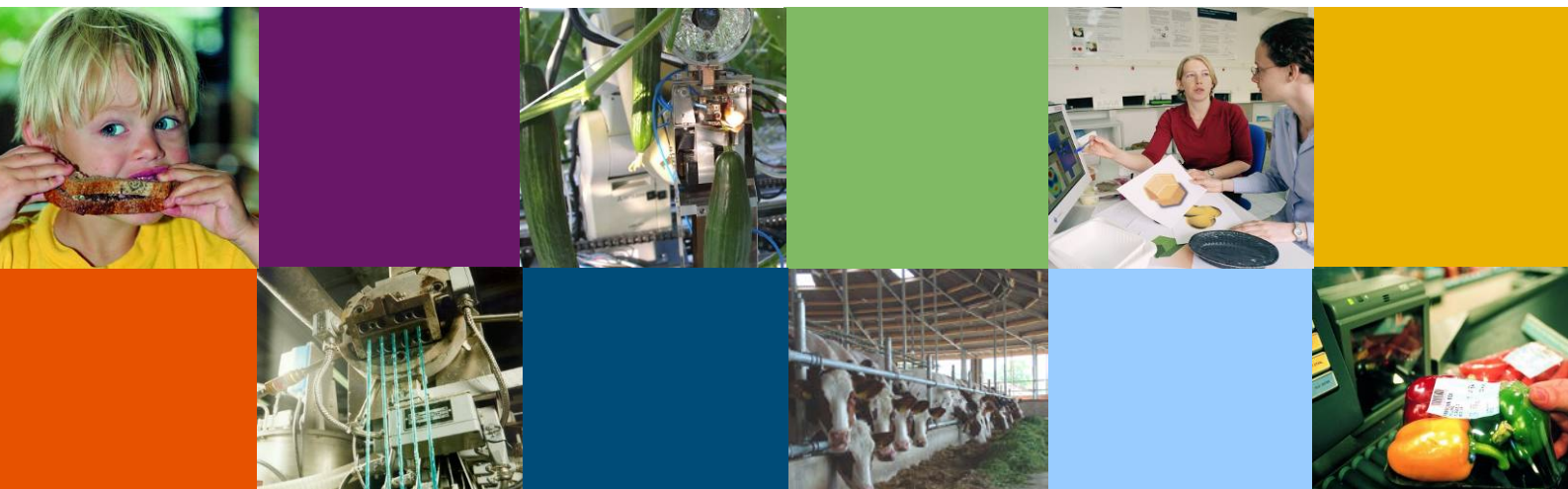# Perspectives on the distribution of fresh food in emerging metropolises

The cases of Mexico City and Cairo

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Report 1529

Colophon

Executive Summary

This research is situated in the context of striving for improved food security and more sustainable food chains in metropolises in order to give as many people as possible access to high quality and safe food at a fair price. It attempts to offer starting points for an improved food security in metropolises of emerging countries by looking at agrologistics improvements and the performance of urban food distribution systems. In the project a theoretical framework for an urban food distribution network is developed, which serves as a theoretical outline for two following case studies, namely the cases of Mexico City and Cairo. The findings of these lead to recommendations regarding improvement initiatives for urban fresh food distribution in emerging metropolises.

Urban food distribution network

The urban food distribution network developed in this project describes the key elements that constitute the food logistics system in the urban area. The four physical elements goods, vehicles, facilities and infrastructure and the four subsystems transport, accessibility, traffic and land use together form the managed system of the urban food distribution system. These aspects can be described and analysed on urban level.

The central element of the network is '(re)design and execution', which contains the aspects to be taken into account when designing and executing improved agrologistics in developing countries, namely managing system, information and organizational structure. These are aspects on supply chain level and can therefore not be described and analysed for an urban area as a whole. The food market of a city is organized in different market channels with each market channel having specific requirements for their supply chain. This results in several food supply chains existing in parallel that use the key (common) elements of the urban food distribution network. These parallel supply chains may partly be combined or entirely separately organised.

A further important categorization for understanding the current urban food distribution systems in emerging countries is the differentiation between traditional and modern market channels. Mostly, supply chains can be linked to either the traditional or the modern channel and can thus also be categorized as either traditional of modern supply chains. However, in transition periods hybrid systems might exist. The food distribution network is impacted by context factors (such as regulations) and results in a food distribution performance in logistics terms as well as in terms of food security. The key logistics performance indicators are cost, quality and sustainability. The key performance indicators for food security are access, availability, food quality and stability.

Case studies Mexico City and Cairo

In both Mexico City and Cairo a transition from local to formal market channels takes place with hyper- and supermarkets as well as convenience stores slowly but surely gaining market share from the local, more traditional forms, in particular from the small grocery stores. A consequence

of this transition from traditional to modern channels is that supply chains also develop from traditional to modern. However, it is not the traditional supply chains themselves that develop towards more modern forms but modern supply chains developing in parallel to and mostly independent from the traditional chains. The more modern market channels hyper-/ supermarkets and convenience stores require high and constant quality, which traditional supply chains do not seem to be able to deliver. Consequently those modern market channels more and more set up their own, independent and fully controlled supply chains. Both developments, the transition towards modern market channels and the development of modern supply chains, are significantly more advanced in Mexico City than in Cairo. Based on the experience in Mexico City though it is to be expected that Cairo will go through a similar transformation in the years and decades to come. Differences in cultural, social, political and other aspects, the context factors, might impact the process or the concrete shaping of the market channels and the modern supply chains, the transformation itself, however, is expected to be comparable.

In both cities the urban fresh food distribution system is underperforming on almost all defined performance indicators. All three logistics performance indicators are negatively impacted by the current situation of fresh food distribution in Mexico City and Cairo. Complexity of the distribution, the number of transits and handling as well as congestion lead to high logistics costs and a low responsiveness to orders. The product quality suffers significantly with high food losses and issues regarding food safety, and transparency in the food chain is low. As regards food security the KPIs food quality and stability are assessed to be most negatively impacted. Access to and availability of food seems to be less important issues in both cities. The reasons leading to the underperformance of the urban fresh food distribution system mainly occur in two major areas:

(1) Traditional supply chains: Problems in the traditional supply chains – such as longer transit times and more handling of the food, poor packaging, rough handling and transportation and no or insufficient cooling – and the resulting food losses are not limited to the urban distribution but occur throughout the entire chain.
(2) The logistics system of the urban area as a whole: Both modern and traditional chains suffer from general problems in urban distribution that are not limited to fresh food distribution, mainly infrastructural and congestion problems. Improvements are necessary in these areas and fresh food distribution will benefit from it as much as other sectors.

Recommendations
Recommendation 1: Support the transition from traditional to modern supply chains
Traditional supply chains generally do not transform towards more modern forms but modern supply chains develop in parallel. Traditional supply chains face serious challenges leading to food losses and issues with regard to food safety. Measures to be taken to improve traditional chains and support them in developing towards more modern forms could be:

- Offer trainings on post-harvest technology and supply chain management;
- Set up shared modernized cooled facilities and transportation for small growers to enable cold chain management practices;
- Establish national or adopt existing international quality standards;
- Support small growers by setting up growers' unions for supporting the above.

Recommendation 2: Look at the complete picture

Urban distribution does not stand alone and therefore for realizing significant impact a holistic approach to the described challenges should be taken. In the case of targeting reduced food losses by improved urban fresh food distribution a holistic approach has two relevant dimensions: (i) urban fresh food distribution as one element of the entire fresh food value chain and (ii) urban fresh food distribution as a part of the whole urban distribution system of the respective metropolis.

(i) In fighting food losses measures should take the entire value chain into account. Measures could for example be:
- Ensure a higher starting quality through better production methods or better starting material;
- Set up closed cold chains and monitor temperature throughout the chain;
- Improve packaging to better protect the products and ensure a longer shelf life;
- Reduce transit times and product handling;
- Improve transport and handling conditions for reduced mechanical damage.

(ii) Urban fresh food distribution faces a number of challenges that are caused by general urban distribution problems. An improvement of the entire urban distribution system will therefore also benefit to the urban fresh food distribution. Possible measures and actions are:
- Measures targeting capacity and infrastructure (managed and organization system)
  - Improved and coordinated city planning combined with inner-city traffic management;
  - Construction of tunnels for transportation of goods to reduce lead times;
  - Improved public transportation with good coverage of the urban area, reliable service and high safety;
  - Set up of loading and unloading zones for goods transportation, if possible at short distance from delivery points;
- Measures targeting the use of other modalities or co-use of existing infrastructure (managed system)
  - Transportation via inner-city waterways;
  - Delivery with cargobikes;
  - Use of bus lanes for delivery vehicles;
  - Use of tramlines for delivery of goods;

- Measures targeting bundling of transportation volume (managing system)
    - Bundling of goods;
    - Bundling of goods and people.

Recommendation 3: Take local circumstances into account

When introducing measures in emerging countries local context factors have to be taken into account. Solutions that work in Western countries might not necessarily work in emerging markets and it is therefore important to know the local context and assess the impact of context factors on proposed actions.

Recommendation 4: Use an integrated network model approach

The integrated network model approach integrates physical activities (hardware), information activities (software) and organizational activities (orgware), which all need to be respected for implementing successful solutions. Furthermore, all various stakeholders are included in the model as the early integration of all relevant stakeholders will strengthen the solution and significantly reduce the risk of failure. A lack in local knowledge and real understanding of the drivers of the problem often lead to failure. Besides local knowledge it is also crucial to build up trust and have good local partners and a strong network, which can help to form consortia for local initiatives. All this means that when aiming at local initiatives organizations have to be aware that a long-term vision and investment in local networks, trust and knowledge are necessary.

Recommendation 5: Never forget the human factor

Human beings are hesitant to change their behavior. The best actions can fail if they do not take behavioral aspects into account. This applies to consumers, e.g. regarding the perception of freshness, as well as to companies, e.g. creating incentives for change such as reduction of costs, gaining of market share, CSR aspects or a forced change due to policy or regulations.

Content

Acronyms and abbreviations

AFSD	Agrifood Systems Development
CBI	Centrum tot Bevordering van de Import uit ontwikkelingslanden (Centre for the Promotion of Imports from developing countries)
CODP	Customer Order Decoupling Point
DIPAS	Designing Innovative Pathways for Agrifood Systems
FBR	Food & Biobased Research
FSC	Food Supply Chain
GDP	Gross Domestic Product
ICT	Information and Communication Technology
KPI	Key Performance Indicator
PPP	Public-Private Partnership
R&D	Research & Development
SCM	Supply Chain Management
UN	United Nations
VIA	Vision International Agrologistics

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Acknowledgements

This study was initiated and supported by the Dutch Ministry of Economic Affairs. A large number of experts in the Netherlands, in Mexico and in Egypt were willing to share their knowledge and experience on urban distribution in general and Mexico City and Cairo in particular as well as on earlier initiatives regarding knowledge transfer projects from the Netherlands to emerging countries. The authors wish to express their gratitude in particular to these persons as well as to all others who during the process of this research have thought along, been willing to share ideas and have given feedback on the research approach, findings and recommendations.

1 Introduction

1.1 Background

A rising world population and growing urbanization are two major developments that will result in significant challenges in the coming decades. According to UN expectations the world population will amount to 9 billion people in 2050 of which almost 70% will live in cities (UN, 2014). This has four major implications (Argenti, 2000). First, the need for food will rise and larger quantities will need to be transported to and distributed within ever growing cities, which consecutively will increase the pressure on food security[1] in general and in the urban environment in particular. Second, increasing wealth and rising middle classes will lead to changed food consumption patterns and food purchasing behaviors with more demand for Western-style diets. A third aspect of urbanization is an increased competition in use of land between housing, infrastructure and industry on the one side and agricultural production within and around cities on the other side. Finally, low-income households will reside further and further away from food markets and thus face additional time and transport cost in accessing food, which will form a particular problem for these groups of society.

Looking at current urban food distribution networks it is evident that these are not fit for future challenges and demands. Strategies need to be developed to face those issues and build urban food distribution networks that are able to satisfy the increasing demand of food with complex and diverse needs in growing urban areas in a cost efficient and sustainable manner.

