FOOD SAFETY REGULATION IN TANZANIA'S INFORMAL DAIRY SECTOR: ENABLERS AND CONSTRAINTS TO ALTERNATIVE POLICY APPROACHES

A thesis submitted in partial fulfilment of the requirements for the degree of Doctor of Philosophy of the University of Pretoria

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ABSTRACT

Food safety systems in agricultural value chains safeguard the wholesomeness of foods consumed, yet they often fail in developing countries. The agricultural value chains in developing countries are often characterized by the dominance of informal food markets which lack food safety regulations. The informal markets elicit food safety concerns among consumers and government authorities. Yet, even alternative food safety interventions by governments in the informal markets have had a poor uptake. Little research exists on these failures from a capacity, incentives, and coordination perspective. This research addresses this gap by asking: What challenges limit the food safety regulation and formalization of Tanzania's dairy sector under the current policy framework, and what has limited the success of an alternative policy approach to food safety and formalization of the dairy sector in Tanzania?

Given its overall informal market and food safety gaps, Tanzania's dairy sector was chosen as a case study. The research adopted a pragmatic mixed-methods grounded theory approach. Data were collected through a semi-structured survey, key informant interviews, and document review. Deductive analysis revealed a failure of the training and certification (T&C) intervention to achieve the anticipated intervention outcomes. An inductive thematic analysis revealed seven main themes explaining the failures of the food safety policy approaches in Tanzania's dairy sector:

1. Lack of autonomy in decision-making among policymakers

2. Multiple and overlapping governance roles among policy makers

3. Inadequate financial capacity among value chain actors and policy makers

4. Incongruence between food safety regulation and the cultural norms and beliefs

5. Lack of knowledge of the regulatory requirements among the traders

6. Lack of technical capacity among value chain actors and policy makers

7. Lack of adequate infrastructure among value chain actors and policy makers

A key finding was that the food safety policy approaches used to address food safety and informality in Tanzania's dairy sector were mismatched with the capacities and needs of the value chain actors and regulatory agencies. The implications for designing and reviewing such food safety management systems include the following: The core incentive for the training and certification intervention needs to be reviewed from a government-enforced policy requirement to a value chain actors-driven self-regulation incentive. Informal sector value chain actors must be facilitated to access credit facilities to acquire appropriate milk handling equipment. Lastly, the intervention financing model needs to be altered; government needs to take up the training costs to lift the cost burden from value chain actors, and where impossible, a training of trainers' approach could be used within trader associations where trainers train fellow association members for free to eliminate the costs of training individual traders. The training approach must also change from the traditional lecture-type model to the more effective adult learning approach. Adult learning is grounded on three key foundations; andragogy (student-directed learning), self-directed learning and transformative learning, which results in a transformation of perspectives among adult learners. Additionally, adult learning considers social perspectives and contextual influences on learning.

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DECLARATION

The findings and conclusions of this research are the original work of the named candidate and have not been submitted for any other academic award.

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LIST OF ABBREVIATIONS

A

Artificial Insemination (AI)

B

Business development service (BDS)

Business Registration and Licensing Agency (BRELA)

C

Chama cha Mapinduzi (CCM)

Hazard Analysis Critical Control Point (HACCP)

Contagious Bovine Pleuropneumonia (CBPP)

D

Dairy Development Forum (DDF)

Dsability-Adjusted Life Years (DALYs)

E

East Coast Fever (ECF)

East Africa Community (EAC)

East Africa Dairy Development (EADD)

European Union (EU)

F

Fire and Rescue Agency (FRA)

Food and Agriculture Organization(FAO)

Food Borne Diseases (FBDs)

Foodborne Disease Burden Epidemiology Reference Group (FERG)

G

Government Chemist Laboratory Authority (GCLA)

Gross Domestic Product (GDP)

H

Hazard Analysis Critical Control Point (HACCP)

I

International Organization for Standardization (ISO)

L

Livestock Development Authority (LIDA)

Low-and- Middle- Income countries (LMICs)

M

Making Markets Work for the Poor (M4P)

Metric Tonnes (MT)

Ministry of Industry and Trade (MIT)

Ministry of Livestock and Fisheries Development (MLFD)

Ministry of Livestock, Agriculture & Fisheries (MOLAF)

N

National Atomic Commission (NAC).

