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REVIEW

How formality and informality impact urban food systems

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Abstract

Urban food markets have formal and informal components which are classified with reference to various factors. There is a tendency to pathologize informal systems but valorize formal ones as being better for food systems. This postulation has often created tension between and among food system stakeholders, especially local authorities and traders. This paper looks into the characteristics of business formality/informality and the pros and cons of the same in food systems in an effort to create a better understanding of the two and their impact on food systems. It draws from the experiential learnings of the authors and supported by relevant literature. Our observations indicate that informal and formal aspects of food systems play critical roles towards the sustainability of urban food systems but also have negative impacts on the same. Hence, efforts should be directed at leveraging the strengths of each side while mitigating their negative impacts. Food systems are better with both as opposed with either of the two in their efforts to achieve zero hunger (SDG 2). Indeed, a purely formal or informal food system would not be able to meet all

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the needs of urban dwellers; the poor, middle class and the rich.

Keywords
Formal and informal food businesses attributes, urban food systems, SDG 2, sustainable food systems, informality, formality

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1.0. Introduction

What is an informal food system and to whom is it informal? Informal food systems are described as those parts of a food system that operate outside the formalities required by a local authority and other government organs. These formalities include legal registration, compliance to regulation, taxation, licensing and permits, and operational requirements.[1–3] As such, informality is primarily a perspective of governments while looking at food systems. Informality occurs due to one or more reasons which include but are not limited to gaps in policies and regulations, poor enforcement of policies and regulations, poverty leading to inability to comply with required regulations, complex licensing and regulatory procedures that make it daunting for traders to comply, inadequate participation of informal actors in governance processes, and failures by formal systems to adequately respond to the realities and needs of urban food system traders and urban populations. Formality and informality, to varying degrees, exist in all food systems of the world and both have their pros and cons. Yet, there is a tendency to pathologize informal food systems for their disadvantages even though formal systems also have their weaknesses.[4,5] The purpose of this paper is to critically examine the contributions of formality and informality of urban food systems and their implications on food and nutrition security and general wellbeing of humanity.

We first present the characterizing features of formality and how they impact urban food systems. Thereafter, we present the impacts of non-informality attributes on urban food systems. These attributes are not formality requirements by local authorities and other government agencies but they do characterize and impact urban food systems. Thereafter, we discuss how formal and informal food business contribute to climate change according to the greenhouse global warming theory. Then we wind up with some concluding remarks.

This paper is not a systematic review of literature. Rather it is a conceptual review paper drawing from the experiential learning of the authors supported by existing literature as is appropriate with a few examples from Kisumu city.

2.0. Characteristics of a formal food system and how they impact an urban food system

Formality of a food system is a governance issue characterized by the following attributes.

2.1. Legal status

This refers to the registration of the business so that the government can have its details. It specifies the nature, address, location, scope of operation (local, national, and international) and proprietor(s) of the business. Registration of a business helps the government to identify and hold accountable the owners of a business in case they do not comply with certain regulations. Because of the traceability of a registered business back to its owners and location (address), such businesses are more likely to comply with stipulated standards and regulations than are informal food businesses. This will generally enhance food and feed safety, and more particularly where enforcement is above bar. Proprietors of unregistered businesses, most of whom are small-scale in nature, out of a sense of moral duty will also try to comply with food and feed safety regulations. However, where commercial interests override one's sense of moral responsibility, food and feed safety standards will be thrown to the wind through the use of harmful preservatives and or adulteration of foods and feeds.[6–8] Registration of a business does not necessarily mean immunity to such malpractices in a food system. On several occasions, registered businesses have been reported to have used harmful preservatives, or adulterated their products for economic gain.[9–11]

2.2. Regulatory compliance

This is the adherence of a business to the laid down standards and procedures of performance. It involves both industry standards and government regulations. Compliance requires accurate record keeping from which adherence to set out standards can be assessed. Regulatory compliance will include such things as financial systems adopted in a business, food and feed safety standards, standardization of quality parameters, and environmental management. Regulatory standards should be relevant, appropriate, beneficial, and enforceable for them to solicit compliance from entrepreneurs.[12,13] Being under regulatory compliance does not automatically mean that compliance is secured. Many factors such as perception of risk, capacity to comply, frequency of inspections, demand for low food prices, and corruption among others come into play to determine compliance.[14–16] It is, nonetheless, noteworthy that being under a formal responsibility to comply with stipulated regulations and standards is a great step towards ensuring food and feed safety in an urban food system.