Efficient food distribution networks are also important due to the fact that enough food is produced worldwide for the current world population; however, many people are still suffering from chronic hunger today (Leathers and Foster, 2009). This is due to a large number of factors, among which significant food losses in the chain. Currently, about one third of the food intended for consumption is lost between production and consumption (FAO, 2011). In other words, improvements for efficient, sustainable and technologically advanced food chains are an important aspect for improved food security and an important part of solving the global food problem. Efficient agrologistics positively impacts food security in the following way (Buck Consulting International, 2015):

- Efficient logistics reduces food losses, thus positively impacts the availability of food.
- Efficient logistics results in reduced food prices due to more efficient procedures, handling and lower transportation cost, thus positively impacts the access to food.
- Efficient logistics results in higher food quality due to shorter lead times, thus positively impacts the quality of the available food.
- Efficient logistics is demand-driven and allows worldwide sourcing, thus positively impacts the steady supply of food.

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[1] *The World Food Summit of 1996 defined food security as existing "when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life".*

For this reason, one of the focus topics of the Dutch Ministry of Economic Affairs is international agrologistics that aims to develop effective international logistics distribution networks for agri and food products (Dijksma, 2013; Dijksma, 2013a; Ploumen, 2013).

The project reported on in this document is situated at the crossroads of these two aspects, i.e. improving food security in metropolises of emerging countries through improvements in agrologistics. A number of questions arise around this topic, for example:
- What are the main challenges in urban food distribution of emerging countries?
- How do these challenges impact urban food security?
- Which are the most promising starting points for improving urban food distribution in emerging countries?
- Which key factors impact success or failure of such initiatives?

This project aims at delivering first indicative answers to some of the above questions.

1.2 Objectives

The project is situated in the context of striving for improved food security and more sustainable food chains in metropolises in order to give as many people as possible access to high quality and safe food for a fair price.

The goals of the project are:
(1) to identify the main challenges in urban food distribution in emerging countries that are at the root of food losses;
(2) to indicate possible starting points for improvements and innovation taking into account contributions of the Dutch industry and knowledge field;
(3) to offer practical advice for the Dutch Ministry of Economic Affairs and the Postharvest Network on how to use these findings in further activities around food losses and food security in metropolises.

This research is commissioned by the Dutch Ministry of Economic Affairs and supports the policy directed at food security and the internationalization of the Dutch business sector.
 The results will be useful for a number of organizations supporting Dutch business in going international, such as:
- TopSector AgriFood,
- TopSector Horticulture & Starting Materials,
- TopSector Logistics,
- Netwerk Agrologistiek,
- Greenport Holland International,
- Sector organization Frugiventa,

- Other governmental institutions among which the Dutch Ministry of Foreign Affairs, AgentschapNL and the Centre for the Promotion of Imports from developing countries (CBI).

The final target audience, however, is the Dutch industry and the research results should support Dutch businesses in their international strategies.

1.3   Scope and definitions

The scope of the project is defined as follows:
- The project focuses on fresh food products (fruit and vegetables, dairy, meat and fish). Commodities (potatoes, grains, soya, rice, cacao), non-food products (flowers) and other products (beer, coffee, tea) are out of scope of the project.
- The project analyses urban food distribution systems in emerging countries. Emerging countries are typified by their high speed of economic growth and development. It was agreed with the Ministry of Economic Affairs to have the topic illustrated by analysis of two case studies, namely Mexico City and Cairo.
- The project focuses on the urban area, therefore those links of the food chain before reaching the urban area are out of scope of the project.
- Chances are that infrastructural problems form the root of many problems. These problems are not expected to be solved with Dutch knowledge and expertise and are thus out of scope of this project.
- The project will take into account other current and earlier projects on international agrologistics, in particular the following:
  - o Postharvest Network (BO-20-007-208, BO-20-007-303)
  - o Vision Agrologistics Mexico
  - o Losses and waste in the chain (BO 20-007-303)
  - o Research Programme Global Food Security: Scarcity and Transition (KB 1 programme).

The following definitions are used throughout the project and report:

Logistics management is defined by the Council of Supply Chain Management (SCM) Professionals as follows: 'Logistics is that part of the supply chain process that plans, implements and controls the efficient, effective flow and storage of goods, services and related information from the point-of-origin to the point-of-consumption in order to meet customer requirements and satisfies the requirements imposed by other stakeholders such as the government (new rules and regulations such as the General Food Law) and the retail community (e.g. Global Food Safety Initiative)'

AgroLogistics concerns all activities in the supply chain to match product supply from the farm with market demand for those products. It aims at getting the right agro and food product, at the right place, at the right time, according to the right specifications (including quality and sustainability requirements) at the lowest cost (Van der Vorst and Snels, 2014). Actors in these types of chains understand that original good quality products might be subject to quality decay because of an inconsiderate action of another actor, for example storing a unit load of milk on a dockside in the burning sun.

Postharvest Food Losses are food products intended for consumption but lost in the postharvest chain, i.e. the chain between the harvest and the sale to the consumer (**Figure 1**). The current project focuses on the 3rd and 4th links of the chain (processing and manufacturing; wholesale, retail & export).
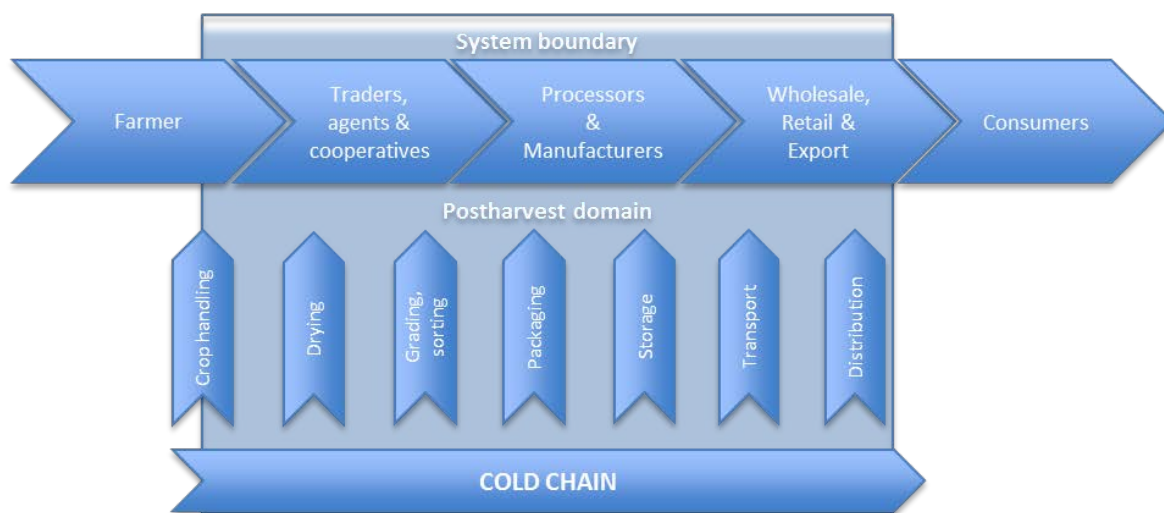
Figure 1: System boundaries Postharvest Chain (van Gogh et al., 2013).

Challenges in urban food distribution are understood as underperformances of the system. Identifying underperformance in terms of logistics and food security will be the first step in order to then go back in the system and analyze the underlying reason(s) for this underperformance.

1.4   Report outline

The report consists of four main chapters. In chapter 2 a theoretical framework of urban food distribution is developed based on earlier projects, a literature study and interviews. This framework underlines the main elements of urban food distribution and serves as a theoretical outline for the following case studies and recommendations for improvement. Chapter 3 describes the current situation of fresh food distribution in the two chosen case studies Mexico City and Cairo using the framework of chapter 2 as a reference. Chapter 4 presents the

conclusions from the case studies comparing the current situation of the respective urban fresh food distribution networks, assessing the performance of the system and stating the major challenges in both cities. Recommendations for intervention are given in chapter 5 taking into account the conclusions from the case studies, urban distribution initiatives and projects in Western European cities and expert interviews. Chapter 6 gives an outlook into further research.

2 Urban food distribution: A conceptual framework

This chapter forms the theoretical backbone of the case study analyses and the identified recommendations for improvement of urban fresh food distribution in emerging countries. Based on earlier projects and a literature review a conceptual framework was developed that outlines the elements of urban food distribution and result in a certain food distribution performance.

The developed framework (**Figure 2**) consists of four main building blocks: (1) the urban food distribution network, (2) market channels, (3) context factors and (4) food distribution performance. The urban food distribution network describes the key elements that constitute the food logistics system in the urban area. The food market of the city is organized in different market channels with each market channel having specific requirements for their supply chain[2]. This results in several food supply chains existing in parallel that use the key (common) elements of the urban food distribution network. These parallel supply chains may partly be combined or entirely separately organised. The food distribution network is impacted by context factors (such as regulations) and results in a food distribution performance in logistics terms as well as in terms of food security. The development of the framework is based on earlier work by Binsbergen and Visser, 2001, Van der Vorst and Snels, 2014, Achterbosch et al, 2014, Lindholm and Behrends, 2012, and Mgonja et al., 2013.
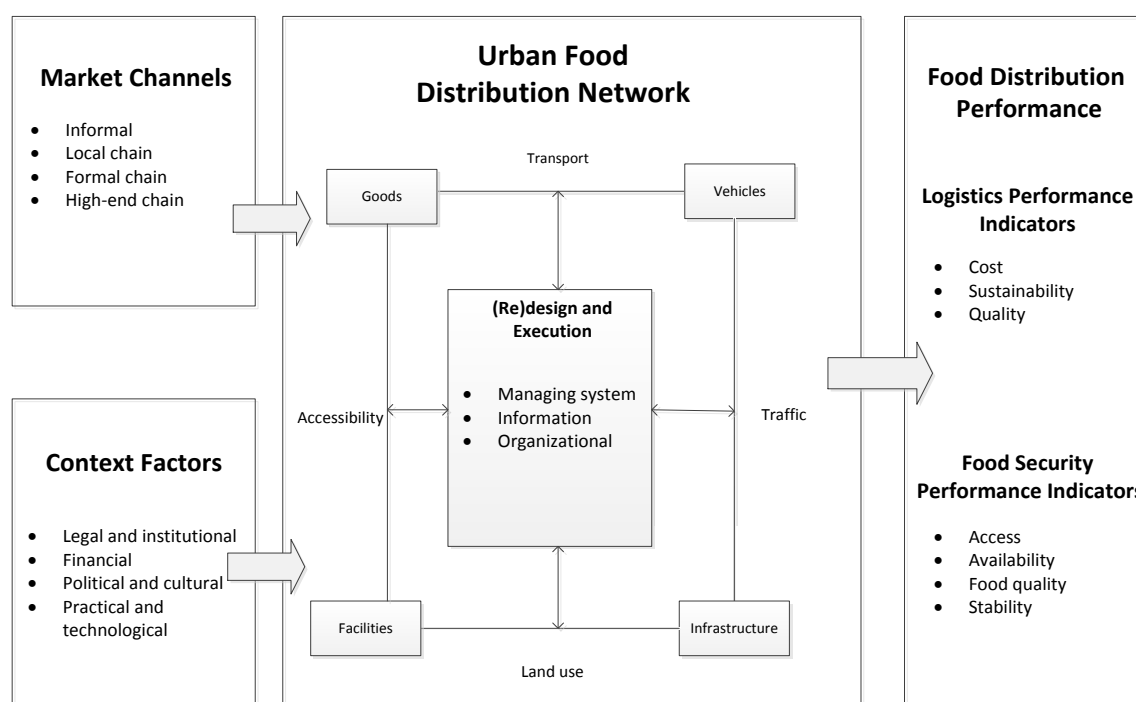

Figure 2: Conceptual framework for urban food distribution (developed based on Binsbergen and Visser, 2001; Van der Vorst and Snels, 2014; Achterbosch et al, 2014; Lindholm and Behrends, 2012, and Mgonja et al., 2013).

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[2] See **Figure 1** for the elements of a food supply chain.

2.1 Urban food distribution network

In order to analyse the urban distribution network systematically Visser et al. (2001) introduced a layer model, which was further developed by Lindholm and Behrends (2012) into a framework demonstrating relationships between factors affecting sustainable urban freight transport. It includes *facilities* where the economic activities take place, *goods* that demand transport to and from these facilities, *vehicles* that provide transport services, and *infrastructure* (referring only to public infrastructure). These elements interact in pairs in four different subsystems, which are: *accessibility, land use, transport* and *traffic.* Together the interaction of the subsystems determines the performance of the transport system. Since economic activities require the movement of goods, a prerequisite for a functioning urban economy is the accessibility of goods to these facilities. Providing this accessibility is the main function of urban freight transport and it is the accessibility needs which drive the whole urban freight transport system. The land use subsystem comprises the supply of transport infrastructure as well as the location of the facilities in relation to the traffic infrastructure, which are both crucial factors for accessibility.

