Food Flow Analysis

of

Seven Commodities in Sri Lanka

Summary Report

Authors

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Executive Summary

Context and Background

A sustainable food system focuses on simultaneously generating positive outcomes across economic, social and environmental dimensions. The challenges are multiple and multi-faceted for Sri Lanka, in making the food system more climate resilient, more productive, and more inclusive, especially targeting marginalized populations that are adversely affected under challenging scenarios.

This study focuses primarily on Colombo, the business capital of Sri Lanka, linked to other major city regions in the country (i.e. 25 districts in nine provinces). The city of Colombo which covers an area of approximately 37 km^2, is the epicentre of the Sri Lankan economy and is home to an estimated 612 535 inhabitants (2020), with a nearly 500 000 daily floating population.[1] The overall population density of the city is 13 364 persons/ km^2 (country's average population density is 325 persons/ km^2). The agricultural production within the Colombo District is negligible, providing for only 2 percent of total demand, mainly for self-consumption. This clearly indicates that most of the food is brought from outside the city/urban region, resulting in long supply chains involving multiple actors and high food miles. Thus, in this context the Colombo city region is considered the "Consumer" in relation to the rest of the country.[2] A rapidly-growing urban-poor population, reduced food flow inefficiencies and longer food miles have prompted the need for urgent changes in the structure and governance of a future Colombo City Region Food System (CRFS) through a systematic approach.

Tracing the flows and sources of food (food flow analysis) is an important approach to identifying food system activities taking place within city region boundaries and in ascertaining food system risks, vulnerabilities, resilience capacities, weaknesses and strengths. The analysis of food flow paths from production to consumption and disposal is useful in determining where significant inefficiencies may occur. At each operational step in the flow, active management of food production, processing, supply and distribution and value addition is essential in strengthening rural-urban connectivity for end users (households and business) of the food chain. Food flow data provide unique insights into the debates surrounding the sustainability of production and consumption at multiple levels.

Studying and identifying vulnerabilities, weaknesses and strengths of food systems operating within the country's decentralized geographic regions, through tracing of food flows was considered necessary, to address inefficiencies occurring across localized supply and value chain nodes. Such a study, at least for selected food commodities, is important considering extreme climate events and stresses, pandemics, economic shocks and global supply chain disruptions (e.g. the Russia-Ukraine conflict,) all of which impose restrictions on Sri Lanka. Seven food commodities, namely, rice, maize, potato, bean, banana, chicken meat and marine fish, were thus selected for the study.

The overall objective of the study is to: *Strengthen the Colombo city region food system to be more resilient to vulnerabilities and weaknesses through improvements in food flow inefficiencies within geographic regions of Sri Lanka.*

[1] https://ruaf.org/assets/2021/09/Assessing-risk-in-times-of-climate-change-and-COVID-19-_Colombo.pdf
[2] FAO, RUAF, IWMI and CGIAR (2016): City regions food systems situation analysis – Colombo, Sri Lanka. Working Document. http://www.fao.org/3/a-bl821e.pdf

Study Approach

The methodology adopted is a mapping of food flow networks to identify potential ways to tackle food supply challenges including during climate and other shocks/stresses and improve urban-rural linkages within the context of Colombo City Region Food System (CRFS) needs and recommend viable options for efficiencies.

The scope of the study included key actors identified in the food flow pathways of specific commodities (e.g. farmer/fisher, collector/transporter, processor/warehouse manager/miller, retailer/supermarkets and consumer) in 25 districts across 9 provinces in Sri Lanka. A sample of 1 942 actors covering seven food commodities across their food flow paths were interviewed both in the *Yala* and *Maha* seasons, using questionnaire surveys. In Sri Lanka, there are two main seasons that greatly affect the agrifood systems of the country. These are the *Yala* season, which occurs from May to August, and the *Maha* season, which takes place from November to February. During *Yala*, the weather is hot and dry and during *Maha* it is cooler and wet. The report illustrates the Colombo CRFS mapping for each of the seven commodities with a depiction of critical factors affecting respective supply chains.

Summary Findings

(1) Inflows and outflows of commodities between different transaction nodes were severely affected by social distancing, lockdowns and closure of markets, owing to the COVID-19 pandemic and climate events such as extremes rainfall, temperatures, etc.;
(2) These stresses have negatively impacted food flow leading to disruptions in the urban (consumer) - rural (producer) connectivity. Any such impact will determine the overall efficacy of the flow of food commodities to Colombo, as well as within and between different districts;
(3) Lack of production in urban and peri-urban areas;
(4) High food miles between consumers, producers, processing installations, storage facilities and intermediary suppliers and related issues arising from monopolistic operations; and
(5) Distribution inefficiencies, poor storage management, loss and damage of produce, transport challenges and low production and lack of related labour.

Summary Recommendations

(1) Mainstream CRFS into national policies through a Stakeholder Advisery Group (SAG) for a well-coordinated governance structure and facilitate “core teams” representing participating institutions to implement strategic CRFS actions via streamlined/multi-stakeholder collaborated mechanisms;
(2) Incentivize the establishment of storage, processing and cold chain facilities, improve packaging, consolidate transporter services and strengthen regional food distribution centres with a view to increasing efficiencies and reducing loss/wastage along the chain;
(3) Ensure the supply of a wide product range and scale up best practices;
(4) Educate actors and supply chain players on the significance of improving food flow efficiencies for multiple benefits and build capacities of relevant stakeholders;
(5) Conduct in-depth map revisions and analyses at the district level; and
(6) Increase urban and per-urban agriculture production along with improved small-scale processing operations in the Western Province.

1. Introduction

A food system comprises of a complex set of activities, interactions and actors along the food value chain involving production, aggregation, processing, distribution, consumption and disposal of food products that originate from agriculture, fishery and livestock sectors, and less extent from forestry, as parts of the broader economic, societal and natural environments in which they are embedded.[3] Food systems also entail enabling policy environments and cultural norms around food. An ideal food system[4] would be nutrition, health- and safety-driven, productive and efficient (and thus able to deliver affordable food), environmentally sustainable and climate-smart, resilient and inclusive. Reshaping existing food systems to make them more resilient and sustainable is one of the major challenges faced globally in the current era.[2]

2. The FAO City Region Food Systems Approach

About 68 percent of the world population is expected to live in urban areas by 2050.[5] This level of urbanization would increasingly challenge food security and resilience of food systems. Urban areas in countries are often negatively affected by food insecurity, influencing the economic vibrancy of cities that produce more than 80 percent of global Gross Domestic product (GDP). *FAO[6] defines a city region as,* "*a larger urban centre or conglomeration of smaller urban centres and the surrounding and interspersed peri-urban and rural hinterland*", *and defines CRFS as* "*all the actors, processes and relationships that are involved in food production, processing, distribution and consumption in a given city region*". The illustrative depiction of CRFS (Figure 1) addresses broader and complex issues within the urban-rural continuum. World cities are unique with many characteristic features and related challenges with solutions that are generally city specific. The FAO CRFSs strongly link cities with rural areas within a country and operate in complex settings with many actors and external influences, including a changing and variable climate, economic shocks and public health crises.

