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FOOD AS AN INFRASTRUCTURE IN URBANIZING REGIONS

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Keywords: urban food systems, urban agriculture, food infrastructure, urban rural spheres, urban metabolism, spatialization

Abstract: This paper focuses on urban food systems, examining spatial structures and potentials of food in the city as part of the urban metabolism as well as part of an urban infrastructure. The article assesses linkages and interactions between urban food system components in order to foster integrated, multi-dimensional food planning approaches for a better management of urbanizing regions.
The first part of the paper poses the following questions: How to describe an urban (contextualised) food system? What are its components and what role does urban agriculture play? These issues require a theoretical and methodological discussion. At the same time there is a need to generate contextualised and site specific knowledge on the spatial dimension of urban food systems, as well on systemic relations between the identified components. Taking the spatial dimension – as a significant part of planning – into consideration, geographies of urban food systems will be identified, described and analysed.
Beside the above mentioned theoretical approach, this paper expands in a second part on concrete cases of urbanizing regions in the context of two research projects. Selected findings and results of the inter- and transdisciplinary research project "Urban Agriculture Casablanca" (2005-2014) led to a definition of urban agriculture and the knowledge generation on urban agriculture´s (UA) contribution to the urban food system of the urbanizing region Greater Casablanca. The paper further examines the components of urban food systems using the example of Kigali (Rwanda) and Da Nang (Vietnam), which are case cities of the trans-sectoral research project "Rapid Planning" (2012-2019).
In conclusion, the paper offers a contribution to a more holistic understanding of urban food systems as well as related theoretical and methodological approaches by linking relevant contemporary debates on urban food systems and infrastructures.

1. Introduction

Urban growth centres face particular challenges in urban infrastructure development, both with regard to creating new and adjusting existing infrastructures to changed conditions. In contrast, urban growth centres with their high concentration of people, knowledge, resources, political power and built environment allow for identifying beneficial interfaces and creating synergies between the spatial distribution of resources (water, waste, energy and food), their flows and actors. A systemic approach is required to target the complex issues of urban growth centres towards developing new and interactive infrastructures that respond to the needs of a changing urban system.

Food and the city is an increasing issue especially in urbanizing regions. Not only a rising number of research activities, but also several international initiatives and policies are dealing with the topic of urban growth with regard to food planning. A very first step is to understand and describe urban food systems (UFS) in an integrated, trans-sectoral way in order to overcome traditional sectoral

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approaches. Applying a systemic view and considering the region as a demarcated area supports this step. Regional food production and access to food are dimensions to be as well analysed as part of the UFS. This is a challenging task due to the need to develop a general method to investigate the different components of an urban regional food system in their multiple dimensions (economic, social, cultural, ecological and/or spatial) without neglecting the context specific variations. This paper offers a methodological approach for understanding, describing and modelling an urban food system through the use of spatialization. The description of the UFS in its spatial manifestation offers a new perspective to methodologically assess urban food systems in relation to spatial development and urban growth.

The spatial conceptualisation of the UFS and its components (from production to reuse) serves to understand and assess processes, actors, scales and flows within UFS. The systemic view of food serves as a lens to analyse food as part of the urban metabolism with flows between components and interfaces with other relevant thematic fields of urban planning in growth centres. The spatialization of the UFS enables to:

- structure and localize resource flows within an urban system and make linkages and interfaces visible,
- address and localize actors and stakeholders' roles within the food system,
- identify and generate possible synergies and interlinkages between related sectors,
- address the administrative and governance needs of territorial urban planning and discuss the question of appropriate scale for food system components in the context of urban growth centres.

2. An approach to describe the urban food system

Urban Agriculture (UA) as part of the Urban Food System (UFS)

Within our research, urban agriculture served as a starting point towards understanding and analyzing the urban food system. The 9-year inter- and transdisciplinary research project “Urban Agriculture as an Integrated Factor of Climate-Optimized Urban Development, Casablanca/Morocco (UAC)” (2005-2014, funded by the Federal Ministry of Education and Research) focused on conceptualizing and operationalizing urban agriculture as part of the UFS. Urban Agriculture is defined as comprising primary or secondary agriculture. In this definition primary agriculture refers to land uses that are primarily focusing on the activity of agriculture whereas secondary agriculture comprises all land uses that integrate agricultural activities as an add-on to their primary land use including vertical farming, roof-top gardens on residential or commercial buildings or window sill and house gardens (Giseke et al., 2015, pp.34). The urban region of Greater Casablanca was used as reference location to investigate and test linkages between agriculture and the urban sphere in form of pilot projects. These linkages served as lenses to understand the spatial manifestation of urban agriculture as part of the UFS.