We used this model as a basis for the development of our conceptual framework. The four physical elements and four subsystems as proposed by Lindholm and Behrends (2012) form the *managed system* of the urban food distribution network and contain hardware[3] and technological aspects. They can be described and analysed on urban level. The central element of the network is '(re)design and execution', which contains the aspects to be taken into account when designing and executing improved agrologistics in developing countries as proposed by Van der Vorst and Snels (2014). These are aspects on supply chain level and can therefore not be described and analysed for an urban area as a whole. They include soft- and orgware aspects such as skills, knowledge, training, communication, R&D, organizational, institutional and financial aspects and procedures. These supply chain aspects are categorised into the following three elements:

- *Managing system*: The managing system refers to the planning, control and coordination of business processes in the logistics system. It deals with strategic, tactical and operational decision making, with determining the level of coordination in the supply chain, and the determination of the location of strategic inventories, hence the customer order decoupling point (CODP).
- *Information system*: The managing system takes decisions based on information generated in the chain. Software systems keeping track of information in the chain needed for transactions, ordering, planning, forecasting, and more form the information system. Sometimes information for one or more actors in the chain is organized through a decision support system to keep a more effective and efficient overview of all processes.
- *Organizational system*: The division of tasks and the coordination of those tasks in and between supply chains are examples of the organizational system. It defines the responsibilities and communication lines (Visser and Van Goor, 1996).

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[3] *For the hardware-software-orgware concept see appendix 1.*

In our context a special note needs to be given to the element *goods*. Goods flows themselves have certain characteristics by which they can be categorised, such as the total volume, the shipment size, the composition of the flow and other. Additionally, fresh food products have specific characteristics, which need to be taken into account in the design of an urban fresh food distribution network (Van der Vorst and Snels, 2014, Bourlakis and Weightman, 2004, Jongen and Meulenberg, 2005). Fresh food products are perishable and have a relative short shelf life. Quality decay is accompanied with the transportation process, and cooling facilities are often required in the transportation process. Thus the level of perishability and its corresponding transportation temperature requirement are also of critical importance for urban fresh food distribution and need to be taken into account. Further, production depends on seasonality of the products, which requires global sourcing, and quantity and quality of the products can vary depending on biological variations, seasonality, and random factors connected with weather, pests, and other biological hazards. And finally, quality and environmental requirements and product responsibility result in high demands in terms of traceability of the products.

2.2   Market channels and distribution concepts

Food reaches the consumer in the city through different market channels. Each channel has its own characteristics and functionalities that need to be reflected in the urban food distribution network and this should be taken into account in innovation and improvement initiatives. Within the Designing Innovative Pathways for Agrifood Systems (DIPAS) project (Achterbosch et al, 2014) researchers from Wageningen UR developed an agrifood systems development (AFSD) model which outlines the relation between market and marketing development and product and production development resulting in different development stages of the value chain. This model helps to understand the transfer from one development stage to another and supports efficient innovation and market development processes (**Figure 3**).

The following four stages of value chain development can be distinguished:
- *Informal*: subsistence or smallholder farmers mainly producing for their own consumption and marketing surplus (products not consumed themselves) to local fresh markets,
- *Local*: emerging farmers marketing to wholesale markets,
- *Formal*: emerging or commercial farmers marketing to wholesale, retail or out of home consumption markets,
- *High-end*: commercial or industrial farmers marketing to retail or specialised markets including virtualisation and last mile deliveries.

In developing and emerging market economies the transaction costs involved in moving up the ladder towards more advanced value chains can be rather high as new production-marketing mechanisms and systems have to be developed when markets are functioning poorly or are non-existent. In attempts for innovation and development it is important to take into account at

which point of development a certain market is situated in order to design the development step accordingly. Furthermore, it is essential to understand that market and production development depend on each other. For developing towards more sophisticated markets the product as such and related production processes also need to develop further.
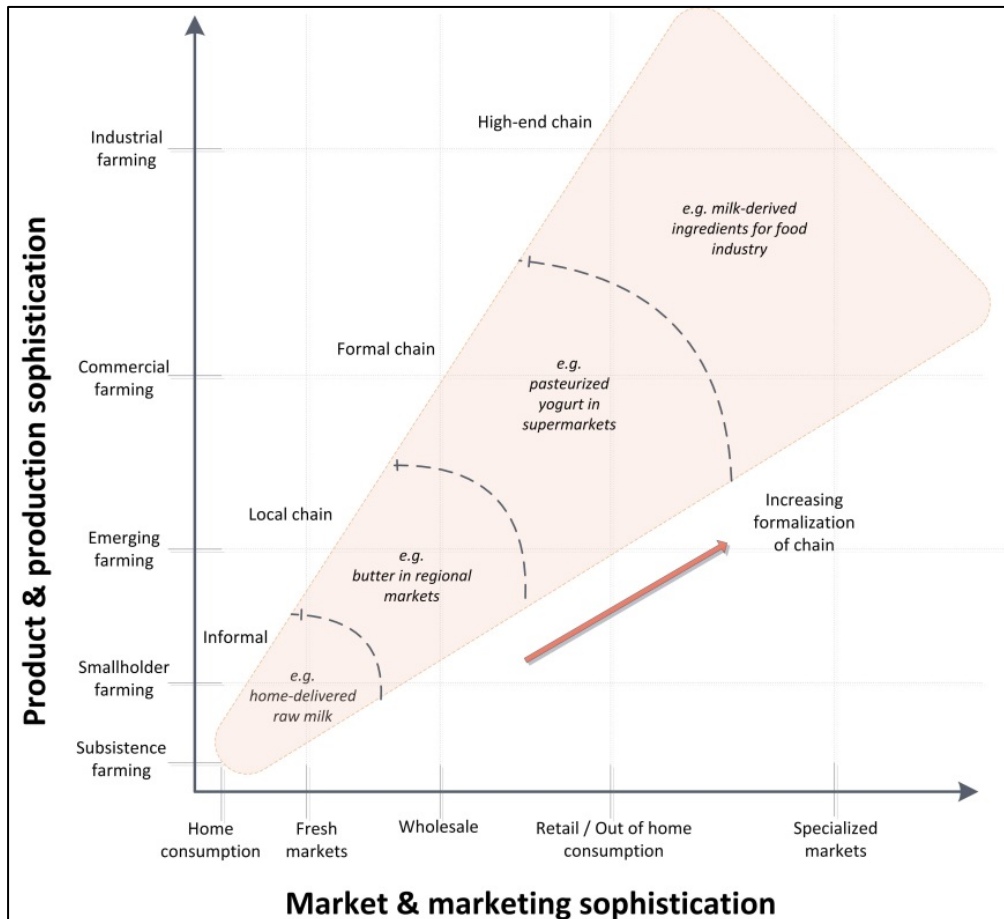
Figure 3: Pathways for Agrifood Systems Development (Achterbosch et al, 2014).

Another categorization, which is a helpful in understanding the current urban food distribution in emerging countries, is the distinction of traditional and modern market channels. Mostly, chains can be linked to either the traditional or the modern channel and can thus also be categorized as either traditional of modern supply chains. However, in transition periods hybrid systems might exist. For example, supermarkets clearly belong to the modern channel but might in the beginnings depend on traditional chains for their supply. In emerging countries both co-exit, yet with a clear dominance of the traditional supply chains (e.g. Blanco and Fransoo, 2013).

2.3 Context factors

Context factors, such as regulations, are only indirectly linked to the urban distribution network but can have a significant impact on the performance of the urban distribution network. The recommendations of the current project will not target these context factors as they are assumed to be stable in the short term. Even local authorities might often not be able to influence these factors as they depend for example on culture, national policy or national legislation. However, as they are important for the success or failure of any innovation or improvement initiative, context factors as well as lessons learned from earlier knowledge transfer projects and initiatives were taken into account in formulating recommendations (Chapter 5).

Lindholm and Behrends (2012) summarize context factors in the following categories:
- *legal and institutional factors*, which includes issues such as weight and time restrictions on road infrastructure;
- *financial aspects* such as road pricing/tolls;
- *political and cultural aspects* such as road safety and inspection;
- *practical and technological factors* such as city size, location and population density, cooling facilities as well as postharvest technology.

2.4 Food distribution performance

The urban food distribution network will result in a certain food distribution performance of the respective urban area, which can be divided into a *logistics performance* and a *food security* performance. In other words, a better designed urban food distribution network should result in an improved logistics performance and in improved food security.

Key logistics performance indicators of food supply chains as identified in the Worldbank's position note for agrologistics (Van der Vorst and Snels, 2014) are cost, quality and sustainability. *Cost* link to all investments and operational expenses in the managed, managing, information and organisational system to be able to deliver all food products in the system in line with the requirements (such as responsiveness and service). *Quality* refers to product quality (with its intrinsic and extrinsic quality attributes) and the reduction of food waste, and *sustainability* is associated with the environmental (foremost emissions) and social performance (noise pollution, health) of the food supply chain. Note that the logistics performance of the network can be assessed at the urban level (of the city as a whole) or at the level of the individual supply chains that are delivering specific markets.

The World Food Summit of 1996 defined food security as existing "when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life". Over the years the concept of food security has evolved to comprise four pillars (CIARD, 2014), which form the performance indicators for food security:

- *Access* – having sufficient resources to obtain appropriate foods for a nutritious diet, which refers to the ability to produce one's own food or buy it, i.e. having the purchasing power to do so;
- *Availability* – sufficient quantities of food available on a consistent basis;
- *Food quality* – from a nutritional, sanitary, sensory and socio-cultural point of view, which integrates the notion of food safety;
- *Stability* – in terms of availability, accessibility and quality. This fourth pillar incorporates issues of price stability and securing incomes for vulnerable populations.

By defining concrete quantitative KPIs targets could be set and the development towards these targets could be measured.

3   Urban food distribution in Mexico City and Cairo

This chapter is dedicated to the urban fresh food distribution in two major emerging metropolises, namely Mexico City and Cairo. Based on the concepts and the framework described in Chapter 2 the relevant market channels for food purchases (local, formal, high-end), the related supply chains (traditional and modern) and current distribution challenges are analysed for each metropolis. As mentioned earlier, only the managed system (the four physical elements and the four subsystems) as defined in the urban food distribution network can be described on urban level as managing systems, information and organization structure are elements on supply chain level. The context factors are not listed here as giving an exhaustive overview of those factors would go beyond the scope of the project and need significant additional research. Furthermore, as mentioned earlier, context factors are assumed to be stable in the short term (see chapter 2.3).

3.1   The case of Mexico City

Mexico City is the capital of Mexico, located between the United States of America and Central and South America. The population of Greater Mexico City is approximately 21 million people, making it the largest metropolitan area in the western hemisphere. In 2012, the GDP of Mexico City stood at an estimated USD 411 billion (c. MXN 5.4 trillion). These numbers account for 24% of the population and 19% of the GDP of Mexico's total respectively (Brookings, 2013).

3.1.1   *Market channels*

The retailing sector in Mexico City has traditionally been highly fragmented. Whereas small grocery shops and local specialized stores are still the main market channels in rural areas, chain supermarkets (including hypermarkets and convenience stores) and large specialized stores have established themselves mostly in urban areas since the fifties of the previous century. Consumers in Mexico City spent almost MXN 33 billion on food in 2012, including out of home food purchases. **Figure 4** shows that specialized stores, supermarkets, market halls and restaurants are the main channels where consumers in Mexico City buy their food (INEGI, 2013).

The main market channels are described below according to the structure of the AFSD model. The relevant channels for our purposes are local, formal and high end channels. The informal channel is not considered relevant in the context of urban food distribution in general as the products of this informal channel are not considered to enter the urban system in larger amounts.

3.1.1.1   Local channels

Local market channels in Mexico City are market halls, open air markets, small grocery stores and specialized stores.