Figure 1. Components of FAO City Region Food Systems

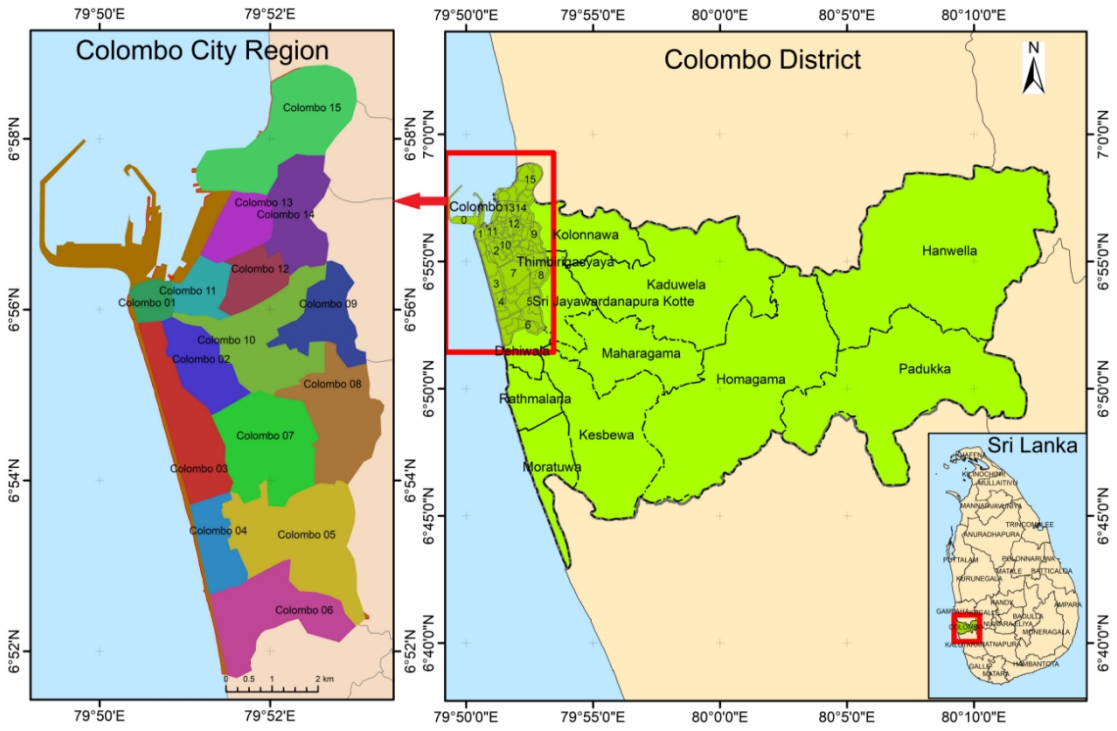
[3] FAO (2018): Sustainable food systems – Concept and framework, Food and Agriculture Organization of the United Nations, Rome
[4] IFPRI (2020) https://www.ifpri.org/topic/food-systems#:~:text=Food%20systems%20are%20the%20sum,foods %20to%20 consumption%20 and%20disposal.
[5] https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html
[6] FAO (2020): The CRFS Approach. http://www.fao.org/in-action/food-for-cities-programme/overview/crfs/en/

It is important that food systems assess their food dependencies, identify weaknesses and potential pressure points, and where possible, develop targeted strategies to improve their food systems to achieve better economic, social and environmental sustenance in both urban and rural areas and contribute to achieving SDG 11 which aims to "Make cities and human settlements inclusive, safe, resilient and sustainable". As explained by FAO,[7] tracing the flows and sources of food (food flow analysis) is an important way of identifying food system activities taking place within city region boundaries and obtaining a sense of food system vulnerabilities, weaknesses and strengths. In view of the growing challenges of the global food system, the local level has increasingly been identified as a relevant scale to develop sustainable alternatives[8].

3. Colombo City Region Food System (CRFS)

The Colombo city (Figure 1) which covers an area of approximately 37 km^2 is the epicentre of the Sri Lankan economy and is home to an estimated 612 535 inhabitants (2020) and almost another 500 000 daily floating population[9]. The overall population density of the city is 13 364 persons/ km^2 (country's average population density is 325 persons/ km^2). Agricultural production within the Colombo District is negligible providing only 2 percent of total demand, which is mainly for self-consumption clearly indicating that, nearly all the food has to originate from outside the city region. This results in long supply chains involving multiple actors and high food miles6.[6] Thus, the Colombo region is considered the "Consumer" with an expanded food print covering the entire country.[10]

Figure 2. Colombo city region (source: Natural Resource Management Centre, Department of Agriculture)



In recent years the urban food systems in Sri Lanka, particularly in the city of Colombo and its peri-urban regions have gained much attention, causing concern over the multifaceted challenges being faced in the context of rapid and further

[7] https://www.fao.org/in-action/food-for-cities-programme/toolkit/crfs-scan/characterisation-of-the-crfs/food-flow-mapping/ru/#:~:text=Tracing%20the%20flows%20and%20sources,supply%20sources%2C%20gaps%20in%20local

[8] https://www.cambridge.org/core/journals/renewable-agriculture-and-food-systems/article/abs/city-food-flow-analysis-a-new-method-to-study-local-consumption/FD948014C0D3B0055745CEB6918DA0BC

[9] https://ruaf.org/assets/2021/09/Assessing-risk-in-times-of-climate-change-and-COVID-19-_Colombo.pdf

[10] FAO, RUAF, IWMI and CGIAR (2016): City regions food systems situation analysis – Colombo, Sri Lanka. Working Document. http://www.fao.org/3/a-bl821e.pdf

expansion of urbanization, economic shocks (high food inflation), climate implications and public health stresses. High food prices in urban Colombo have continued to increase where food inflation (year-on-year) rose to 94.9 percent in September 2022 from 93.7 percent in August 2022. When faced with food shortages, the urban poor in Colombo city region resorted to negative coping mechanisms such as reducing adult food consumption, limiting portion sizes and reducing the number of meals eaten in a day.

4. The Need – CRFS Food Flow Mapping

Although different actors often agree on the aim to increase local food supply, the discussions and initiatives convey a lack of knowledge and data availability about the actual origin of food supplied to cities. Without knowing where food comes from and through which channels it reaches the consumer, it is difficult to develop alternatives that could eventually change the food system. Food flow data provide unique insights into the debates surrounding the sustainability of production and consumption at multiple scales.[11]

This report provides a study carried out in identifying vulnerabilities, weaknesses and strengths of food systems operating within geographic regions of Sri Lanka by tracing food flows considered necessary to help strengthen the Colombo city region food system by eliminating inefficiencies in different operational nodes. The need of such food flow mapping at least for selected food commodities has become imperative, especially considering recent external events that have caused economic and public health chaos that led to major food supply disruptions faced by Sri Lankans in the recent past. The overall and specific objectives of the study are presented below.

5. Overall and Specific Objectives and Expected Output

5.1. Overall objective: Strengthen the Colombo CRFS to be more resilient to vulnerabilities and weaknesses through improvements in food flow inefficiencies within geographic regions of Sri Lanka.

5.2. Specific objectives:

1. To develop "hypothetical market chains" of existing agrifood supply chains of representative key commodities in Sri Lanka characterized by all possible players and their potential interrelationships in respect to each commodity through a mapping of its food flow networks in all in 25 administrative districts.

2. To record climate and COVID-19 related vulnerabilities, risks and inefficiencies at different nodes within each food supply chain/food flow network and their interactions.

5.2. Expected output:

Indicative food flow networks of seven commodities with recommendations for improved efficiencies and resilience in its CRFS rural-urban linkages

[11] https://www.researchgate.net/publication/309762870_Using_Food_Flow_Data_to_Assess_Sustainability_Land_Use_Displacement_and_Regional_Decoupling_in_Quintana_Roo_Mexico

6. Key Activities

Analyse the distribution channels of food items; a field-based activity to map agriculture supply chain distribution networks across the country, identify the critical challenges along the supply chain nodes and propose resolutions related to logistics, collection, storage distribution, food safety, food miles, food loss, high prices, markets, etc., while addressing vulnerable groups (e.g. urban poor/farmers earning low margins).

7. Study Approach

All stakeholders in the Colombo CRFS, were mapped for their involvement in agricultural production, food processing and storage, food transport and distribution, food marketing, food safety and food loss and waste, and food governance.[12] Stakeholders were categorized based on their engagement as resource providers and contributors to food imports/exports and building climate resilience in food systems, as well as creating awareness on climate and food systems. The stakeholder mapping was visualized based on the FAO CRFS components (Figure 1.3) with a mix of the food system nodes and the systemic elements of food security, natural resources management, social inclusion and equity, livelihood development and economic development. The mapping exercise was further fragmented to cover the specific components in the food value chain.

The key actors in the food flow pathways of the commodities (e.g. farmer/fisher, collector/transporter, processor/warehouse manager/miller, retailer/supermarkets and consumer) were identified and analysed using survey questionnaires administered in 25 districts across 9 provinces in Sri Lanka. Some actors in the food system performed multiple roles (e.g. paddy farmer is also a maize farmer, a miller is also a transport agent, in the food flow path of the same commodity, etc.) and their operations were recorded using separate questionnaires (i.e. a separate questionnaire for the different roles played by the same actor in support of one commodity or several commodities).

In this study, the food flow segments are characterized using some of the factors listed below.

i. Type of the food item
ii. Quantities of the food item passed along the segment (inflow and outflow in this study)
iii. Number of actors involved
iv. Transport distance
v. Days of storage
vi. Average price level
vii. Average quality level
viii. Exposure to a shock
ix. Use of technology
x. Entrepreneurial skills/asset ownership of value chain actors, etc.

The indicators used in this study to measure the performance of a food flow segment can be used to compare food flow segments with the exact characteristics. For example, the performance of the rice flow network cannot be compared with that of the marine fish flow. Furthermore, a shorter food flow segment may not perform better because of fewer food miles. If researchers identified matching pairs of food segments with the same characteristics, then the following indicators were used to evaluate their performance and to make recommendations.

i. Food quantity loss in physical units;
ii. Food quality loss as measured by perception of quality by value chain actors;
iii. Marketing margin or the gap between price of inflow and price of outflow ;
iv. Profit earned by the value chain actors (only normal profits);

[12] GCP/INT/275/GER - Building a Climate Resilient City Region Food System (CRFS) through Adapted Production Systems

v. Market power exercised by the value chain actors; and
vi. Vulnerability to shocks (COVID-19 shocks and climate shocks & stresses).
vii. If a large data set does exist, the characteristics listed above can be controlled statistically and the above indicators can be used for comparison purposes. This project has adopted a regression analysis for this purpose.

