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A New Rural-Urban Fish Food System Was Established in Kenya—Learning from Best Practices

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Abstract: Kibera, the largest slum in Nairobi, Kenya, is increasing in size and complexity due to migration from rural areas. Reaching the objectives of zero hunger and sustainable cities and communities (SDGs2 and 11) are urgent and complex challenges to future development. In this survey a new fish value-chain has been set up between a rural area called Nyeri district and the inhabitants of Kibera, to supply small-sized affordable and accessible fish. The main aim of this article is to investigate this best practice example to assist future initiatives to overcome the complex challenges and discuss reasons why it was successful. The methods applied to obtain information to conduct this survey include a literature review, two workshops, and five preparatory interviews of Kibera inhabitants. The contributions by two community leaders, one in Kibera and one in Nyeri, are central to understand why this project was successful. The community leaders were trusted in their local networks. To ensure a resilient rural-urban food system in the future, it is critically important to understand context-specific institutional mechanisms, which in Kenya are based in communities run by strong community leads with capacities to motivate and influence other actors in the network to improve and make changes.

Keywords: rural-urban food system; fish value-chain; Kibera; Nyeri; Kenya; zero hunger; food security; nutrition; formal and informal institutions



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1. Introduction

Increasingly, people move from rural to urban areas in search of food, income, employment, and a better life worldwide. About 30–35% of the global urban population live in slums or informal settlements [1,2]. A lack of understanding of the complexities of slums has birthed a lot of misconceptions and misinformation about the actual challenges and opportunities for improving the food systems. Linkages between urbanisation, rural-urban migration, food system transformation, and food security are little researched [3–6].

In Kenya, 60–80% of the urban population lives in informal settlements (i.e., slums), and in Nairobi, around half of the population lives in at least 100 slums and squatter settlements [7]. The larger informal settlements in Nairobi include Kibera, Mathare, Korogocho, Kangemi, Kawangware, Mukuru, and Kiambio [7]. Of these, Kibera is the largest, and also one of the largest informal settlements in Africa. People are moving into Nairobi settling in slums and specifically in Kibera to improve their lives due to lack of resources [8,9]. The informal settlements provide cheap housing with a promise of jobs and an allure of a better life. However, the rural-urban migration places increased pressure on food systems in urban areas.

Food insecurity is a reality in the informal settlements in Nairobi. According to the literature, slum households spend on average 40–50% of their income on food, and a

majority of the households are supported by informal employment that provides irregular income, resulting in chronic food insecurity being a norm in the slums [10]. Besides, the quantity and quality of food are not always ensured in the slums. Cases of lack of important nutrients and micronutrients are reported, while possible contamination of food due to poor hygiene and sanitary conditions are judged to be the cause of high infant mortality rates [11,12]. The food situation is characterised by: households running out of food items to feed children, reliance on a limited number of foods, running out of money to buy food, cutting the size of meals, skipping meals due to lack of money to buy food, and children going to bed hungry [13].

Although Kenya is considered a low fish consumption country in the region and globally (at 3–5 kg/person), fish is an important food item to communities from the western part of the country, and lately, an increase in consumption is observed by non-traditional fish-eating communities [14]. Fish is one of the key food items to the persons that have migrated into the slums in Nairobi. Most of the fish consumed by the residents in the slums are sourced from Lake Victoria fisheries, transported from the western part of Kenya to Nairobi. However, at present, the supply of affordable fish is very scarce in comparison with the demand.

In a project called ‘Feeding cities and migration settlement’, the design of the project made it possible to set up a new fish value-chain between a rural area called Nyeri district, which supplies small-sized affordable and accessible fish, and Kibera, Nairobi. More than 1000 farmers in Nyeri County (90–120 km from Nairobi) are producing large quantities (50–60 tonnes/year) of small-sized fish that are not marketable through higher-end fish markets. This constitutes up to 70% of their production. It is a cost problem for the farmers to breed and feed this fish and not earn back the investments made. The Nyeri district never supplied fish to Kibera. Still, on 11 August 2020, the first truck delivered fish stemming from Nyeri to Kibera, and a tonne of fish was brought to Kibera on a weekly basis. This delivery was established in the middle of the corona pandemic. The excellent opportunity to supply affordable, accessible small-sized fish sourced from Nyeri County, was discussed in detail during a stakeholder workshop on 29 May 2020 in Nairobi, when two very different communities met to solve different challenges together [15]. This exceptional development in this region points to the urgencies of gaining an improved understanding of interrelations between the dynamics of the institutional rural-urban food system mechanisms.

Against this background, the main aim of this article is to investigate this best practice example to assist future initiatives to overcome the complex challenges and discuss reasons why it was successful. The institutional setting of the rural-urban food system is investigated at a local level through the process of establishing the new fish value chain. This is followed by a more generic discussion of the institutional setting in the region.

Learning from such best practices, to be further developed based on insights developed, will assist us in reaching the Sustainable Development Goal (SDG) 2; zero hunger, and SDG 11; sustainable cities and communities, and ensuring sustainability and viability through future food system transitions [16].

