Food Mapping Approaches and the Needs for Agri-food System Mapping in Yobe State, Nigeria: A Review

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A B S T R A C T

The study review articles on food mapping approaches and the needs for Agri-food system mapping in Yobe state, Nigeria. The need for Agri-food system mapping in the state is highly encouraged due to the fact that a clear picture of the food supply chain in the state will be revealed even though there is no empirical evidences on food mapping in Yobe state. Food mapping will help ensure absolute food security and made the supply chain easier to all parties across the Agri-food system and will serve as a very important activity in food strategy development and response. The study revealed an overview on the whole mapping processes which will serve as a stepping stone for researchers, government and NGO's to carry out the food mapping. The mapping can be participatory involving stakeholders across the food system or static geospatial approaches are important to understand the directional flow of food commodities from a range of dimensions. The study recommended that food mapping should be done in order to understand the food inflow and outflow in the state, standard supply chain linkages among the stakeholders in the Agri-food system, food dessert areas and the nutritional needs of the communities as well as a strategic food development and production plan to improve food security should be encouraged.

Keywords: Food, Mapping, Agriculture, System, Approaches, Security

1. Introduction

The global food system has been experiencing a serious setback as a result of various factors associated with climate changes, insecurity, economic, political, and social factors. It was revealed that over 3.1 billion people cannot afford to buy a healthy diet, with 691–783 million people suffering from extreme hunger (FAO, IFAD, UNICEF, WFP, and WHO, 2023). Food systems contribute to human health, economic prosperity, and planetary health. Therefore, achieving food system transformations toward lively systems that ensure more sustainability, healthier, and equitable food system will require a vast shifts in mindsets, including the recognition of food as not just a commodity but the foundation of cultural heritage, nutrition, livelihoods, and landscapes (Webb *et al.*, 2020). The FAO's Global Report on Food Crises 2022 classified nearly 193 million people as "acutely food insecure," an increase of nearly 40 million compared to 2020 (FAO and WFP, 2022). The process of food mapping is tied up with the concept of food security, which is described as the situation of having easy access to a choice of acceptable, affordable, healthy food without anxiety or fear (World Food Summit,2002). The world's food systems are rapidly changing due to socioeconomic, environmental, and demographic changes as well as globalization, and urbanization. These result in more food crisis across the globe.

In today's age of globalization, food systems are affected by multiple interacting threats. These include inflation, the cost of living crisis, rising exchange rate, uneven post-COVID-19 economic recovery, conflicts (e.g. Northern part of Nigeria), and climate change tremendously hindered the Agri-food systems. These are compounded by the world inequality impacting supply chains and access to food, with marginalized consumers in low income countries bearing the brunt of ongoing food, energy, and economic crises (WFP, 2022). It is known that majority of the grain/crops grown in the country are from the North-eastern part of Nigeria but sadly when it comes to food aid distribution in the country, most of the grains were brought from other states particularly Kano, Kaduna and Abuja. This made food supply and accessibility to be difficult in the state thereby increasing food insecurity, hunger and the cost of food items in the market. In Yobe state, there is no empirical evidence on food mapping but a lot of data were collected on available food items as well as on crop grown in the state agricultural zones. Therefore effort should be made on food mapping in order to have a clear analysis of value chain and food flow maps.

2. Concept and Approaches

According to Blair (2003), Food mapping has been defined as the process of finding out where people can buy and eat food, and finding out what the food needs of local people are. Food mapping is a term applied to the process of developing a picture of the extent of provision of an aspect of food in a certain area. Food access is the aspect that is most commonly mapped, for example, gaining understanding of where food can be obtained, and what kinds of food are available. It is also common to map different food services being delivered in an area, for example cereals grains, legumes etc. An effective food mapping exercise might identify 'food desserts', i.e. the places where access to food is poor. Also by mapping the kinds of food that are accessed and consumed, we can get an understanding of nutritional needs in different communities across Yobe state.

A food map is not necessarily compiled in the geographical sense, i.e. like an A-Z, or Ordinance survey, but might exist simply as information on a database. There are however a lot of advantages to mapping food data on a geographical map, such as a GIS (Geographical Information System), which can be made publicly accessible through the internet. The advantage with GIS is that it enables users to obtain easily understandable visual representations of a situation, plus users have flexibility and choices in how they access and cross examine data. Food system mapping represents an

approach used to identify all stakeholders, institutions, goods and activities (including losses and waste), food flow levels and rates, along with policies, economic (e.g., value addition, food safety and quality, food diversity, poverty reduction, etc.), and environmental characteristics, to record the "status quo" and "dynamic change" of any food system in the world. Food mapping tends to provide a static depiction of the basic structure and a framework to guide systematic analysis (Kiambi *et al*., 2018), and a time course-based food mapping can reveal rates of changes and dynamics in Nigerian Agri-food systems. Time course-based food mapping consists of measuring food system characteristics along successive time points.