It is also important to note that lack of a formal registration of food system businesses does not excuse them from regulatory compliance. Indeed, municipal and city authorities regularly enforce regulatory standards on informal businesses. Sometimes they do raids on non-compliant formal and informal businesses in order to enhance compliance. For fear of being arrested or their food and feeds being confiscated, some informal (unregistered) businesses do their best to comply with food and feed safety standards. Others do this from their moral sense of responsibility to local authorities

and their customers. Some informal traders who are averse to compliance play cat and mouse games with local authorities. In order to reduce such games with traders, local authorities and departments are shifting strategy from being punitive to being facilitative so that many businesses can comply.

While regulatory standards are usually formulated to safeguard consumers and the environment, some standards, especially in the preservation and flavouring of food and feeds, have been proven to be positively harmful to the environment and consumers in permitted quantities. For example, preservatives such as nitrites, nitrates, sodium benzoate, and potassium sorbate, even though are approved by regulatory bodies, have been demonstrated to be injurious to human health when habitually used.[17–19] Even though a strong relationship between registration of a business and compliance to stipulated regulations and standards is expected, it can be seen from the foregoing that non-registration of a business does not necessarily imply non-compliance with stipulated regulations and standards.

2.3. Licensing and permits

Licenses and permits signal conferment of permission to a business by the government to operate and undertake certain activities. They are regulatory tools to ensure that operations of the businesses and enterprises meet required standards to safeguard public health and maintain set operational standards. In Kenya, they are usually reviewed annually through the County Finance Act, and constitute part of the Own-Source Revenue (OSR) raising initiatives by County Governments. Others are statutory requirements, particularly under Public Health to enhance food safety and handling. Some of these legal requirements include Single Business Permit (SBP), Food Hygiene License, Food Handlers Medical Examination Certificate, Market fees/Levies, and Distribution license for distribution trucks.

2.4. Payment of taxes

Taxes are mandatory contributions by businesses to government revenue and are often based on the income the business has made. It requires accurate and transparent financial record keeping so that the tax is accurately determined. Registered businesses are captured in government systems through which their tax payments can be tracked. Such businesses are always required to pay their taxes directly to bank accounts in selected banks. Informal food system vendors are not registered and their payment of tax is not always trackable by the government. Instead, local authorities charge them daily hawking or market access fees which they pay by cash on spot or through mobile money transfers to government bank accounts. Collectively, these act as revenue streams for the government and part of them are used to support the development of food infrastructure like markets, sanitation facilities, storage facilities, roads and payment of salaries for staff managing markets among others. Informal vendors sometimes avoid taxes because of high compliance costs or by playing evasion tactics like hiding from local authority officers. While formal food businesses generally pay higher taxes than informal ones, our observation in Kisumu indicates that sometimes, the sum of daily market fees in a year exceeds the single business permit fees for formal small business which ranges between KSh 2500–10,000 depending on the location and type of business. Daily market fee is approximately KSh 30. Assuming that an informal food vendor operates five days a week, the annual market daily fees would total to KSh 7,800. There would be savings in registering such a business. We also note that excessive taxation can discourage small food businesses from formalizing their enterprises.

Food businesses as a standard practice usually transfer the taxes they pay to customers. This increases the price of food. Whether this increase significantly limits the economic access of food by the urban poor is something that needs to be ascertained. Even so, the payment of taxes enables the government to provide critical infrastructure and services that improve an urban food system. So taxation helps distinguish between formal and informal actors in the way in which they make their payments and in some cases in the amounts they pay.

2.5. Spatial formality

This concerns the operation of a business in an appropriate space that is permitted by the local authority. The space can be privately owned or designated by the local council and could be used for production or trade of food items. A number of issues drive spatial informality of food business in urban areas. These include but are not limited to easy access to customers, avoidance of taxes and fees, transient businesses, high rental fees in formal market spaces, shortage of spaces within formal markets, cartelism in formal markets, and early closure of formal market spaces. Spatial informality has several advantages and disadvantages on urban food systems.