Four pilot projects focused on different synergies between agriculture and urban processes with regard to industry, informal settlements, tourism and health. For instance, the pilot project “Urban Agriculture and healthy food production” used the location of an educational farm at the western periphery of Casablanca to establish a linkage to the core city through a delivery system of food baskets to urban dwellers. These food baskets were supplied by a cooperative of 14 farmers working in close vicinity of the educational farm, using it as a platform for networking and training in agro-ecological farming. The multi-facetted processes of urban-rural linkages within the demarcated areas

of the pilot projects presented a first step towards understanding and investigating the systemic and spatial relations between the components of the food system within the urban system.

The spatialized Urban Food System

Using the interaction of rural and urban spheres as a starting point, the UAC approach to the urban food system is based on the understanding of food systems in their complexity of interrelated process components and social, political, economic and natural context (Giseke et al 2015, Nourishlife.org 2012). The UAC project used a revised systemic approach that was broadened to the food system components and spatialized within the context of Casablanca. In the UAC action-research approach, spatialization was an inherent part of the pilot projects, serving to generate knowledge about the implications of urban agriculture to the "life-world" (Giseke et al., 2015, p.40-49). The analysis of the pilot projects, being part of the urban food system, enabled a greater embedding of the knowledge generated. Six food system components, partly including the spatial manifestation (production; processing; distribution; access/acquisition; consumption / food culture; input-/output processes and resource flows) (Giseke et al. 2015, pp. 396-407) were identified. These component followed the process chain from the production place at the educational farm, the packing in food baskets by the cooperative farmers, the distribution through the delivery system from the farm to the selling point in the core city, serving as an access point for consumption in the households. In addition the educational farm offers composting facilities.

Food in the city as part of the urban metabolism

With regards to rapid urban growth and spatial fragmentation, the UAC project was based on a systemic approach towards the integration of urban agriculture as an integrated factor of urban development. This was reflected in the research design and methodologies of the transdisciplinary UAC project, which viewed urban agriculture as a transversal topic dealing with governance, agriculture, climate change and urban development and focused on interfaces between sectors and (im-)material flows of people, information/knowledge, goods and money within the urban system. The approach towards the city as an urban metabolism was, among others, translated into the developing of sub concepts. These concepts form a bridge for transformation through operationalizing urban agriculture (action plan) and analyzing it as part of the urban metabolism with interfaces to other sectors, spheres, structural levels and scales. The project developed five sub concepts addressing relations between:

- UA and regional food production (1), targeting UAs contribution to the city´s food supply,
- UA and beautiful, productive and recreational spaces (2), targeting the development of a city-regional green and open space system
- UA and resource-efficient urban rural cycles (3), targeting water as key resource for UA within the urban system in order to establish resource-efficient cycles,
- UA and climate regulative services (4),targeting the role of UA in light of climate variations and climate change,
- UA and rurban living spaces (5),targeting the integration of the inhabitants, their practices and relations to UA on the interface between the urban and the rural sphere (Kasper et al., 2015, pp.330-345)

BOX. THE RAPID PLANNING PROJECT

While the findings and results of the UAC project have been published in a project publication written in a transdisciplinary process (Giseke et al., 2015), the systemic approach towards food in urbanizing regions is currently being further developed by TU Berlin – Chair of Landscape Architecture . Open Space Planning within the research project "Rapid Planning - Sustainable infrastructure, environmental and resource management for highly dynamic metropolises" (2014-2019).

"The Rapid Planning (RP) Project is an action oriented research project that has been developed under the umbrella of the Future Megacities Research Program of the German Federal Ministry for Education and Research (BMBF)" (Rapid Planning Consortium, 2015, p.6).This research project follows a transsectoral approach integrating energy, water, waste and urban agriculture/food into a nexus and investigates synergies between these sectors in a metabolistic understanding of the urban system. "The objective of the Rapid Planning project is to develop and test a rapid trans-sectoral urban infrastructure planning methodology, with the focus on supply and disposal infrastructure. […] This has to be developed for specific contexts and urban patterns" (Rapid Planning Consortium, 2015, p. 10). The approaches, methods and solutions towards trans-sectoral urban planning are being tested in the three case cities Da Nang/Vietnam, Kigali/Rwanda, Assiut/Egypt, Frankfurt/Germany is used as a reference city.