8. Commodities

Seven food commodities, namely, rice, maize, potato, bean, banana, chicken meat and marine fish, were prioritized based on items identified in the Risk and Vulnerability Assessment for Resilience Building in the Colombo CRFS (2021)[13], Overview of the Meat Industry in Sri Lanka - A Comprehensive Review (2016)[14] and Critical Analysis of the Status of Fruit Crops in Sri Lanka.[15]

The food flows for each commodity are governed by different players as shown in Table 1.

Table 1. Main governance structures of the specific commodities

Commodity	Key agencies engaged in governance of food flow
Paddy/Rice	State (Paddy Marketing Board - PMB, Cooperative Wholesale Establishment - CWE) and Private sector organizations including farmer organizations, millers and supermarket chains
Maize	Private sector organizations including importers and feed millers
Potato	Government agencies (CWE) and private sector organizations including importers
Bean	State agencies (CWE) and Private Sector Organizations including Dedicated Economic Centres
Banana	Private sector agencies
Chicken meat	Private sector agencies
Marine Fish	State agencies (Ceylon Fisheries Corporation) and private sector including the Peliyagoda Fish Market

9. Sampling Methodology

A total of 1 942 actors covering all seven food commodities across their food flow paths were interviewed using the questionnaire survey in both *Yala* and *Maha* seasons, separately. The same set of interviewees were selected for both seasons. The Northern Province comprised the highest proportion of the sample (34 percent), followed by Central (16 percent) and North Central (13 percent) provinces. This is mainly owing to the increased number of main markets in the Northern Province with a relatively large number of actors in the food system compared with the rest. Potato had the highest sample size (23 percent) followed by rice (18 percent) and banana (15 percent). The high number of players captured also reflects the efficiency of the enumerators selected for this study area compared with the rest.

As for the actors, 280 farmers/fishers, 208 collectors/transporters, 31 millers/warehouse operators, 510 wholesalers (including Dedicated Economic Centres - DECs), 913 retailers (including supermarket chains) were interviewed for collecting data in each *Yala* and *Maha* season.

[13] https://www.fao.org/fileadmin/user_upload/faoweb/ffc/docs/Climate%20Resilient%20CRFS%20in-depth%20assessment_IWMI.pdf
[14] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4869538/#:~:text=In%20addition%2C %20chicken%20meat%20is,et%20al.%2C%202010).
[15] https://www.ishs.org/ishs-article/1278_37

10. Colombo city region food flow miles of seven commodities

10.1. Rice

The rice food flow map generated for the Colombo city region (Figure 3) clearly indicates the different flow paths from farmer or importer to the consumer. Limited availability of agricultural land in peri-urban areas owing to changes in land use patterns resulting from heavy urbanization, has pushed the sourcing of a majority of the rice requirement of Colombo city region consumers from Colombo peri urban areas to far distances in regional locations.

The rice food flow to the Colombo city region (Western Province; WP) initiating at different production localities and mega-millers mainly being located in the North Central Province (NCP), has contributed to increased food miles. For example, some paddy varieties produced in the Southern Province (SP) are transported to the NCP for milling operations with polishing facilities, which then travel to the Colombo city region resulting in a large increase in accumulated food miles even up to 600 km (Figure 4). The long distances traveled increases commodity losses and related hikes in consumer-purchase prices.

10.2. Maize

The food flow map of maize generated for the Colombo city region is illustrated in (Figure 5). The flow paths originating from producer and importer to the consumer differs for the commodity. The maize crop is adapted to dry climates and hence, is not cultivated in the wet zone where the Colombo region is located. Hence, the commodity has to travel relatively long distances from where it is produced, or relatively shorter distances when imported, to reach the consumer in the Colombo city region.

The Colombo city region demand for maize produced in Sri Lanka is met from different production localities in the NCP, Uva Province (UP) and Northwestern Province (NWP). This has increased the maize food miles up to 370 Km (Figure 6), which also increases commodity losses and the consumer-purchase price in the Colombo city region.

10.3. Potato

The potato food flow map to the Colombo city region (Figure 7) shows that production in Sri Lanka reaches Colombo from Welimada and Nuwera Eliya areas in the Central province (CP) and Jaffna in the Northern Province (NP) owing to the specific localities the crop is cultivated. A majority of the potato requirement for Sri Lanka is imported. The climatic conditions in Colombo or peri-urban areas in WP are not suitable for crop cultivation.

Food flow of locally produced potatoes to the Colombo city region initiates at different production localities at far distances, except for those that are imported. This has increased the food miles of locally produced potato even up to 525 Km in reaching the Colombo city region (Figure 8), again leading to commodity losses and increased consumer pricing. Potato is a highly perishable crop and hence poor storage conditions contribute to more losses than that of grain-type crops.

10.4. Bean

The food flow map of beans to the Colombo city region is illustrated in Figure 9. The bean crop is commercially cultivated in the Central Province of Sri Lanka. The total requirement of beans in Sri Lanka is met through local production. The climatic conditions in the Colombo city region and its peri-urban areas in the WP are not suitable for this crop.

The demand for beans in the Colombo city region is met from different production localities at far distances from the city region. More importantly, the flow of beans to the Colombo city region is mainly through the wholesale markets such as DECs located across the country, including those at Dambulla in the CP, and Peliyagoda and Narahenpita in WP. This commodity thus travels from producers to the wholesale markets and then to the retailers. This has increased

food miles of beans even up to 660 Km when reaching the consumer in the Colombo city region (Figure 10). Long-travel distances and the absence of proper storage conditions would also increase losses of beans because of being a perishable product and contribute to a higher consumer pricing.

10.5. Banana

The food flow map of banana generated for the Colombo city region is illustrated in Figure 11. The banana crop is cultivated in the peri-urban areas including the home-gardens in the Colombo city region. However, the majority of the demand for banana in Colombo is met from the crop cultivated in the SP, NCP and NWP. The total requirement of banana in Sri Lanka is met through local production.

Similar to that of beans, the flow of banana to the Colombo regions is mainly through the wholesale markets such as DECs located across the country. This commodity thus travels from producers to the wholesale markets and then to the retailers. As the large production extents of banana are located at far distances from the Colombo city region, the food miles of the commodity have increased up to 800 Km in reaching the city (Figure 12). Being a perishable product, transport distances and absence of proper storage conditions would increase losses and the consumer-purchase price.

10.6. Chicken meat

The food flow map of chicken meat to the Colombo city region (Figure 13) shows that the production areas are found in peri-urban areas, districts bordering the Colombo district such as the Gampaha district and in the CP. The chicken meat requirement in Sri Lanka is met through local production, which is an entirely private sector governed industry.

The food miles of the commodity can increase up to 300 Km (Figure 14) based on the production region and traveled miles, as well as the location of the mass-scale cold-storage facilities. Maintaining cold-chain during transport and proper storage on the way to end-markets becomes extremely important to minimize losses and stabilize consumer-prices.

10.7. Marine fish

The marine fish food flow map generated for the Colombo city region is illustrated in Figure 15. The results show that the fish-catch landing sites are closer to the Colombo city region, as well as far distances along the coastal belt of the Eastern province (EP).

The food miles of marine fish can increase up to 650 Km (Figure 16) depending on the type of fish-catch from different landing sites. The availability of cold storage facilities and proper transport with cold chain facilities are critical in long-distance travel of the commodity to minimize losses and to keep this commodity fresh.

