and diet outcomes. We highlighted areas of vulnerability and resilience using data and case studies from eight cities where WFP operates. We developed a typology of resilience using selected indicators to show how different parts of the food system may exhibit different levels of resilience and capacities for resilience. This helps to identify where interventions may be needed to strengthen resilience and generate transformational responses in urban food systems.

Broadly we found that COVID-19 has increased levels of vulnerability and food insecurity in cities through three main mechanisms, which varied between cities and throughout the pandemic:

- **Disruptions to food supply chains**
- **Increased food prices**
- **Loss of income**

We identified and showcased a range of interventions and responses that may help to mitigate the impacts of the pandemic and protect the urban poor. Based on our study findings, we present the following recommendations as potential entry points for governments and development actors to consider in the response to COVID-19 and to strengthen the resilience of urban food systems against inevitable future shocks.

The recommendations specific to WFP are highlighted in blue.

Program and policy recommendations:

Provide financial support through loans/grants and technical assistance to SMEs in the food sector to protect the integrity of food supply chains. Provide technical assistance directly or leverage partners' expertise (e.g. SUN Business network) with the private sector and knowledge transfer with financial contributions, with particular focus on SMEs in the food sector such as manufacturers, suppliers, retailers, stands selling prepared meals, and street vendors. This would have multiple benefits throughout the food system: protecting the integrity of food supply chains in cities; protecting the livelihoods of small business owners and their employees; ensuring access to affordable food for the urban poor who may not have access to alternative ways of acquiring food (such as supermarkets or online services). Blended finance could support financing for technical loans and grants to invest in food storage, quicker food chains or improved food safety. Hardship grants could be made available for SMEs during crises to support their survival and continuous availability of nutritious foods.

Recommendation specific to WFP:

- Use WFP's expertise in cash transfer to support e-voucher grants for SMEs to support a sustainable and resilient food systems. Business loans or grants to business with low or no interest (targeting could be done either based on location or products sold). Advertise existing support schemes more widely, especially those that are accessible to unregistered vendors.

- To increase street food vendors' resilience, provide skills development to street food vendors to make transformative changes to their business that allows greater resilience, notably through online sales, delivery platforms and marketing in general, or support to diversify their business. Skills training could be provided together with financial support.

- Support vendors to use technology to move to online orders via collective channel (sales platform at low cost) or improve connections and communication with consumers. Support e-commerce that can reach poor urban-dwellers. Specifically for the case of Pasar Mitra Tani intervention in Jakarta, support targeted action to reach low-income residential areas and involve Jakarta's poor population more actively.

Support dynamic urban food supply chain.
Disruptions caused by the pandemic require rethinking of business models and facilitation of movement of goods within and to the city trough use of technology and dynamic distribution chains.

Recommendation specific to WFP:
- Supporting vendors to access wholesalers and pool resources to coordinate shared deliveries and negotiate better prices.

- Connect small urban vendors with small rural suppliers and bypassing the big operators

- Setup Covid19/pandemic safe logistics processes that put in place systems and safety to facilitate movement of goods while meeting safety requirements and tracking provenance

- Support the development of communication platforms reaching poor urban dwellers: These platforms could support information sharing targeting por households on where food at most affordable price can be found in their community.

- Support government and municipalities initiatives during crisis such as the MoA led intervention in Dhaka to bring markets and foods closer to poor urban dwellers (refer to the deep dive case studies C2) and explore new approach such as mobile markets. For these interventions, advocate to increase the nutrition-sensitivity of the project by promoting nutritionally higher quality foods. WFP supply chain could work with programme and relevant government counterparts to explore more effective supply chain and logistical solutions (e.g., for transporting goods to overcome difficulties encountered when using public transportation systems, liaising with DAM about warehousing, cold chain, distribution mechanisms). This would however require broad-based consultation and intensive support from the different relevant stakeholders (including, ministries, departments and NGOs). Mobile markets can support access of fresh products in poor urban areas during lockdowns and physical restrictions.

Social protection and safety net programs that are nutrition sensitive, adaptive and responsive to shocks and support those worst affected including the urban poor. These include social assistance schemes – predictable and reliable transfers of cash, food or other goods, as well as subsidies and service fee waivers for vulnerable groups. While most countries have longstanding social protection programs, many were developed for rural populations that were previously considered the most vulnerable to low incomes and food insecurity. COVID-19 has exposed the vulnerability of urban populations, especially daily wage earners and informal sector workers, who were among the worst affected by loss of income. Social protection programs must have inclusive eligibility criteria and accessible registration systems so that people can apply for benefits quickly when circumstances change unexpectedly.

Recommendation specific to WFP:
- Demonstrate impact of cash transfer programme on food diversity for the current WFP led cash back intervention in Dhaka slums (refer to deep dive case studies C2) and promote the potential of cash incentives for Government and agencies to implement nutrition-sensitive social safety net programmes that have both food and nutrition security benefits for the target group.
- Increase the sustainability of cash programme by leveraging the potential of the programme to influence other components of the food system, including producers, retailers and consumers as part of a systemic approach to

food value chains. This can be achieved by ensuring that the cash is spent towards reinforcing the food supply chain (for example, via accredited street food vendors selling healthy foods).
- Promote the use of targeting and modalities that are urban and nutrition sensitive – recommend using Multi Dimensional Poverty Index (MDPI) for targeting, complement with SBCC tackling barriers of purchasing healthy foods, and include cash modality matching the cost of a healthy diet.

Urban agriculture programs to enable city residents and communities to grow their own food and generate extra income. Urban agriculture has the potential to strengthen the resilience (and sustainability) of urban food systems in several ways: shortening supply chains and reducing reliance on food transported into the city; improving food access, affordability and quality for the urban poor; physical and wellbeing benefits associated with being outside and growing food; greener neighborhoods and environmental benefits (such as urban greening and cooling). Training and resources should be tailored to local needs, including what grows best in the local climate and the amount of space people have for growing food. Advocating for policies that support local production by making or protecting land available for growing within or close to the city. Vertical and indoor growing solutions may also be considered.

Recommendation specific to WFP:
- Advocate for the inclusion of the urban poor and particularly families that are at risk of malnutrition (such as families with young children) into urban agriculture programmes (specifically in Quezon City where an urban agriculture programme is already operational – refer to the deep dive case study C2).

- Provide technical guidance on increasing nutrition-sensitivity of the urban agriculture programmes.
- Provide strategic guidance on what foods make sense to do as urban agriculture and where foods will not be competitive with rural suppliers. e.g. specialist foods that are highly nutritious and/or can be sold as specialist cash crops....
- Consider technical guidance on urban farming solutions (hydroponics, fertilizer) and provide specialist support lines and websites for problems solving and sale of cheap equipment. Create a city urban farming platform that links suppliers, transporters, equipment suppliers, consumers, technical experts, people providing loans/grants
- Demonstrate the impact of current urban agriculture programme on dietary diversity (Grow QC)

Methodological recommendations:

Standardized indicators of resilience and vulnerability to facilitate comparisons between cities. With support from WFP colleagues, we searched for and collated available data for eight cities on key food and nutrition outcomes and other indicators of vulnerability. However, we found that data were not complete or standardized across cities (or countries). This heterogeneity is illustrated in the city briefs (Section 4). The best data availability was for food prices and we developed a composite indicator for average change in food prices in 2020 (Table 4). Furthermore, standardized indicators are lacking for individual factors and consumer behaviour – two important components of (urban) food systems. There is an opportunity for international and multi-sectoral collaboration to improve the evidence base on food systems.

Recommendation specific to WFP: In future food system assessment in these 8 cities, the indicators included in the urban analysis should be considered and can be adjusted depending on the type of shock in question or depending on local priorities in order to compare how resilience levels have evolved over time. These include: Cultivated land within 50 km of city (km2 per 100,000 persons), proportion of food sector businesses with most suppliers located within the city, average change in food prices during a specific time frame based on 4 selected food items, reduction in average household income, Minimum Dietary Diversity for Women of Reproductive Age (MDD-W). For individual factors, child Food Insecurity Experience scale indicator (currently being tested) should be used to capture the level of food insecurity experienced by children and adolescents as research as shown that their experience is different to the household's head.

More research should be undertaken to provide guidance on a standardized indicator relevant to consumer behavior.

Increase granularity and frequency of data collection to enable timely and targeted intervention as well as an appropriate monitoring over time. Data available typically do not feature the geographic disaggregation (rural vs urban) necessary to guide targeting of interventions to urban populations most in need and its frequency rarely allows for timely responses.
Recommendation specific to WFP: Advocate that survey efforts include slum populations and that urban data are disaggregated per wealth quintile to reflect intercity inequalities. Promote urban specific surveys with municipalities.

Further development and application of the typology of urban food systems resilience. The typology we have developed is intended as an operational tool, which may be modified and adapted by future users. When selecting the indicators for the typology, we considered which indicators were most relevant to our analysis of resilience during the COVID-19 pandemic, and the indicators for which we had the best available/consistent data. It is likely that different indicators would be selected by future users. The reductionist approach of selecting one indicator for each dimension of the food system has obvious limitations. A typology cannot convey the complexity of urban food systems. It is a simplified classification system that may be used to identify broad patterns and make comparisons between urban food systems. We hope it will provide a starting point for the identification of priorities and opportunities to strengthen resilience.
Recommendation specific to WFP: Support the formalization of the urban food system analysis.