The advantages of spatial informality include: 1) easy access to buyers by traders since traders often position themselves on pavements along urban roads used by pedestrians in the evenings as they make their way back home. This positioning by traders as it were intercepts buyers who would otherwise visit City markets for food purchases. Traders also occupy pavements in front of supermarkets where they attract buyers to their food items that may not available in the supermarkets; 2) food businesses that operate in informal spaces tend to offer cheaper prices for their food items or allow bargaining. The low prices could also be due to the fact that some of them avoid taxes and do not pay rent for the

space. This enables economic access to food by the urban poor; 3) Informality also contributes to the revenue of the local authority where the city or municipal council manages to collect hawking fees; 4) There are urban food business that are transient and often operate on a seasonal basis when there is abundance of produce. Such entrepreneurs see no need to rent spaces or register their businesses since they will be in business only for a short time. Such businesses reduce food loss by availing their excess produce in the urban space for sale; 5) Such transient businesses also create employment opportunities for the unemployed who take advantage of the short lived bounty to make a living. The roadside informal food businesses also create employment opportunities for the entrepreneurs; 6) Urban farming (livestock and crop production) sometimes operate in areas like roadsides which are not designated for such activities. Some cities and municipal councils also have no policies and regulations to guide urban agriculture. Nonetheless, food production takes place in urban areas. Even though the production is not significant enough to ensure food security for farming households, it supplements food availability for such families[20,21]; and finally, 7) Spatially informal businesses because of the small scale at which they operate and lack of food preservation equipment like fridges and freezers tend to supply fresh produce to the market since they restock very frequently. It is, therefore, the case that fresh food is readily available in small eateries from which also home takeaways can be secured.

The disadvantages of spatial informality include but are not limited to: 1) poor food hygienic because such business often operate in structures (e.g. small roadside kiosks) and areas (e.g. pedestrian walkways) which do not have access to clean and safe water and where dust settle on food which is not covered. These raise the burden of food bone diseases in urban areas when necessary precautions are not taken. Indeed, most informal ready to eat food businesses are often considered as high risk areas for the spread of food bone diseases[22]; 2) informal roadside food traders often have no bins for disposing their wastes except where public waste bins are provided. Even in such circumstances, it is not uncommon to find food wastes littered on the streets where informal traders operated the previous evening; 3) informal traders also cause obstruction of pedestrian walkways which they occupy as they trade. These cause hampered flow of human traffic along such streets; 4) Where traders avoid payment of hawking fees, the local authority suffers loss of income but have the extra load of cleaning the streets that they litter with food wastes; 5) informal food systems besides encroaching on pedestrian pathways sometimes occupy other spaces like road reserves and drainage water ways for production. Depending on what is constructed or grown on these parcels of land, different risks do emerge. Roadside kiosks which are not secured at night pose security risks to pedestrians. Crops grown on waterways conveying contaminated water produce contaminated food which pose health risks to the consumers; and finally, 6) spatially informal businesses also encroach into urban green spaces making them unable to provide the services they were designed to provide to urban residents. Such was once the case with Oile park in Kisumu city when traders progressively occupied it until it became known as “Oile market.” However, reforms brought it back to its original green space function.

As much as spatial formality in an urban food system brings order within the urban space, it does not automatically follow that spatially formal business have positive contributions to an urban food system. Big and small spatially formal businesses could have processes that impact negatively on the urban food system. For instance, some big food processing industries discharge their poorly treated factory effluents into the environment.[23,24] Spatial formality may not necessarily equate to compliance with environmental safety standards. Intensive livestock keeping farms in urban and peri-urban spaces frequently have challenges managing their wastes. Often, neighbourhoods suffer the negative externalities of bad smell (air pollution) from those farms even though they are spatially formal.