Market halls

Market halls ("mercados") have a market share of 14% in total food expenditure in Mexico City. In the city there are more than 300 market halls, mostly in middle and lower income neighbourhoods, where about 70,000 independent vendors sell their products every day. The market halls are almost always located in buildings owned and operated by local government. This is the result of an attempt to replace unregulated open air markets which operate only one or a few days a week. The income of market vendors has decreased significantly since supermarket chains established themselves in Mexico City. By 2002 it was already estimated that sales had declined almost 60% in the past decade and it is expected that revenue has fallen only more since then (Valdes, 2011). Consequently, many stalls at these markets are empty, with 20% of all market halls having been abandoned altogether (Santiago, 2008). This large decline is caused among others by the neglected and unhygienic conditions of many market halls. There are no inspections of meat and dairy products and the market halls lack sufficient sanitary measures for the handling of meat. The market halls and the areas surrounding them are also associated with crime (Ramos & Rivera, 2012).

In reaction to the strong competition from supermarkets, vendors at market halls have partially shifted their supply from fresh food products to ready-made food and luxury items (Santiago, 2008). Because vendors in market halls base the prices they charge on the characteristics of each individual item of produce and many market vendors are willing to bargain about prices, customers feel that they receive more value for their money than at modern channels (USDA, 2002).
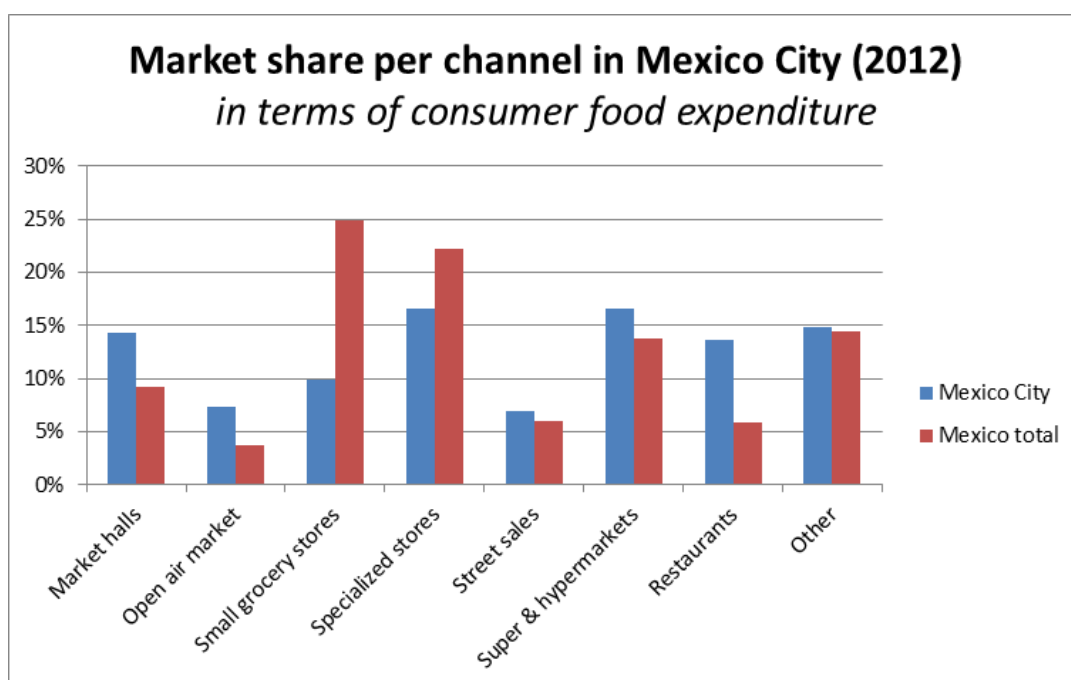

Figure 4: Market share per channel in Mexico City (adapted from INEGI, 2013).

Open air markets

Open air markets ("tianguis") have a market share of 7% in the total consumer food expenditure in Mexico City. There are more than a thousand open air markets in Mexico City, some of them having been operated without interruption for over several centuries. A few decades ago, the open air markets were part of the Mexico City government's strategy to supply the city with food staples, particularly the working class (Pena, 1999).

Nowadays, open air markets are part of the informal economy since this kind of unregulated commerce is no longer legal. Despite laws against them, open air markets still exist because of their traditional place in people's daily life, the many people they employ and because officials are bribed. Vendors also don't pay taxes over their sales (Orihuela, 2001). Open air markets are often set up next to market halls and in areas with a limited presence of supermarkets. They are taken down at the end of each market day. Some open air markets are mobile, whereas others are always set up at the same place, frequently blocking entire streets. Almost a third of all open air markets in Mexico City are located in the Iztapalapa borough (Padgett, 2004; Pena, 1999).

Due to their accessibility, open air markets have traditionally been very popular among Mexican consumers, who perceive open air markets as complementary to formal channels. Open air markets have developed into offering a relatively small share of fresh food in the total supply provided (Orihuela, 2001; USDA, 2002).

Small grocery stores

Also known as "abarottes", "mom and pop stores", traditional small grocery stores can be characterized as *nanostores* as well. They have a market share of 10% in the total food expenditure of consumers in Mexico City. These small stores have limited assortments with few fresh products. The stores are present at practically every street in Mexico City, especially in poorer neighbourhoods. They are small to very small, family-run business with a social role in the neighbourhood. Just like other traditional market channels, these stores face strong competition from modern market channels, especially convenience stores. It is estimated that at least fifteen small grocery stores are put out of business by every modern convenience store that opens in an area (USDA, 2010b).

Small grocery stores are however expected to remain an important market channel. Due to their dense presence, they are more accessible than supermarkets. Because the traditional small stores are cheaper than convenience stores, they are also more attractive to lower income groups. Consumers in the lower income groups also don't have the access to cars and credit which is generally required to make purchases at formal market channels, as these are usually located outside residential areas and don't accept informal credit (Blanco & Fransoo, 2013; Lida, 2008).

Specialized fresh stores

Just like small grocery stores, specialized stores are small, often family-run businesses with a large presence in the neighbourhood. Specialized fresh stores also have their informal relations with suppliers and customers in common with small grocery stores, just like their competition with modern market channels. The difference with small grocery stores is that these fresh stores specialize in the sales of specific fresh products groups, such as fruit (greengrocers, "fruteria") or poultry (butchers, "polleria"). The assortment of specialized fresh shops consists practically in its entirety of perishable products (INEGI, 2013; USDA, 2010).

3.1.1.2   Formal channels

Formal market channels in Mexico City consist of supermarkets and hypermarkets, which have a combined market share of 17% of total consumer food expenditure in the city.

Supermarkets and hypermarkets

Despite fierce competition among a variety of chains, the supermarket and hypermarket segment in Mexico City is dominated by five retailers: Walmart de México, Soriana, Chedraui, Comercial Mexicana and Oxxo. Walmart de México is part of Wal-Mart Stores, Inc., the American retail corporation. Walmart de México has several subsidiaries, each company focusing on a different type of income group. In terms of number of shops and revenue generated in Mexico City, Walmart de México is the largest retailer in Mexico City. The other four main retailers are of Mexican origin (UK Trade & Investment, 2014). Especially hypermarkets requite a lot of space, both in terms of floor area and parking space. Due to the lack of available space in the central parts of the city, hypermarkets and large supermarkets tend to be located outside the city's centre, such as in suburbs and at the outskirts of the city (USDA, 2002).

Formal channels are mostly favoured by people under 35 who have higher incomes and live in the suburbs of Mexico City. Supermarkets and hypermarkets are generally better maintained and offer higher hygienic standards than traditional channels such as market halls (Santiago, 2008).

Several chains aim to access low and middle income neighbourhoods by establishing smaller, basic stores with a limited assortment there. Such stores crowd out traditional markets, despite generally not being as accessible for those who cannot afford transportation. Thus the rise of supermarkets in Mexico City potentially has also a negative impact on the food security of poor households (Biles, 2008).

Because Mexican consumers traditionally have a preference for very fresh produce, many supermarkets have attracted customers by evoking the image of traditional food markets in their retail stores, for example by explicitly displaying popular fresh fruits and vegetables in the supermarkets and marketing campaigns. Supermarkets have significantly more access to

refrigeration than traditional channels, resulting in less spoilage of perishable foodstuffs in supermarkets (USDA, 2002).

3.1.1.3 High end channels

High end channels are convenience channels such as (fast food) restaurants and convenience stores.

<u>Restaurants and fast food</u>

Driven by a trend toward modernization and a faster pace of life eating habits in Mexico City have developed to include a larger variety of foods and more out of home consumption. Consequently, the restaurant sector has expanded rapidly. Although consumer expenditure in both regular and fast food restaurants decreased during the economic crisis, these channels recovered quickly in 2012 to a total of 14% of total consumer food expenditure in Mexico City. The great majority of regular restaurants are in hands of domestic owners, no matter whether the cuisine is of Mexican or Latin American origin or not. International chains have a more prominent presence in the fast food sector, but except for several specific niche markets (burger, bakery and chicken fast food, where Burger King and McDonald's, Subway and KFC respectively have a strong presence), the rest of the fast food market is also dominated by domestic brands (Agriculture and agri-food Canada, 2010; USDA, 2013).

<u>Convenience stores</u>

The market share of convenience stores in the total food expenditure of Mexico City consumers was small in 2012 but has been increasing rapidly since then. Convenience stores strongly compete with local market channels, especially small grocery shops. Unlike small grocery shops, convenience stores sell practically no fresh produce. Most convenience stores are part of a chain. The main chains in Mexico City are 7-Eleven (originating in the United States) and Oxxo (a similar concept of Mexican origin). Convenience stores keep longer opening hours (up to 24 hours a day) and charge higher prices than their predecessors. The modern, chain convenience stores are however notably absent from low income neighbourhoods, where they are an easy target for robberies due their long opening hours (Lida, 2008; Mexico News Daily, 2014).

3.1.2 *Urban food distribution network*

Distribution of fresh food products in Mexico City is carried out through both traditional and modern supply chains. As explained earlier in general several supply chains exist in parallel and might partly be shared or totally be separated. These supply chains can be defined as either traditional or modern. In other words there are two significantly different distribution concepts with different implications for the urban food distribution network. Consequently, the traditional and modern supply chains are described separately below.

3.1.2.1 Traditional supply chains

Traditional supply chains consist of a long chain of distributors, intermediaries and wholesalers to deliver food products to a variety of traditional, often small stores and restaurants. The traditional supply chain in Mexico City is dominated by Central de Abasto, the city's main wholesale market which is located at the outskirts of the city, in the Iztapalapa borough. With 328 hectares where more than 6,000 wholesalers sell fresh produce and some processed foods Central de Abasto is the largest wholesale market in the world. On average 700,000 tons of fruit and 500,000 tons of vegetables are sold each month. The market attracts 300,000 to 350,000 visitors each day, including both retailers and final consumers (Agriculture and agri-food Canada, 2014). Approximately 6000 trucks and 50,000 other vehicles, such as thousands of manually pushed trolleys and handcarts, transport the products to the market itself and its 114,000 tons of storage capacity (USDA, 2002; Ohio Department of Agriculture, 2008; Twilley, 2010). The wholesale market is government owned and created to be the axis of food distribution for all of Mexico. About 80% of the total food supply of Mexico used to pass through Central de Abasto. These days this share has decreased to only 20 to 30%. Yet, nowadays approximately 80% of all fresh produce consumed in greater Mexico City still passes through Central de Abasto. Because of the large quantities of food sold at the wholesale market, prices are formed there as well (USA Today, 2009).

Similar to Central de Abasto, Nueva Viga is the second largest seafood market in the world. The market includes over 200 wholesale warehouses and 55 retail warehouses and attracts 15,000 to 25,000 customers per day, mainly owners of local restaurants. On a daily basis, 500 tons of fresh fish and 1,000 tons of frozen fish are sold (increasing to 2,500 tons total a day in peak periods), which accounts for 60% of the total domestic market. Unlike Central de Abasto, the neighbouring Nueva Viga wholesale market is privately owned (Seafood Today, 2008). Products transferred from the wholesale markets to market halls and open air markets are exclusively transported by the local freight transport public service, a third party logistics service provider which mostly uses trucks and lorries. Transport to small, traditional market outlets is carried out by countless, partially informal intermediary transport service providers (Ecorys, 2008).

We can state that these two wholesale markets are an important link the fresh food distribution of Mexico City and as such have a significant impact on the performance of the system. Consequently, they need to be taken into consideration in attempts to improve the performance of the urban fresh food distribution system.