Food mapping approaches aim to develop visual representations of geospatial and other sources of data to enable improved decision-making. Food mapping can be participatory, involving stakeholders across the food system to expose hidden disparities, strengths, and weaknesses within the food system (Sweeney *et al*., 2016). While static geospatially tagged "snapshots" are important, it is also necessary to understand the directional flow of food commodities from a range of dimensions. Ideally, assessments should provide a better understanding of the relative importance of each food flow component. This is important to avoid the risks of blind spots as a result of missing, biased, or skewed data sources (Alarcon *et al*., 2021).

2.1 Approaches to Food Systems Mapping

- Participatory (Ahmed *et al*., 2019; Terdoo and Feola, 2021), qualitative (Batista *et al*., 2021), and quantitative methods. Like in all community food mapping processes it uses an approach to community development called Participatory Appraisal, which enables local people to identify persistent food insecurity issues in their community and explore ways in which those problems can be addressed effectively. Participatory Appraisal (PA) uses visible and committed approaches, tools and activities to assist community members express their views in an accessible, non-judgemental, inclusive and enjoyable way. Participatory method usually has to do with the creation of maps particularly when trying to understand the way communities work, where things and places are located and what happens where and why. The approach involves going to places where people already come together and encourages them to talk, listen and think together for effective food mapping and security.

- Geospatial methods frequently involve the use of geographic information systems (GIS)-based mapping software (Widener *et al*., 2011; Jensen and Orfila, 2021), spatial analysis, and visualization including internet-based geospatial tools such as *Google Earth, ArcGIS Open Data,* and *ArcGIS Storymap*, and guides such as FAO's City Region Food System (CRFS) programme (Posthumus *et al*., 2021). In addition to static representations, geospatial analytic approaches can also be employed to analyze and communicate geospatial changes over time. Despite the technological power of geospatial methods, limitations such as the relevance of data points, scale, cost, and feasibility can be encountered.

Food mapping is one method used to describe and measure a community's level of food security and is therefore not just about producing spatial maps describing physical and economic access to food. *'Food maps must also be able to describe how people feel about local food access – for example, how culturally acceptable and appropriate it is, how convenient it is to access, how appealing it is, how safe it is to eat, do people have the skills and confidence needed to prepare healthier food options if available?'* Mapping efforts can be constrained by data availability. Therefore it is recommended that food flow mapping could be used to identify the flows and quantities of food from production and processing to preparation, consumption, and waste, to facilitate accurate and comprehensive food system, decision making and planning (Schreiber *et al*., 2021). Most food flow analysis as given by Drechsel *et al*. (2007), rely on tracing food to its source through the use of market surveys.

Comprehensive analysis of food systems also require an improved understanding of value generation (including what is meant by value and different stakeholders' perceptions of value) along the food value chain, including all waste streams and negative environmental externalities associated with the particular food value chain. Hence, food mapping also needs to carefully consider the dynamic sub-systems that manage the by-products and waste disposal through the food system.

2.2 The Food Mapping Process

- **Identify the area to be studied**

The area chosen to map should be considered carefully. Consider the population density is for the area, available resources, natural geographic boundaries such as motorways, railway lines, town centres. Ensure all these factors are taken into consideration.

- **Identify the food items (grains) available to the local population**

Using participative research methods or participatory appraisal, a list of key, basic foodstuffs typically consumed by the local groups were identified.

- **Identify the local retail availability in the community**

Where are these foods available locally? What kinds of retailers exist? Where are these shops? Are they near a bus route or pedestrian access? Are they accessible to people or have mobility problems? Are they only reachable by car? Are there busy roads to cross? What quality and freshness of food is sold? To capture this range of information, a full census of all retail outlets selling food etc must be known.

- **Recording quantitative data**

Coding of quantitative data into SPSS ver. 16 and retailed-based indices of availability and Mean Cost Price for items should be calculated. Coding adds extra complexity to the mapping process but contributes to a more inclusive and robust consultation process.

- **Generating maps of quantitative data**

By using the data generated and GIS, maps should be produced to illustrate the availability and price for food items.

- **Analysis and Interpretation of data**

Analyze the data using the most suitable statistical tools for analysis and interpret the results of the findings clearly.