National Environment Management Council (NEMC)

Non-Governmental Organizations (NGOs)

O

Local government authority (LGA)

Occupational Safety and Health Authority (OSHA)

S

Southern African Development Community (SADC)

Sanitary and Phyto Sanitary (SPS)

Small Industries Development Organization (SIDO)

Small and Medium-Sized Enterprises (SMEs)

Sub Saharan Africa (SSA)

T

Tanzania Bureau of Standards (TBS)

Tanzania Dairies Limited (TDL)

Tanzania Dairy Board (TDB)

Tanzania Food and Drug Authority (TFDA)

Tanzania Industrial Research and Development Organization (TIRDO)

Tanzania Milk Processors Association (TAMPA)

Tanzania Milk Producers Association (TAMPRODA)

Tanzania Revenue Authority (TRA)

The East African Community (EAC)

Training and Certification (T&C)

U

Ultra-High Temperature (UHT)

W

Weights and Measures Agency (WMA)

World Animal Health Organization (OIE)

World Food Program (WFP)
World Health Organization (WHO)

World Trade Organization (WTO)

CHAPTER 1

1 INTRODUCTION

1.1 INTRODUCTION

This research is about the root causes of the poor performance of Codex food safety regulation. It also addresses the effectiveness of an alternative food safety regulation and the influence of contextual factors on the effectiveness of the alternative food safety regulation in Tanzania. It analyses the interaction of the socio-economic dynamics experienced by value chain actors and regulatory agencies with the two policy approaches to illuminate how the capacities and incentives of value chain actors and regulatory agencies enable or constrain their implementation of the food safety regulations. In this respect, it carries important lessons for policymakers and development practitioners on what limits the uptake of food safety regulation and what would constitute feasible policy options for food safety regulation.

1.2 BACKGROUND

Food safety of animal source foods in informal markets is at the centre of debate globally due to the severe safety hazards in animal source foods in these markets. Food-borne diseases, including diarrhoea in developing countries, which contribute significantly to disability-adjusted life years (DALYs), have been attributed to animal source foods. The Food Borne Disease Burden Epidemiology Reference Group (FERG) study indicated that in 2010, 31 major food hazards caused 33 million DALYs, 600 million illnesses, and 420,000 deaths. Children under five bore a disproportionately higher burden of FBDs at 40% (WHO, 2015). While it is still not possible to quantify the burden of malnutrition-related to illness caused by animal source foods, current estimates indicate that in 2019, 144 million children under five years of age were stunted globally (FAO et al., 2020).

Poor nutrition before and during pregnancy, compromised maternal health, inadequate breastfeeding, consumption of unsafe foods by young children, and inadequate sanitation and hygiene are some key causes of stunting in children. Stunting occurs mainly in children under two years, is almost always irreversible, and has severe impacts. The effects of stunting include reduced

physical and neurodevelopment, increased morbidity, and mortality, among others. Diarrhoea is a major cause of undernourishment in children under five years. While little is known about the cause of diarrhoea among children in low-and middle-income countries, it is likely caused by livestock products harbouring various bacteria. A recent World Bank report reported 208 DALYs per 100,000 population in Sub- Saharan African (SSA) countries with adequate funding for veterinary services. In comparison, 569 DALYs per 100,000 persons were reported in countries without adequate funding (WHO, 2015).

Traditional smallholder production and marketing systems, which provide most animal source foods in Sub-Saharan Africa, are ill-equipped to respond to food safety. Without regulation and monitoring, such systems can harbour food safety hazards. Microbial and chemical hazards (e.g., salmonellosis, tuberculosis, brucellosis, antimicrobial residues, and mycotoxins) are often identified in these informal sector animal food value chains (Kikuvi et al., 2010; Namanda et al., 2009; Paudyal et al., 2017).