2. A Transitioning Rural-Urban Food System Approach and Methodology

2.1. The Rural-Urban Food System Framework

Existing food systems are outcomes of an interplay of multiple factors operating at multiple scales with defined levels of food security, food safety, and accessible and available nutritious food [6,17]. To understand how food proceeds from producer to consumer and how this transfer is impacted by different activities, including policies that intend to correct for negative environmental and social impacts of food system activities, a food system approach can assist in understanding the complexities to gain optimal outcomes [18]. A food system approach activates traceability through production, processing, distribution, preparation, and consumption of food by addressing biophysical, economic, political, and social factors, as well as the outcomes of these activities, including socioeconomic and

environmental context and dynamics [19]. The food system approach looks at all activities' impacts within the system and on outcomes, how they interact and how feedback loops within the food system impact socioeconomic and environmental drivers of the system [6]. A food system approach views the behaviour of a system as an interplay of interacting subsystems (i.e., for instance, parts of the food supply activities, markets, and biophysical subsystems like land or water), in which feedback plays a key role, rather than as a simple chain of cause-effect relationships. In the food system literature, different orientations can be found; for instance, some explore multiple narratives that may cause food system failures [20], some investigate impacts on natural resources [21], whilst others explore consequences for diets [22].

Figure 1 provides an overview of a food systems approach with sustainability and resilience, safe and healthy diets, inclusiveness, and equal benefits, as well as food security.

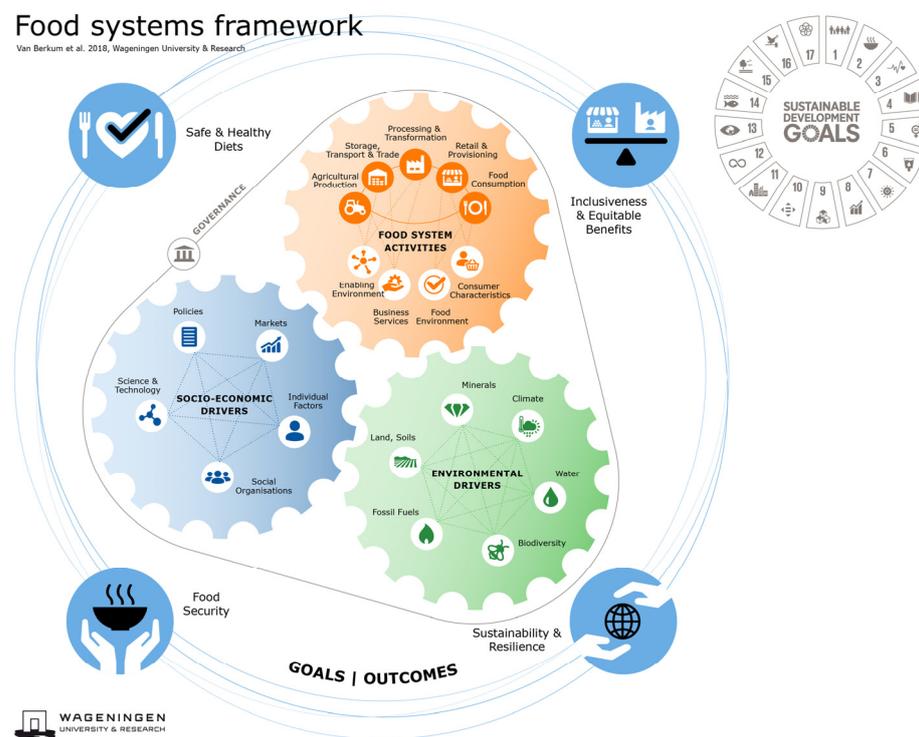


Figure 1. A food systems framework with food system activities, and socio-economic and environmental drivers, bounded in governance and aiming towards outcomes of food security, sustainability and resilience, safe and healthy diets, and inclusiveness and equitable benefits.

The rural-urban interlinkages. Rural food systems link with urban food systems through interrelationships across the spatial dimensions [6,23]. Three main categories of interrelationships appear. First, market features include, for instance, value chain relationships such as production and trade. Second, drivers of migration include people moving from rural to urban areas and vice versa, and also people who tend to live in both rural and urban areas and go back and forth in a split household [24]. Third, the social and economic relationships of cities with their rural hinterland include, among others, family and/or community networks in the different locations and flows of remittances from urban to rural communities.

The institutional settings. Institutional refers to the structures influencing contexts for acting and involves both informal and formal rules that encourage or restrain citizens' behaviours [25]. According to Rauschmayer et al. [26], informal network leaders are individuals with the capacities to motivate and influence other actors in the network to improve and motivate change and are critically important to food system transitions. Notably, there are multiple names for slightly different but nevertheless similar roles in the literature, including 'enablers' [27–29] and 'knowledge brokers' [30] who take a

transitioning role in transitions involving social innovation. A similar role is described in the literature as ‘innovating actors’, referring to people who continuously are looking for and actively create opportunities to realise their innovative ambitions within ever-changing institutional environments [31]. Moreover, whereas the ‘innovation intermediaries’ aim to overcome information gaps, managerial gaps, and cultural and cognitive gaps in relation to innovation processes [32], the so-called ‘innovation brokers’ are intermediaries that act as brokers in the formation and maintenance of innovation networks and systems, focusing on their capacities for establishing and embedding [33]. A network lead is characterised as a person who connects, informs, and encourages trust among different people [30].