Spatial formality and informality also have some things in common. An example is in the use of chemicals some of which are not very safe for human health even though they are legally permitted for use in the preservation of processed food.[17–19] Another example is in the cooking methods used by registered food factories as well as by street food vendors. For instance, street food venders recycle deep frying oil until it turns to a blackish colour, which makes it carcinogenic. Some food factories also deep fry certain foods like peanuts, crisps, green peas, and chevda in oil that is recycled which equally makes them carcinogenic. The street vendors’ oil might be very dark compared to the factory oil. Nonetheless, they are superheated which makes them carcinogenic.[25,26] Street vendors as well as spatially formal food factories use additives, food colours, too much oil, sugar and fat in their foods that make them health risks when repeatedly consumed.

3.0. The impacts of non-informality attributes on urban food systems

The attributes discussed in this section are often associated with informal food systems, although they do not necessarily determine whether an enterprise is formally or informally recognized by government authorities. Rather, these attributes influence the organization, efficiency, inclusiveness, resilience, and sustainability of urban food systems. In rapidly urbanizing cities such as Kisumu, they shape food access, livelihood opportunities, market relations, and the movement of food from producers to consumers. Although these characteristics are commonly linked with informal systems, they also exist within formal food enterprises and, therefore, should not be treated exclusively as indicators of informality.

3.1. Scale of operation

Scale of operation refers to the size, capacity, market reach, labour force, and organizational structure of food enterprises within an urban food system. Food businesses may operate on either a large scale as in supermarkets, wholesalers, hotels, distributors, and food processing firms, or on a small scale as in street food vending, kiosks, market stalls, and household-based enterprises. In Kisumu City, the scale of operation within the urban food system is predominantly informal and small-scale. Scale of operations links with the five attributes of formality required by governments in that large scale businesses are often registered. With registration, it will be easy for governments to enforce regulatory compliance, ensure payment of taxes, require acquisition of licenses and permits, and spatial formality. Big and small scale business impact urban food systems in different ways by virtue of their scale.

Small scale food business sell food items in small quantities that are often not found within supermarkets. For instance, selling sugar in 0.25 kg or even 0.125 kg quantities. Chicken meat are sold in the streets as organs (feet, thigh, gizard, heads, wings, etc.) which a single person can buy for a meal as opposed to buying a whole chicken in a supermarket. Big fruits like watermelons can be sold in small slices while in supermarkets the least size could be a quarter of a watermelon. This way, economic access is enhanced, enabling the poor to access variety while at the same time avoiding food waste that could occur in small families (campus and college students, young single professionals and family persons living away from their families) when they buy large quantities of food. Large scale businesses are more endowed financially and can enhance food diversity by importing exotic food items like fruits and nuts and sea food. Small scale business source food locally thus absorbing local production and supporting local livelihoods. Small scale food eateries form one of the most significant components of Kisumu's urban food system because it provides affordable, convenient, and readily available meals for urban residents. Most consumers prefer street foods because they are inexpensive, freshly prepared, and available without long waiting periods and walking distances, unlike meals sold in large hotels and restaurants that are often more expensive and less accessible to low-income consumers. Street foods, therefore, serve students, transport operators, casual labourers, traders, and workers whose food choices are largely influenced by affordability, convenience, and time constraints.[27] Large food businesses because of their economic capabilities and facilities are able to serve large gatherings like conferences and workshops in an urban area. Thus small and big food businesses work together to feed their cities. Furthermore, some big food businesses operate like wholesalers from which small scale business purchase their goods. Thus scale of operation characterizing big and small businesses are important characteristics of informality working together to feed the diverse populations of urban areas.

3.2. Supply chain structure

Supply chain structure refers to the organization, coordination, and movement of food products from producers to consumers through different actors, institutions, and distribution channels Supply chains for businesses can be structured and standardized or unstructured and relationship based. In urban food systems, supply chains may be highly structured and standardized, involving formal contracts, regulated logistics systems, and quality assurance mechanisms, or they may be relationship-based and flexible, relying on social networks, trust, and informal arrangements. Supply chains are shaped by multiple actors including farmers, transporters, brokers, wholesalers, market governing authorities, retailers, and consumers, all of whom influence food availability, pricing, accessibility, and resilience of the urban food system. Formal supply chains are characterized by registered businesses, written contracts, documented transactions, regulated operations, quality certifications, and traceable products among others. Informal supply chains will miss some of these elements. That which links this attribute to the five formality requirements is registration which makes taxation and quality standards easy to apply.