3.1.2.2 Modern supply chains

Traditionally, vendors from all retail market channels in Mexico City bought their fresh food merchandise at the Central de Abasto and Nueva Viga wholesale markets, supermarket chains included. Aiming to reduce costs and to gain more bargaining power, supermarket chains have

attempted to establish more efficient supply chains by eliminating intermediaries and becoming independent of wholesale markets. Despite these efforts, supermarkets remained relying on traditional channels for their supply for several reasons (USDA, 2002):

- The great majority of Mexican producers is too small to sort, classify, wash, pack and palletize their products, let alone in the quantities required by supermarket chains. Because of economies of scale these tasks are carried out at the central wholesale market.
- Mexican producers are reluctant to directly supply supermarket chains. These chains are perceived to be more difficult to work with than other retailers because they usually demand more uniform product quality, pay for products only after up to 45 days after delivery and demand the right to reject products which don't meet their exact specifications.
- Many supermarket chains initially operated on too small a scale to justify building and operating their own distribution centers.

Supermarket chains also strive to develop their own supply chains because they are dissatisfied with product quality control within the traditional supply chain. According to stakeholders in supermarket chains fresh products are poorly packed at the wholesale markets and insufficient effort is made to satisfactorily develop the cold chain.

At the turn of the century, only about 12% of wholesalers with perishable products at Central de Abasto used any form of cold storage on their premises. Because of longer transit time to and from the wholesale markets, the inclusion of wholesale markets in the supply chain causes additional food losses by definition. Consequently, an estimated 50 to 60% of all harvested perishable products are lost before they even reach the consumer. Despite this, the great majority of supermarket chains bought at least half of their fresh products at wholesale markets. At the same time only one tenth of all products handled at the wholesale markets was sold to supermarket chains. Because other retail channels do not require further development of the chain, the very price-conscious wholesalers are reluctant to invest in cold storage facilities (USDA, 2002; Gasca & Torres, 2013).

In the past decade, supermarket chains have gradually become less dependent on wholesale markets after all, although the remaining level of dependency varies among chains. Supermarket chains have established direct shipment contracts with a limited number of large producers and well organized producer associations, which already maintained higher quality standards due to their involvement in the export market. These supply chains have developed into modern distribution systems which bypass wholesale markets in Mexico City. Supermarket chains have their own fully automated, refrigerated distribution centers to directly link producers and supermarket locations. Transport to and from the distribution centers can be carried out with refrigerated trucks which are owned by the supermarket chains themselves, the producers or by a third party logistic service provider (Agriculture and agri-food Canada, 2014; USDA, 2002).

3.1.3 Freight transport challenges

In 2007 approximately 195,000 freight vehicles were utilized in Mexico City, excluding the agglomeration surrounding the actual city. Registered commercial and private freight vehicles make up 78% of total freight vehicles. Of those vehicles 70% are small trucks and vans with two axle and 3.5 tons or less, which often carry less than full truck loads. The remaining 22% consist of public service freight vehicles, which presumably carry full truck loads much more often. Informal freight transport such as pedestrian transport and carriages exists as well, but because of their unofficial nature there is no information available about their contribution to total freight service in Mexico City.

Table 1 provides an overview of the number of delivery points and transport kilometres per type of freight transport in Greater Mexico City.

Table 1: Number of delivery points and transport kilometers per company type of freight transport in Greater Mexico City (adapted from Antún & Lozano, 2009).

Freight transport in Greater Mexico City per company type	Number of delivery points	Average journey length (km)	Average km per delivery point
Federal public services	2.1	62.8	30.1
Local public services	1.8	49.6	26.1
Commercial services <100 vehicles	3.8	70.6	18.1
Commercial services 100-500 vehicles	23.8	56.5	2.4
Commercial services >500 vehicles	22.2	48.1	2.2

In total an estimated five million vehicles are in circulation in Mexico City each day, one of the most populated cities in the world. Because the city's public passenger transport is insufficiently developed, inhabitants strive for car ownership. Consequently, the city is heavily congested. Congestion is worsened by the lack of space for loading and unloading for freight vehicles. Only an estimated quarter of all freight vehicles have access to loading/unloading zones. The majority of trucks and vans park on the street when they make deliveries, mostly by double parking and thus further blocking streets. As a result of the congested roads in Mexico City journey times are increasingly longer, resulting in less efficient and more expensive distribution of food. Congestion isn't any longer limited to peak hours but continues for the duration of the entire day.

Other issues with regards to freight transport in Mexico City, as mentioned in a survey among 1650 truck drivers, are the following (Ecorys, 2008; Lozano, 2006):

- The complexity of legislation relating to freight transport;
- The risk of theft of vehicle loads and the lack of safety;
- The corruption of the police.

Government agencies seem to be aware of the strong negative impact of congestion and its consequences and have implemented a variety of policies and regulations. However, due to fragmentation with a variety of national and local agencies responsible for transport in Mexico City, these measures are mainly isolated actions rather than forming an integrated policy. With regards to freight transport, such policy measures include (TURBLOG, 2011):

- The establishment of a Zero Emissions Corridor in Eje Central, one of the main roads in the city centre. Eje Central sometimes was taken up by freight transport for 70%, but the policy measure completely restricts all freight vehicles on this road, redirecting freight vehicles to other roads instead.
- The limitation of freight vehicles heavier than 3.5 tons movements in the historic centre of Mexico City between 07.00 and 22.00. Electric freight vehicle corridors, loading/unloading bays and micro-platforms for distribution are expected to be developed instead.
- The restriction of circulation of freight transport on Federal District Freeways and specific roads.
- Time restrictions for freight vehicles moving from the city to toll roads within the city.
- Restrictions on loading and unloading on roads served by the city's bus rapid transit system.

With logistics innovation being characterized as the key to metropolitan competitiveness, commercial organisations are also taking measures to increase their city distribution performance (TURBLOG, 2011):

- Reduction of the number of distribution centres in Greater Mexico City by consolidating logistics operations of several business units.
- Introduction of information technology innovations in logistics for more efficient planning and distributing.
- Introduction of electric freight vehicles for city distribution.
- Outsourcing of logistics operations to logistics service operators.

Looking at the urban food distribution system in Mexico City it becomes evident that the city is suffering from many issues, which heavily impact the performance of the system, which is outlined in more detail in chapter 4. Policy makers as well as commercial organizations seem to be aware of the impact of this underperformance and start taking measures. However, these are rather isolated than forming an integrated approach, which is supposed to limit their effectiveness.

3.2 The case of Cairo

Cairo is the capital of Egypt, the largest market in the Arab world. Excluding the outer regions of the agglomeration, the city of Cairo inhabits almost 13 million people and accounts for a GDP of USD 128 billion in 2012 (Brookings, 2013; Ramzy, 2011). Egypt as a whole and Cairo in particular is growing in an uncontrolled manner. Experts currently estimate that the net growth of Egypt amounts to c. 2 million people per year.

The political and social unrest that has characterized Egypt for the past few years has significant impacts on society, economy and also the retail landscape in Cairo. As an example, in June 2014 two minor supermarket chains were shut down by the government due to ties with the now forbidden Muslim Brotherhood. The supermarkets were later reopened as part of a governmental holding company (Daily News Egypt, 2014). This current turmoil is certainly one of the most important context factors that have to be taken into account in launching improvement initiatives in Cairo.

3.2.1 Market channels

Despite the gradual establishment of supermarket chains the retailing sector in Cairo is highly fragmented and especially lower income groups still heavily rely on traditional market outlets. There is no comprehensive overview of local consumer expenditure or revenue per channel, but in terms of number of outlets and total surface per type Cairo's retail sector is still dominated by traditional small grocery stores and street stalls (GIM, 2011). The market shares included in this part of the chapter are estimates based on statements of experts as no reliable figures are available. The household expenditure on food for Egypt as a total amounts to over 40% overall and over 50% in poor families. In 2011 about 25% of the inhabitants of Greater Cairo had poor access to food and lived in a state of food insecurity (CAPMAS, 2011).

There are several factors adding further complexity to the food market channels in Cairo (ITDA, 2013; Rohac, 2013), such as:
- the high share of micro-enterprises in the total retail sector;
- the predomination of fragmented food distribution chains;
- the high share of informal outlets in the total retail sector;
- Egypt's elaborate subsidy system for bread, vegetable oil, sugar and rice.

3.2.1.1 Local channels

Small grocery stores are traditionally the main market outlet for food products in Cairo. These stores are independent and they often are family-run and family-owned. They offer mostly a limited assortment of fresh local products such as fruit, vegetables and meat.

Although supermarkets expand at the expense of the traditional stores, especially in the middle to high income groups, small grocery stores are still an important market channel. In Egypt as a whole it is estimated that 90 to 95% of all food outlets are small grocery stores (USDA, 2010a). Because of their accessibility in the neighbourhood traditional grocery stores are still popular among people from low to middle income groups and people from local high income neighbourhoods who want to make last minute purchases (Ecorys-NEI, 2005; Ramzy et al., 2011).

Traditional grocery stores are also known to adapt to the changing retail market by becoming part of a larger, already existing chain of stores. Under pressure from the competition from modern market channels traditional outlets have also become more customer driven by employing service-minded staff, increasing services, improving hygienic standards and broadening the assortment (Dihel & El Shinnawy, 2006; IFAD, 2008).

Other traditional market channels in Cairo are food specialists such as butchers, bakers and dairy specialists, and street sales at open markets. Just like small grocery stores these traditional channels lose revenue to the rising number of supermarkets in the metropolis.

Consumers can be loyal to these traditional outlets, for example because such channels are part of the Egyptian culture and the traditional neighbourhood. Especially lower income consumers also appreciate the informal transactions, including the informal granting of credit that traditional outlets provide (GIM, 2011).

3.2.1.2   Formal channels
Formal channels in Cairo consist of supermarkets and hypermarkets. These two channels combined are estimated to have a market share of about 9% of the total food retail market (Adam, personal communication, 25 September 2014).

Supermarkets
The establishment of supermarkets in Egypt began in the late 1970s. A handful of supermarkets emerged in the wealthiest neighbourhoods of Cairo, such as Zamalek and Maadi (Dihel & El Shinnawy, 2006). Since then sales have been increasing both due to expansion of the number of stores and because of a larger number and variety of products offered. Just like their target groups, supermarkets are mainly located at inner-city sites and in upscale urban areas surrounding the central city.

Among supermarkets there is a high fragmentation between local and regional stores and national and international chains. Domestic chains such as Metro, Ragab Sons and Abu Zekri have the highest market share among supermarkets. International chains include Spinneys and Carrefour. Many of these chains have however only a handful of outlets in Cairo. Additionally, many

supermarkets are relatively small. These modern supermarkets almost exclusively target middle and higher income groups. Supermarkets therefor remain mainly located in in affluent districts of the metropolis. Shopping in modern supermarkets with a varied assortment, including western products, has become a leisure activity among Egyptians in higher income groups. The supermarkets also attract a high number of foreign consumers, who care more about quality than about price. As a whole, the supermarket channel is developing rapidly, becoming one of the main market channels in Cairo (Ashraf, personal communication, 4 December 2014; Bahaa, personal communication, 24 September 2014; USDA, 2010a).

<u>Hypermarkets</u>
The first hypermarkets in Egypt were opened in Cairo in the second half of the 1980s (Dihel & El Shinnawy, 2006). In the following decades the number of hypermarkets has expanded with sales increasing to some extent at the expense of supermarkets. Hypermarkets have become well accepted because of the one-stop shopping experience and low prices they provide thanks to the economies of scale they accomplish. Due to the lack of available space in central Cairo and the large amounts of space that hypermarkets require for their large shopping area, storage rooms and parking lots, hypermarkets are located at the outskirts of Cairo (USDA, 2010a).

3.2.1.3 High end channels

The market share of convenience stores in total consumer food expenditure in Cairo has been steadily increasing in the past few years. Convenience stores are particularly popular among young people, who appreciate the sit-in space that is part of many of these stores. Convenience stores are mostly opened in new residential areas and along main highways. Especially during hot days consumers are drawn to the very modern, air-conditioned stores. With its brands 'Mobil market', 'Esso snack and shop' and 'On the run', ExxonMobil is by far the market leader in the convenience sector (USDA, 2010a).

3.2.2   *Urban food distribution network*

Just like in Mexico City traditional and modern supply chains co-exist in Cairo. Much more so than in Mexico City especially the modern supply chain is underdeveloped.