2.2. Nyeri-Kibera

The existing fish value-chains in Kenya, including value chains stemming from Lake Victoria, e.g., Homa Bay (300 km) and Lake Naivasha (90 km), fail to deliver sufficient affordable high-quality fish, which is in demand in Kibera (Figure 2). Moreover, the women who at present own small-scale fish businesses face dramatic challenges. These challenges include the women risking their lives in unsafe early morning travels to get hold of scarce fish far away from the Kibera markets. Setting up a new fish value chain sourcing from Nyeri can solve a series of these challenges (150 km). This is because the fish is affordable and is of a small size, and it is brought by means of a cooling truck to Kibera directly.

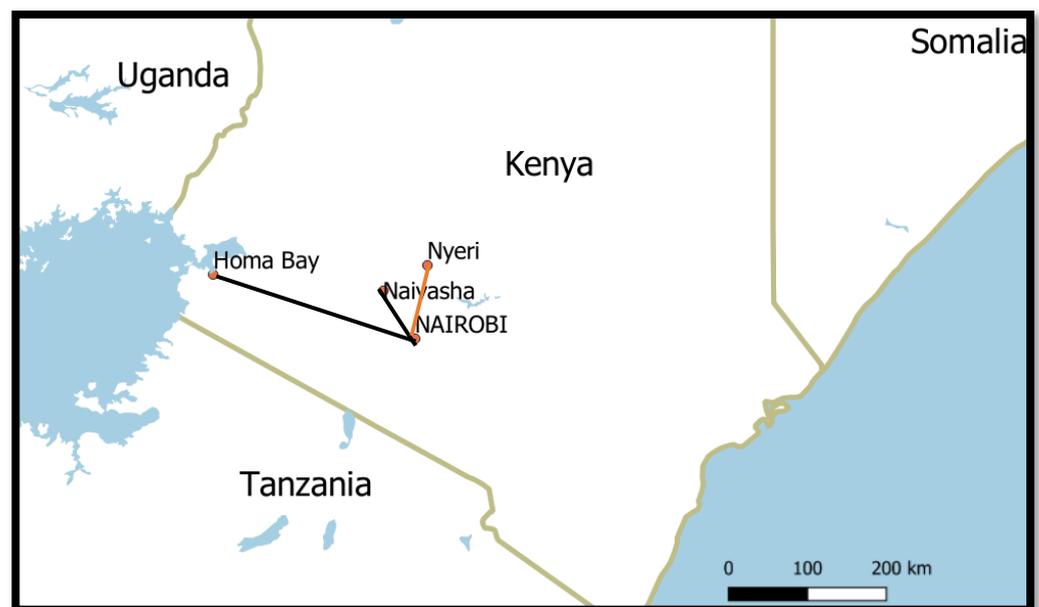


Figure 2. The new Nyeri-Kibera fish value chain (orange), as well as already established rural-urban fish value chains sourcing from Lake Victoria and Lake Naivasha, in Kenya.

2.3. The Methodological Approach

The methods applied to obtain information to conduct this survey include a literature review conducted by Egerton University, two workshops organised by the ‘Feeding cities and migration project’, as well as in-depth interviews of community leaders, and a total of four households for which three were fish vendors operating in Kibera. The five preparatory interviews took place in December 2019.

The important part of this project is an actual implementation of a new fish value chain. A series of research-related activities with stakeholders from 2019–2020 led to the new transport route of fish supply to Kibera. Exploring sustainable, smart, and inclusive fish food system opportunities, workshops organised allowed stakeholder interactions to discuss innovative ideas in the aquaculture sector in Kenya. Moreover, a total of four documentaries (see Supplementary Videos S1–S6) have been made with stakeholders in Kenya.

The new fish value chain includes the coordination and inclusiveness of a total of 1000 farmers in Nyeri. The new fish value chain was not just generated overnight, but many practical issues had to be solved. They included the logistics in Nyeri collecting fish among the 1000 farmers, cleaning, freezing, and transporting to Kibera. In Kibera, a series of licenses had to be arranged by the public sector (i.e., health certificate per worker, Covid-19 certificate, single business permit, facility/office certification, food hygiene license for food handlers, company registration technicalities, taxation regimes such as PIN certificate and Tax compliant Certificate). In addition, the business location had to be arranged, the inclusion of a total of 56 vendors who are willing to process and sell the fish in Kibera were informed, included, and consulted with, among others (see Supplementary Videos S4 and S5). These events go hand in hand with weekly problem solving by the community leads in Kibera and Nyeri, in dialogues with Wageningen University and Research (WUR) in the Netherlands and Egerton University in Kenya. The new innovative fish value chain was supported financially by WUR to cover the most urgent bottlenecks. Hence, funds were provided for payments of three freezers, licences for half a year, and facilitation of a workshop. Other arrangements needed were organised by the network leads involved, including the Kibera community lead and the Nyeri Fish Farm Cooperative, with support from Egerton University in Kenya.