2.3 The Benefits and Challenges of Food Mapping

The process of food mapping is complex and is seldom about finding quick fixes. There are many other issues to consider, some of which include:

1. **Frequency**

Food mapping therefore has to be an ongoing activity in order that progress can also be mapped and measured. This is another challenge, as resources have to be in place for this to happen on a regular basis otherwise the food mapping process cannot be achieved in the state or at the community level.

2. Mapping for Change

Food mapping can also be a very useful tool to promote changes particularly dialogue with retailers, planners and policy makers, particularly spatial maps as they are in a language and style that is often more familiar to them. In doing so, food mapping could help bring about positive change and effectively tackle the interlinking barriers to healthy food security. One of the reasons for food mapping at the state or community level is to provide changes in the food sector. And in doing so, the mapping for change process usually applies the principle to the food system associated with a place; for example a housing estate, neighbourhood, town, city or region etc.

A compiling list of the most frequently used food items in the daily food basket of Yobe state (Table 1) based on the survey conducted by OFI unit, Yobe State College of Agriculture, Science and Technology, Gujba.

Table 1: Distribution of the frequently used and available grain/crops grown and marketed in the Agric-food systems of Yobe state

Major Grain Markets	Minor and Linked Markets	Available Food Grains/Crops Grown	Food Mapping Approach	Scale of Mapping	Mapped Feature of Food System
Damaturu	Kukareta	Whole grain (sorghum, millet, cowpea)			
	Katorko	Whole grain (sorghum, cowpea) and sesame	Food Flow and Value Chain Mapping using Participatory research method	Local	Agri-food system and value chain
	Ngelzarma	Whole grain (millet, sorghum, groundnut, cowpea) and sesame			
	Babban gida	Whole grain (millet, cowpea) and sesame			
Potiskum	Ngalda	Whole grain (maize, millet, sorghum, groundnut, cowpea) and sesame	Food Flow and Value Chain Mapping using Participatory research method	Local	Agri-food system and post harvest losses
	Dawasa	Whole grain (millet, sorghum, groundnut, cowpea)			
	Ngelzarma	Whole grain (millet, sorghum, groundnut, cowpea) and sesame			
Buni Yadi	Tettaba	Whole grain (maize, rice sorghum, cowpea) and sesame	Food Flow and Value Chain Mapping using Participatory research method	Local	Agri-food system e.g. food supply and distribution, sustainable food items, food production etc.
	Bumsa	Whole grain (maize, millet, sorghum, groundnut, cowpea) and sesame			
	Wagir	Whole grain (sorghum) and sesame			
Garin Alkali	Jajimaji	Whole grain (millet, cowpea)			

	and sesame			
Girgir	Whole grain (rice, millet, sorghum, cowpea) and sesame	Food Flow and Value Chain Mapping using Participatory research method	Local	Agri-food system and post harvest losses
Buduwa	Whole grain (rice, millet, cowpea) and vegetables			
Baimari	Whole grain (millet, cowpea) and sesame			
Yunusari	Whole grain (millet, cowpea) and sesame			

Source: OFI survey, 2021.

3. Conclusion

In conclusion, food mapping is an extremely valuable part of local food strategy development and should be considered as an important activity in the early stages of strategy development. The purpose of food mapping is to ensure that your local food strategy responds to the needs, interests and experiences of different individuals and communities in the state. If the strategy is to truly represent the state you need to hear what different local communities and groups think about food and how the food system relates to them. However, food mapping requires time and effort and the capacity of your food strategies will be a key consideration in deciding whether or not and when to embark on this work. Community food mapping for some partnerships may be more appropriate as momentum builds and team capacity is developed. The process of public participatory appraisal can have a strong impact on food mapping and serve to bring active members together during the sessions. The work can bring a very powerful and motivating energy and build strong and meaningful connections with specific communities and groups. The participatory session is designed to be held as a public drop-in session which is accessible to individuals who might be active in the Agri-food system. This session could be held in a variety of public spaces with particular groups e.g. youth groups, elderly residents, retailers and wholesalers.

4. Recommendations

The study recommended that:

1. A comprehensive food mapping of all grains and other available food items should be done in order to understand the food inflow and outflow in the state.

2. There should be standard supply chain linkages among the stakeholders in the agri-food system so that food access will not be an issue.

3. A strategic food development and production plan should be encouraged to improve the food basket of the state.

4. Food dessert areas and the nutritional needs of the state communities must be captured to address food insecurity.

Acknowledgements

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