Figure 3. The main food flow paths of rice to Colombo city region (Source: Data generated from the study)

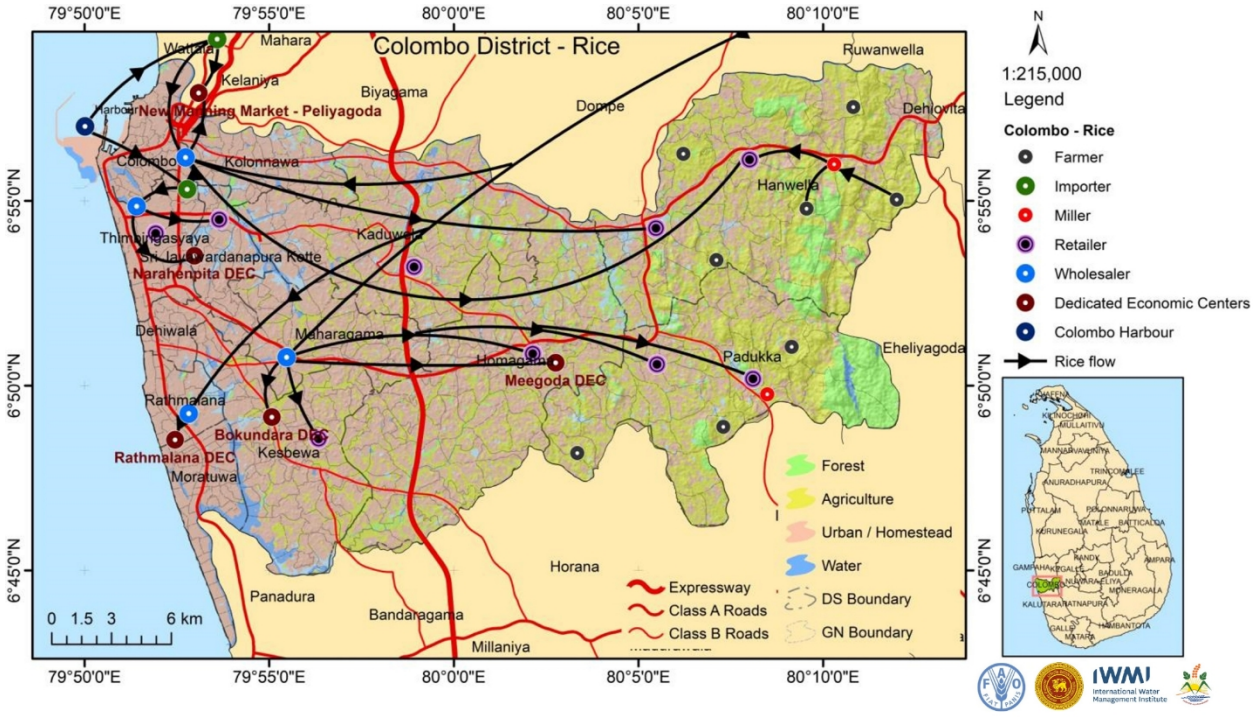
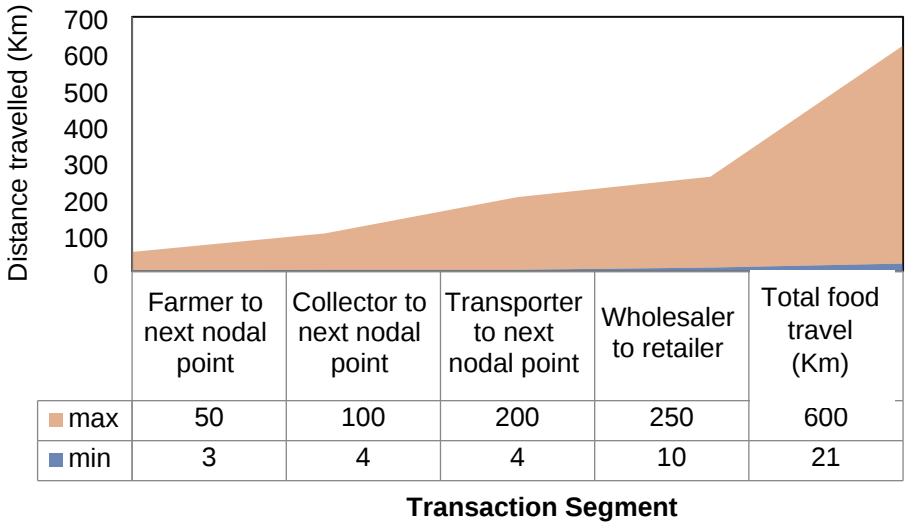


Figure 4. Maximum and minimum distance (food miles) travelled by paddy/rice in normal *Yala* and *Maha* seasons in Sri Lanka



	Farmer to next nodal point	Collector to next nodal point	Transporter to next nodal point	Wholesaler to retailer	Total food travel (Km)
max	50	100	200	250	600
min	3	4	4	10	21

Figure 5. The main food flow paths of maize to Colombo city region (Source: Data generated from the study)

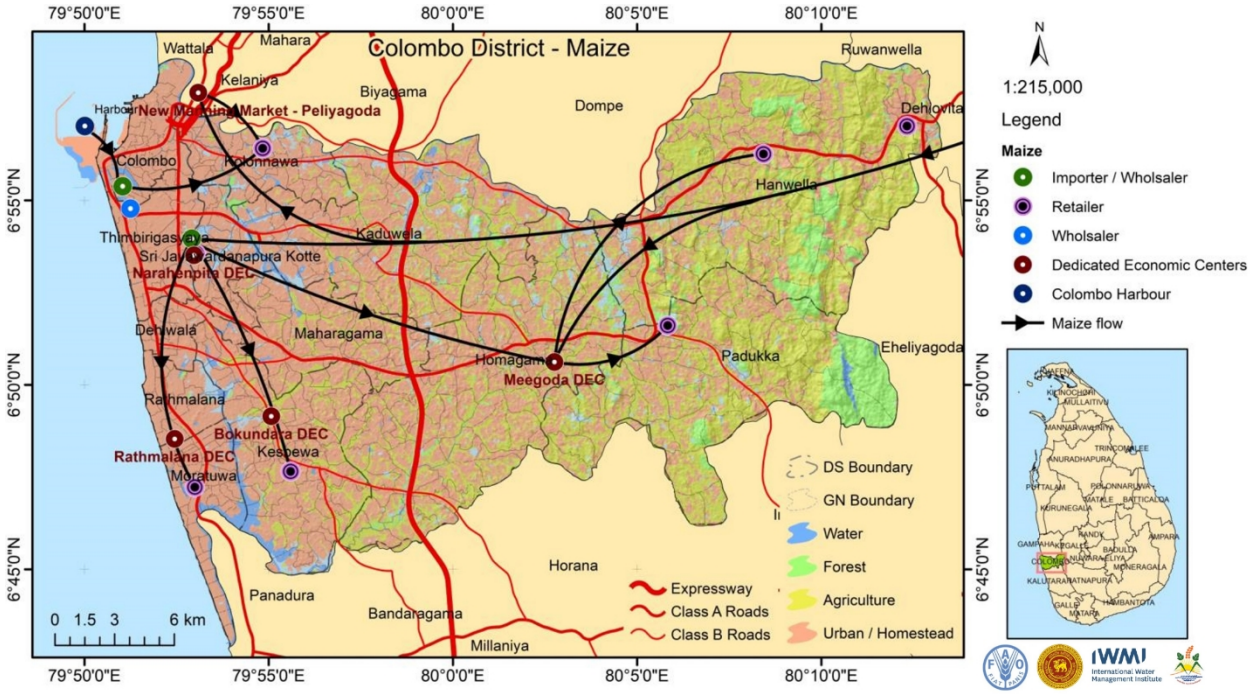


Figure 6. Maximum and minimum distance (food miles) travelled by maize in normal *Yala* and *Maha* seasons in Sri Lanka

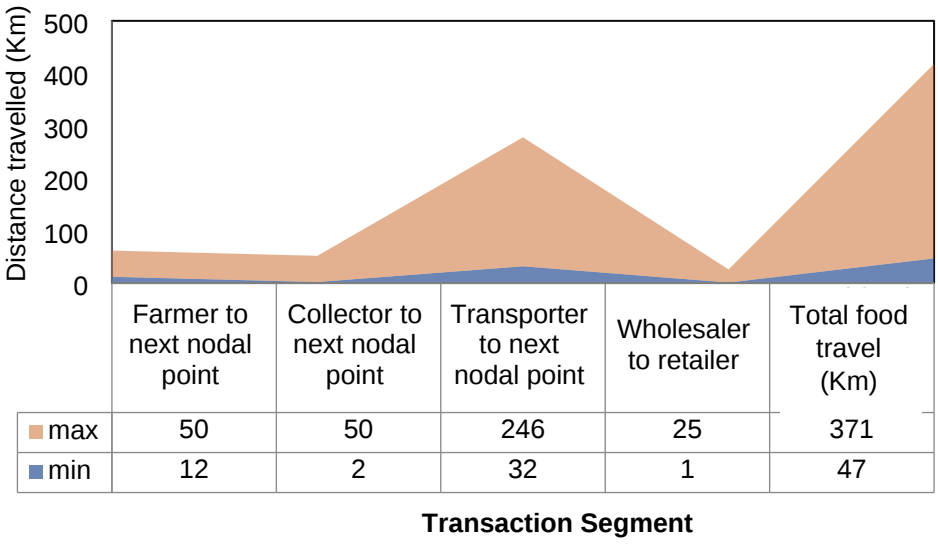


Figure 7. The main food flow paths of potato to Colombo city region (Source: Data generated from the study)