Innovative approaches to defining urban areas and collecting city specific data. In general, there is a dearth of city-level data and, as mentioned above, a real lack of local/granular data on food and food systems related data at the city-level. Combining local surveys (household and enterprise surveys, key information interviews etc.) with spatial, remotely sensed data can bring unique insights, both in terms of how cities and their food systems function and the characteristics and location of populations that are more likely to be susceptible to food security shocks and stresses.
Recommendation specific to WFP: Recognizing that it might not be feasible for WFP to collect detailed data frequently, approaches that support and improve government's existing assessment, monitoring and surveillance tools and systems are recommended.

Further information is provided in Appendix 3.

WFP World Food Programme

Appendix

Appendix 1.Results of Dikoda surveys Private Sector Survey – Round 1

Table 1. Which category best describes your business?

	Chittagong (n=142)	Dhaka n=145	Jakarta n=161	Kabul n=226	Lucknow n=103	Peshawar n=160	Phnom Penh n=208	Quezon City n=54	Cox Bazaar refugee camp n=5
Agriculture / food producer	31.9%	21.0%	41.6%	12.4%	1.9%	18.1%	0%	7.4%	0%
Food manufacturer / processor	12.5%	18.9%	3.7%	20.8%	-	15.0%	0%	22.2%	0%
Food storage / supplier	50.0%	44.1%	9.3%	15.9%	12.6%	18.1%	3.4%	40.7%	80.0%
Food retail / caterer	5.6%	14.0%	40.4%	47.3%	20.4%	37.5%	96.2%	29.6%	20.0%
Other (please specify)	0%	2.1%	5.0%	3.5%	65.0%	11.3%	0.5%	0%	0%

P<0.05 However, 8 cells (17.8%) have expected count less than 5. The minimum expected count is 0.45.

Table 2. How many workers does your business currently employ?

	Chittagong (n=142)	Dhaka n=145	Jakarta n=161	Kabul n=226	Lucknow n=103	Peshawar n=160	Phnom Penh n=208	Quezon City n=54	Cox Bazaar refugee camp n=5
Sole trader	10.6%	5.6%	6.2%	8.8%	40.8%	25.0%	8.2%	7.4%	
Fewer than 10	69.7%	62.5%	21.7%	65.0%	41.7%	51.3%	81.3%	40.7%	
Between 10 and 49	16.2%	27.1%	44.1%	21.7%	15.5%	21.9%	9.6%	33.3%	40.0%
Between 50 and 199	2.8%	3.5%	24.8%	4.0%	1.0%	1.9%	1.0%	14.8%	20.0%
More than 200	0.7%	1.4%	3.1%	0.4%	1.0%	-	-	3.7%	40.0%

P<0.05 However, 10 cells (25.0%) have expected count less than 5. The minimum expected count is .25.

Table 3. Where are your suppliers mostly located?

	Chittagong (n=142)	Dhaka n=145	Jakarta n=161	Kabul n=226	Lucknow n=103	Peshawar n=160	Phnom Penh n=208	Quezon City n=54	Cox Bazaar refugee camp n=5
Within the city	46.5%	61.1%	46.6%	69.3%	53.4%	34.4%	91.8%	37.0%	60.0%
Region surrounding the city	26.8%	8.3%	36.0%	20.0%	19.4%	43.1%	8.2%	37.0%	20.0%
Other regions of the country	26.1%	27.1%	15.5%	5.3%	21.4%	21.3%	-	25.9%	
Internationally	0.7%	3.5%	1.9%	5.3%	5.8%	1.3%	-	-	20.0%
More than 200	0.7%	1.4%	3.1%	0.4%	1.0%	-	-	3.7%	40.0%

P<0.05 However, 7 cells (21.9%) have expected count less than 5. The minimum expected count is .67.

Table 4. Have your supply chains been disrupted by the COVID-19 pandemic?

	Chittagong (n=142)	Dhaka n=145	Jakarta n=161	Kabul n=226	Lucknow n=103	Peshawar n=160	Phnom Penh n=208	Quezon City n=54	Cox Bazaar refugee camp n=5
Yes – severely	14.1%	15.2%	6.2%	29.2%	42.7%	64.4%	1.0%	51.9%	
Yes – moderately	54.9%	68.3%	54.7%	51.3%	22.3%	25.6%	96.2%	22.2%	40.0%
No	31.0%	16.6%	39.1%	19.5%	35.0%	10.0%	2.9%	25.9%	60.0%

P<0.05 However, 7 cells (21.9%) have expected count less than 5. The minimum expected count is .67.

Table 5. Where are your customers (or market) mostly located?

	Chittagong (n=142)	Dhaka n=145	Jakarta n=161	Kabul n=226	Lucknow n=103	Peshawar n=160	Phnom Penh n=208	Quezon City n=54	Cox Bazaar refugee camp n=5
Within the city	72.5%	92.4%	52.2%	57.6%	58.3%	48.8%	92.3%	25.9%	40.0%
Region surrounding the city	17.6%	2.1%	22.4%	35.7%	16.5%	41.3%	7.7%	59.3%	40.0%
Other regions of the country	8.5%	2.1%	23.6%	4.9%	19.4%	9.4%	-	14.8%	
Internationally	1.4%	3.5%	1.9%	1.8%	5.8%	0.6%	-	-	20.0%

P<0.05 However, 9 cells (28.1%) have expected count less than 5. The minimum expected count is .49.

Table 6. Has your access to customers (or markets) been disrupted by the COVID-19 pandemic?

	Chittagong (n=142)	Dhaka n=145	Jakarta n=161	Kabul n=226	Lucknow n=103	Peshawar n=160	Phnom Penh n=208	Quezon City n=54	Cox Bazaar refugee camp n=5
Yes – severely	18.3%	11.0%	34.8%	25.3%	42.2%	64.4%	0.5%	55.6%	
Yes – moderately	59.2%	66.2%	56.5%	49.3%	23.5%	27.5%	96.6%	11.1%	40.0%
No	22.5%	22.8%	8.7%	25.3%	34.3%	8.1%	2.9%	33.3%	60.0%

P<0.05 However, 1 cell (4.2%) has expected count less than 5. The minimum expected count is 4.59.

Table 7. Has your business income increased or decreased during the COVID-19 pandemic?

	Chittagong (n=142)	Dhaka n=145	Jakarta n=161	Kabul n=226	Lucknow n=103	Peshawar n=160	Phnom Penh n=208	Quezon City n=54	Cox Bazaar refugee camp n=5
Increased	3.5%	13.8%	-	8.4%	-	7.5%	-	22.2%	
Decreased	72.5%	70.3%	90.1%	64.6%	59.2%	78.8%	86.5%	63.0%	
No change	23.9%	15.9%	9.9%	27.0%	40.8%	13.8%	13.5%	14.8%	100.0%

P<0.05 However, 1 cell (4.2%) has expected count less than 5. The minimum expected count is 4.59.

Table 8. By what percentage has your business income increased?

	Chittagong (n=142)	Dhaka n=145	Jakarta n=161	Kabul n=226	Lucknow n=103	Peshawar n=160	Phnom Penh n=208	Quezon City n=54	Cox Bazaar refugee camp n=5
Less than 25%	60.0%	55.0%	-	77.8%	-	66.7%	-	33.3%	
Between 25% and 50%	40.0%	45.0%	100.0%	22.2%	-	25.0%	-	16.7%	
Between 50% and 75%	-	-	-	-	-	8.3%	-	33.3%	
More than 75%	-	-	-	-	-	-	-	16.7%	

P<0.05 However, 19 cells (79.2%) have expected count less than 5. The minimum expected count is .02.

Table 9. How did your business generate more income during the pandemic?

	Chittagong (n=142)	Dhaka n=145	Jakarta n=161	Kabul n=226	Lucknow n=103	Peshawar n=160	Phnom Penh n=208	Quezon City n=54	Cox Bazaar refugee camp n=5
Marketing	20.0%	20.0%	-	5.6%	-	8.3%	-	66.7%	
Customer service	-	20.0%	-	72.2%	-	41.7%	-	-	
Online sales or discounts	60.0%	55.0%	-	11.1%	-	25.0%	-	16.7%	
Diversified business model	20.0%	-	-	11.15	-	25.0%	-	16.7%	
Other	-	5.0%	-	-	-	-	-	-	

P<0.05 However, 21 cells (84.0%) have expected count less than 5. The minimum expected count is .08.

Table 10. By what percentage has your business income decreased?

	Chittagong (n=142)	Dhaka n=145	Jakarta n=161	Kabul n=226	Lucknow n=103	Peshawar n=160	Phnom Penh n=208	Quezon City n=54	Cox Bazaar refugee camp n=5
Less than 25%	34.0%	51.0%	38.4%	23.3%	3.3%	39.7%	94.4%	17.6%	
Between 25% and 50%	51.5%	34.3%	49.3%	51.4%	36.7%	27.8%	5.6%	47.1%	
Between 50% and 75%	11.7%	11.8%	11.6%	14.4%	40.0%	15.9%	-	35.3%	
More than 75%	2.9%	2.9%	0.7%	11.0%	20.0%	16.7%	-	-	
Other	-	5.0%	-	-	-	-	-	-	

P<0.05 However, 3 cells (9.4%) have expected count less than 5. The minimum expected count is 1.08.

Table 11. Have you received any financial support from the government?pandemic?

