Mapping Nairobi's dairy food system: An essential analysis for policy, industry and research

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ABSTRACT

Demand for dairy products in sub-Saharan Africa, is expected to triple by 2050, while limited increase in supply is predicted. This poses significant food security risk to low income households. Understanding how the dairy food system operates is essential to identify mitigation measures to food insecurity impact. This study aims to determine the structure and functionality of Nairobi's dairy system using a value chain mapping approach.

Primary data were gathered through focus group discussions and key informant interviews with dairy value chain stakeholders in Nairobi to obtain qualitative information on people and products in the chains while describing their interactions and flows. Qualitative thematic analysis combined with flowcharts created by participants enabled identification of key food system segments and the development of chain profiles (or flow-diagrams) which together form Nairobi's dairy system.

Seven chain profiles forming Nairobi's dairy value chain were identified. These were found to be dominated by small-scale individuals who operate largely independently. Our profiles for the urban and peri-urban farming systems were structurally similar in their downstream networks, obtaining inputs from similar sources. Upstream, the urban systems were shorter, supplying mostly to immediate neighbours or based on own consumption, while the peri urban systems supplied to a wider network and showed some affiliations to producers' associations. Two distinct profiles characterize the milk flow from traders belonging either to a Dairy Traders Association (DTA) or those not belonging to this association (non-DTA). DTA traders sell mainly to fixed retailers and non-DTA traders to mobile retailers (hawkers or roadside vendors). Profiles associated with medium and large cooperatives were driven by networks of collection centres, but with medium-sized cooperatives selling half of their production to large processing companies, and large cooperatives only to fixed retailers. Large processing companies' profiles indicated distribution of high volumes and value addition processing. They reported strategic milk collection arrangements with suppliers on long, medium - or short - term contracts and with well-established product distribution channels.

We have identified numerous inter-linkages across dairy chain profiles in Nairobi's complex system, demonstrating significant interdependency among the stakeholders. Therefore, enhancing the system's efficiency requires a holistic, system-wide approach and any policy interventions should consider every segment of the value chain. This study provides a methodological approach for organizations and policy makers to understand and address structural and functional vulnerabilities within food systems more broadly. The insights from this study are relevant to other rapidly growing cities in the region.

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1. Introduction

Global demand for dairy products has gained prominence over the past few decades due to population growth and increase in per capita income in developing countries (Herrero et al., 2014), coupled with alteration of the global supply that has been influenced by significant changes in husbandry, genetics and nutrition linked to new processing and marketing systems. By 2050, it is estimated that in sub-Saharan Africa milk demand will triple with the greatest increases in East Africa (Herrero et al., 2014). However, milk supply across the region is not predicted to match the estimated demand. An in-depth consideration of milk value chains to identify strengths and weaknesses of the existing systems to estimate how they will respond to the shortfall in supply is critical.

In 2012, Kenya, the country with the highest per capita milk consumption in Africa (SDP, 2004), produced about 4.8 billion litres of milk (FAOstat, 2012); 75% was obtained from cows, 18.8% camels, 5.4% goats and 0.7% from sheep. The dairy sector is one of the largest agricultural segments of the country contributing about 4% of the national Gross Domestic Product (GDP) and 14% of the agricultural GDP (KDB, 2014). The industry which was initially monopolized by the government through the Kenya Cooperative Creameries (KCC) has rapidly evolved following its liberalization and decontrol of prices in the 1990s (Leksmono et al., 2006) resulting in an explosion of informal dairy markets while generating many opportunities for private processors (Muriuki et al., 2003). Growing at an annual rate of about 5 to 7%, the sector is a source of livelihood to roughly 1.8 million small-scale producers who account for over 80% of the country's milk producers (KDB, 2014). The marketing channels are mainly driven by the informal sector which is responsible for over 70% of all marketed milk (FAO, 2011a). This translates to over 40,000 employment opportunities which are approximately 70% of personnel working in the dairy industry in Kenya (FAO, 2011a).