3. Implementation of New Innovative Fish Food System Solutions for Kibera

An innovative new fish value chain was established between Nyeri and Kibera in Kenya in August 2020 [15]. On a weekly basis, one tonne of fish; mostly Nile tilapia (*Oreochromis niloticus*), but also some African catfish (*Clarias gariepinus*), is brought to Kibera after this date. This is a rural-urban connection that was not established earlier. Activities along the new value chain include the cleaning of small-sized fish in Nyeri, transport by truck to Kibera sales station, purchase of fish to consumers or vendors, cooking by the vendors in Kibera, and consumption of the fish. This illustrates, although still in relatively small volumes, that the blue economy is transitioning towards a future sustainable, smart, and inclusive fish food system. In this section, the matching of challenges and local solutions when implementing the innovative fish food system solution between Nyeri and Kibera will be reported in more detail.

It all started in a workshop held on 5 December 2020, when the Chair of the Nyeri Fish Farmer Cooperative was informed that the 1000 farmers he represents were faced with an urgent problem, namely that about 70% of the fish produced did not attain the preferred market size of 250 g and above. A win-win could potentially be obtained by solving the problem of missed income and high costs on feed for the fish farmers of Nyeri by supplying the small-sized fish to Kibera people where affordable, good quality fish is in high demand. To discuss this win-win opportunity, a workshop on 29 May 2020 was arranged with the Kibera vendors, i.e., the women fish traders, and Nyeri Fish Farm Cooperative [*ibid.*]. During the dialogues in this workshop [*ibid.*], a series of practical, but critically important challenges and local solutions were derived. A selection of challenges and matching solutions are provided in Table 1.

Against this preparatory workshop, illustrating the local urgencies, local ownership, and willingness to solve the challenges that needed to be arranged locally, the new innovative fish food system with fish stemming from Nyeri is supplying vendors and consumers in Kibera with highly demanded accessible and affordable fish [15]. The supply of one tonne of fish per week strengthens the food system in Kibera in at least four manners; (1) by enhancing health and safety in Kibera, (2) by gaining consumer trust in new fish products supplied, (3) by creating more work opportunities for Kibera vendors, and (4) by offering new opportunities for fish farmers in Nyeri to improve qualities and upscale fish production. These are further discussed below.

Table 1. Challenges and local solutions for establishing a new fish food system value chain sourced from Nyeri fish farmers—arriving in Kibera—sold and processed by the Kibera vendors [16].

Challenges	Local Solutions
<i>Demand meets supply challenges</i>	
<ul style="list-style-type: none"> • Is there actual demand for this farmed small-sized fish in Kibera? • Are vendors welcoming the supply of fish to the prices demanded by farmers to buy and prepare the fish? • Can the supply of fish be provided as whole fish products that are actually demanded by consumers in Kibera? • Can the farmed fish compete with the fish cultivated in Lake Victoria when it comes to taste, conservation, and qualities? • Will it be possible to set up an online ordering system to facilitate supply and demand? • Will it be possible for research purposes to document amounts of sales from farmers, transport, post-harvest losses, and sales at Kibera and the prices involved? 	<ul style="list-style-type: none"> • After a discussion, it was confirmed there is actual demand for small-sized fish sourced from Kibera. The Kibera community leader: ‘fish is now valuable as gold in Kibera’ • The prices were discussed, and they are within the range of affordable in Kibera. A vendor in the workshop: ‘If we agree on prices, we are ready to buy fish as early as now.’ • The Chair of the Nyeri Fish Farmer Society informed: ‘There is no problem for the Nyeri Fish Farm Cooperative to process the fish as cleaned whole fish as demanded in Kibera.’ • The differences in tastes, conservation, and qualities of fish stemming from different locations were discussed in detail, concluding that the fish will be welcomed. • An online ordering system is set up by the Nyeri Fish Farm Cooperative and orders can be made online. • The Nyeri Fish Farm Cooperative and the Kibera Community Lead confirmed that all transactions will be documented and shared with Egerton University and WUR for research purposes.
<i>Kibera quality assurance challenges</i>	
<ul style="list-style-type: none"> • During COVID-19, will it be possible to make the necessary arrangements given lockdown and other restricting policies (needs of Corona certificate, etc.)? • Will it be possible to arrange a safe sales location in Kibera that is suitable for receiving and storing the fish when it arrives in Kibera? • Will it be possible to ensure cooling when fish arrives in Kibera before vendors buy the fish? • Will it be possible to arrange the public licences, including electricity, of such sales location? • Will it be possible to appoint people who can be responsible for the sale and purchase on the sales location in Kibera without increasing sale price? • Will the vendors and consumers in Kibera distinguish the fish from Nyeri from the cheap and not welcomed Chinese fish supplied in Kibera? • Will it be possible to organise the vendors as a group and register them formally so that they can obtain credits/loans in the future? 	<ul style="list-style-type: none"> • These challenges are with lots of effort solved by the Kibera community lead, including the COVID-19 certificates. He said: ‘I am sure I can do this, but it will not be easy because a lot of public offices are closed.’ • In Kibera, a shopping mall, close by a petrol station with guards, and protected with iron doors, and guards of the shopping mall, the location is judged suitable and safe for the fish stemming from Nyeri. • This was identified as one of the core bottlenecks and finally solved by support provided by the WUR; contributing with three freezers in Kibera, etc. • The formalities of licences and electricity in the sales location have been arranged by the Kibera community lead and supported by the WUR. • Three people were selected and provided with a COVID-19 certificate, allowing them to sell fish in Kibera. The Kibera community lead explained: ‘I have been talking with a total of 56 vendors who are willing to take up this business at any time.’ • To be sure that people in Kibera can distinguish fish arriving from Nyeri, a Kibera team of young people were trained to distribute the news across Kibera. They had earlier informed the inhabitants of the Kibera about the restrictions imposed due to the COVID-19 epidemic. • The idea is to ensure vendors get organized and formalised to make it possible to make further investments in the business in the future.
<i>Nyeri fish farm cooperative quality assurance challenges</i>	
<ul style="list-style-type: none"> • Can Nyeri Fish Farm Cooperative clean and prepare and transport the fish to Kibera without increasing the prices affordable to the Kibera market? • Is the use of pesticides and antibiotics in fish farms monitored according to international health standards? 	<ul style="list-style-type: none"> • The Chair of the Nyeri Fish Farmers Cooperative Society explained: ‘The Nyeri Fish Farmers Cooperative holds a factory where people from the Nyeri County are hired to clean and prepare fish and this can be done also for the fish to be brought to Kibera’. • The fish of Nyeri is produced according to international set standards and management systems like Hazard Analysis Critical Control Point (HACCP) on antibiotics and pesticides and is healthy.