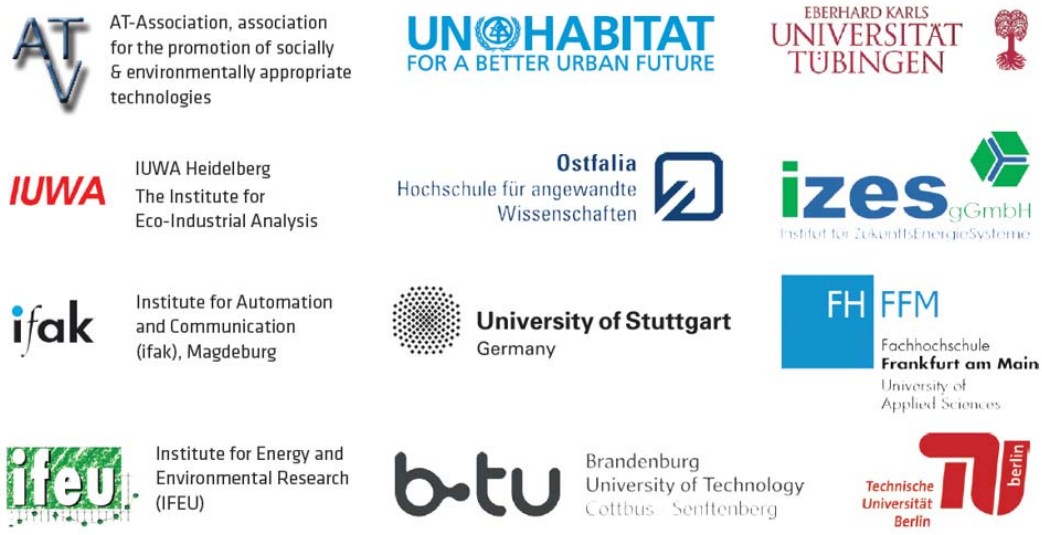

Figure 1.The Rapid Planning Consortium.

The research work is based on practical experiences in the case cities and in cooperation with 12 German research institutions, local stakeholders in city administration, regional governments, universities and other partners in the three cities as well as UN-Habitat as a partner from a trans-national organization.

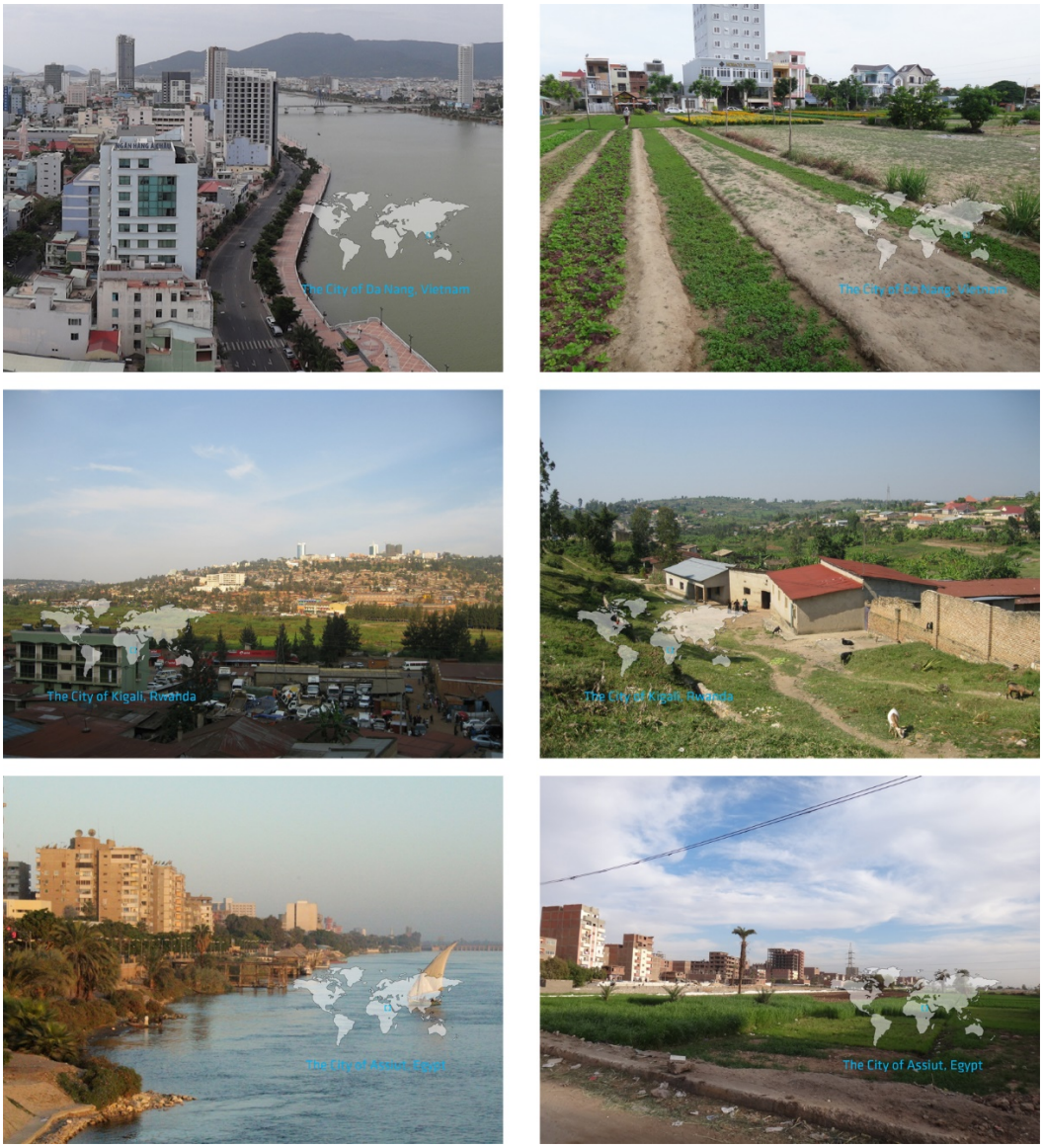

Figure 2. The Rapid Planning case cities: Da Nang / Vietnam, Kigali / Rwanda and Assiut / Egypt.