Government annual reports on milk production indicate that milk production within Nairobi accounted for about 37 million litres per year (unpublished government milk production data, 2012). Conversely, milk intake is estimated to be highest in the urban centres at 125 l per capita (SDP, 2004). This implies that Nairobi, with a population of about 3.1 million people (KBS, 2010) consumed more than 388 million litres of milk in 2009 or approximately 10% of the country's production. Thus, over 90% of milk consumed in Nairobi is supplied through value chains linked to production outside the city. Understanding the structure and functionality of such milk chains is essential.

A few studies have attempted to describe the structure of the country's dairy value chain (Baltenweck et al., 1998; Staal et al., 2001; TechnoServe, 2008; Rademaker et al., 2016). However, the methodologies used have been on general flows rather than a comprehensive description of each of the specific segments of the dairy value chain, which is critical in understanding the overall dairy system.

The current study utilizes the 'Mapping' component which is one of the four critical steps in conducting a value chain analysis (VCA) (Kaplinsky and Morris, 2000; FAO, 2011b). Mapping involves a systematic analysis of the people involved and products flow along the value chain taking into consideration input supply, production, processing, distribution and marketing activities of a specific product or service (Kaplinsky and Morris, 2000). It provides a visual depiction of the basic structure and a framework to guide systematic chain analysis and other important areas such as food safety and pathogen flows (Alarcon et al., 2017). The aim of this study was to identify and assess the structure and functionality of the Nairobi's cattle dairy value chain.

2. Materials and methods

This cross-sectional study was implemented in Nairobi County between January 2014 and January 2015. The research questions investigated in this study were: 1) Who are the people (and organizations) involved in the Nairobi's dairy value chain? 2) What is the structure of the milk production and milk flow into the city? 3) What is the overall structure of the Nairobi's dairy value chain? and 4) What are the factors that define the interaction of different stakeholders? The mapping methodology used in this study is based on (Alarcon et al., 2017).

2.1. Study area

Nairobi County, the capital city of Kenya, is the second largest city by population in Africa's Great Lakes Region after Dar-es-Salam and is the 13th most populated city in Africa (CIA, 2014). With a population of > 3.1 million multi-ethnic residents, Nairobi hosts approximately 8.1% of the country's total population (KBS, 2010). With the projected annual growth rate of 4% (Aubry et al., 2010), Nairobi will be home to > 5.7 million people by 2030 and approximately 8.2 million people by 2050. The County is divided into nine sub-counties (Fig. 1). Dairy farming is practised in all the sub-counties (unpublished government milk production data, 2012). Kasarani and Lang'ata sub-counties produce the highest quantities with an average annual production of > 12 million litres while Embakasi, Makadara and Kamukunji produce less than one million litres per year.

2.2. Selection of participants

A stakeholder analysis was done through a detailed desktop review to identify the main organizations and people involved in the dairy value chain and to determine the process of data collection.

2.2.1. Key informant interviews

Key informant interviews (KIIs) with relevant senior staff at the Directorate of Veterinary Services (DVS), Directorate of Livestock Production (DLP) and the Kenya Dairy Board (KDB) were done to further identify and validate the developed list of key people and organizations, and to generate an initial flow diagram of the dairy system in Nairobi. Broad consultations with other researchers who were or had previously worked on dairy value chain studies were done to improve on this stakeholder analysis. These included; United States Agency for International Development dairy value chain competitiveness program; International Livestock Research Institute and the Kenya Agricultural and Livestock Research Organization. At the end of each interview, the key informants were requested to suggest another person(s) who could be asked the questions that they could not handle adequately. They also suggested other companies or sectors that were viewed to play an important role in the system (snowballing interview process).

2.2.2. Focus group discussions

Selection of participants in each group was based on their specific type of enterprise and interviews conducted independently to each group. Whenever possible during the focus group discussions (FGDs), representation for both males and females was ensured to account for gender differences.

2.3. Data collection

Twenty FGDs with 105 people and 23 key informant interviews with 35 people were conducted (Annex 1). Secondary data from the Department of Livestock Production was analysed to understand the production systems within the city. Primary data were obtained through FGDs, key informant interviews (KIIs) and researchers' observations. Prior to engagement of the participants, written consent was sought and obtained and agreement on the preferred language (s) for discussions. A minimum of two research assistants recorded the discussions in notebooks and a backup of the audio and video recordings.

In each FGD, local person who understood the local language (s) was identified to clarify words or statements unclear to the group. Participants could brainstorm on each question until there was