	Chittagong (n=142)	Dhaka n=145	Jakarta n=161	Kabul n=226	Lucknow n=103	Peshawar n=160	Phnom Penh n=208	Quezon City n=54	Cox Bazaar refugee camp n=5
Yes	-	1.0%	3.4%	-	6.7%	0.8%	0.6%	17.6%	
No	100.0%	99.0%	96.6%	100.0%	93.3%	99.2%	99.4%	82.4%	

P<0.05 However, 8 cells (50.0%) have expected count less than 5. The minimum expected count is .29.

Table 12. How did your business adapt to lower income during the pandemic?

	Chittagong (n=142)	Dhaka n=145	Jakarta n=161	Kabul n=226	Lucknow n=103	Peshawar n=160	Phnom Penh n=208	Quezon City n=54	Cox Bazaar refugee camp n=5
Reduced costs	40.8%	53.9%	58.6%	35.4%	21.7%	11.9%	61.5%	64.7%	
Sold business assets	19.4%	5.9%	0.7%	4.8%	20.0%	26.2%	0.6%	-	
Business loan	10.7%	2.0%	-	36.1%	11.7%	19.0%	2.8%	11.8%	
Invested personal money	25.2%	34.3%	0.7%	23.8%	35.0%	21.4%	24.6%	17.6%	
Other	3.9%	3.9%	40.0%	-	11.7%	21.4%	10.6%	5.9%	

P<0.05 However, 2 cells (5.0%) have expected count less than 5. The minimum expected count is 2.97.

Private Sector Survey – Round 2

Table 1. Business Owner's Gender

	Chittagong (n=142)	Dhaka n=145	Jakarta n=161	Kabul n=226	Lucknow n=103	Peshawar n=160	Phnom Penh n=208	Quezon City n=54	Cox Bazaar refugee camp n=5
Female		5.2%	36.1%	2.9%	8.2%	6.8%	5.5%	4.2%	
Male	53.5%	50.0%	27.8%	85.4%	78.7%	13.6%	8.8%	95.8%	100.0%
Co-owned	46.5%	16.7%	36.1%	11.7%	13.1%	78.0%	64.8%		
Not applicable		28.1%				1.7%	20.9%		

Table 2. Main food products produced or supported.

	Chittagong (n=142)	Dhaka n=145	Jakarta n=161	Kabul n=226	Lucknow n=103	Peshawar n=160	Phnom Penh n=208	Quezon City n=54	Cox Bazaar refugee camp n=5
Grains (rice, wheat, maize, etc.)	8.66%	4.26%	8.33%	11%	3.95%	11.66%	3.07%	18.97%	26.32%
Roots or tubers (potatoes, yam, cassava, etc.)	7.87%	4.26%	4.76%	7.33%	3.95%	1.02%	5.19%	0.86%	5.26%
Nuts or seeds	7.09%	3.83%	2.38%	7.09%	3.29%	6.54%	6.84%	0.86%	5.26%
Legumes (beans, lentils, peas)	6.3%	3.83%	2.38%	6.85%	2.63%	0.61%	7.55%	0%	0%
Fish	5.51%	6.38%	7.14%	2.44%	2.63%	12.07%	9.67%	3.45%	0%
Meat	12.6%	11.91%	17.86%	3.67%	11.18%	12.07%	9.2%	7.76%	0%
Dairy	14.96%	8.09%	5.95%	8.31%	13.16%	11.66%	9.91%	9.48%	15.79%
Eggs	5.51%	5.53%	7.14%	10.51%	9.87%	12.07%	14.15%	6.9%	10.53%
Vegetables	7.09%	10.64%	5.95%	4.4%	10.53%	12.07%	12.74%	4.31%	5.26%
Fruit	6.3%	11.91%	2.38%	4.4%	15.13%	11.86%	10.61%	1.72%	0%
Processed/manufactured foods low in sugar and/or fat	5.51%	3.40%	11.9%	11.74%	12.5%	4.29%	6.37%	0%	15.79%
Processed/manufactured with high sugar or high fat or content	10.24%	10.21%	19.05%	11.98%	10.53%	4.09%	3.77%	2.59%	15.79%
Not applicable	0.79%	0.43%	0%	1.22%	0%	0%	0%	5.17%	0%
Other (please specify)	1.57%	15.32%	4.76%	9.05%	0.66%	0%	0.94%	37.93%	0%

Table 3.Target groups. Which of these groups are mostly your end consumers (e.g. the ones who consume the foods)?

	Chittagong (n=142)	Dhaka n=145	Jakarta n=161	Kabul n=226	Lucknow n=103	Peshawar n=160	Phnom Penh n=208	Quezon City n=54	Cox Bazaar refugee camp n=5
Everyone across age groups and gender	100.00%	95.00%	97.20%	82.50%	100.00%	100.00%	96.70%	100.00%	100.00%
Babies only		1.00%	2.80%	1.90%					
Women only							1.10%		
Men only		4.00%		15.50%			2.20%		

Table 4. Which of the following effects of the coronavirus pandemic have impacted your company's supply chain in the last 12 months? Select all that apply.

	Chittagong (n=142)	Dhaka n=145	Jakarta n=161	Kabul n=226	Lucknow n=103	Peshawar n=160	Phnom Penh n=208	Quezon City n=54	Cox Bazaar refugee camp n=5
None of the above	17.65%	6.9%	2.56%	17.95%	7.41%	0%	0.57%	14.19%	60%
Shortage of supplies	35.29%	7.59%	12.31%	12.82%	24.07%	42.42%	18.13%	18.24%	0%
Suppliers closing down	10.29%	10.34%	3.08%	10.26%	16.67%	0.76%	20.68%	15.54%	0%
Production stoppage/ suspension	2.94%	9.66%	6.15%	11.79%	11.11%	0.76%	19.26%	13.51%	0%
Change of production focus	5.88%	1.38%	1.03%	9.23%	10.19%	5.3%	18.13%	3.38%	0%
Transportation disruption	11.76%	39.31%	5.13%	12.82%	12.04%	44.7%	5.1%	21.62%	0%
Shift to a more localized supply chain	7.35%	0.69%	8.21	2.56%	0.93%	4.55%	1.42%	0%	0%
Work with more suppliers	1.47%	2.76%	0.51%	10.77%	5.56%	1.52%	4.25%	3.38%	20%
Reduce product lines and/or ingredients	5.88%	1.38%	2.05%	8.21%	8.33%	0%	7.08%	7.43%	0%
Move operations to other location	0%	0.69%	0.51%	3.08%	3.7%	0%	5.38%	0%	0%
Other (please specify)	1.47%	19.31%	0.51%	0.51%	0%	0%	0%	2.7%	20%
Processed/manufactured with high sugar or high fat or content	10.24%	10.21%	19.05%	11.98%	10.53%	4.09%	3.77%	2.59%	15.79%
Not applicable	0.79%	0.43%	0%	1.22%	0%	0%	0%	5.17%	0%
Other (please specify)	1.57%	15.32%	4.76%	9.05%	0.66%	0%	0.94%	37.93%	0%

Table 5. What actions has your company taken around the coronavirus pandemic to reduce cost of operations? Select all that apply.

	Chittagong (n=142)	Dhaka n=145	Jakarta n=161	Kabul n=226	Lucknow n=103	Peshawar n=160	Phnom Penh n=208	Quezon City n=54	Cox Bazaar refugee camp n=5
Reduced products	17.54%	3.97%	18.92%	16.99%	29.25%	9.32%	8.07%	7.69%	42.86%
Reduced sales hours or number of days	29.82%	3.17%	48.65%	18.95%	9.43%	0.85%	11.53%	12.82%	14.29%
Reduced suppliers	8.77%	6.35%	2.7%	8.5%	12.26%	27.12%	16.43%	19.23%	0%
Changed to cheaper suppliers	3.51%	9.52%	2.7%	10.46%	8.49%	3.39%	20.17%	5.13%	0%
Changed to lower quality food items	5.26%	0.79%	0%	7.19%	2.83%	3.39%	19.02%	0%	0%
Changed distribution methods to cheaper ones	8.77%	27.78%	2.7%	13.73%	15.09%	5.93%	16.14%	14.1%	0%
Downsized staff	26.32%	46.83%	18.92%	23.53%	22.64%	50%	8.65%	41.03%	42.86%
Other (please specify)	0%	1.59%	5.41%	0.65%	0%	0%	0%	0%	0%

Table 6. Has your company done other adaptations during the pandemic?

	Chittagong (n=142)	Dhaka n=145	Jakarta n=161	Kabul n=226	Lucknow n=103	Peshawar n=160	Phnom Penh n=208	Quezon City n=54	Cox Bazaar refugee camp n=5
Diversification of products	15.38%	13.73%	7.69%	20.51%	38.03%	38.38%	21.05%	13.33%	71.43%
New food products	50%	1.96%	61.54%	26.92%	26.76%	6.06%	24.81%	20%	0%
Sharing workforce with other companies	7.69%	3.92%	7.69%	17.95%	7.04%	0%	25.94%	20%	0%
New distribution methods	26.92%	80.39%	23.08%	34.62%	28.17%	55.56%	28.2%	46.67%	28.57%
Other (please specify)	0%	9.8%	0%	0%	0%	0%	0%	6.67%	0%

Table 7. Which actions do you think would be the most effective to support you to cope with the effects of the pandemic?