Informal food businesses tend to have local and informal supply chains. Because of this very nature, such supply chains promote local livelihoods. They also enhance the resilience of the urban food system because of the strong rural-urban linkages, quick response time to change in local food demand, and trust built between the traders and suppliers. This trust enables the supply of food on credit when traders are financially down for one reason or another. Formal supply chains which source food from beyond the locality also build food resilience in urban areas when localized disasters like floods, droughts among others lead to devastating food losses or low production.

Both formal and informal supply chains, depending on their scale, use different methods to transport food. Many informal businesses using informal supply chains often use small scale transportation means like small vehicles, public passenger transportation vehicles, motorcycles, tricycles and bicycles. Except for meat and milk which have specified container standards, other food items like vegetables, fish, fruits, cereals, tubers among others are transported by whatever means and in whatever containers, sacks or bags available to the trader. Some of these carriers (transport means and containers) lead to high food losses due to physical deformation and exposure to dust and exhaust fumes. These exposures also raise food safety concerns.

3.3. Employment relations

Formal and large scale food business like supermarkets and factories have formal employment relations with their employees. Their formality requires them to comply with existing labour laws. This provides some stability of employment and defined procedures for resolving labour disputes. By this formality, employee have defined job descriptions, and working hours and stand to benefit from health insurance, paid leave, National Social Security Fund (NSSF) deductions, gratuity payments or contributions to pension schemes. The government also benefits from their tax payments. Informal businesses, however, engage their employees informally on the basis of trust. Some of these employee are family members and are not paid monetarily but enjoy support from the business in providing for family sustenance. A study by Battersby and Watson,[28] found that 90% of food retail outlets in Kisumu were of this nature. Where non-family members are engaged and payments are made, the wages are often negotiated, relationship based, paid daily or weekly, and often do not comply with labour laws. Other than the wages, there are no benefits as stipulated in labour laws irrespective of the duration of engagement.[29] This leaves such workers vulnerable to labour injustices and dependent on social support during periods of illnesses. Nonetheless, informal food businesses provide employment opportunities to the majority of urban poor without formal interviews and submission of academic certificates while at the same time allowing the employees, especially mothers, to attend to their motherly duties.[30]

3.4. Market infrastructure

Food business can operate in fixed and approved structures, fixed unapproved structures or on mobile structures and locomotives. In most African cities like Kisumu, where a majority of residents rely on the informal economy for sustenance, these three modes of infrastructure form an interconnected network that ensures food reaches both the commercial urban core and sprawling informal settlements.

Fixed and approved food structures operate within the legal, fiscal, and spatial frameworks of the urban environment. This category includes formal supermarkets, licensed wholesale depots, and traders operating within the physical and administrative boundaries of designated municipal markets. These structures benefit from formal land tenure, integration into the city's master plan, and access to municipal services like waste collection, security, and sanitation.[31] Furthermore, businesses in these structures are formally recognized by their local authorities. Some food market infrastructures like supermarkets have improved cleanliness and ambience when compared to others like open air markets. Food items are also protected from harsh weather conditions which reduces food loss. Additionally, they also protect customers and employees from harsh weather conditions. Nonetheless, the risk of causalities in case of disasters like fire outbreaks can be higher than open air markets because of their restricted exit doors. Other infrastructure facilities like food warehouses and silos act like urban granaries storing food for the urban population. These facilities enhance food system resilience in situations of short lived shortages. Facilities like slaughter houses, when well-managed, help local authorities in overseeing meat safety in urban areas. Nevertheless, when they are poorly managed, they can be hot spots for meat safety concerns. Furthermore, when the wastes from such facilities are also not properly manage, they often contribute to air pollution because of the bad smell.

Urban food system infrastructures also consist of semi-permanent kiosks, iron-sheet stalls, and makeshift wooden tables erected on road reserves, along pedestrian way leaves, or on vacant municipal land. While these structures are critical for bringing food close to the people, especially on their way home, they are often associated with low food hygiene because of the poor food handling and packaging practices. This is especially of great concern because they are exposed to dust and fumes from the road, vehicles and pavements. Since the food sold on or from such infrastructure often do not have sufficient protection from harsh weather conditions, they are bound to contribute to more food loss than approved infrastructures.