2.1 The components of the urban food system and their spatialisation

As mentioned above, this paper introduces a systemic approach for the description of an UFS within a demarcated area (Giseke et al., 2015), a hypothetical urban growth centre, based on the findings and experience of the two above described inter- and transdisciplinary research projects. There are various approaches to UFS from different perspectives, such as an agro-economic or nutritional perspective, which will not be the focus here. We refer to a systemic reflection, focussing on the localization and spatialisation of existing components (Stierrand, 2008, Pinstrup-Anderson, 2012) developed within the UAC Project (cf. Giseke et al., 2015, pp. 396-407).

The systemic approach indicates the cross-scale consideration of links, exchange processes and urban metabolic flows within the urban food system with reference to its components. Given to the

multidimensionality of the UFS a variety of (im-)material urban-rural linkages and interactions should be taken into consideration, such as "ecological interactions (energy, water, waste, other resources, pollution), social interactions (people, information, innovation, practices, ideas)and economic interactions (material, commodities capital, production, goods) (Kasper et al., 2015, p. 191)". The integrative UAC approach is adapted within the context of the RP project applying a stronger focus on interactions and flows between different infrastructure sectors. With regard to the examination of the four sectors (see bottom) we distinguish five spatialized components of the UFS, namely production, processing, distribution, access/consumption and reuse (see chapter 2.2). As another key component resource flows are investigated that span across scales and integrate multifaceted structures of practices, techniques, values, norms and systems (Giseke et al., 2015, p. 397).
Assuming the urban food system is a spatialized system with related food geographies (Pothukuchi and Kaufman, 1999, Wiskerke and Viljoen, 2012), requires first the definition of a demarcated area and the system boundaries. Consequently, some urban food system components as well as sub-components of the urban system are situated outside the system boundaries (like large scale mono-culture production sites). Starting from the understanding of urban food systems as a food supply system (cf. Stierrand, 2008) or as part of the supply and disposal infrastructure food is further conceptualised as an interactive infrastructure.

The following section briefly presents the five spatialized UFS components. Apart from labour, food production requires active input of different resources, leading to their transformation into agricultural products. Production mainly takes place in the areas previously described or perceived as rural, but can also take place within the system boundaries of the UFS. Here, urban agricultural activities have a particular role as part of food production that takes place in close interaction with the urban system. A farmer who produces food within an urban region for export is an urban farmer that practices urban agriculture with a low degree of interaction. In contrast, both the local commercialization of his products and the integration of his production within urban resource flows like water and waste reuse can increase the degree of interaction with the urban system. The production of food through urban agriculture enables other input possibilities where inputs are partially outputs from other urban processes (e.g. use of reused urban waste water for urban agriculture, cf. nourishlife 2012).

Processing describes the transformation process of agricultural products, comprising methods of preservation, industrial food processing and food preparation (cf. Moubarac et al., 2014). Food processing is neither bound to the place of production nor to the place of consumption. Taking the system boundaries into consideration, places of processing are highly dependent on the mode of agricultural production and products. With regard to health related food planning aspects, we differentiate between food industry for highly processed food and locally refined products coming from urban agricultural activities within city-regional economies.

Distribution describes the process of transport of raw and processed food products and organic waste between the places of food production, processing, sale, consumption, disposal and reuse respectively. It describes not only the process of transport and arrival of agricultural products to the access points for consumption; it also marks the connection between industry, farmers and consumers on household level and commercial consumption in restaurants or canteens. Therefore, distribution can be viewed both as flow and as spatial manifestations. In a spatial manner, the component distribution can use a service of other spatial infrastructures (e.g. the transport roads) or has own specific spatial typologies (e.g. distribution hubs).

Food access and acquisition spans from small scale typologies such as mobile street vendors to large scale typologies such as megastores. It comprises public, commercial and private acquisition places.

Consumption includes the preparation of food, food culture aspects and the transformation into organic waste. Notably the food access component of the UFS is highly visible in the urban system and many different forms/typologies exist. Consumption itself is mainly taking place on household level and bound to the same actors. Therefore – from the spatialized viewpoint – access and consumption are part of only one component of the UFS.

Organic waste, including food waste is either disposed or reused by transforming it into a resource for further use in agricultural production. Spatially, this component can take place on different levels, ranging from collecting systems on household level up to large dumping sites.