	Chittagong (n=142)	Dhaka n=145	Jakarta n=161	Kabul n=226	Lucknow n=103	Peshawar n=160	Phnom Penh n=208	Quezon City n=54	Cox Bazaar refugee camp n=5
Support to ensure continuity of workforce	4.05%	14.22%	29.79%	11.03%	10%	18.84%	7.71%	11.11%	33.33%
Provide unemployment insurance or paycheck continuity support for employees	5.41%	1.9%	8.51%	1.78%	6.11%	19.52%	10.05%	1.75%	6.67%
Access to financial support	20.27%	11.37%	10.64%	16.37%	8.33%	16.1%	14.25%	19.88%	6.67%
Technical support to cope with the impact	5.41%	20.38%	2.13%	7.47%	7.78%	17.47%	15.19%	5.85%	6.67%
Provide incentives	1.35%	14.69%	6.38%	3.91%	5%	1.37%	12.38%	3.51%	0%
Increase and/or facilitate more procurement of my firm's food products	6.76%	1.42%	0%	3.2%	6.67%	0%	13.08%	5.85%	0%
Re-open retail outlets	2.7%	0.47%	2.13%	5.34%	10.56%	0.34%	10.98%	4.09%	6.67%
Expand working or store-opening hours	1.35%	2.37%	17.02%	6.76%	6.67%	0%	7.71%	2.92%	13.33%
Facilitate domestic transport of goods	1.35%	9.95%	0%	9.25%	10.56%	2.05%	3.27%	6.43%	6.67%
Keep borders open	6.76%	3.79%	0%	12.1%	6.67%	19.18%	1.87%	7.6%	0%
Facilitate trade	27.03%	9%	0%	14.59%	18.33%	4.79%	1.64%	11.7%	20%
Don't know	17.57%	6.16%	23.4%	8.19%	3.33%	0.34%	1.87%	15.79%	0%
Other	0%	4.27%	0%	0%	0%	0%	0%	3.51%	0%

Table 8. Has your business needed money to cope with the impact of the coronavirus pandemic in the last 6 months?cope with the effects of the pandemic?

	Chittagong (n=142)	Dhaka n=145	Jakarta n=161	Kabul n=226	Lucknow n=103	Peshawar n=160	Phnom Penh n=208	Quezon City n=54	Cox Bazaar refugee camp n=5
No	60%	12.9%	56.82%	19.37%	22.73%	0%	7.34%	54.95%	80%
Yes, for paying salaries	6%	29.03%	15.91%	19.82%	12.73%	25. 43%	22.73%	10.99%	0%
Yes, for paying suppliers	6%	10.75%	9.09%	14.86%	11.82%	24.57%	22.73%	5.49%	0%
Yes, for inventory purchase	4%	11.83%	0%	6.76%	10%	2.59%	18.53%	5.49%	0%
Yes, for working capital	14%	2.15%	2.27%	8.56%	8.18%	3.45%	10.84%	16.48%	0%
Yes, for equipment financing	0%	10.75%	2.27%	7.21%	9.09%	1.29%	3.85%	2.2%	0%
Yes, for capital intensive asset purchase	4%	4.84%	4.55%	5.86%	8.18%	4.31%	5.24%	3.3%	20%
Yes, for service existing loans / debt repayment	4%	1.61%	4.55%	9.91%	10%	25%	5.94%	1.1%	0%
Yes, for refinancing	2%	16.13%	4.55%	7.66%	7.27%	13.36%	2.8%	0%	0%
Keep borders open	6.76%	3.79%	0%	12.1%	6.67%	19.18%	1.87%	7.6%	0%
Facilitate trade	27.03%	9%	0%	14.59%	18.33%	4.79%	1.64%	11.7%	20%
Don't know	17.57%	6.16%	23.4%	8.19%	3.33%	0.34%	1.87%	15.79%	0%
Other	0%	4.27%	0%	0%	0%	0%	0%	3.51%	0%

Table 9. Were you able to borrow money or get financial support?

	Chittagong (n=142)	Dhaka n=145	Jakarta n=161	Kabul n=226	Lucknow n=103	Peshawar n=160	Phnom Penh n=208	Quezon City n=54	Cox Bazaar refugee camp n=5
No, because no money lender	4.62%	8.51%	0%	31.82%	60%	46.73%	16.29%	14.29%	0%
No, because rate too high	80%	0%	18.18%	13.64%	11.11%	0%	30.9%	0%	0%
No, because already too much debt	3.08%	38.3%	0%	0%	8.89%	45.79%	28.65%	47.62%	0%
No, because no grant available	3.08%	34.04%	27.27%	30.3%	11.11%	0%	20.22%	9.52%	0%
Yes	9.23%	19.15%	54.55%	24.24%	8.89%	7.48%	3.93%	28.57%	100%

Table 10. What did you need in the last 6 months? (in USD)

	Chittagong (n=142)	Dhaka n=145	Jakarta n=161	Kabul n=226	Lucknow n=103	Peshawar n=160	Phnom Penh n=208	Quezon City n=54	Cox Bazaar refugee camp n=5
Less than US$5000	45.50%	26.90%	54.50%	20.30%	69.40%		4.30%	52.60%	100.00%
US$5000 - US$10000	45.50%	37.20%		27.10%	27.80%	1.70%	24.30%	47.40%	
Greater than US$10000	9.10%	30.80%	18.20%	52.50%		91.50%	64.30%		
Don't know		5.10%	27.30%		2.80%	6.80%	7.10%		

Table 11. Do you need technical assistance to cope with the impact of the coronavirus pandemic?

	Chittagong (n=142)	Dhaka n=145	Jakarta n=161	Kabul n=226	Lucknow n=103	Peshawar n=160	Phnom Penh n=208	Quezon City n=54	Cox Bazaar refugee camp n=5
Yes, for Business resilience planning	4.76%	15.52%	1.69%	4.06%	22.86%	15.43%	7.39%	1.04%	33.33%
Yes, for Advice on measures to keep staff in the workplace	3.17%	0.72%	1.69%	4.43%	8.57%	10.37%	14.37%	1.04%	0%
Yes, for Advice on input sourcing	1.59%	6.14%	0%	4.8%	6.43%	2.66%	14.77%	2.08%	0%
Yes, for Advice on sales/ distribution	6.35%	9.03%	0%	9.59%	4.29%	6.91%	12.77%	5.21%	0%
Yes, for Advice on price information	3.17%	2.89%	3.39%	7.38%	1.43%	10.9%	7.39%	3.13%	0%
Yes, for Advice on fortification	1.59%	6.86%	0%	2.95%	4.29%	0.53%	0.4%	1.04%	0%
Yes, for Advice on product reformulation	1.59%	0.36%	0%	3.69%	1.43%	3.72%	1.6%	2.08%	0%
Yes, for Advice on food safety	1.59%	1.44%	6.78%	5.54%	1.43%	1.86%	3.19%	0%	0%
Yes, for Advice on nutrition labelling	3.17%	1.08%	0%	7.01%	1.43%	0.8%	4.79%	1.04%	0%
Yes, for Advice on reducing costs/ making products more affordable	4.76%	0.36%	1.69%	3.69%	2.14%	8.51%	5.19%	2.08%	11.11%
Yes, for Marketing advice	6.35%	12.27%	28.81%	7.38%	7.86%	11.44%	6.99%	6.25%	11.11%
Yes, for Quality Assurance and Quality Control advice	6.35%	0.36%	1.69%	2.95%	3.57%	1.33%	7.19%	0%	11.11%
Yes, for Links to distribution or logistics channels	1.59%	4.33%	0%	5.54%	3.57%	1.86%	5.19%	1.04%	11.11%
Yes, for Update business plan	6.35%	15.16%	8.47%	6.27%	5%	9.84%	2.99%	6.25%	0%
Yes, for Development of online platforms for business operations	3.17%	9.03%	20.34%	4.06%	7.14%	12.77%	4.19%	3.13%	0%
Yes, for Support to Improve staff health/ nutrition	1.59%	12.64%	1.69%	5.9%	8.57%	1.06	1.6%	2.08%	0%
No	42.86%	1.81%	23.73%	14.76%	10%		0%	62.5%	22.22%

UN/NGOs Survey – Round 1

Table 1. Prior to the start of the COVID-19 pandemic, did your organisation have a focus on urban populations?

	Dhaka n=208	Jakarta n=145	Quezon City n=54	Yangon n=208	Kabul n=226	Chittagong n=160	Phnom Penh n=208	Peshawar n=208	Lucknow	Cox Bazaar refugee camp n=5
Yes	96.6%	49.2%	61.0%		77.0%	100.0%	96.7%	95.7%	57.1%	100.0%
No	3.4%	50.8%	39.0%	100.0%	23.0%		3.3%	4.3%	42.9%	

Table 2. Since the start of the COVID-19 pandemic, has your organisation increased its focus on urban populations?

	Dhaka n=208	Jakarta n=145	Quezon City n=54	Yangon n=208	Kabul n=226	Chittagong n=160	Phnom Penh n=208	Peshawar n=208	Lucknow	Cox Bazaar refugee camp n=5
Yes	100.0%	53.8%	53.7%		74.7%	100.0%	24.4%	37.1%	83.9%	89.7%
No		46.2%	46.3%	100.0%	25.3%		75.6%	62.9%	16.1%	10.3%

Table 3. What is the primary focus of your organisation in urban areas?its focus on urban populations?