Mobile food businesses infrastructures represent the most flexible, yet physically demanding, infrastructural typology in urban areas. This category includes street hawkers, vendors pushing handcarts, and traders utilizing, trucks, pickups, bicycles, tricycles or motorcycles to distribute perishables like fresh vegetables, fruits, fish, boiled and eggs, and also purified water. The infrastructure or facilities help mobile vendors to serve a critical "last-mile" distribution function. They navigate pathways and roads to deliver food directly into densely populated neighborhoods where large, fixed markets do not exist and where residents may lack the means to travel to the central business district.[28] In the urban core, they help bringing food to those who, because of one reason or another, are not able to leave their duty stations to access stationary markets. Moreover, mobility is also used as a strategic adaptation by vendors to evade municipal harassment, avoid paying daily market levies, and chase shifting consumer demand throughout the day.[30] However, relying on locomotive structures means these vendors suffer from severe infrastructural deficits, including a lack of safe overnight storage and high exposure to extreme weather, leading to significant post-harvest losses.

Urban food systems utilize the three infrastructural typologies to serve their residents. While local authorities normally prioritize fixed and approved structures, they have their risks just as do the often unapproved semi-permanent and mobile infrastructures which also have their advantages.

3.5. Use of technology

Food businesses may involve the use of advanced and efficient technologies or be heavily manual. There are technologies that help with manual labour and those that help with soft processes. These technologies are distributed along the food value chain from production to waste management and are meant to ease labour, enable value addition and increase efficiency thereby reducing losses and wastages. Formal and informal businesses in urban food systems use technologies in varying degrees depending on the nature of the food businesses. Formal business like food processing factories use heavy duty machines to process and package food while informal small scale businesses use small machines to do the same. For example, informal juice and smoothie vendors use blenders and juicers to process their food products. Large scale formal food businesses also use a combination of various technologies to do quality testing and batch traceability in processed foods. These may include laboratory analytical tools, process monitoring tools, digital traceability systems, and statistical quality management tools. Further, formal retail outlets use various technologies to take product inventories, track product sales, monitor stock levels. All these technologies combine together to reduce food and economic losses.

Informal urban food system business because of their small sizes use fewer technologies than formal large scale ones. Even so, where they use them, there are gains in efficiency. For instance, use of mobile payment platforms like MPESA reduces the need to visit banks to deposit or withdraw cash. These platforms also help in keeping financial records which could help them in accessing credit to boost their businesses.

As much as technologies help in achieving efficiency and reducing losses, not all of them contribute positively to health security which is the ultimate goal of food systems. Pasture raised livestock products such as meat, milk and eggs have nutritional and sensory advantages when compared to those raised largely on grains and in intensive production systems. For instance, they have a more favorable fatty acid profile (especially higher omega-3 fatty acids and conjugated linoleic acid [CLA]) and higher concentrations of some antioxidants and phytochemicals.[32,33] Prolonged use of inorganic fertilizers is also known to lead to poor soils.[34,35] Technologies that lead to super refined foods are actually technologies of value subtraction rather than value addition for they sometimes subtract nutritional value that the foods actually have in order to make them refined. As already noted in earlier sections of this paper, some technologies of food preservation employ chemicals that are altogether not health promoting but are rather detrimental to health when habitually used. In spite of the increase in food production and reduction in food loss due to pests and diseases, the use of biotechnology has also been blamed for negative impacts in food systems. Biotechnology, therefore, has advantages and disadvantages as summarized by Nasser, et al.[36] Since informal food business sometimes depend on the products of formal ones, the negative impacts of technology cut across the technology divide and are intertwined.

3.6. Pricing systems

Food system business may have fixed or flexible prices for their goods. Formal retail businesses tend to have fixed prices for their goods while informal ones tend to allow for bargaining. Some formal food system businesses also allow for bargaining. The decision to purchase food items, for example, from a supermarket or a street vendor, may be informed by the opportunity for bargaining which for the urban poor may mean the difference between missing a meal and having one. Governments may control the prices of certain food system items to avoid exploitation or in consideration of the poor. However, because of low incomes for the urban poor, the opportunity to bargain means a lot to them. The middle and upper income classes also take advantage of bargaining whenever they can.