3.2.2.1 Traditional supply chains

Fresh food products are at the farm level mainly directly sold to one of Egypt's few central markets or sold to small traders who then sell the products to the central markets, which function as wholesale markets. These traders also package the products if necessary (El-Habbab, 2004).

El Obour Market is the wholesale market in Cairo where in practice very large food retailers function as wholesalers as well. The prices are set at this market and products are sorted here as

well. The products from wholesalers at El Obour Market are subsequently sold to a variety of retailers or other intermediary traders (Adam, personal communication, 25 September 2014; IFAD, 2008; Ramzy et al., 2011). It is estimated that due to poor packaging, a lack of cold chain facilities, rough transport and multiple handling, up to 40% of total production of perishable products is lost during transport or handling (Ecorys-NEI, 2005).

In 2003 the Refrigerated Perishable Terminal with a daily capacity of 180 tons was established at Cairo airport to improve the international cold chain, but the domestic cold chain is still underdeveloped. Rather than refrigerated trucks, cooling is done by dipping natural fibre sheets in water which are set up in the truck and lead to cooling of the produce (Adam, personal communication, 25 September 2014; El-Habbab, 2004).

3.2.2.2 Modern supply chains

Because of the fragmentation of the modern market channels it is difficult for modern retailers to set up their own, independent supply chains. Several supermarket chains rely on existing, traditional supply chains to source products or have suppliers deliver products directly with the suppliers' own transport. The latter can result in the same supermarket receiving a variety of deliveries at the same day (Ecorys-NEI, 2005). An additional challenge is the reported lack of cool chain continuity of third party logistic service providers or refrigerated trucks not being utilized at all (Adam, personal communication, 25 September 2014; Ashraf, personal communication, 4 December 2014).

Only the largest players in the modern channels have their own distribution centres. Kheir Zaman, for example, owns a large warehouse and processing facility just outside Cairo, which is managed with up-to-date IT systems. Company-owned, natural gas-operated trucks deliver goods directly to supermarkets in the city on a daily basis. Orders from the supermarkets are placed automatically, based on sales at the modern cashier machines. Suppliers transport their goods to the distribution centre themselves (GIM, 2011). To ensure a sufficient supply of products in terms of quantity and quality, supermarkets which bypass the traditional wholesalers assist suppliers with credit and inputs to improve their output quantity and standards (Ecorys-NEI, 2005).

However, vertical integration doesn't frequently occur yet, and chains that have taken this step struggle to keep their wholesale distribution services efficient, especially with regards to highly perishable products (Dihel & El Shinnawy, 2006). Home delivery, possibly in exchange for a small fee, is a common service offered by large modern channels in Cairo. Chains aim to create customer loyalty by providing this convenience (USDA, 2010a; Tawfik, personal communication, 23 September 2014).

3.2.3   Freight transport challenges
Cairo is no exception to the transport problems that many emerging metropolises face. Due to a variety of reasons the streets of Cairo are chronically congested (El Araby, 2013):
- The mix of vehicles, pedestrians and vendors on the streets;
- Further increasing private car ownership;
- Lack of clear, functional hierarchy of roads;
- Underdeveloped public transport in terms of service, coverage and inter-modal transfer;
- Poor city planning;
- Inadequate residential parking spaces;
- Inadequate parking spaces and bus stops;
- Inadequate sidewalks;
- Inadequate traffic planning, control and management;
- Poor observance of traffic laws by road users;
- Non-uniform distribution of urban populations;
- Complex decision and city planning structure.

The yearly economic cost of traffic congestion in Egypt, which is mostly occurring in Cairo, is estimated to be 4% of the GDP of Egypt as a whole. Direct, negative impacts of these freight transport issues on food distribution in Cairo include daily out-of-stock situations and inner-city supermarkets which become inaccessible due to the chronic lack of parking space (Ramzy et al., 2011). With regards to agrologistics the quality condition of fresh products varies among deliveries to market outlets. The quality in which the products leave the farm influence the conditions upon arrival at the market channels to some extent, but the main deterioration of quality is occurred during transportation, distribution and handling of the products (Ashraf, personal communication, 4 December 2014).

The analysis of the urban food distribution system in Cairo makes it clear that Cairo is also suffering from an underperforming system (see chapter 4). So far this seems to not have been taken up in policy making and fast and uncontrolled growth of the city only worsens the problem.

4   Case comparison and challenges

In both cities we can see a transition from local to formal market channels with hyper- and supermarkets as well as convenience stores slowly but surely gaining market share from the local, more traditional forms, in particular from the small grocery stores. This development is so far limited and local market channels are still dominant, but the development is true in particular for younger people and wealthier parts of society and can be assumed to widen from here to larger parts of society in the coming years. Lower income groups keep doing their groceries at local market channels and we expect that local market channels – especially the small neighbourhood grocery stores – will keep existing in the future. Among the reasons are (i) limited to no access to transportation necessary to reach hypermarkets in the suburbs and outskirts, (ii) the possibilities to get informal credits in small grocery stores and to buy very small quantities of one item as well as (iii) the social and cultural role of these stores to their neighbourhood, they are more than 'just a grocery store'. Additionally, safety issues in lower income neighbourhoods are a particular threat for supermarkets and convenience stores with late opening hours. This keeps them from opening stores in these areas.

A consequence of the transition from traditional to modern channels is that supply chains also develop from traditional to modern. However, it is not the traditional supply chains themselves that develop towards more modern forms but modern supply chains developing in parallel to and mostly independent from the traditional chains. As the more modern market channels hyper-/supermarkets and convenience stores require high and constant quality, which traditional supply chains seem to not be able to deliver, those market channels more and more set up their own, independent and fully controlled supply chains.

Both developments are significantly more advanced in Mexico City than in Cairo, which seems to be in the very beginning of this transformation. Based on the experience in Mexico City though it is to be expected that Cairo will go through a similar transformation in the years and decades to come.

The analysis of chapter 3 combined with expert opinions lead us to the following statements regarding the KPIs as defined in chapter 2.4.

- All three logistics performance indicators are negatively impacted by the current situation of fresh food distribution in Mexico City and Cairo. Complexity of the distribution, the number of transits and handling and congestion lead to high logistics costs and a low responsiveness to orders. The product quality suffers significantly with high food losses and issues regarding food safety, and transparency in the food chain is low. All these issues are a challenge in particular in traditional supply chains but to a more limited extent also affect modern chains.
- As regards food security the KPIs food quality and stability are assessed to be most negatively impacted. Access to and availability of food seems to be less important issues in both cities.

As a summary we can state that in both cities the urban fresh food distribution system is underperforming on almost all performance indicators.

From the analysis of the two case studies we can conclude that the reasons leading to this underperformance mainly occur in two major areas, namely the traditional supply chains and the logistics system of the urban area as a whole. Table 2 and Table 3 give insights in the characteristics of the elements of the urban food distribution network of both cities.

Table 2: Urban food distribution network Mexico City.

Mexico City		Distribution concept	
		Traditional	*Modern*
Aspects of urban food distribution network	Elements		
	Goods	Large volume, small assortment of fresh products	Smaller volume, broad assortment of fresh products
	Vehicles	Mostly small and uncooled; many informal	Mostly cooled and formal
	Facilities	Dated, small and uncooled; owned by wholesaler	State of the art, large and cooled; owned by chain
	Infrastructure	Insufficient; gradually upgraded	Insufficient; gradually upgraded
	Subsystems		
	Transport	Delivered from wholesale market by intermediairies	Partially direct store deliveries from DC
	Accessibility	Severely limited	Limited
	Traffic	Heavily congested	Heavily congested
	Land use	Central locations only	Also decentral locations
	(Re)design and execution		
	Managing sytem	Supply-driven, limited coordination, limited ownership	Increasingly demand-driven, coordination and partial ownership by retail chains
	Information	Limited availability of information, personal mobile phones	Increased information availability, dedicated software
	Organizational	Many small producers, few wholesale markets, countless small outlets	Mainly large producers, few wholesale markets and private DCs, many large outlets

Table 3: Urban food distribution network Cairo.

Cairo		Distribution concept	
		Traditional	*Modern*
Aspects of urban food distribution network	Elements		
	Goods	Large volume, small assortment of fresh products	Smaller volume, broad assortment of fresh products
	Vehicles	Mostly small and uncooled	Partially cooled and formal
	Facilities	Dated, small and uncooled; owned by wholesaler	Modern and cooled
	Infrastructure	Insufficient; gradually upgraded	Insufficient; gradually upgraded
	Subsystems		
	Transport	Delivered from wholesale market by intermediairies	Limited direct store deliveries from DC
	Accessibility	Severely limited	Severely limited
	Traffic	Heavily congested	Heavily congested
	Land use	Central locations only	Also decentral locations
	(Re)design and execution		
	Managing sytem	Supply-driven, limited coordination, limited ownership	Slightly demand-driven, still limited coordination and ownership by retail chains
	Information	Limited availability of information, personal mobile phones	Somewhat increased information sharing, dedicated software
	Organizational	Many small producers, few wholesale hubs, countless small outlets	Number of large chains, private DC's and large outlets still limited

As stated earlier supermarkets and hypermarkets often have – or are in the process to organize – their own supply chains with modern facilities, formal vehicles and closed cold chains. By having better organized chains their share of food losses is lower than that in the traditional chains. Their customers and target groups have a higher awareness of food quality and safety and are able and willing to pay higher prices for better food. Traditional chains suffer from a number of

problems. Due to the high fragmentation of the retail landscape with a large number of small to very small stores, traditional chains have more chain links (e.g. middle men, traders, wholesalers) and a more complex distribution system which leads to longer transit times and more handling of the food. Combined with poor packaging, rough handling and transportation and no or insufficient cooling the share of food losses is significant. It is important to note though that these problems and the resulting food losses are not limited to the urban distribution but occur throughout the entire chain.

Secondly, we can conclude that both modern and traditional chains suffer from general problems in urban distribution that are not limited to fresh food distribution, mainly infrastructural and congestion problems. Improvements are necessary in these areas and fresh food chains will benefit from it as much as other sectors. Causes for congestion are insufficient capacity, poor and uncoordinated city planning, less than full truck loads, lack of space for (un)loading and (residential) parking, insufficient public passenger transportation, rising car ownership and others. All these issues are well known in Western cities as well, though in emerging countries they show a different dimension due to much larger city populations, missing structure and higher complexity in urban areas.

5   Recommendations

Based on the case findings and conclusions in chapter 4, recommendations are given regarding improvement initiatives for urban fresh food distribution systems in emerging metropolises aiming at the reduction of food losses. In the discussion around urban and distribution different stakeholders usually have different improvement goals. The Dutch Council for the Environment and Infrastructure, for example, identifies the following most common targets: (i) efficiency; (ii) reduction of congestion; (iii) sustainability (in particular reduction of emissions, reduction of noise and increase of road safety) and (iv) manageability (Council for the Environment and Infrastructure, 2013). It is not always clear which goal improvement initiatives are targeting and different targets can sometimes be incompatible or even conflicting. For example, reducing congestion by keeping traffic outside the urban center can lead to more kilometers per transport movement in total and thus to higher total emissions. Before implementing a measure it is therefore important to clearly define the targeted improvement. In our study we focus on recommendations targeting reduced food losses by improved urban fresh food distribution. The recommendations therefore do not take into account recommendations regarding air quality, costs, safety or other.

Recommendation 1: Support the transition from traditional to modern supply chains
As stated earlier traditional supply chains generally do not transform towards more modern forms but modern supply chains develop in parallel. Traditional supply chains face serious challenges leading to food losses and issues with regard to food safety. Measures to be taken to improve traditional chains and support them in developing towards more modern forms could for example be:
- Offer trainings on post-harvest technology and supply chain management;
- Set up shared modernized cooled facilities and transportation for small growers to enable cold chain management practices;
- Establish national or adopt existing international quality standards;
- Support small growers by setting up growers' unions for supporting the above.

Recommendation 2: Look at the complete picture
Urban distribution does not stand alone and therefore for realizing significant impact a holistic approach to the described challenges should be taken. In our case of targeting reduced food losses by improved urban fresh food distribution a holistic approach has two relevant dimensions: (i) urban fresh food distribution as one element of the entire fresh food value chain and (ii) urban fresh food distribution as a part of the whole urban distribution system of the respective metropolis.