Table 1. Cont.

<ul style="list-style-type: none"> • Will it be possible for the Nyeri Fish Farm Cooperative to adjust language and practices to fish units and sizes used in Kibera? • Will it be possible to ensure cooling during the transport? • Will it be possible to bring the fish the whole way to Kibera to avoid vendors having to take unsafe travels in early mornings to the sale locations elsewhere in Nairobi? 	<ul style="list-style-type: none"> • The different measures of units are investigated by Nyeri Fish Farm Cooperative and in their processing of fish, they take the Kibera language and measurements into account. • The Nyeri Fish Farm Cooperative has a truck with a cooling system that is made available for the transport of fish to Kibera. • The truck will bring the fish all the way to the Kibera mall so that vendors of Kibera will not have to undergo dangerous travels to other sale areas in Nairobi.
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First, the safety issue in Kibera is an urgent one and one of the core bottlenecks of the food system. In some cases, the crimes target vulnerable groups, specifically women, and are associated with dark periods of the day [34]. The majority of the vendors are women travelling to purchase their commodities in town early in the morning, to prepare and cook the fish during daytime, and to sell the fish during evening hours when the majority of customers are available. In the interviews conducted (December 2019), they informed us that some sell in close proximity to where they live while others sell at strategic positions in the villages where human traffic is heavy. In the morning specifically, the walk towards the bus station further up in Nairobi can be risky, as so many travel by rickshaw (tuk tuk) or motorcycle (boda boda) as this is perceived to be secure. Accordingly, the business costs increase. During election periods criminal and ethnic gangs become active, and the impacts on security and businesses escalate even more. Children and female clients are exposed to risks of attacks (mainly rape) if purchasing commodities at late hours of the day. The safety is enhanced sufficiently when fish is brought directly into Kibera, which was facilitated by the new innovative fish food value chain established in this survey.

Second, the issue of consumer trust in fish supply is still not extensively explored, although a study informs there is some degree of trust between already established wholesalers of fish, for which payments of delivery are made first a day or a week after selling [35]. Still, the discussion in the workshop (May 2020) confirmed that entry into the Kibera fish market is not necessarily straightforward, even though for outsiders it seems to give new opportunities for nutritious food. This is because, although available, the fish is not necessarily in demand, because first, the consumers have to trust the source and quality of the fish products. In this survey, to encourage trust among the consumers, a network of young Kibera fellows were trained to inform inhabitants about the healthiness of the fish supplied from Nyeri. The entry into the Kibera market becomes an opportunity by cooperating with highly skilled and influential community leaders taking responsibility for the population living in different villages. Exploring innovative solutions to the opportunities for increased fish supply in the slum, one of these community leaders played a very central role. Moreover, the Chair of the Nyeri Fish Farmer Cooperative has a similar role as community leaders among the farmers in Nyeri. Since they have high trust among their community members, communicate well, and are highly skilled, they can contribute to solving challenges in very creative ways (see Table 1). The characters of the community leads in this survey coincide with the network leads described theoretically in Chapter 2.

Third, cheap imports from China are the main challenge to fish trade in Kenya [36], and the inhabitants mistrust any new affordable fish source to Kibera, suspecting it to be from such an unwanted source. Therefore, the supply of cheap fish to the Kibera market is facilitated by the established network of fish vendors preparing and selling the fish in already existing fish value chains. Vendors access larger amounts of fish to prepare and sell in Kibera, and in this way, they increase their business opportunities and income. Moreover, the project will result in a new organisational structure among the vendors, as they now plan to register formally as a group, which will give them new valuable opportunities to obtain credits and loans to invest further in their businesses.