Research on food safety risks from livestock products in developing countries is limited. However, the few studies that have been conducted indicate that food safety in the informal sector is low. The contributing factors to the low food safety include adulteration, inadequate processing, and high microbial loads, as most foods in the informal market are not inspected. Where inspected, the method used is sporadic and does not follow the farm-to-fork chain (Grace et al., 2008; Mengistie et al., 2013; Omore et al., 2004). Hyera, (2015); Lubote et al., (2014); Velázquez-Ordoñez et al., (2019) report food safety concerns over milk safety in Tanzania. The concerns include poor hygiene due to lack of potable water, inappropriate milk transportation containers, lack of hygiene, and poor refrigeration. Important pathogenic bacteria, including Escherichia coli 0157:H7 and Salmonella, have also been found in milk sampled from milk traders, smallholder dairy producers, street vendors, and retail shops (Lubote et al., 2014; Scoder et al., 2013).

In Tanzania, 95% of all milk traded is sold through the informal sector, where boiling is a common practice before consumption (Njombe et al., 2011). The boiling eliminates most pathogenic bacteria from milk. Still, the consumer could be exposed to pathogenic bacteria through possible recontamination and the presence of heat-stable toxins produced by bacteria, other chemicals, and aflatoxins (Kilango et al., 2012). Some traders also ferment milk and sell it as sour milk; traditional

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milk fermentation inhibits pathogenic bacteria growth, including Staphylococcus aureus, but safety is not guaranteed (Roesel & Grace, 2015). Some consume raw milk without subjecting it to any treatment, increasing their chances of contracting food-borne diseases, which reduces the productivity of individuals by diminishing their ability to work (Grace, 2015). This theory highlights a food safety challenge in the prevalent informal dairy sector due to a lack of food safety regulation.

Governments in developing countries, including Tanzania, have adopted risk-based food safety regulation approaches, but these have been largely ineffective. Consequently, the informal sector continues to dominate economic activities in the less industrialized countries and economies dominated by subsistence peasantry. The Codex food safety regulation has been adopted by developing countries but has failed due to a lack of requisite capacities and incentives among value chain actors and regulatory agencies responsible for its implementation (Jaffee et al., 2019; Unnevehr, 2015; Unnevehr & Ronchi, 2015). Moreover, there is a gap in knowledge on the nature, extent and drivers of the capacity and incentives deficiencies among value chain actors and regulatory agencies in the context of Tanzania's socio-economic dynamics.

While governments have intervened in the informal markets using alternative policy approaches such as the Training and Certification (T&C) intervention in several countries, such interventions have met limited success. There is a knowledge gap on why smallholders involved in informal production and the market often fail to embrace these initiatives. In the case of Tanzania, indications are that the T&C intervention was received with little enthusiasm. In addition, very little is known about why smallholders have not taken up the T&C. Some have suggested that the business development service (BDS) providers have not been proactive in training traders, the training fees required from the traders have been a disincentive, the dairy inspectors have not been efficient in enforcing the Dairy Industry Act to create demand for the training and certification among traders, and stakeholders have not been adequately sensitized on the potential business returns of implementing the training and certification (Blackmore et al., 2020; Johnson et al., 2015).

1.3 RESEARCH PROBLEM AND STUDY RATIONALE

The lack of knowledge of context-specific root causes for failure to implement the Codex food safety regulation constrains appropriate intervention by government and development practitioners. Further, the knowledge gap on the effectiveness of the alternative T&C policy approach and the underlying causes for its degree of effectiveness constraints scaling and intervention improvement by development practitioners. Investigating the root causes of the ineffectiveness of the Codex food safety regulation approach, the effectiveness of the T&C policy approach and underlying reasons for the degree of effectiveness achieved is important. Such information could convince policymakers to adopt context-appropriate and effective policy approaches to food safety regulation. It is also important to inform development practitioners in formulating and implementing context-appropriate, effective strategies for food safety regulation. This study, therefore, seeks to contribute to the scholarship on the informal sector, its formalization, and the underlying factors affecting governments' attempts at formalization. Tanzania is characterized by low economic development and underdeveloped governance institutions, making it a suitable case study to inform policy food safety interventions in similar contexts.