2.2 Understanding food as an infrastructure

The Rapid Planning project focuses on the question how to provide urban systems with adequate infrastructure services. The project “seeks to develop a rapid trans-sectoral urban planning methodology, specifically targeting supply and disposal infrastructure. The service sectors covered by the project include energy, water, […] waste and urban agriculture/food” (Rapid Planning Consortium 2015, p.6). The project gives the possibility to think and treat food as an equal and "new" infrastructure.

Urban Agriculture as an urban infrastructure
First integrated approaches dealing with these aspects were developed within the UAC research project, which conceptualizes urban agriculture as a productive green infrastructure within the urban region of Greater Casablanca. Nine spatial categories of urban-rural morphologies were identified within the region with respect to scale and actor appropriate urban agriculture (Giseke et.al, 2015, pp. 316-329). Furthermore, these concepts were operationalized through the common development of an action plan for the implementation of urban agriculture in the Greater Casablanca region, locating existing and planned activities beneficial to support the integration of urban and rural spheres (Giseke et al., 2015). The conceptualization of urban agriculture as a productive green infrastructure encompasses the different practices attributed to the urban food system components from food production to reuse of food waste. It is understood as a first step towards assessing the systemic inter-connections of urban food system processes as part of the urban metabolism using urban agriculture as a lens.

Food as an urban infrastructure
The RP project attempts to qualitatively and quantitatively assess, structure and localize resource flows within the four mentioned infrastructure systems. In this approach the components of the urban food system are considered as an infrastructure with spatial manifestations of flows and knots in the form of material infrastructure, people (as actors), practices and process components. This approach is used to develop a framework to identify and investigate flows between urban food system components. The generated knowledge serves for a comprehensive view and understanding of the urban food system, its interfaces and the set screws that have the potential to transform the UFS. Through defining aggregated typologies of the UFS components, the Rapid Planning Project aims to pinpoint the spatial manifestation of these components from production to reuse. The typologies refer to extension and spatial context, scale, actors and economic level. This framework

will be tested and used to qualitatively and quantitatively assess the UFS as an infrastructure in the three case cities and to identify, localize and address the roles actors and stakeholders play. In a broader framework it also responds to administrative and governance needs of territorial urban planning that use spatialized approaches.

Traditional definitions on infrastructure

Traditionally, infrastructure is defined as the foundation of an economy, a prerequisite for the production, distribution and use of goods and services. In other words, infrastructure encompasses the entirety of physical, institutional and human facilities and institutions an economy relies on (Jochimsen, 1966). From a classical point of view, physical infrastructures include transport facilities, equipment of power generation and distribution, water supply, disposal (supply and disposal; waste water treatment plants) and news transmission - as well as the facilities of education, culture, health and leisure, including public space such as parks and playgrounds (Jochimsen, 1966, Libbe et al., 2010). Characteristic features are the indivisibility of its facilities, its durability and being some kind of network (Frey 2005). According to the German Institute of Urban Affairs, infrastructure can be distinguished in network-Infrastructure such as all sorts of pipes and mains for gas, water, electricity and transport infrastructure in terms of roads, canals and railways - or point-infrastructure, technical elements as electrical substations, wastewater treatments plants, or airports and train stations or social institutions such as schools, hospitals, public space etc. (Libbe et al. 2010). Until the 1980s, it was mainly the government's duty to build and maintain infrastructure. Since then, notably the maintenance part has slowly shifted to the private sector, while the government ensures a fair access to infrastructure services for the public (Frey, 2005).

Discourses about broadening the definition

Due to globalization, process-decoupling and bottom-up approaches as well as dealing with generally decreasing resources, the definition of infrastructure has become more flexible. Particularly in professional circles of urban theories and landscape theories the comprehension of infrastructures has changed. Along with a new understanding of nature, infrastructures are addressed with a systemic approach of connecting relations between nature, infrastructure and urban space, which leads to multidimensional and transformative landscapes (Wieck, 2015). "Extending the view of interaction and exchange processes as cooperation with the natural sphere means assigning agency to nature as well as accepting its hybridization through technical infrastructure and social entities" (Giseke et al., 2015, p. 308).

Rapid urbanization appears to necessitate a broadening of the idea of infrastructure. Perrotti (2015) argues, that basic urban services have to be re-bundled and re-designed as living landscapes, which adjust to transforming, urbanizing cities. Interestingly, she considers food cultivation along water resources, waste cycling, and energy generation as one of the major urban services. "These viewpoints focus on synergies and geographical, economic, and ecological interconnections between green, gray, and blue networks within metropolitan regions. Indeed, these synergies seem to better support fluid, dynamic patterns of urban growth (i.e., the flow of water, waste, energy, and food, which mostly transcend geopolitical borders) instead of reproducing or consolidating the vertical, centralized, and inflexible structure of modern `industrial´ cities." (Perrotti, 2015, p.72)