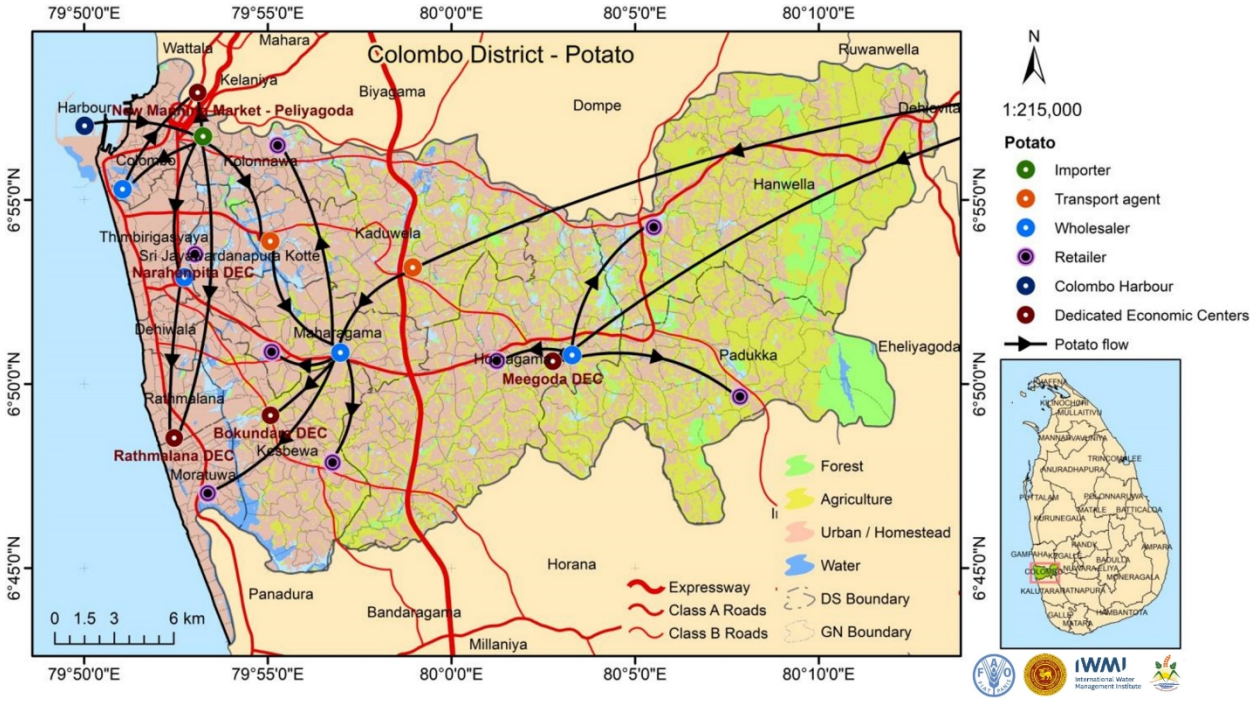


Figure 8. Maximum and minimum distance (food miles) travelled by potato in normal *Yala* and *Maha* seasons in Sri Lanka

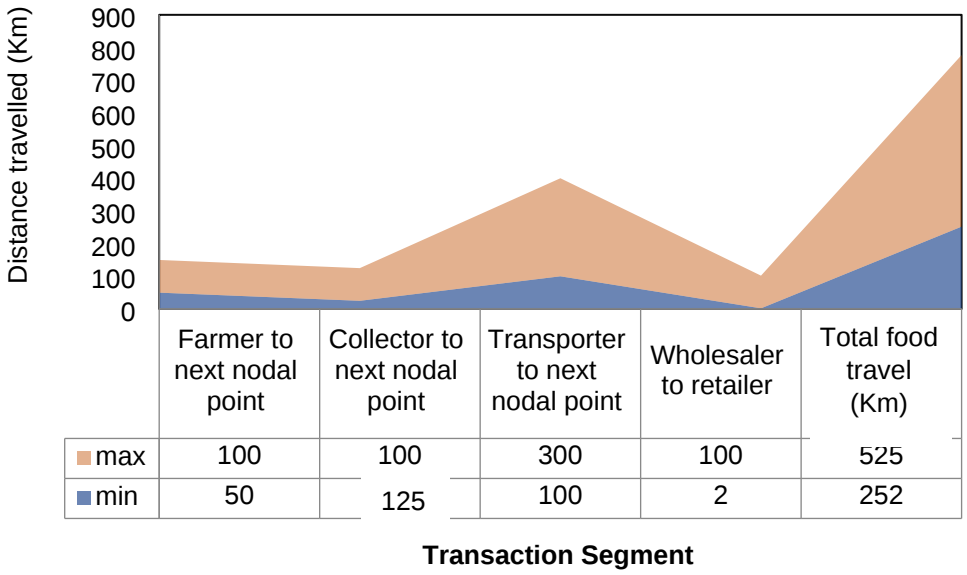


Figure 9. The main food flow paths of beans to Colombo city region (Source: Data generated from the study)

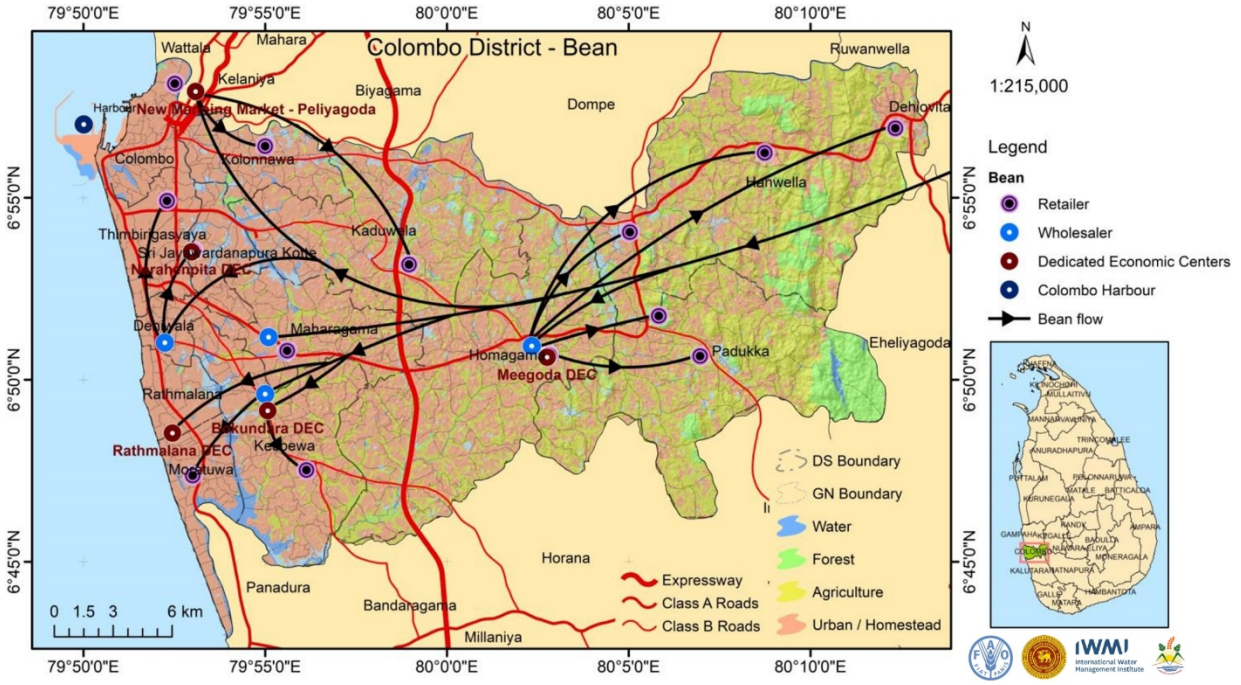


Figure 10. Maximum and minimum distance (food miles) travelled by beans in normal *Yala* and *Maha* seasons in Sri Lanka