Fourth, the fish food system of Kibera benefits the rural areas in Nyeri, which can sell a large share of their fish products which is not marketable elsewhere. Increased sources of income will enhance opportunities for the farmers of Nyeri to invest in new and improved fish production systems and upscale fish production [14,37].

4. Discussing Institutional Contexts in Sub-Saharan Africa (SSA)

The food system approach in Figure 1 addresses the interplay of different components in the food system [6]. This involves the interrelationship across the different components of the value chain, and the links with ongoing activities such as the public sector regulations and laws, investments and banking. Moreover, the roles of socio-economic, environmental and climate drivers in, and outcomes of, a food system, are explained.

However, it is unclear how the food system mechanisms work when we transfer the thinking from one continent to another. To understand the resiliency of these mechanisms, it is critically important to understand the institutional system in a country or region where we are operating. In this article, institutions are interpreted broadly, following Ostrom's [25] definition of formal as well as informal rules influencing the structures of contexts for acting because they restrain or encourage actors' behaviours. In the following we broaden our understanding of the institutional contexts of Sub-Saharan Africa by a brief investigation of three critical factors to the Sub-Saharan Africa's institutions: actors' behaviour, colonisation, and the community.

Actors' behaviours. A heavily studied component for understanding institutions and human behaviour in the literature includes cooperation, referring to behaviour of actors when sectors and/or policy domains are working or operating together, aiming for obtaining mutual benefits and defining collective goals. A tension has been explained between individual preferences and rationalities, and social rationalities [38]. On the one hand, individuals as utility maximisers are often referred to as the standard self-interest model, implying that utility increases the better when individuals gain more for less costs, which exhibits the characteristic human behaviour assumed by neo-classical economic theory [39]. On the other hand, the social rationalities favour cooperation based on fairness and equity concerns that motivate people to deviate their behaviour from the standard self-interest model [40]. Ostrom [41] demonstrated that reciprocity, reputation and trust are factors overcoming short-run self-interests. Moreover, the internal trust dimension to a group dynamics, combined with the exclusion behaviour of people not belonging to the group, can explain cooperation based on social rationalities [42]. While for individual rationalities, cooperation occurs only if personal self-interest coincide with objectives of obtaining public goals [43], social rationalities will stimulate communicative cooperation more broadly to develop good arguments and solutions about how best to comply with the common interests of the society [44]. Cooperation can also be explained by so-called positive reciprocity, which is a concept referring to the impulse or the desire to be kind to those who have been kind to us [45]. This relates to the concepts of trust, and social capital. Social capital levels can be judged according to levels of institutional relations in the form of strengths of shared norms and values, networks and trust between and within groups of people [46].

Vatn [47] (p. 208), refers to distinction between social rationality and individual rationality as the 'we' and the 'I' rationalities, respectively. This distinction is relevant to explain behaviour in a market situation, but also provides the basis for the rationales of 'left' and 'right' wing policies, for which the 'left' base their arguments on social rationalities, and the 'right' on the individual rationalities. See, for instance, rationality and social choice as explained by Sen [48].

Colonisation. The colonial and post-colonial influences have provided an external layer of institutional contexts to real life in the Sub-Saharan countries, which deviates from the traditional community practice-based institutions. For instance, Birhane [49] explains that technological solutions are developed in accordance with Western norms, perspectives, values, and interests, and implemented in developing countries with little

regulation or critical scrutiny of potential negative influences on social, political, and economic institutions in the Global South. Whereas earlier traditional colonialism was driven by political and government forces, currently the algorithmic colonialism is driven by corporate agendas. As such, it is explained that Western tech monopolies, with their desire to dominate, control and influence social, political, and cultural discourse, share common characteristics with traditional colonialism [*ibid.*].

Referring to industrial growth more broadly, Austin et al. [50] explain that world industrial influencers have been interrupted in Sub-Saharan Africa. This is explained by, on the one side, very high costs for pursuing industrialisation for states; and on the other side, colonial and post-colonial rulers who poorly adopted and dedicated policies that modified the region's existing comparative advantage in primary production. A trend is described as positive by Frankema and van Waijenburg [51] when developments are based on contextual institutions. They inform that, although the expectations of accelerated poverty reduction in Africa through labour-intensive export-led growth have little historical foundation, the evolution of rural-urban exchange networks can contribute positively along three main features: (1) an increase in consumer demand along current process of urbanisation in Africa, (2) an increase in labour division, resource sharing, access to public goods (health, education) and faster spill-overs of knowledge, and (3) a process of domestic market integration which strengthens the linkages between the agricultural, industrial and services sectors, without having one sector (i.e., manufacturing) pulling the economy to higher Gross Domestic Product (GDP) levels.

Hence, the literature makes a distinction between positive developments that are rooted in Africa's own contextual institutions, and potential negative consequences of externally imposed institutions of manufactory, high-tech, industrialisation along colonial and post-colonial influences, notably involving a large share of the African people themselves.