To put it simply, the broadening comprehension of infrastructure takes place on two levels. The so far immanent feature of being a structure made and managed by the government - or influential companies - is fading, while cooperation with urban-social actors appear who maintain decentralized solar panels, constructed wetlands, backyard compost facilities and roof top gardens. Instead of

linear networks or points, grids or mini grids are frequently mentioned. On the other hand, infrastructures are no longer solely physical, spatial elements, but also exist as flows or processes. Multifunctional land use structures are upcoming elements in today’s cities that serve as infrastructures. Planners, sociologists and scientists have recently come up with a whole variety of new concepts and scopes for different infrastructure structures. There are soft infrastructures concerning civic activities (BIG et al., 2014), smart infrastructures that are interconnected and technology/software-orientated (Bunschoten and Pahl-Weber, 2013), green infrastructures that highlight capabilities, potentials and services of any kind of natural systems (Benedict and McMahon, 2006; Karhu, 2010; Lennon, 2014), blue and green infrastructure taking natural water cycles into account (Blue-Green Cities Research Project, 2015) as well as productive green infrastructure highlighting urban agriculture as part of the supply system (Giseke et al., 2015) in an interactive way.

3. From theory to practice and back

One important goal within the Rapid Planning research project is the design of a methodology towards the development and optimisation of resilient infrastructure systems for growing city regions, taking the site specific conditions into consideration. The innovation is not only to pay attention to the “traditional” infrastructure sectors, but also introducing food as an infrastructure. Here, it is the challenge to identify the site specific food system and to describe the four infrastructures in a comparable methodological way by using a systemic approach. The four infrastructures are captured as equally important infrastructures including different actors, physical facilities and metabolic flows. As an interim result, it can be stated that the four examined infrastructure sectors can be qualitatively and quantitatively assessed and surveyed in a comparable structure that includes the process components production/generation, distribution, access/consumption, and disposal/reuse. Trans-sectoral interfaces are identified at an early stage in order to point out potential synergies and set screws to influence the urban system.

As mentioned above the first step is the generation of knowledge concerning the spatialization of the food system. For that, the team of Technische Universität Berlin develops a methodology by using mapping sheets (field research) for the identification of typologies of existing UFS components. The following chapter 3.1 gives examples of the first findings. The second step is the knowledge generation and quantification of the (metabolistic) flows between the identified components. A series of trans-sectoral interviews on household level (approx. 500 per case city) was conducted by the whole RP team to give answers on the demand side. In addition, specific studies will be prepared, e.g. what are the in- and outputs of food in wholesale markets or other food supplying components of the UFS, with the goal to generate further quantitative data on the side of the producers, processors, distributors and re-users. By modelling material flows, synergies will be identified in a further step towards an optimised infrastructure system. This is only possible by working simultaneously in different scales within the system boundaries.

A very important additional part of the research poses the question, how to link sectors and how to implement new trans-sectoral solutions in the life-world context? Chapter 3.2 gives an example by presenting the concept of the so called “entry projects” taking a community compost module in Da Nang/Vietnam as an example.

3.1 Identification of concrete and contextualised urban food system components

Within the Rapid Planning Project, the urban food system is treated like any other major infrastructure and can therefore be tracked down in its spatial manifestation with its components production, processing, distribution, access & consumption and reuse. TU Berlin is working on segmenting these components into spatial typologies that are accurate and suitable to describe the urban food system of the three case cities. The importance of the relations between these typologies and their inherent logic will vary by case cities. The typologies are distinguished by means of defined parameters, which are subjected to adaption as the final setting is work in progress.
To give an idea for the component „production“, the parameters include location within the urban system, size, format and formality. An agricultural plot can for example be located in urban core areas, the urban fringe, in urban-rural affected areas or rural core areas (Kasper et al. 2015 296-297). The size can vary from huge fields larger than 5 ha for the production of cereals or medium to small urban plots around or less than 1 ha to micro productive elements that are not detached to the ground. The format can vary significantly depending on whether it is primary or secondary urban agriculture (Giseke et al., 2015, p.34) and whether its purpose is for subsistence or commercial. An additional parameter looks at the legal status and whether land use is formal (with permission) or whether it is undertaken informally, such as the temporary use of future building sites (without permission). As an example, the following figure shows the typology of “large scale primary urban agriculture” in three different locations within the production component of an UFS. This typology is attributed to the category primary agriculture for commercial purposes mostly with a legal status in mono-culture production.

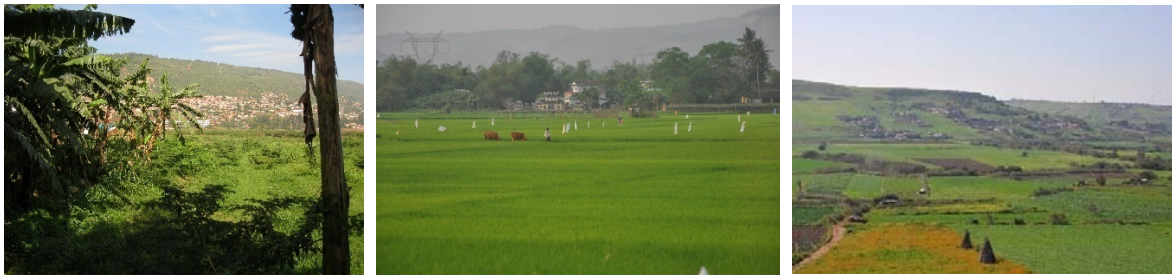

Figure 3. Three Examples of “large scale primary UA in rural core areas” in Kigali, Da Nang and Casablanca.