	Dhaka n=208	Jakarta n=145	Quezon City n=54	Yangon n=208	Kabul n=226	Chittagong n=160	Phnom Penh n=208	Peshawar n=208	Lucknow	Cox Bazaar refugee camp n=5
Agriculture	16.07%	4.62%	13.95%	0%	11.44%	16.28%	9.86%	13.59%	7.83%	28.57%
Food security and nutrition	14.29%	3.08%	20.93%	0%	12.53%	13.95%	3.06%	12.62%	8.7%	22.86%
Gender	5.36%	7.69%	13.95%	0%	17.71%	4.65%	28.57%	22.33%	11.3%	14.29%
Health	21.43%	6.15%	20.93%	50%	21.8%	16.28%	28.23%	28.16%	15.65%	7.14%
WASH	7.14%	0%	3.49%	50%	10.63%	2.33%	1.36%	16.99%	5.22%	10%
Shelter/protection	14.29%	6.15%	22.09%	0%	20.44%	11.63%	13.95%	6.31%	12.17%	17.14%
Other	21.43%	72.31%	4.65%	0%	5.45%	34.88%	14.97%	0%	39.13%	0%

Table 4. Which components of urban food systems have been disrupted by COVID-19?urban populations?focus on urban populations?

	Dhaka n=208	Jakarta n=145	Quezon City n=54	Yangon n=208	Kabul n=226	Chittagong n=160	Phnom Penh n=208	Peshawar n=208	Lucknow	Cox Bazaar refugee camp n=5
Food supply chains	30.16%	34.43%	16.22%	25%	26.85%	32.43%	0.99%	25.16%	36.73%	46.67%
Food access	23.81%	47.54%	32.43%	25%	26.85%	51.35%	34.16%	35.22%	22.45%	26.67%
Food affordability	12.7%	14.75%	27.03%	25%	28.02%	8.11%	60.89%	24.53%	31.63%	17.78%
Food safety	33.33%	3.28%	24.32%	25%	18.29%	8.11%	3.96%	15.09%	9.18%	8.89%
WASH	7.14%	0%	3.49%	50%	10.63%	2.33%	1.36%	16.99%	5.22%	10%
Shelter/protection	14.29%	6.15%	22.09%	0%	20.44%	11.63%	13.95%	6.31%	12.17%	17.14%
Other	21.43%	72.31%	4.65%	0%	5.45%	34.88%	14.97%	0%	39.13%	0%

Table 5. Which vulnerable groups in urban areas have been most affected by the COVID-19 pandemic, including social and economic impacts?

	Dhaka n=208	Jakarta n=145	Quezon City n=54	Yangon n=208	Kabul n=226	Chittagong n=160	Phnom Penh n=208	Peshawar n=208	Lucknow	Cox Bazaar refugee camp n=5
Women	7.84%	3.23%	13.39%	2.44%	20.08%	3.45%	0.81%	18.61%	17.46%	0%
Children	15.69%	12.9%	20.54%	2.44%	7.34%	3.45%	0%	24.24%	18.25%	0%
Adolescents	0%	0%	13.39%	2.44%	12.74%	0%	2.02%	8.23%	11.11%	0%
Elderly	56.86%	12.9%	19.64%	2.44%	32.82%	79.31%	48.18%	15.15%	11.11%	65%
People in slums / informal settlements	19.61%	50%	20.54%	2.44%	21.24%	13.79%	48.99%	17.32%	42.06%	35%
Other marginalized groups	0%	20.97%	12.5%	87.8%	5.79%	0%	0%	16.45%	0%	0%
Other	21.43%	72.31%	4.65%	0%	5.45%	34.88%	14.97%	0%	39.13%	0%

Table 6. Which foods were in short supply compared to normal times?COVID-19 pandemic, including social and economic impacts?VID-19?urban populations? focus on urban populations?

	Dhaka n=208	Jakarta n=145	Quezon City n=54	Yangon n=208	Kabul n=226	Chittagong n=160	Phnom Penh n=208	Peshawar n=208	Lucknow	Cox Bazaar refugee camp n=5
Fruits and vegetables	55.32%	31.75%	0%	77.78%	22.33%	16.54%	0%	24.77%	36.13%	41.67%
Animal source foods	27.66%	15.87%	47.92%	11.11%	17.15%	5.26%	3.89%	20.72%	17.65%	35.42%
Staple grains	2.13%	52.38%	18.75%	11.11%	17.8%	0%	28.33%	15.77%	9.24%	10.42%
Nuts and seeds	2.13%	0%	2.08%	0%	14.24%	75.94%	0%	19.37%	10.08%	8.33%
Manufactured, packaged or processed foods	10.64%	0%	18.75%	0%	27.83%	2.26%	67.78%	18.92%	17.65%	4.17%
Other	2.13%	0%	12.5%	0%	0.65%	0%	0%	0.45%	9.24%	0%
Other	21.43%	72.31%	4.65%	0%	5.45%	34.88%	14.97%	0%	39.13%	0%

Table 7. Has your organisation implemented or supported any of these measures to alleviate food insecurity in urban areas during the COVID-19 pandemic?

	Dhaka n=208	Jakarta n=145	Quezon City n=54	Yangon n=208	Kabul n=226	Chittagong n=160	Phnom Penh n=208	Peshawar n=208	Lucknow	Cox Bazaar refugee camp n=5
Cash transfers	39.53%	76.6%	9.84%	50%	15.66%	50%	15.63%	17.37%	2.2%	46.51%
Food vouchers	6.98%	2.13%	18.03%	0%	16.06%	10%	1.56%	21.13%	5.49%	27.91%
Food aid	11.63%	14.89%	44.26%	50%	30.12%	3.33%	44.53%	24.41%	46.15%	6.98%
School meals	2.33%	4.26%	1.64%	0%	11.65%	6.67%	33.59%	22.54%	14.29%	4.65%
Urban agriculture	18.6%	2.13%	3.28%	0%	24.9%	26.67%	3.91%	14.55%	2.2%	13.95%
Other	20.93v	0%	22.95%	0%	1.61%	3.33%	0.78%	0%	29.67%	0%
Other	21.43%	72.31%	4.65%	0%	5.45%	34.88%	14.97%	0%	39.13%	0%

Table 8. Has your organisation monitored the impact of the COVID-19 pandemic on food security or nutrition outcomes in urban areas?to alleviate food insecurity in urban areas during the COVID-19 pandemic?

	Dhaka n=208	Jakarta n=145	Quezon City n=54	Yangon n=208	Kabul n=226	Chittagong n=160	Phnom Penh n=208	Peshawar n=208	Lucknow	Cox Bazaar refugee camp n=5
Yes	72.4%	58.3%	68.3%		74.5%	65.2%	56.1%	24.3%	33.9%	44.8%
No	27.6%	41.7%	31.7%	100.0%	25.5%	34.8%	43.9%	75.7%	66.1%	55.2%

Table 9. Which of these outcomes did your organisation monitor during the pandemic?food security or nutrition outcomes in urban areas?to alleviate food insecurity in urban areas during the COVID-19 pandemic?

	Dhaka n=208	Jakarta n=145	Quezon City n=54	Yangon n=208	Kabul n=226	Chittagong n=160	Phnom Penh n=208	Peshawar n=208	Lucknow	Cox Bazaar refugee camp n=5
Food prices / affordability	23.53%	64.52%	21.74%	32%	16%	44.81%	14%	26.92%	4.55%	46.51%
Food insecurity	11.76%	16.13%	26.09%	23.5%	4%	20.78%	24%	19.23%	9.09%	27.91%
Food purchasing patterns	2.94%	12.9%	8.7%	24%	12%	1.3%	20%	25%	9.09%	6.98%
Diet diversity / diet quality	23.53%	0%	8.7%	10.5%	20%	32.47%	18%	13.46%	45.45%	4.65%
Nutritional status	32.35%	6.45%	34.78%	10%	32%	0.65v	24%	13.46%	31.82%	13.95%
Other	5.88%	0%	0%	0%	16%	0%	0%	1.92%	0%	0%

Governance Survey – Round 1

Table 1. What is the focus of your role in local government?

	Chittagong (n=142)	Dhaka n=145	Jakarta n=161	Kabul n=226	Lucknow n=103	Peshawar n=160	Phnom Penh n=208	Quezon City n=54	Cox Bazaar refugee camp n=5
Agriculture	0%	4.17%	17.78%	8.7%	8.33%	31.34%	6.82%	7.87%	42.86%
Food security and nutrition	0%	4.17%	33.33%	4.35%	12.5%	11.94%	15.91%	12.36%	14.29%
Health and social care	100%	14.58%	31.11%	17.39%	16.67%	29.85%	27.27%	22.47%	0%
Urban planning	0%	29.17%	13.33%	34.78%	12.5%	23.88%	28.41%	6.74%	0%
Food markets	0%	2.08%	4.44%	10.87%	12.5%	2.99%	15.91%	1.12%	0%
Other	0%	45.83%	0%	23.91%	37.5%	0%	5.68%	49.44%	0%

Table 2. Where does food come from to feed the city (in normal times)?