The community as benchmark. To understand Sub-Saharan Africa's institutions we have to understand the role communities play in the wellbeing of the African population. The institutional contexts that matter to the African people are their tribes and communities, not necessarily nation states with the public administration and the bureaucracy set up to serve it. The conflict between communities and imposed projects and programmes targeting the public sector are nicely illustrated for coastal management in Mozambique [52] and coastal aquaculture in Tanzania (see Supplementary Video S7) [53]. In Mozambique it was explained that in circumstances of peace and political stability, the principal threat to coastal management and local communities in Mecufi were: (1) a potential loss of common property resources and land tenure in the face of prospects of privatization, and (2) a cultural gap and language differences between intellectuals from Maputo and local villagers, with little effective cooperation existing between government coastal management initiatives and the traditional leaders. In Tanzania, a few international corporations held monopoly to purchase aquaculture products at very low prices, which was unfavourable to the coastal fish farmers. Moreover, a huge project was proposed for the Rufiji mangrove delta, which initially met strong opposition from local communities, government managers, scientists, journalists, lawyers and environmental NGOs. Even though it was clear that the consequences of the project would be seriously deleterious, the government eventually approved it. To encourage sustainable and inclusive coastal development including aquaculture, more ecologically and socially viable aquaculture developments are encouraged based on these experiences.

Combining the literature survey with the findings of the implementation of a fish-food system in Kibera, it becomes obvious that community network leads play a critical role to encourage community wellbeing and livelihood, commitment, work responsibilities and willingness to contribute to economic developments. This is in accordance with how the network lead was introduced as a critical factor in transition theory [30], to actually reach sustainable, inclusive and economic viable food systems locally by support of network leads who connect, inform and encourage trust among the different people. From a community-

based thinking perspective, the rationality contexts get disputed, because they are based on both individual and social rationalities. Within a community the thinking of 'I' and 'we' rationalities seem to go hand in hand because they are mutually inclusive. Interestingly, according to interviewees during the implementation of this survey, 'in Sub-Saharan Africa 'right' and 'left' thinking does not dominate, because people equally much think according to 'left' when working for a community following the social rationality thinking, and according to 'right' when taking the role as a market agent targeting short-term benefits following the individual rationality thinking'. This implies that the rationalities are not mutually exclusive. As such, if the institutional resiliency is highest where the social capital is high, the resiliency of rural urban food systems can be directly connected with the community structures of Sub-Saharan Africa.

Whereas the community thinking follows social rationalities when supporting community wellbeing, the individual rationalities are needed for strategic business performances to ensure these businesses perform to the extents to which the families and communities can be supported and facilitated. This combination of rationalities is in accordance with Vatn [54] and Soma and Vatn [55] who inform that institutions define rationality contexts by signalling which logic pertains in a certain context. As such, institutional norms and rules can prescribe what the individual should or should not do in processes of cooperation and can vary according to which activities are performed: business or community based.

The Sub-Saharan African institutional setting at a glance. The social capital may be judged strong within communities, and weak on the broader imposed institutional system of national unity, public management and bureaucracy, multinationals roles of influence, and external relationships in Sub-Saharan Africa. In Figure 3, the assumed friction between this external circle of institutional capacities, and more trusted community institutions in the inner circle are illustrated for further discussion.

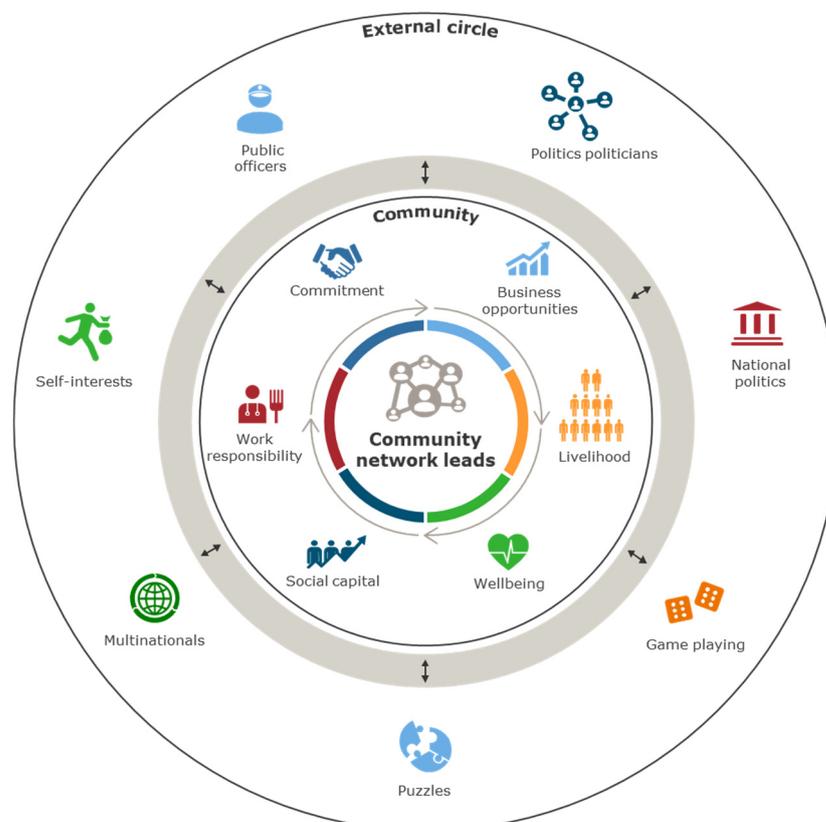


Figure 3. The tensions between the external circle and the community-based institutional settings of Kenya, Sub-Saharan Africa.