As a second example for a typology within the production component of the UFS the following figure is showing three sites of medium scale primary UA activities located in urban-rural affected areas. These plots are integrated into the urban structure that produce mainly vegetables and fruit trees. The purpose can be both, for subsistence or sale, as well as the legal status.

Figure 4. Three Examples of “medium scale primary UA in urban-rural affected areas” in Kigali, Da Nang and Casablanca.

The typologies and their inherent logic dependent on local cultural and environmental conditions are documented in each case city. There are not only differences between the case cities. The following figure gives an idea of the band of one specific typology, using Da Nang as an example. All three photographs assigning the same typology: a medium-scale temporary and informal production. Here, the type of production is informal as it takes place on the plentitude of fallow land or temporarily non-used land of future constructions sites that occur through rapid urbanization of Da Nang. Vegetable growing activities on temporary flooded riverbanks also belong to that typology, as Da Nang is located at the Hàn river delta. The locally popular morning glory is mainly produced at the riverbanks.

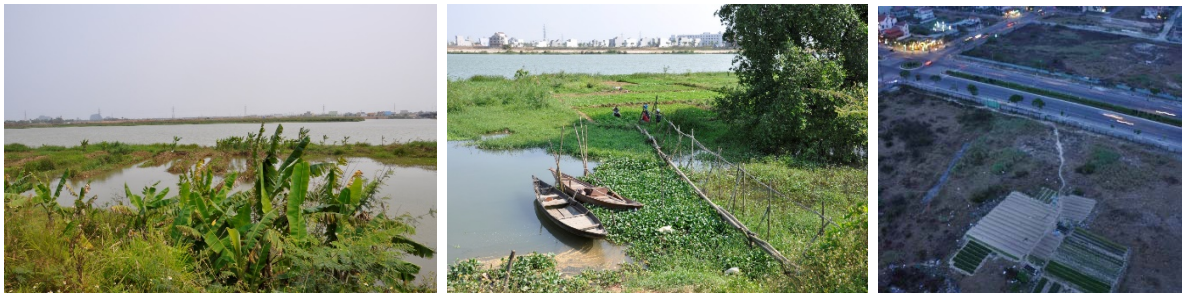

Figure 5. Three examples of “medium-scale temporary and informal production” in Da Nang

The assessment of the spatial manifestation through typologies helps to understand the systemic nexus of the urban food system, to structure and classify different occurring spatial phenomena according to the food system process components and to identify corresponding scales and actors through aggregated information gathering. It also serves to identify interfaces with other urban metabolistic systems. This classification of the food infrastructure in typologies helps to show the spatial elements of the UFS in the different cities with broad enough clusters to present their similarities but that also allow for showing the differing compositions through typologies that refer to local specific contexts. As a further step linkages (resource flows) between typologies will be qualitatively and quantitatively assessed according to their specific importance in each case city in order to reveal a characteristic picture of the respective UFS with its potentials and challenges.

3.2 Entry Projects

The Rapid Planning project is an action-research oriented project with the broader aim to develop resource efficient infrastructure management including food as an infrastructure. On the one hand the project generates knowledge on site specific conditions.
On the other hand, the question arises how to fill the gap between planning and reality (implementation) and how to create synergies between different sectors and stakeholders. In the context of the Rapid Planning project we work with the concept of “entry projects”, which are defined as follows: “Entry projects”should:

- be spatially visible, tangible and to provide an experience,
- be a catalyst between the “real world” and the researcher,
- be stakeholder driven and problem oriented, address actual problems and focus on them,
- take up existing programs and activities (funding)
- use the door opener function to generate cooperation and communication,
- be different in the case cities but address all RP infrastructure sectors and be trans-sectoral,
- generate knowledge and access to data for the RP methodology

- be transferrable, and
- have limited time frame (2 years)

For a more in-depth understanding, this article illustrates this concept by a concrete example. The selected showcase is situated in the Hoa Minh Ward in Da Nang/Vietnam, a densely populated quarter. The reduction of organic waste on the household level by activating the social capacity of a neighbourhood community and based on existing capital and resources without external funding was the focus of the “entry project”. The "entry project" thus creates knowledge about trans-sectoral linkages and synergies (the interface of the sectors waste and food), about flows between urban food system components (reuse and production) as well as about the interactions between people, nature and the urban. Da Nang city generates about 674 tons of waste per day, with 93.5% coming from households, and on average organic waste accounts for more than 70% (Otoma et al., 2013, pp.187–194). In addition the “entry project” aimed at small scale income generation, compost production and the demonstration of possible further synergies, like small scale food production units.