	Chittagong (n=142)	Dhaka n=145	Jakarta n=161	Kabul n=226	Lucknow n=103	Peshawar n=160	Phnom Penh n=208	Quezon City n=54	Cox Bazaar refugee camp n=5
Within the city	50%	46.94%	1.49%	31.34%	70.59%	59.49%	24.72%	32.2%	42.86%
Region surrounding the city	0%	48.98%	14.93%	14.93%	17.65%	32.91%	47.19%	39.83%	14.29%
Other regions of the country	50%	2.04%	16.42%	25.37%	11.76%	1.27%	10.11%	27.97%	0%
Internationally	0%	2.04%	1.49%	28.36%	0%	6.33%	17.98%	0%	0%
Food markets	0%	2.08%	4.44%	10.87%	12.5%	2.99%	15.91%	1.12%	0%

Table 3. Were food supplies into the city disrupted by the COVID-19 pandemic?

	Chittagong (n=142)	Dhaka n=145	Jakarta n=161	Kabul n=226	Lucknow n=103	Peshawar n=160	Phnom Penh n=208	Quezon City n=54	Cox Bazaar refugee camp n=5
Yes – severely disrupted	100%	6.38%	89.47%	30.77%	6.67%	0%	17.54%	10.91%	42.86%
Yes – moderately disrupted	0%	53.19%	10.53%	61.54%	26.67%	91.8%	38.6%	29.09%	14.29%
Not disrupted	0%	40.43%	0%	7.69%	66.67%	8.2%	43.86%	60%	0%

Table 4. Which foods were in short supply compared to normal times?

	Chittagong (n=142)	Dhaka n=145	Jakarta n=161	Kabul n=226	Lucknow n=103	Peshawar n=160	Phnom Penh n=208	Quezon City n=54	Cox Bazaar refugee camp n=5
Fruits and vegetables	0%	32.61%	16.67%	21.54%	50%	0%	23.08%	28.21%	42.86%
Animal source foods	0%	17.39%	40.48%	12.31%	12.5%	2%	13.85%	20.51%	14.29%
Staple grains	0%	45.65%	16.67%	29.23%	0%	22%	15.38%	14.1%	0%
Nuts and seeds	0%	2.17%	4.76%	13.85%	0%	30%	16.92%	15.38%	0%
Manufactured, packaged or processed foods	100%	2.17%	21.43%	23.08%	37.5%	46%	30.77%	21.79%	0%

Table 5. Were city food prices affected by the COVID-19 pandemic?

	Chittagong (n=142)	Dhaka n=145	Jakarta n=161	Kabul n=226	Lucknow n=103	Peshawar n=160	Phnom Penh n=208	Quezon City n=54	Cox Bazaar refugee camp n=5
Yes – generally increased		33.3%	100.0%	46.2%	46.7%		21.3%	1.8%	42.86%
Yes – generally decreased		2.2%				6.8%	4.3%	1.8%	14.29%
Yes – fluctuated		64.4%		53.8%	13.3%	1.7%	48.9%	21.8%	0%
Not affected	100.0%				40.0%	91.5%	25.5%	74.5%	0%

Table 6. Did local government provide additional financial support (or food aid) to low-income or vulnerable groups in urban areas during the pandemic?

	Chittagong (n=142)	Dhaka n=145	Jakarta n=161	Kabul n=226	Lucknow n=103	Peshawar n=160	Phnom Penh n=208	Quezon City n=54	Cox Bazaar refugee camp n=5
Yes		97.8%	100.0%	92.3%	26.7%		40.4%	96.4%	42.86%
No	100.0%	2.2%		7.7%	73.3%	100.0%	59.6%	3.6%	14.29%

Table 7. For how long was additional financial support (or food aid) provided to low-income or vulnerable groups in urban areas?

	Chittagong (n=142)	Dhaka n=145	Jakarta n=161	Kabul n=226	Lucknow n=103	Peshawar n=160	Phnom Penh n=208	Quezon City n=54	Cox Bazaar refugee camp n=5
Less than 1 month		5.3%	4.2%	75.0%		52.6%		96.4%	42.86%
Between 1 and 3 months		42.1%	50.0%	25.0%		36.8%	9.4%	3.6%	14.29%
Between 3 and 6 months	27.3%	42.1%	29.2%		100.0%	5.3%	32.1%		
More than 6 months	72.7%	10.5%	16.7%			5.3%	58.5%		

Table 8. Did local government provide additional financial support to food businesses during the pandemic?

	Chittagong (n=142)	Dhaka n=145	Jakarta n=161	Kabul n=226	Lucknow n=103	Peshawar n=160	Phnom Penh n=208	Quezon City n=54	Cox Bazaar refugee camp n=5
Yes		13.3%	100.0%	23.1%			4.3%	40.0%	42.86%
No	100.0%	86.7%		76.9%	100.0%	100.0%	95.7%	60.0%	14.29%

Table 9. For how long was additional financial support provided to food businesses?

	Chittagong (n=142)	Dhaka n=145	Jakarta n=161	Kabul n=226	Lucknow n=103	Peshawar n=160	Phnom Penh n=208	Quezon City n=54	Cox Bazaar refugee camp n=5
Less than 1 month		10.5%	16.7%	100.0%	50.0%		4.3%	40.0%	42.86%
Between 1 and 3 months		68.4%	16.7%		50.0%	22.7%	95.7%	60.0%	14.29%
Between 3 and 6 months	42.9%	15.8%	16.7%			31.8%			
More than 6 months	57.1%	5.3%	50.0%			45.5%			

Appendix 2. Cultivated land per 100,00 persons

Analysis of a regional data set which summarises the amount of cultivated land per 100,000 persons within 50km of each of the cities in the GHSL dataset for Asia.

Hypothesis: food systems resilience/food security is underpinned (to a greater or lesser extent) by the availability of cultivated land within 50km or one-hours' drive of each city (centre).

The availability of land within 50km varies between cities according to geography and according to the variation in the sizes/size classes of cities efficiency in land-use/amount of sprawl etc, land prices/ land market functions etc, availability and quality of road infrastructure. We are using this as an indicator of the ability of a city to feed itself/ contribute to food security for its citizens.

Sample size:

National UN Income classification	N (sample size)
LIC	158
LMIC	3940
UMIC	1690
HIC	171

FIGURE 1: BOX PLOT SHOWING THE RANGE OF VALUES FOR KM2 OF CULTIVATED LAND PER 100,000 PERSONS (WITHIN 50KM OF A CITY). BY UN INCOME CLASS OF COUNTRY.

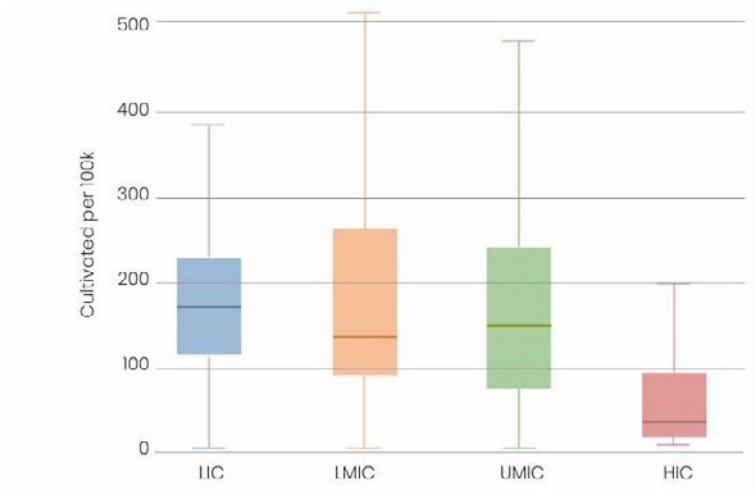


FIGURE 2: SCATTER PLOT SHOWING KM2 OF CULTIVATED LAND PER 100,000 PERSONS (WITHIN 50KM OF A CITY) AGAINST GDP PER CAPITA. BY UN INCOME CLASS OF COUNTRY.