5. Concluding Remarks

The main aim of this article is to investigate a rural-urban fish food system best practice example, and discuss reasons why it was successful. We have illustrated how a rural-urban fish food system implementation can lead to win-wins if local ownership of finding local solutions is present. The fish food system was advanced by connecting two completely disconnected areas: one in rural Nyeri and one in Kibera, Nairobi. On 11 August, the first truck with affordable small-sized fish was brought to Kibera and sold in a sales place arranged specifically for this purpose. Based on local insights to find solutions and local ownership of the project, a series of challenges were dealt with immediately (see Table 1), which was a core reason why this was successful, thanks to the network leads who made the efforts to ensure this happening. The efforts made created opportunities for further expansion of fish trade in the future. Note that the rural-urban linkages are constantly changing and are sustained through associations and networks in urban areas and maintained through sentimental bonds with rural homes or places of origin [56]. The increased supply of small-sized affordable nutritious fish through a new fish food system implemented between Nyeri and Kibera results in ensuring steps towards the SDG2; zero hunger and the SDG11; sustainable cities and communities have been made.

To understand the successes of the Nyeri-Kibera fish food system, based on a literature survey conducted in the discussion, it is advised to further investigate the Sub-Saharan institutional structures. The community structures and community leads are the core influencing parties in Sub-Saharan African food systems and are highly needed for transitions with trusted partnerships that can enhance institutional resiliency in the future. This was judged as a core explanation of why the innovation implementation of a new fish value chain from Nyeri to Kibera was successful. The community leads played the role of the network leads: individuals with capacities to motivate and influence other actors in the network to improve and motivate change [15]. To understand resiliency in future food systems, context-specific institutional resiliency must be investigated in depth.

Often projects aiming at humanitarian help, poverty alleviation or fighting hunger fail in reaching the people in need [57,58]. By noting the tension between the traditional community structure and the external circle of imposed institutional settings stemming from interventions in the past and present, it is logical that multiple projects fail when targeting the low social capital segments of the institutional structure (i.e., external circle).

A future food system should become more resilient and sustainable than at present. The understanding of future food systems can be drawn based on transition theory [59]. Transitions typically follow non-linear processes, involving established practices and interactions, associated rules that stabilise existing systems. They are typically observed according to available skills, urgencies, and capital. At a so-called niche level, trials, experiments, successes, and failures are made. To judge on actual improvements, the food system can be assessed according to [28,30]: (1) smartness to develop an economy based on knowledge as well as technological, social, and organisational innovations, (2) sustainability to ensure a resource-efficient, greener, and more competitive economy, and (3) inclusiveness to foster a high-employment economy delivering economic, social and territorial cohesion. This is in accordance with how the European Commission [60] explained the blue economy paradigm.

In addition to the survey referred to in this article, another survey interviewing a total of 386 households in Kibera has been conducted in the same project (August 2020), as well as a vendor survey planned in Kibera. Following this, from a research perspective, the immediate upcoming surveys include the investigations of relationships between food security and, among others:

- Fish consumption in Kibera [61]
- Migration to Kibera
- Social capital and trust in Kibera [46]
- Environmental factors such as the use of water and energy
- Livelihood factors across the different villages in Kibera

Supplementary Materials: The following relevant videos are available online, Video S1: DOCUMENTARY: Nyeri-Kibera fish food system: https://www.youtube.com/watch?v=2MYOUZdjKVs&list=P Lz_ZBMIqwkG6dgXtreklICZdRMfTJ5fFj; Video S2: DOCUMENTARY: Kibera (Kibra) documentary: https://www.youtube.com/watch?v=K_goJu2encg; Video S3: DOCUMENTARY: Nyeri fish farm documentary: <https://www.youtube.com/watch?v=xH3itzOKWOY>; Video S4: DOCUMENTARY: Lake Victoria fish farm documentary: <https://www.youtube.com/watch?v=VYPnQQ1UwXw>; Video S5: WEBINAR: Food-system-transitions-in-Nairobi-slums-FOOD-FUTURES: <https://www.wur.nl/en/activity/WEBINAR-1-Food-system-transitions-in-Nairobi-slums-FOOD-FUTURES.htm>; Video S6: WEBINAR: Food-system-transitions-in-Nairobi-slums-STAKEHOLDER-REPRESENTATION: <https://www.wur.nl/en/activity/WEBINAR-2-Food-system-transitions-in-Nairobi-slums-STAKEHOLDER-REPRESENTATION.htm>; Video S7: OCUMENTARY: Documentary of a community based conflict in Tanzania <https://youtu.be/mAhGG8D9i9w>.

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