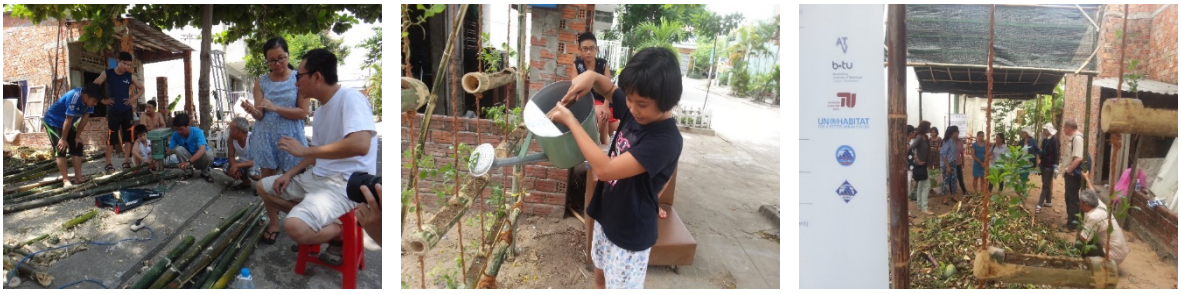

Figure 6. Different steps of implementation of the entry project “community compost” in Da Nang, Hoa Minh Ward: 1. Discussion of the design and construction on site 2. Neighbourhood involvement during the construction phase (Storch, H., 2015) 3. Workshop and training on site (Storch, H., 2015)

The integration of public institutions on different levels (e.g. Peoples Committee, Da Nang Institute for Socio-Economic Development, Department of Agriculture and Rural Development, Environmental Protection Agency, Urban Environment Company) and members of the community themselves was a crucial point. In the preparation phase a series of discussions with the main stakeholders took place during several networking missions and the core group of the community was identified. In the further process a cooperative group named “Cooperative group for Environment and Community” under Hoa Minh Ward was established. The identification of a site for implementation was organised entirely through the active members of the cooperative, which allowed the cooperative to rent a plot of vacant land from the Peoples Committee Hoa Minh Ward for the purpose of setting up a compost. The intervention of a low cost roofing of the site using local building materials, designed by TUB, was successfully realised with the help of teachers and students from Da Nang University of Architecture within a period of 5 days in July 2015. Subsequent a training workshop concerning composting techniques for the community members, farmers and involved local institutions was successfully organised. Up to this point the project was very successful. Though very intensive stakeholder involvement, especially in the neighbourhood, at this point the RP team decided to stop the entry project, due to arising fear and worries from few neighbours within the community related to expected negative health impacts of the composting process. In the sense of mutual learning and collaboration in transdisciplinary processes this is a brilliant example for facing and dealing with difficulties and challenges towards successful implementation. The presented project is one part of

developing a module catalogue for an actor generated blue green infrastructure. This experience will be used as a process to identify and initiate further necessary steps.

The guidance of this process, the design and technical training was mainly done by a trans-sectoral working group of the RP Consortium, in particular BTU Cottbus (Department of Environmental Planning and focal point Vietnam), AT Verband Stuttgart (RP project management and waste sector responsible), the local RP Office managed by UN Habitat and TU Berlin.

4. Conclusion and outlook

The article provided a conceptual framework and methodological assessment for a spatialized urban food system and a theoretical linking of systemic approaches including urban metabolism and infrastructure discourses. A practical approach of bringing these discourses together and qualitatively and quantitatively investigating them was shown in the context of two long term research projects (Urban Agriculture Casablanca and Rapid Planning). This knowledge can serve to identify set screws and in a methodological approach to adapt or transform (parts of) the UFS in the long term towards better working food systems that are more integrated, interactive and resilient.

With regard to further research it can be stated that the urban food system with its multiple trans-sectoral interfaces, different actors and practices, central and de-central structures and transversal components offers an extra wide range of possible linkages in terms of urban metabolism. Food infrastructure as one way to understand the urban food system within the urban metabolism inherently deals with the complexity of urban growth centres. It can be assumed to play a key role in further developing urban infrastructure systems in the context of changing urban regions that face complex problems and require new scale-appropriate and flexible infrastructures. Spatializing food infrastructure as a trans-sectoral and interactive infrastructure has the potential to foster new ways of thinking towards methods and concepts. This kind of infrastructure is not necessarily technology-orientated but has a strong focus on (civil) actors and their social practices, trans-sectoral planning and metabolistic flows and processes related to spatial entities. Interactive infrastructure indicates a general endeavour for networking and exchanging in different dimensions - between people on a cultural and economic level, between physical infrastructure and social actors, between the urban and natural system and between other infrastructures - actively enabling an urban metabolism by seeking for trans-sectoral linkages.

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