Firstly, losses occur throughout the entire chain and the moment when losses occur is not necessarily identical to the moment when losses were caused. For example, starting quality and handling and transportation can have a significant impact on losses at later stages. In fighting

food losses measures should therefore take the entire value chain into account. Measures could for example be:

- Ensure a higher starting quality through better production methods or better starting material;
- Set up closed cold chains and monitor temperature throughout the chain;
- Improve packaging to better protect the products and ensure a longer shelf life;
- Reduce transit times and product handling;
- Improve transport and handling conditions for reduced mechanical damage.

Secondly, urban fresh food distribution is part of the entire urban distribution system. Urban fresh food distribution faces a number of challenges that are caused by general urban distribution problems as pointed out in chapter 4. An improvement of the entire urban distribution system will therefore also benefit to the urban fresh food distribution. In our context we focus on congestion problems as of all urban distribution challenges these, combined with effective cold chain management practices, are assessed to having the highest impact on food losses. Usually measures to reduce congestion target an increase in capacity and a reduction of the number of transport movements. Western countries face the same problems, although to a lower extent, and are also working on possible solutions. Possible measures and actions are:

- Measures targeting capacity and infrastructure (managed and organization system)
    - Improved and coordinated city planning combined with inner-city traffic management;
    - Construction of tunnels for transportation of goods to reduce lead times;
    - Improved public transportation with good coverage of the urban area, reliable service and high safety as to encourage people to use public instead of private transportation and thus reduce the amount of vehicles in the urban area;
    - Set up of loading and unloading zones for goods transportation, if possible at short distance from delivery points as to avoid (un)loading vehicles to block roads;
- Measures targeting the use of other modalities or co-use of existing infrastructure (managed system)
    - Transportation via inner-city waterways, in Amsterdam this service is for example offered by Mokum Maritiem and by Van Keulen, in Utrecht the *Bierboot* (beer boat) delivers in the city center;
    - Delivery with cargobikes;
    - Use of bus lanes for delivery vehicles as is done for example in Groningen;
    - Use of tramlines for delivery of goods as was done in Amsterdam with the *vrachttram* (freight tram), unfortunately this initiative failed due to high costs and missing investors;
- Measures targeting bundling of transportation volume (managing system)

- Bundling of goods, examples in the Netherlands are the initiatives of Binnenstadservice[4] and Maatwerkdistributie[5];
- Bundling of goods and people, examples are the Cargo Hitching[6] project in the Netherlands and the lunch box delivery system in Mumbai (*dabbawala*)[7].

Recommendation 3: Take local circumstances into account

Many knowledge transfer projects have taken place earlier and not few of them failed. When introducing measures in emerging countries local context factors have to be taken into account (see also chapter 2.3). Solutions that work in Western countries might not necessarily work in emerging markets and it is therefore important to know the local context and assess the impact of context factors on proposed actions.

Recommendation 4: Use an integrated network model approach

The Postharvest Network has developed an integrated network model approach for initiatives aiming at reducing food losses in developing countries based on the fact that solutions to food losses in those countries are almost always complex and of a long-term nature. The model (**Figure 5**) integrates hardware, software and orgware activities[8] as all need to be respected for implementing successful solutions. Furthermore, all various stakeholders are included in the model as the early integration of all relevant stakeholders will strengthen the solution and significantly reduce the risk of failure. A lack in local knowledge and real understanding of the drivers of the problem often lead to failure. It can also be useful to get into touch with organizations that are already active in the target market to learn from them. Experience shows that initiatives with strong local project leaders, ideally situated at the end of the chain, have significantly higher chances of being successful and followed through after the end of the project, especially with the project leader having a strong interest in chain improvements and being willing to pay for these. Besides local knowledge it is also crucial to build up trust and have good local partners and a strong network, which can help to form consortia for local initiatives. All this means that when aiming at local initiatives organizations have to be aware that a long-term vision and investment in local networks, trust and knowledge are necessary. The integrated network approach model proposes a three phase approach to take these aspects into account, namely: (1) demand articulation and forming of a consortium, (2) quick scan for establishing a business case and (3) business case implementation.

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[4] www.binnenstadservice.nl

[5] www.maatwerkdistributie.nl

[6] https://cargohitching.wordpress.com

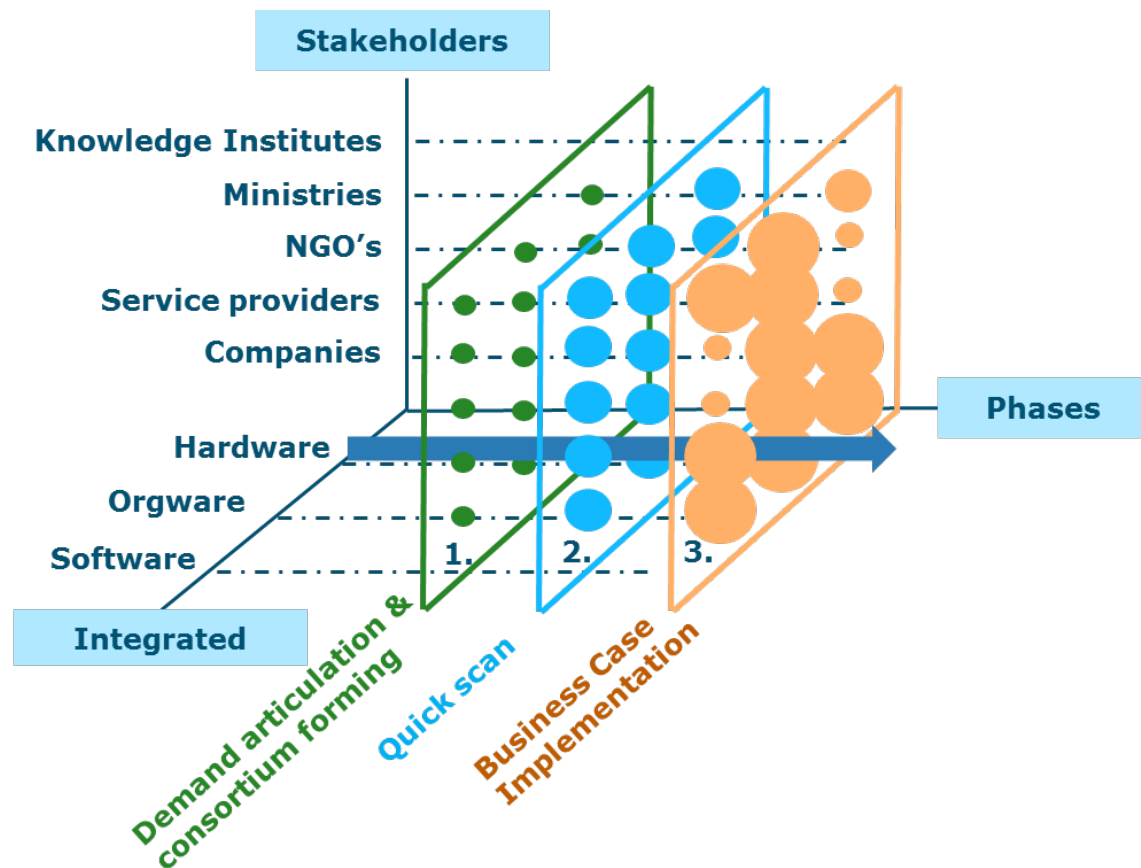[7] http://mumbaidabbawala.in/

[8] See appendix 2.

Figure 5: Integrated network model approach in 3 phases

Recommendation 5: Never forget the human factor
Human beings are hesitant to changing their behavior. The best actions can fail if they do not take behavioral aspects into account. This applies to consumers as well as to companies. Aspects to be taken into account could be:

- The perception of consumers regarding the product, for example consumers perceive fresh products at markets to be fresher and of higher quality than packed fresh products in supermarkets. As long as this perception does not change consumers will always tend to buy fresh products at markets.
- Companies also need incentives to change their behavior, typically these are reduction of costs, gaining of market share, CSR aspects or it can be a forced change due to policy or regulations.

6   Conclusion and further research

This study looked at the current situation of urban fresh food distribution in emerging metropolises and formulated generic recommendations for improvement actions targeting a reduction of food losses.

It is clear that much more detailed analysis of the urban food distribution network can be done to identify more concrete actions in line with the framework developed in chapter 2. Relevant questions could be for example:

- What kind of transportation system can reduce food losses and increase cold chain management practices?
- What changes in the road infrastructure are crucial?
- How many consolidation centers are needed to establish high-frequent deliveries to market outlets?

In setting this study into a broader context it could be valuable to look at further examples of emerging metropolises to validate the conclusions of this study being based on the cases of Mexico City and Cairo. Further refinement of the KPIs defined in chapter 2.4 could be used for benchmarking different emerging and future metropolises at different points in their development. In that case it might be worthwhile to analyze practices and performances of concrete supply chains and compare the design of these chains in different cities.

A different aspect that could be included in further research are current trends in food and distribution, such as the strongly rising online food market and urban farming. Also, we see a growing demand for flexibility as to what food is available when and where. The urban food distribution system will have to offer possibilities to satisfy this demand. These trends might change consumption patterns dramatically, confront our current distribution systems with entirely different challenges and ask for new concepts and solutions.

References

Achterbosch, T.J., Dorp, M. van, Driel, W.F. van, Groot, J.J., Lee, J. van der, Verhagen, A., Bezlepkina, I., 2014. The food puzzle: pathways to securing food for all.

Agriculture and agri-food Canada, 2010. Mexico: the foodservice industry.

Agriculture and agri-food Canada, 2014. Agriculture, food and beverage profile – Mexico.

Antún, J.P. & Lozano, A., 2009. Efectos ambientales del Transporte de Carga en la Zona Metropolitana del Valle de México.

Argenti, O., 2000. Food for the cities: food supply and distribution policies to reduce urban food insecurity, "Food into cities" Collection, DT/43-00E, FAO.

Atkinson, S.J., 1995. Approaches and actors in urban food security in developing countries, Habitat International, Vol. 19, Issue 2, pp. 151-163.

Biles, J.J., 2008. Wal-Mart and the "Supermarket revolution" in Mexico.

Binsbergen, A. van & Visser, J., 2011. Innovation Steps Towards Efficient Goods Distribution Systems for Urban Areas, TRAIL Thesis Series nr. T2001/5, The Netherlands TRAIL Research School.

Blanco, E.E. & Fransoo, J.C., 2013. Reaching 50 million nanostores: retail distribution in emerging megacities.

Buck Consulting International, 2015. Bijdrage efficiënte logistiek aan voedselzekerheid, in: Ministerie van Economische Zaken, DG Agro: Van voedselverliezen naar business kans. Workshop for agricultural counsellors, 10 February 2015.

Brookings, 2013. The 10 traits of globally fluent metro areas – Mexico City.

Cadilhon, J.-J. et al., 2006. Traditional vs. modern food systems? Insights from vegetable supply chains to Ho Chi Minh City (Vietnam), Development Policy Review, 24.1, pp. 31-49.

CAPMAS, 2011. Household Income, Expenditure and Consumption Survey.

Council for the Environment and Infrastructure, 2013. Dutch Logistics 2014. Designed to last.

Daily News Egypt, 2014. Government seizes Seoudi supermarkets, among other Muslim Brotherhood assets.

Dihel, N. & El Shinnawy, A., 2006. Assessment of trade in distribution services in Egypt in relation to the GATS.

Dijksma, S.A.M., 2013. Policy document "Toekomst Agrologistiek".

Dijksma, S.A.M., 2013a. Policy document "Duurzame Voedselproductie", Kamerstuk 31 512, nr. 118.

Ecorys, 2008. Challenges for urban freight in Mexico City.

Ecorys-NEI, 2005. Egyptian processed food sector review.

El-Amir, A. & Burt, S., 2007. Sainsbury's in Egypt: the strange case of Dr Jekyll and Mr Hyde?

El Araby, K., 2013. Urban transport issues in Egypt.

El-Habbab, M.S., 2004. Export and marketing of horticultural products in Egypt.

FAO, 2011. Global food losses and food waste – Extent, causes and prevention.

Gasca, J. & Torres, F., 2013. Corporate control of food distribution in Mexico.

Hubbard, M. & Onumah, G., 2001. Improving urban food supply and distribution in developing countries: the role of city authorities, Habitat International, Vol. 25, Issue 3, pp. 431-446.