In formal retail outlets like supermarkets, discounts and gifts are offered instead of bargaining. These encourage bulk purchases and also help in reducing food losses at the supermarkets. In informal businesses, discounts may be offered from the onset of a prospective purchase or may come as a result of bargaining. Thus, in informal food businesses, discounts and bargains often intersect. Formal and informal food system businesses have pricing mechanisms that help in enhancing economic access to food, which is critical for the urban poor, and reduce food loss at the retail stage of food systems.

4.0. Impacts of formal and informal food system actors on climate change

United Nations Framework Convention on Climate Change (UNFCCC), in its Article 1, defines climate change as: ‘a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods’.[37] This definition implies that there are human activities that alter the composition of the global atmosphere which in turn alters the climates of the world. According to this perspective, human activities release greenhouse gases (GHG) such as

methane, carbon dioxide, nitrous oxide, among others into the atmosphere. These gases once released into the first layer of the atmosphere called the troposphere, it is postulated that they help trap a lot of Sun's heat within the layer. This leads to global warming. High global temperatures leads to high evapotranspiration which could lead to heavy rainfall which in turn erodes river banks, floods neighborhoods and destroys property such as houses and vehicles. Heavy rainfall could also lead to other hazards such as landslides, poor sanitation and destroyed infrastructure. High temperatures also lead to heat waves, droughts, risk of hunger, wildfires, and water scarcity. Due to these associated risks, anthropogenic global warming theory appears to be the most popular theory of climate change to which even Pope Francis weighed in in his encyclical letter *Laodato Si.* Still, not all scientists and religious persons agree as to the actual causes of the various hazards and disasters associated with climate change. There are competing theories and religious perspectives concerning this issue,[38–40] which is not the purpose of this paper to attempt to resolve. Since anthropogenic global warming theory (greenhouse warming theory) is the most common perspective, we apply our conceptual evaluation of formal and informal businesses against it.

According to this theory, GHG from human activities are the major culprits in climate change. This informs mitigation measures such as carbon sequestration through planting of trees, development of efficient machineries to reduce emissions, promotion of the use of green energies like solar energy to avoid emissions, and direct capture of methane from landfills among others. These strategies, respectively, boil down to carbon sequestration, emissions reduction, emissions avoidance, and methane abatement. Several studies have observed that informal and formal food businesses do contribute to GHG emissions through their various value chain activities.[41–44] The one source of GHG that has been keenly pointed out is from food loss and waste since one third of food produced globally does not reach the consumer. These losses and wastes of food happen within the value chain activities of formal and informal businesses and in the households of consumers. Besides GHG from food loss within informal and formal food businesses, there is also the emissions from machinery like power generators and vehicles that use fossil. Formal business that import perishables like fruits by freight also have a higher climate change impact according to the GHG global warming theory. Informal food traders, because of their scale, may not use big power generators. Yet, they use small generators to power irrigation in peri-urban areas and use public service vehicles most of which use fossil fuels. On one hand, big formal businesses often use electricity and liquid petroleum gas (LPG) (which has a low GHG emissions rating) to cook or process food. On the other hand, informal businesses like street food vendors frequently use charcoal, firewood, and kerosene which have a higher rating than LPG. Having noted that, both formal and informal food business contribute to GHG emissions.

Conclusion

From the foregoing discussions of informality and formality of urban food systems, it can be seen that the two work together in contributing to food and nutrition security in urban areas. Informal aspects of urban food systems have frequently been pathologized as being a hindrance to the sustainability of urban food systems. We have demonstrated that both formal and informal aspects of urban food systems have their pros and cons in making urban food systems sustainable. As stakeholders work towards achieving food and nutrition security by eradicating hunger (SDG 2), it is best to leverage on the strengths of and reduce the negative impacts of formal and informal food system aspects within their jurisdictions. Transforming urban food systems into purely formal or informal will not be able to meet the crisis of food and nutrition security in urban areas.

Ethics and consent

Ethical approval and consent were not required.

Data availability

This is a conceptual article and did not require data.

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