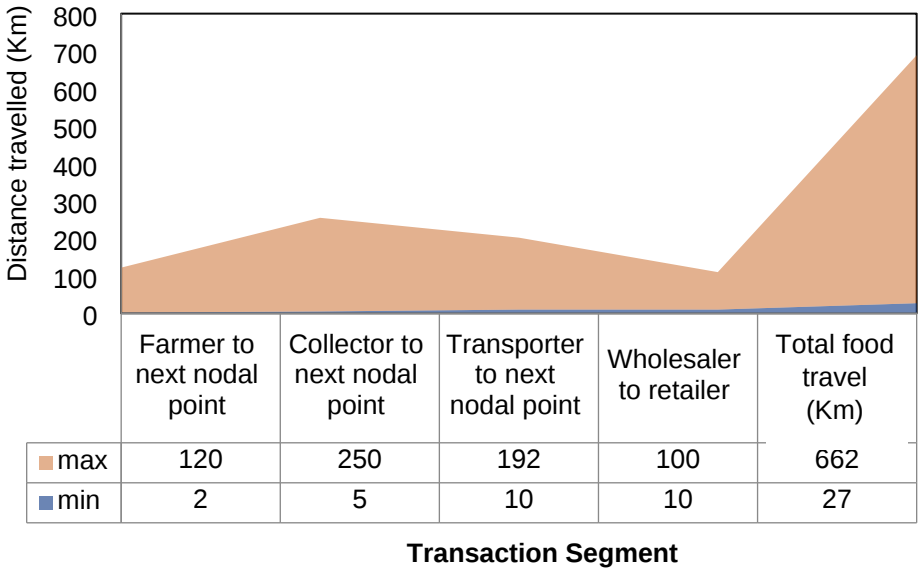


Figure 11. The main food flow paths of banana to Colombo city region (Source: Data generated from the study)

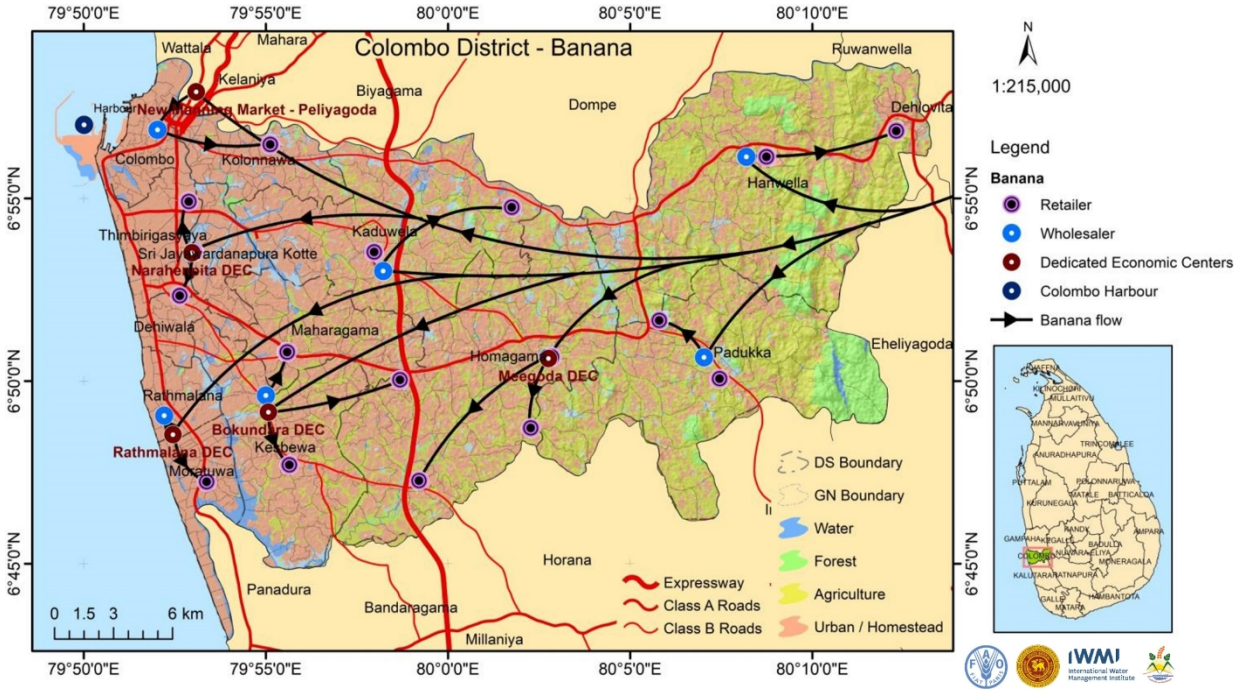
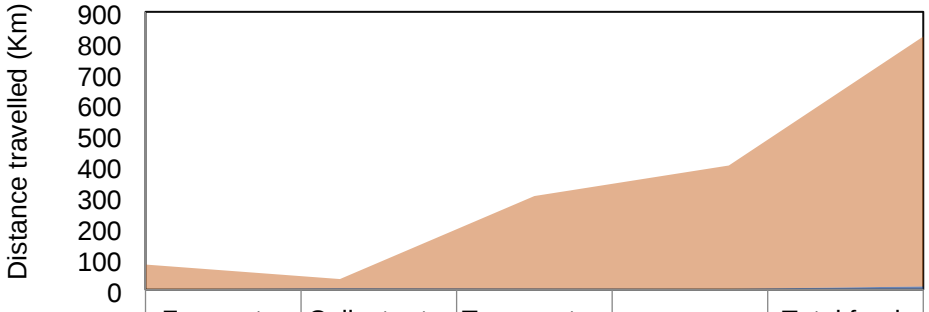


Figure 12. Maximum and minimum distance (food miles) travelled by banana in normal *Yala* and *Maha* seasons in Sri Lanka



	Farmer to next nodal point	Collector to next nodal point	Transporter to next nodal point	Wholesaler to retailer	Total food travel (Km)
max	80	30	300	400	810
min	1	4	3	2	10

Transaction Segment

Figure 13. The main food flow paths of chicken meat to Colombo city region (Source: Data generated from the study)

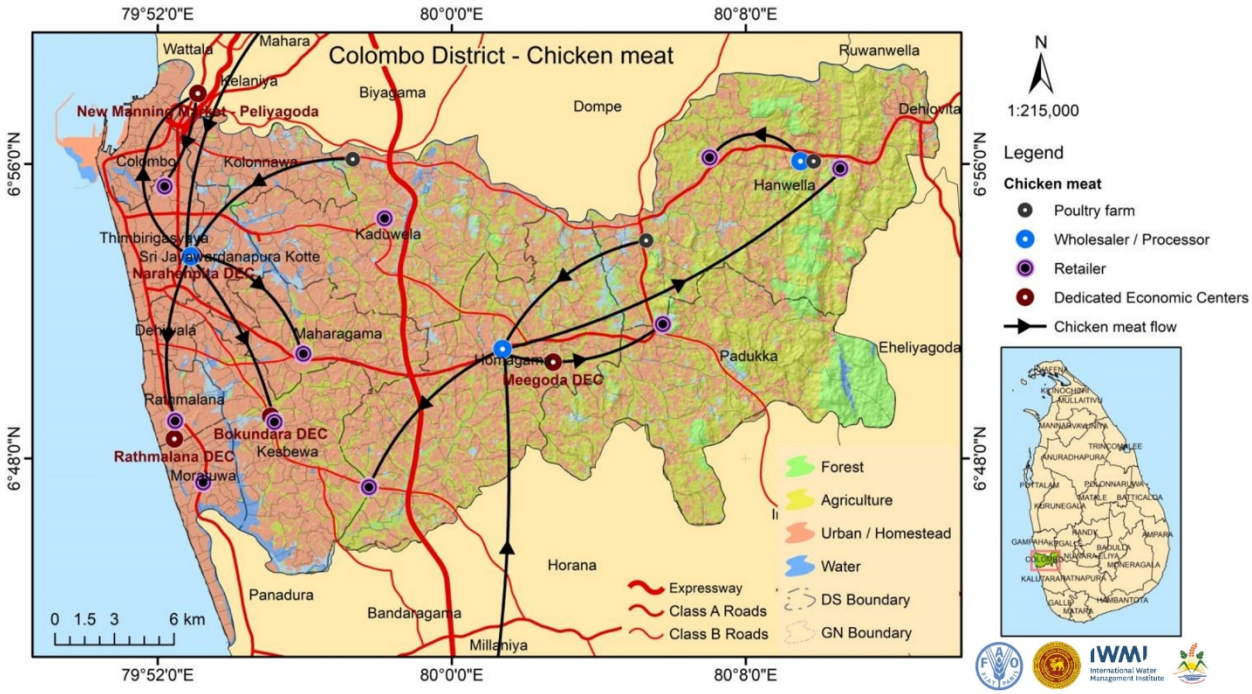
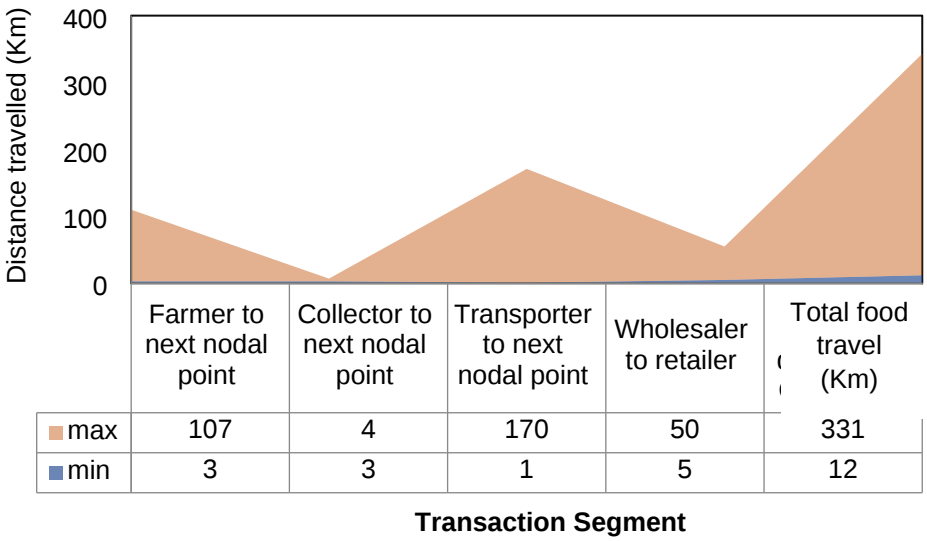