IFPRI (2008): High Food Prices: The What, Who, and How of Proposed Policy Actions, Policy Brief, May 2008.

INEGI, 2013. Gasto en alimentos por producto según lugar de compra.

ITDA, 2013. Sector background.

Jarosz, L., 2008. The city in the country: Growing alternative food networks in Metropolitan areas, Journal of Rural Studies, 24.3, pp. 231-244.

Leathers, H., & Foster, P., 2009. The world food problem: toward ending undernutrition in the third world.

Lida, D., 2008. First stop in the new world: Mexico City, the capital of the 21st century.

Lindholm, M. & Behrends, S., 2012. Challenges in urban freight transport planning – a review in the Baltic Sea Region. Journal of Transport Geography, 22, pp. 129-136.

Lozano, A., 2006. Estudio integral metropolitano de transporte de carga y medio ambiente para el Valle de México.

Mallik S., Mandal P.K., Chatterjee C., Ghosh P., Manna N., Chakrabarty D., Bagchi S.N., Dasgupta S., 2011. Assessing cold chain status in a metro city of India: an intervention study, Afr Health Sci., Mar 11(1), pp. 128-33.

Mexico News Daily, 2014. As Oxxo grows, abarrotes decline.

Mgonja, J.T., Luning, P., Van der Vorst, J.G.A.J., 2013. "Diagnostics model for assessing traceability system performance in fish processing plants", Journal of Food engineering, 118, pp. 188-197.

Ohio Department of Agriculture, 2008. The Mexican food market.

Orihuela, G., 2001. El comercio informal: entre negocio y cultura.

Padgett, H., 2004. Invaden tianguis las calles.

Pena, S., 1999. Informal markets: street vendors in Mexico City. Habitat international, Vol. 23, Issue 3, pp. 363 – 372.

Ploumen, L., 2013. Policy document "Wat de wereld verdient: Een nieuwe agenda voor hulp, handel en investeringen", kamerstuk 33625, nr. 1.

Ramos, A. & Rivera, R., 2012. Director de Central de Abasto niege presencia criminal.

Ramzy, O., Ogden, J. R. & Ogden, D. T., 2011. The Egyptian retailing industry.

Rohac, D., 2013. Solving Egypt's subsidy problem.

Santiago, K., 2008. Enfrentan mercados públicos el abandono.

Seafood Today, 2008. The La Nueva Viga market, on its way of avant-garde tradition.

TURBLOG, 2011. Transferability of urban logistics concepts and practices from a world wide perspective, Deliverable 3.4 - Urban logistics practices –Public policies for urban logistics in the Mexico City Metropolitan Area.

Twilley, N., 2010. The axis of food.

UK Trade & Investment, 2014. Mexico: a destination for growth.

UN, Department of Economic and Social Affairs, Population Division, 2014, World Urbanization Prospects: The 2014 Revision, Highlights (ST/ESA/SER.A/352).

USA Today, 2009. Mexico's huge wholesale markets play smaller roles.

USDA, 2002. Mexico's changing marketing system for fresh produce: emerging markets, practices, trends, and issues.

USDA, 2010a. Egypt retail food sector.

USDA, 2010b. Mexico retail sector report 2010 – updated.

USDA, 2013. Mexico food service – Hotel restaurant institutional.

Valdes, M., 2011. Megastores endanger Mexico City's open air markets.

Van der Vorst, J. & Snels, J., 2014. Multi-donor Trust Fund for Sustainable logistics (MDTF-SL), Position Note on Agro-Logistics, World Bank Group.

Appendix 1 – Postharvest Network

The Postharvest Network is an initiative of the Dutch Ministries of Economic Affairs and Foreign Affairs creating a community of companies, knowledge institutes, NGO's and government organizations with expertise and experience in postharvest supply chain management. The aim is to reduce postharvest food losses and enhance food security in developing and emerging countries by stimulating Dutch stakeholders in co-operation with local experts to provide their experience and expertise on a basis of mutual benefit. In its performance as intermediary role and matchmaker between members and clients the network makes knowledge available to chain actors in emerging and developing countries, thereby contributing to the reduction of high losses in fresh supply chains in these countries. The concept of this network is developed by Wageningen UR and the Dutch Ministries of Economic Affairs and Foreign Affairs. Besides the involvement of knowledge institutes, not-for-profit organizations, intermediary organizations and public agencies also the private sector has a role to play in the process of developing and implementing practical and appropriate solutions for tackling the complexity of postharvest losses.

In developing and implementing solutions the network makes use of the hardware – software – orgware concept (Van Gogh et al., 2013) for capacity building in the postharvest chain. This approach aims at bringing the right volume with the right quality at the right moment to the right consumer with the least possible losses in the chain and integrates physical activities (hardware), information activities (software) and organizational activities (orgware) (**Figure 6**). For successful solutions all three categories need to be taken into consideration in the activities.
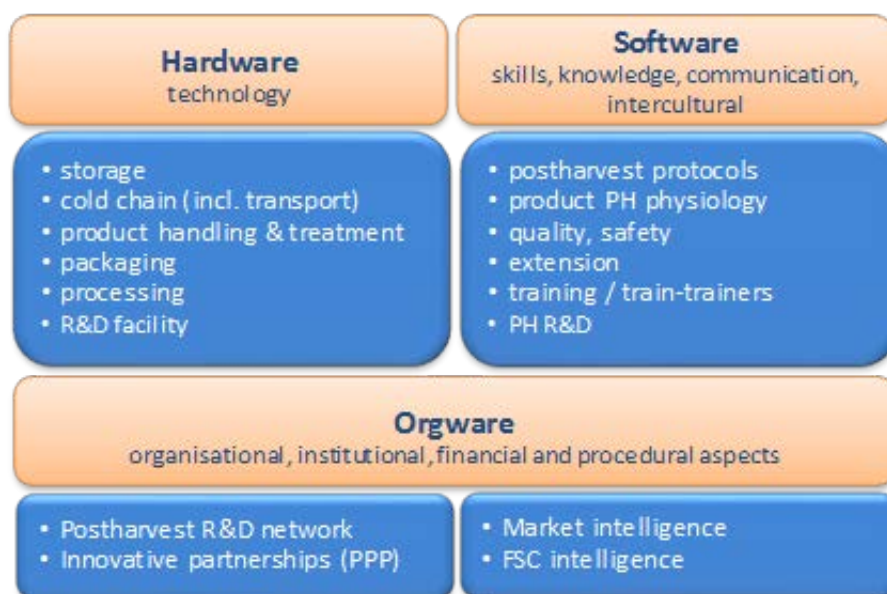

Figure 6: Interdependency hardware-software-orgware regarding capacity building in the postharvest chain (van Gogh et al., 2013).

The network organisation contains, amongst others, a service desk from where the different network tasks are coordinated and network activities are implemented. Since the end of 2014 the functions and staffing of this service desk are operational. Business stakeholders are closely involved in the development of this organisational layout of the network. In the preceding phases a number of parties have been identified and involved in the process of exploring and developing the network's expertise platform and its strategy. The further development of the Postharvest Network is coordinated by Wageningen UR, in this represented by Food & Biobased Research (FBR). In this coordinating role FBR closely cooperates with other stakeholders from respectively the knowledge network and the business network.

Appendix 2 – Interview partners

The following persons were interviewed in the context of this project:

Adam, Amir, Gafman Food, personal interview, 25 September 2014.

Ashraf, Mohammed, Pico Agriculture, email interview, 04 December 2014.

Bahaa, Mohammed, Agrovate, personal interview, 24 September 2014.

Berk, Tom, Deli XL, personal interview, 28 November 2014.

Broek, Willie van den, Topsector AgriFood International, personal interview, 27 November 2014.

Fransoo, Jan, Eindhoven University of Technology, email interview, 27 November 2014.

Konijn, Rupert, Topsector Horticulture & Starting Materials International, telephone interview, 28 November 2014.

Tawfik, Tareq, Cairo Poultry, personal interview, 23 September 2014.

Appendix 3 – Questionnaire

<u>Part 1   General: Innovations and improvements in urban distribution of fresh products in emerging countries</u>

To experts

Current situation:

1. What are the main issues in the urban distribution of fresh products in emerging countries?

2. Which of the following performance factors are negatively impacted by these issues?
    a. Logistics cost
    b. Responsiveness to orders
    c. Quality
    d. Sustainability

3. Which of the following dimensions of food security are impacted? Please also specify how these dimensions are impacted.
    a. Access
    b. Availability
    c. Food quality
    d. Stability

Innovations and improvement:

4. In which area do you think that innovations and improvements are most likely to be made to improve urban food distribution in emerging countries? (choose the most important/feasible 3 areas from the list below)
    a. ICT
    b. Management
    c. People
    d. Infrastructure
    e. Vehicle
    f. Commodity (goods)

5. What particular innovation and improvement initiatives are most likely to succeed and why?

6. What are the key factors to successful implementation of new initiatives?

7. What are the biggest obstacles in making the indicated improvements?

8. Do success factors and obstacles differ between different urban environments?

   If yes, please specify _____

9. What support is necessary to facilitate the process of innovation and improvement?

To companies

Current situation:

1. What are the main issues in the urban distribution of fresh products in emerging countries?

2. Which of the following performance factors are negatively impacted by these issues?
   a. Logistics cost
   b. Responsiveness to orders
   c. Quality
   d. Sustainability

3. Which of the following dimensions of food security are impacted? Please also specify how these dimensions are impacted.
   a. Access
   b. Availability
   c. Food quality
   d. Stability

Innovations and improvement:

4. In which area do you think that innovations and improvements are most likely to be made to improve urban food distribution in emerging countries? (choose the most important/feasible 3 areas from the list below)
   a. ICT
   b. Management
   c. People
   d. Infrastructure
   e. Vehicle
   f. Commodity (goods)

5. Do you think YOU can contribute to the chosen area(s)?

   If no, indicate reason_____

   If yes, what precisely can you do? _____

6. Are you already working on this?

   If no, indicate reasons and/or obstacles_____

   If yes, detail further _____

7. Are there any particular partners/other parties from whom support is needed in order to make what you can do or are doing successful?

   If yes, indicate which ones_____

8. Is there any other kind of support that you need to be successful?

9. What are the key factors to successful implementation of what you can do or are doing?

10. What are the biggest obstacles in making the indicated improvements?

11. Do success factors and obstacles differ between different urban environments?

    If yes, please specify _____

12. Is your expertise transferable to other countries (emerging markets in particular)?

    If no, indicate reason _____

    If yes, which countries in particular? _____

Part 2   Case studies: Urban food distribution in Mexico City and Cairo

Current situation:
1. What are the most particular aspects of fresh food distribution in Mexico City / Cairo that differentiate this city from other cities in the world?

2. What are the main challenges in the urban distribution of fresh products in Mexico City/ Cairo?
   a. Which stakeholders are involved?
   b. Which specific problems occur?
   c. Are any new / changed challenges expected in the future? (If yes, please specify.)

3. Which of the following performance factors are negatively impacted by these issues?
   a. Logistics cost
   b. Responsiveness to orders
   c. Quality
   d. Sustainability

4. Which of the following dimensions of food security are impacted? Please also specify how these dimensions are impacted.
   a. Access
   b. Availability
   c. Food quality
   d. Stability

Improvements and innovations:
5. In which area do you think that innovations and improvements are most necessary to improve the distribution of fresh products in Mexico City/ Cairo? (choose the most important/feasible 3 areas from the list below)
   a. ICT
   b. Management
   c. People
   d. Infrastructure
   e. Vehicle
   f. Commodity (goods)

6. Are there ongoing initiatives to improve the situation of urban food distribution?

   If yes
   a. detail further what kind of initiatives and who are the participating parties
      _____

   b. what support is necessary to increases the chances of success of these initiatives
      _____

   If no, what support would be necessary to start initiatives_____?

7. Which specific expertise, technology etc. would be required to innovate / improve food distribution in Mexico City / Cairo?

8. What specific contextual factors have to be taken into account in Mexico City/ Cairo that will impact the success or failure or respective initiatives?

9. Which specific bottlenecks or obstacles are expected when tackling the current challenges related to urban food distribution in Mexico City/ Cairo?

10. Dutch expertise

    a. Are Dutch companies currently involved in food distribution in Mexico City / Cairo?

        If yes, specify further _____

    b. How could Dutch companies (further) contribute to food distribution in Mexico City / Cairo?