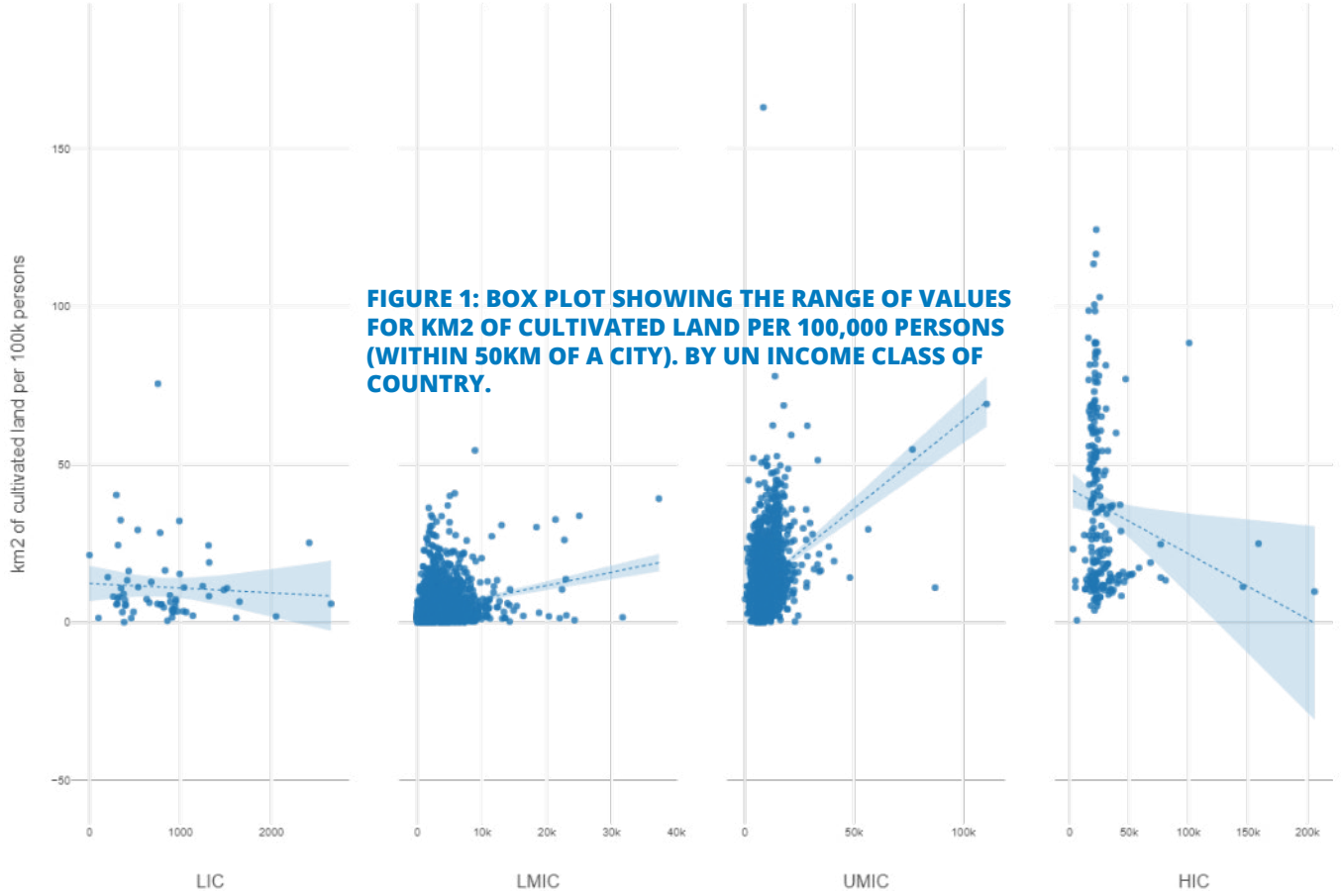


FIGURE 1: BOX PLOT SHOWING THE RANGE OF VALUES FOR KM2 OF CULTIVATED LAND PER 100,000 PERSONS (WITHIN 50KM OF A CITY). BY UN INCOME CLASS OF COUNTRY.

We can clearly see that with the exception of cities in Higher Income Countries (HIC) – the amount of cultivated land per 100,000 persons tends to rise with GDP – in an almost co-linear fashion for UMICs. So perhaps as cities grow and expand outward, more land is cleared for agriculture to feed its citizens/used productively for agriculture, output rises until a larger share of non-farm output contributes to the city economy. Cities in HIC for example have greater share of manufacturing/services (greater value-added) and as such the amount of agricultural land close to the city is not what is driving increase in GDP. This graph likely confirms the contribution agriculture continues to make to city economies in LMICs, UMICs regardless of city-size. What this doesn't tell us is how big a contribution this cultivated land makes to feeding its own citizens. Afghanistan, Nepal and North Korea are the only LICs in Asia.

Approach to defining 'cut-offs'

If we assume that better access to agricultural land close to the city means both better economic growth prospects and potential to feed the city (with directly through the agricultural production and/or overall increases in wealth). In order to define cut-offs at which we feel the capacity of the city changes from absorptive to adaptive to transformative we could take somewhat arbitrary values that we see in the distribution of values from our 7,000-city sample.

All of the focal cities are in LICs or LMICs – therefore one could take the lower bounds, interquartile range, and upper bounds of the distribution of values from the sample of to define cut-offs:

Absorptive capacity	<8.6 km2
Adaptive capacity	8.6-25.3 km2
Transformative capacity	≥25.3 km2

Appendix 3
methodological approaches to defining urban areas

Below a number of methodological approaches are presented to defining urban areas, beyond administrative boundaries. Cities typically grow in population and area through a combination of three factors – endogenous growth (in-situ population growth), migration of those living outside of cities, re-definition of administrative boundaries. Very often the functional area of a city extends well beyond the formal city, administrative boundaries – which remain fixed, or change through a process of political settlement over longer-time periods. The result is an increasing number of people occupying land outside of municipal jurisdictions who contribute to the city economy, in mainly through the provision of labour, and yet do not benefit from municipal services or other government support. As land on the urban fringe is converted from rural/agricultural land to urban, infrastructure provision rarely keeps pace often resulting in the growth of settlements with lower standards/provision of basic services (WASH, roads/drainage., electricity etc.) and poorer housing conditions. These settlements may also house the urban poor, some of the more vulnerable groups in society, in marginal locations.

It is therefore important to have a broader appreciation of the urbanisation process taking place and shaping the growth of the city in order to identify early warning signs of unsustainable growth and the location of vulnerable groups. Further, urban food systems transcend administrative boundaries therefore it may be appropriate to think beyond these boundaries for programming i.e. targeting vulnerable groups. The availability of open, satellite data and opensource Geographic Information System software open possibilities for understanding cities and their food systems. Importantly, advances in cloud-based computing over the last decade now means much of the 'heavy-lifting' in terms of acquiring and processing spatial and temporal datasets has been done making regional and even global studies accessible to anyone with a modern web browser and a little knowledge of common coding languages.

These types of analysis can highlight the implications for a number of policy related issues i.e. land-use, infrastructure investment, public and environmental health, and of course food security. For example, we may highlight issues regarding the efficient use of land both within existing urban areas and on the fringes, particularly thinking about the loss of productive agricultural land and the impact this may have on food supply.

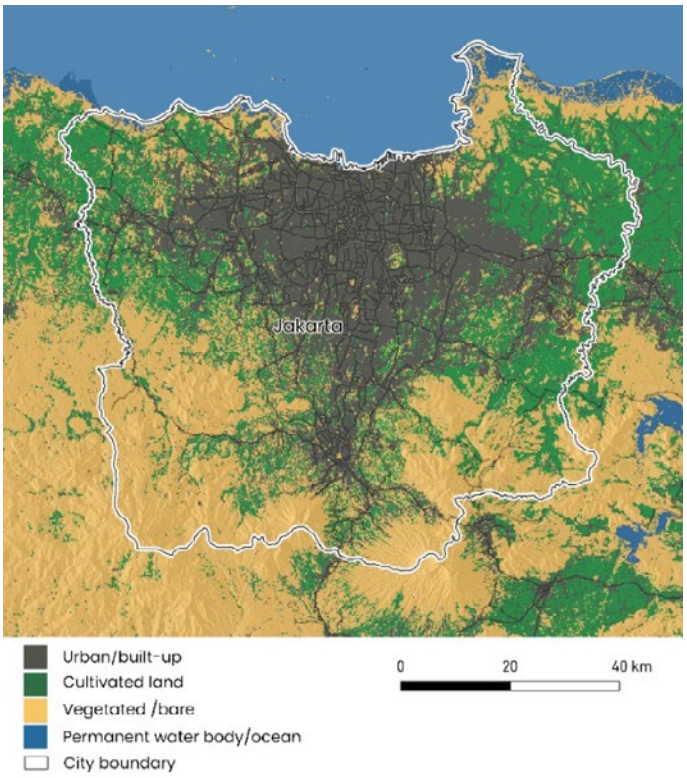
A number of methods for rapidly assessing patterns of urban growth are discussed below with relative costs and benefits summarised in a table below along with suggested sources of data.

Landcover classification

Several global datasets exist that provide spatial classification of landcover at different scales and temporal frequencies. With very little additional processing it is possible to access and analyse these datasets to provide an expanded view of patterns of urbanisation and development of cities overtime. Essentially, the urban 'footprint' for global settlements have been classified through a number of open data products, that provide timeseries data on the form of urbanisation across the globe. These datasets allow one to define the built footprint of each city – which often goes well beyond, formal administrative boundaries, as a basis for generating time-series data on the form and pace of growth of urban settlements and the surrounding landcover.

For example, in this study the Global Land Cover Layers (Copernicus) we're used to generate data on the amount of cultivated land and other types of landcover available within 50k of each of the study cities. The nature of this landcover can then be mapped, visualised and summary statistics produced to provide regional comparative analysis between cities. Also due to the high-resolution of this data product (10m) it is suitable for undertaking intra-urban analyses. For example, monitoring loss of agricultural or forest land over time within and on the fringes of urban areas.

FIGURE 1: EXAMPLE LANDCOVER CLASSIFICATION MAP. SOURCE: GLOBAL LAND COVER LAYERS: CGLS-LC100 COLLECTION (COPERNICUS EU) MAPPING: DIKODA



Landcover classification can help

- visually explore the extent of the city, trends and dynamics relating to urban expansion
- monitoring the loss/gain of particular types of landcover – cultivated, forest etc. and relationships between the loss of some classes and growth of others
- identify priority locations where those in greatest need may have settled
- provide evidence to underpin policy development to better manage urban areas

TABLE 1: SAMPLE DATASETS AND SOURCES. ALL OF THE FOLLOWING ARE AVAILABLE FREELY UNDER CREATIVE COMMONS LICENCE.