Figure 14. Maximum and minimum distance (food miles) travelled by chicken meat in normal *Yala* and *Maha* seasons in Sri Lanka



	Farmer to next nodal point	Collector to next nodal point	Transporter to next nodal point	Wholesaler to retailer	Total food travel (Km)
max	107	4	170	50	331
min	3	3	1	5	12

Figure 15. The main food flow paths of marine fish to Colombo city region (Source: Data generated from the study)

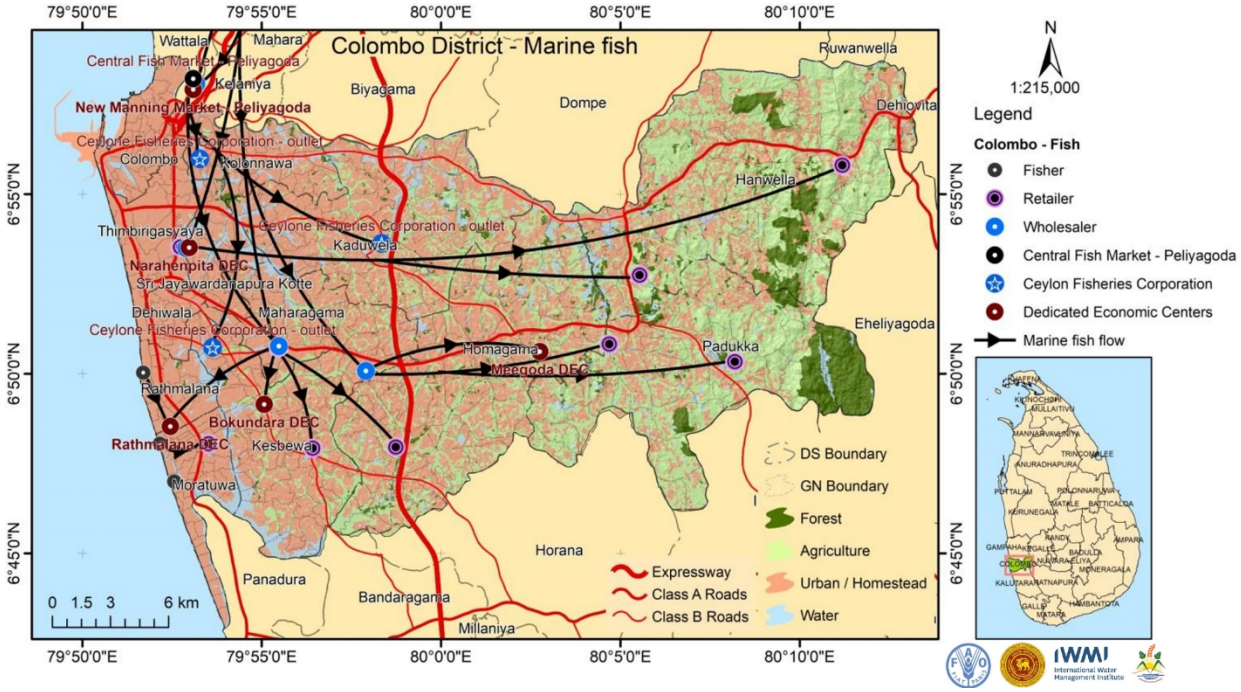
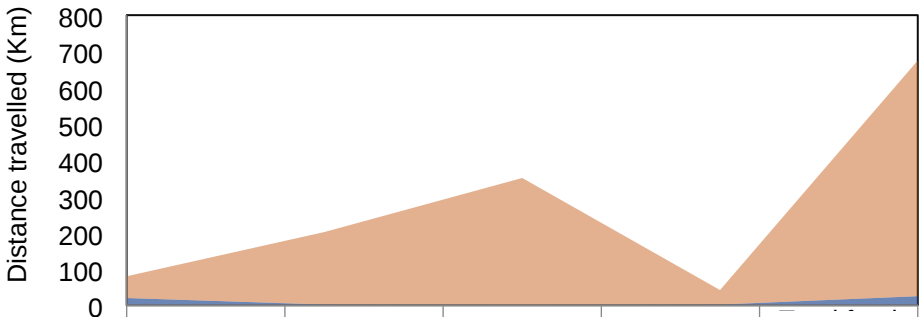


Figure 16. Maximum and minimum distance (food miles) travelled by marine fish in normal *Yala* and *Maha* seasons in Sri Lanka



	Farmer to next nodal point	Collector to next nodal point	Transporter to next nodal point	Wholesaler to retailer	Total food travel (Km)
max	60	200	350	40	๑๖๐
min	20	2	1	2	25

Transaction Segment

11. Common contributing factors across food flows of seven commodities

11.1. General

No major changes were observed in the combinations of transactions[16] in the food flow path of the seven commodities studied, between *Yala* and *Maha* seasons.

11.2. COVID-19 and Climate impacts

The COVID-19 pandemic and climate shocks & stresses (extremes in rainfall, temperature, etc.) have negatively impacted the food flow, including production/catch shortages at farmer/fisher level, owing to the impacts leading to disruptions in the urban (consumer) - rural (producer) connectivity. Any such impact will determine the overall efficacy of the flow of food commodities to Colombo, as well as within and between different districts.

The COVID-19 pandemic has resulted in a negative impact on value addition of commodities such as packaging and labelling, with quick outflows of the product owing to poor storage facilities, especially in the case of highly perishable items. Rice was the least affected among the seven commodities studied owing to the high storability of the product even under minimum standards during the pandemic.

More collectors/transporters entered the food flow path of the commodities to Colombo city region, although the number of transactions reduced along most of these flows during the COVID-19 pandemic to ensure the product reached the consumer quickly. The collectors/transporters might have wanted to avoid long-term storage.

The pandemic has increased quantitative losses of all transactions of the seven commodity flows owing to longer stays of the product at a given nodal point without proper storage (or not stored in a proper manner) and owing to uncertainty and inefficient market operation; thus, increase in product prices observed in transaction segments, but mostly at the farm gate, wholesalers and retailers. Farmers and collectors increased the selling price to the collectors. Potential reason being an opportunity for high bargaining power owing to limited production and collection of the commodity.

Extreme weather conditions always have a negative impact on food flows. Lower production, difficulties in transport owing to flooded road networks, low turnout of workers, and farmers showing a preference of storing agricultural produce longer with the expectation of a higher selling price in the future have affected the food flow of commodities from producer to the consumer.

Climate shocks & stresses have led to spoilage of produce and loss/damage to produce contributing mainly to increased losses in perishable products. Quantitative losses were highest at the retailer level owing to bad weather conditions, especially flooding resulting from heavy rainfall, thus, increasing the purchase price for the consumer.

Inflows and outflows of commodities between different transactions were severely affected by social distancing, lock down, and closure of markets, owing to the pandemic and extreme climate events.

Food flows with fewer actors in transactions between different nodal points were less disrupted owing to COVID-19 pandemic and extreme weather conditions such as rainfall, temperature, drought, wind, and sea level rise.

[16] As there were many transactions with the food flow of each commodity, the descriptive analysis was done considering only the most common transactions involving two- or three-actors. It is important to note that owing to this criteria, the transactions with the involvement of some actors in a food flow path of a commodity may not be captured in the analysis> This is because of the low frequency of occurrence of some transactions in the study sample involving some actors within the food flow.

Disrupted warehouse operations have affected the food inflow and outflow during the COVID-19 pandemic and climate extreme events, increasing the quantitative and qualitative losses and prices, especially of the more perishable food commodities, thus, negatively affecting the accessibility and affordability of those commodities by the consumers.

Financial constraints to invest on value addition and proper storage facilities have further hampered the overall functionality of the food flow path of the seven commodities during COVID-19 and extreme climate events.

Climate shocks & stresses and COVID-19 restrictions have resulted in loss of customers, weakened labour mobility, and shortage of commodity supply owing to lockdown, coupled with the spoilage of perishable commodity, affecting the efficiency of food flow.

11.3. Commodity-specific

The food miles of commodities produced in Sri Lanka from farmer/fisher to the consumer in Colombo city region were high mainly because of the following issues in the food flow path of the seven different commodities.

- **Paddy/Rice**: Distant locations of the main paddy-growing areas and mega rice-milling stations with a polishing facility of paddy/rice are the major contributors to increased food miles in paddy/rice to the Colombo city region. The paddy-cultivation in peri-urban areas is not done on a commercial scale. Hence, there is heavy reliance on the commodity reaching from the rural areas of the country.
- **Maize**: Production areas are located far from the Colombo city region because of the agro-ecological requirements of the commodity. The crop is not suitable to be cultivated in the Wet Zone with heavy rainfall but cultivated in the Dry Zone of the country, resulting in increased food miles when reaching the Colombo city region.
- **Banana and Beans**: Though cultivated at a small scale or in home gardens in the Colombo city region, the demand of consumers is met through the cultivation in Dry and Intermediate Zones located further away from the Western Province. These two commodities are distributed mainly through DECs increasing food miles further.
- **Potato**: Back-and-forth movement of the commodity, which is grown at specific agro-ecological regions in the Central and Northern provinces, along the food flow path owing to limited storage facilities has contributed to increased food miles and quantitative and qualitative losses when reaching Colombo city region. Further, the storage facilities being located and accessible at locations away from the Colombo city region and the monopolistic operation of such services have become the main contributors to increasing the food miles of potatoes.
- **Chicken meat**: Though chicken meat production occurs within the Western province near the Colombo city region, the demand must be met from the output from far distances. Further, the availability of cold storage facilities away from the Colombo city region and poor maintenance of cold chain facilities during transport have increased the food miles and loss of food quantities and quality of the commodity when reaching the Colombo city region.
- **Marine fish**: Supply of specific types of fish products to the city region from far distances where fishing occurs has increased food miles when the commodity reaches the Colombo city region. Further, inadequate availability of cold storage facilities and not maintaining cold chains during long-distance transport have also resulted in quantitative and qualitative losses of the commodity when reaching the Colombo city region.

12. Indicative Priorities and Recommendations

12.1. General recommendations across seven food commodities

Mainstream CRFS into national policies such as the National Agriculture Policy, by incorporating policy statements to strengthen food systems assuring connectivity between urban and rural communities and enhance agricultural production with proper land use plans in peri-urban areas and in provincial and district settings, with financial provisions for its operation.

Constitute an institutional a Stakeholder Advisery group (SAG) comprising of administrators, scientists, academia, and private sector at national and provincial levels with a clear Terms of Reference to form policy and operationalize action planning processes through “core teams” to support CRFS.

Establish thematic working groups as decided by SAG to meet regularly to estimate the demand for food in the Colombo city region (e.g. sourcing food for high end markets such as the port city), discuss priorities, plans with clearly defined Key Performance Indicators (KPIs), budgets, means of implementation to further build up activities from the outcomes of the study.

Introduce and streamline mechanisms by establishing a competitive arena/landscape through invited participation and cooperation of state, private and public sector intermediaries including producers, for efficient and effective supply/value chains, resulting in fairer income distribution and price stability.

Incentivize the establishment of storage and cold chain facilities, improve packaging, consolidate individual transporter services, and strengthen/build networks of the regional food distribution centres with a view to increasing efficiencies and reducing loss/wastage along the chain.

Scale up best practices such as community gardening, school gardening, urban gardening, to support local communities based on local experiences, cultural habits, and local needs.

Ensure that a diverse range of food products are available to the urban region by analysing the product range supplied though the distribution network.

Conduct capacity building programmes engaging local communities, create exchanges between municipalities, include private sector to mentor start-ups, and associate universities to establish ‘hubs’ to develop appealing business models for transformation in retailing.

Conduct in-depth map revision and analyses at district level focusing on the food miles issue to understand the causes of inefficiencies owing to lack/age of food-related infrastructure in specific locations.

Identify needs to improve connections by improving road conditions and identify requirements of utilities (energy, water, etc.). This will help more informed decision making at the district levels, especially on the investments needed to reduce the food miles.

Introduce knowledge transfer mechanisms and capacity building of players along the value/supply chains by creating spaces of discussion to increase vertical and cross-sectorial dialogue between district level and the national level planners, focusing on agro-ecological zoning. Identify district level needs, while effectively serving the national development agenda.

12.2. Based on research methodology

Extend the study on food miles (distance travelled by food from farm-gate to consumer) for a deeper analysis within and between districts and under climate change scenarios.

Follow the same consignment of each food commodity from the producer to consumer, to estimate food miles, food losses, and food price increases in a more precise manner.

12.3. Specific recommendations

Encourage cultivation on available arable land in the peri-urban areas in the Western province of Sri Lanka to support food supply and increase availability of fresh agricultural produce, and reduce food miles, losses and prices.

Upgrade the quality standards of selected small- and medium-scale processing facilities located at closer proximity to the Colombo city region, in the Western Province.

Establish strong links between rural producers and buyers with proper storage facilities who supply from within reasonable distances to the Colombo city region, enabling easy access and quick transport time to reach end user consumers in a timely manner.

Build or improve existing storage facilities of both state and private sector organizations to improve storage life of food commodities.

Provide mobile drying facilities to farmers (farmer organizations), especially in the case of paddy, as a tool to support storability of the product at farmer level and reduce quantitative losses until the product is dispatched to the next transaction segment.

Risk-proof transport networks to ensure continued operations during pandemics and climate shocks & stresses, and perform at higher efficiency, enabling smooth flow of the product from producer to consumer with lower food miles, minimized losses and reduce prices to the best possible extent.

Strengthen the processing centres of all seven commodities with proper storage facilities to support a continuous and a stable supply of food commodities to the Colombo city region.

Educate all actors on critical dynamics of food flow paths of commodities and the effects of pandemics and climate hazards on these flows in relation to food miles, quantitative and qualitative losses and undue increase in consumer prices. Create awareness on efficient food flows to the city regions from production areas.

Direct the DECs in Colombo to serve as major distributors of commodities within the city region in facilitating the food flow. Analyse and direct the DECs in remapping food flows to improve efficiencies.

13. Limitations of the study

13.1. Research tools

The study adopted a snowball sampling technique starting from central market locations and identifying stakeholders' back-and-forth along the food flow (1 942 actors covering all seven food commodities). As such, there were difficulties in following the same consignment of a food commodity from producer to consumer for a more precise estimation of food miles.

13.2. Data collection

The study did not interview many consumers. This is mainly because the consumers opted for different retailers and sometimes wholesalers, in purchasing their requirements and thus, making the data available in this regard was more complicated. The researchers therefore excluded consumers and considered the outflow from the retailers as the inflow for consumers.

Some of the key retailers, such as supermarket chains, did not divulge inflow prices of food commodities because of the internal protocols. Though the outflow prices from the supermarkets were clearly observable, absence of accurate measures of input prices, except what was provided to the survey team by the supplier to supermarkets, could not be verified. Further, the inflow and outflow of retailers were collected on a weekly basis for this study, but availability of such information daily would have provided more accurate information on consumer purchases and actual daily sales from the retailer of a given commodity.

13.3. Data analysis

Food miles (distance travelled by food from farm-gate to consumer) were estimated only under pre-COVID-19 and COVID-19 scenarios, but not in relation to climate change scenarios, as the information generated on the latter was non-conclusive.

The descriptive analysis was carried out only considering the most common two or three-actor transactions. Because of the selection criteria used, the transactions involving farmers in a food flow path may have been ignored, owing to the low number of their occurrences of such transactions in the sample.

14. Acknowledgements

Data collection, descriptive analysis, food flow analysis, estimation of food miles, food losses and change in food prices at different nodal points for the *Yala* season were supported by the Food and Agriculture Organization (FAO) of the United Nations under the "City Region Food Systems Programme". The data verification for *Yala* season, and data collection, food flow mapping and analysis, estimation of food miles, food losses and change in food prices at different nodal points for the *Maha* season were supported by the International Water Management Institute (IWMI) under the project "Data Analysis and Food Flow Mapping of Seven Commodities Across 25 Administrative Districts of Sri Lanka."