Data source	Description	Scale
Global Human Settlement Layer (EC Joint Research Centre)	Global scale, time-series dataset the spatial extent of featuring c. 13,000 global, urban settlements as defined using supervised classification of satellite imagery and a number of spatial covariates. Data is available for four epochs, 1975, 1990, 2000, and 2015 with around 30+ spatial indicators available for each city.	30m, global
Global Land Cover Layers: CGLS-LC100 collection (Copernicus EU)	High resolution, global landcover classification that identifies 20+ landcover classes (urban/built, shrubs, forest etc) annually (2015 – 2019 currently available)	10m, global
MODIS Land Cover Type Yearly Global 500m (NASA)	Global landcover classification that identifies 20+ landcover classes (urban/built, shrubs, forest etc) annually (2000 – 2019 currently available)	500m, global

Gridded population data

The use of high-resolution satellite imagery combined with recent census data and machine learning techniques as yielded a number of global, databases that allow for the visualisation and exploration of the location and density of residents within and proximate to cities. Going further and combing population datasets with other spatial information, natural hazards, infrastructure development, landcover can assist in identifying populations at risk or vulnerable to natural and man-made hazards. Gridded population datasets are available as time-series data with estimates made using the most recent census data, with inter-census years being modelled, to provide time-series data over two decades or more.

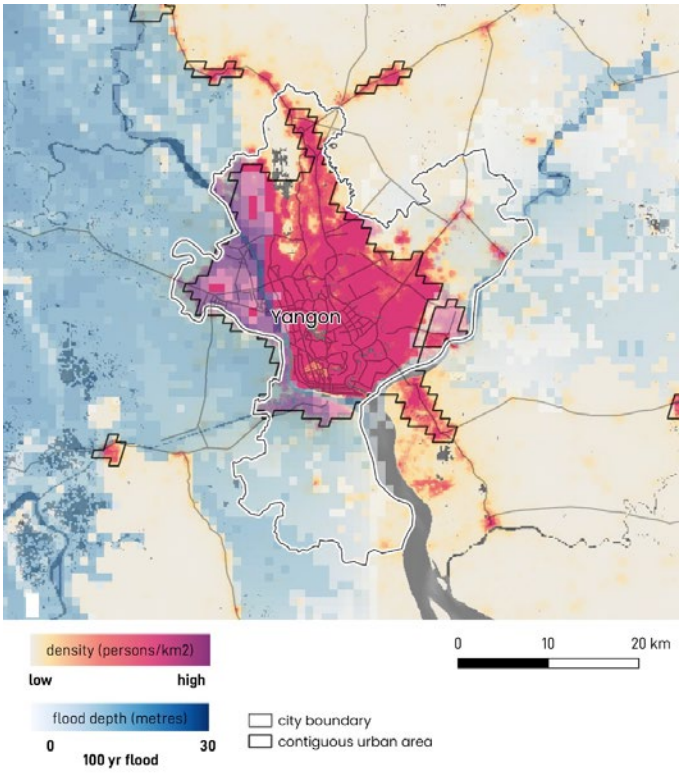


FIGURE 2: EXAMPLE GRIDDED POPULATION DATA MAP OF YANGON, MYANMAR COMBINED WITH GLOBAL 100-YEAR FLOOD ESTIMATES TO IDENTIFY AND COUNT AT RISK POPULATIONS. SOURCE: WORLDPOP POPULATION ESTIMATES FOR MYANMAR AND FLOOD HAZARD MAP OF THE WORLD - 100-YEAR RETURN PERIOD. MAPPING: DIKODA

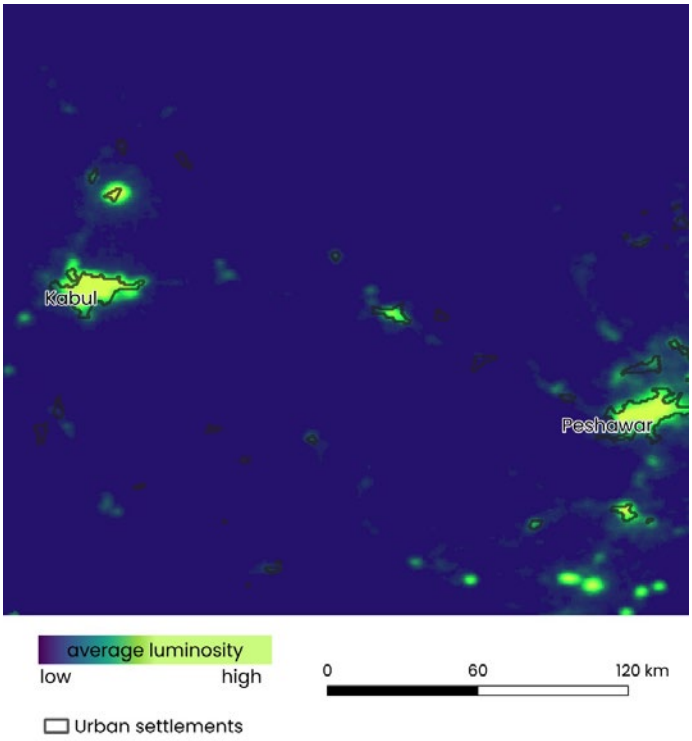
TABLE 2: SAMPLE DATASETS AND SOURCES. ALL OF THE FOLLOWING ARE AVAILABLE FREELY UNDER CREATIVE COMMONS LICENCE.

Data source	Description	Scale
WorldPop	Various gridded population data products available at for most countries over the period 2000-2020. In addition to population counts, other demographic and socio-economic datasets are available that have been developed using a combination of spatial data and census including UN adjusted population totals, population density, age and sex structure, births etc.	c.100m – 1km resolution
Gridded Population of the World (GPW), v4	Similar to WorldPop, GPW products have been available since 1995 and produce population estimates for the years 2000, 2005, 2010, 2015, and 2020 with global coverage. Population counts and densities have also been adjusted to adjusted to national level, historic and future, population predictions from the United Nation's World Population Prospects.	c.1 km resolution
Facebook High Resolution Population Density Maps + Demographic Estimates	Almost global coverage, providing population estimates at 30m resolution building on the approach used for the GPW dataset above. Data is available in GeoTiff (GIS) and Comma Separated Value (CSV) format with estimates of population, sex and age structure.	30m resolution

Night light emissions data

Satellites have been capturing night lights emissions imagery for decades which allows a unique opportunity to observe human activity from space. Mapping urban areas and human populations and economic activity has been a common use of this data and in recent years much has been written about the relevance, effectiveness and limitations of this kind of data for these applications. Very often gridded population estimates described above use night lights emission data to help map settled areas. These datasets complement those on landcover described above and provide additional opportunity for capturing data during cloud-free periods.

FIGURE 3: NIGHT LIGHTS DATA SHOWING THE EXTENT OF URBAN DEVELOPMENT IN AND AROUND THE CITY OF PESHAWAR AND KABUL. SOURCE: MAPPING: DIKODA



Data source	Description	Scale
DMSP	Originally developed to detect clouds at night an unanticipated benefit of the DMSP satellite program was the ability to detect visible and near-infrared emissions, the detection of city lights, gas, flares and fires. Annual and monthly composites available for the globe for the period 1992 to 2013.	1 km
Visible Infrared Imaging (VIIRS) Radiometer Suite (VIIRS)	Similar to the DMSP data above, VIIRS has come onstream in 2012. Imagery is acquired and processed on a daily basis providing potential for fine-grained time-series analysis. Annual composites are available and is at a higher resolution than DMSP data. Note: due to the way the VIIRS sensor operates the data between the two sensors (DMSP and VIIRS) is not particularly compatible, making it difficult to produce a composite product that spans a longer time period.	500m
Facebook High Resolution Population Density Maps + Demographic Estimates	Almost global coverage, providing population estimates at 30m resolution building on the approach used for the GPW dataset above. Data is available in GeoTiff (GIS) and Comma Separated Value (CSV) format with estimates of population, sex and age structure.	(30m forthcoming)

OpenStreetMap

OpenStreetMap (OSM) is a global mapping service which is built upon the contribution of a community of mappers providing data on roads, buildings, infrastructure, places and other features. It operates it self-moderated, meaning anyone can upload data and/or challenge or improve the accuracy of data in their town or city for example. Many development partners and agencies undertake wide scale mapping and then upload features to OpenStreetMap. The data is freely available under a CreativeC Commons licence. Aside from accessing the data direct from OSM, a number of third parties maintain repositories of OSM data in various formats to enable greater accessibility.

In the case of food systems, it is possible to query the OSM database to return for example, location data relating to food outlets, restaurants, convenience stores, supermarkets etc. Although this data should be used with some caution – given the community-based nature of its acquisition – it can often be useful as a starting point to provide some basic context to the study of towns, cities or rural areas. When combined with other datasets such as population, it is also possible to investigate more broadly, accessibility to specific facilities or features, and using GIS to highlight the presence or absence of specific facilities in relation to where people live.

FIGURE 4: MAPPING FOOD OUTLETS ACROSS QUEZON CITY, PHILIPPINES THE MAP BELOW SHOWS THE LOCATION OF SUPERMARKETS ACROSS THE CITY AND BROADLY THE CATCHMENT OF THE STORES, BASED ON A FIVE-MINUTE WALKING DISTANCE (400M). ALSO SHOWN ARE THE LOCATION OF KNOWN INFORMAL SETTLEMENTS, AND POPULATION MORE GENERALLY. SOURCE: OPENSTREETMAP DATA, MAPPING: DIKODA