The M4P framework was applied to determine the root causes for the ineffectiveness of the Codex food safety regulation. The theory of change framework, on the other hand, was used to determine the extent of effectiveness of the T&C intervention and the underlying causes—the application of the two analytical frameworks is detailed in chapter 3.

1.4 RESEARCH AIMS AND QUESTIONS

This research seeks to achieve two broad objectives. The first is to characterize the nature, extent, and drivers of challenges faced by dairy value chain actors and regulatory agencies in achieving food safety in the dairy sector in Tanzania under the current risk-based Codex food safety regulation policy framework. Literature indicates a general lack of adequate capacity, incentives, coordination, and data among dairy value chain actors, policymakers, and regulatory agencies to implement effective food safety in Tanzania's dairy sector. Furthermore, there is incongruence between formal rules and cultural norms and beliefs that govern the dairy sector. However, there is no comprehensive evidence on the nature, extent, and drivers of challenges among the dairy

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value chain stakeholders (value chain actors, policymakers, and regulatory agencies) involved in food safety in the dairy sector. The existing information on these challenges only identifies the nature of challenges and is fragmented, making investment decision-making in addressing the challenges difficult. Therefore, this research seeks to interrogate the nature, extent, and drivers of implementation challenges in food safety among all dairy sector stakeholders under the existing food safety policy.

The second objective is to determine the extent of effectiveness of the T&C intervention in addressing food safety and the contribution of each of the three pillars of intervention success (enabling policy environment, incentives, and simple technologies) to the overall effectiveness of the intervention. The three pillars constitute both direct and indirect policy measures. The information on the effectiveness of the intervention will inform how the direct and indirect policy measures can be combined optimally in the context of implementation to achieve desired food safety outcomes.

The two broad objectives are further broken down into three specific objectives detailed in table 1.1 below.

This study aims to provide a fuller understanding of the issues detailed in the objectives by answering the following central question: What challenges limit the food safety regulation and formalization of Tanzania's dairy sector under the current policy framework, and what has limited the success of an alternative policy approach to food safety and formalization of the dairy sector in Tanzania?

This central question was further broken down into three research questions detailed in table 1.1, which the study sought to address.

Research questions	Research objectives
What are the nature, extent, and drivers of challenges (adequacy of capacities, incentives and coordination of food safety activities) faced by dairy value chain actors in achieving adequate food safety in Tanzania under the current food safety policy?	To investigate the root causes for the poor performance of Tanzania's dairy value chain actors in implementing the risk-based Codex food safety regulation.
What are the nature, extent, and drivers of challenges (adequacy of capacities, incentives, availability and adequacy of data, coordination of food safety regulation activities, and congruency of formal rules and norms and practices) faced by dairy value chain policymakers and regulatory agencies in achieving food safety in Tanzania's dairy value chain under the current food safety policy?	To investigate the root causes for the poor performance of regulatory agencies in Tanzania's dairy sector in implementing and enforcing the risk-based Codex food safety regulation.
What was the effectiveness of the T&C intervention in addressing food safety in Tanzania's dairy sector, and what was the contribution of the direct and indirect policy measures to the overall intervention effectiveness?	To determine the effectiveness of the T&C intervention in addressing food safety regulation in Tanzania's dairy sector and the influence of relevant contextual factors on the effectiveness of the intervention.

1.5 THESIS STRUCTURE

Chapter two of the thesis is a literature review which explains the theoretical framework of informality and policy options to address food safety regulation, an overview of Tanzania's dairy sector, historical policy approaches to food safety regulation in the dairy sector, and how they have failed to address informality.

Chapter three explains the analytical framework, study design, methods, and the analytical framework used for the study. It details the analytical framework, study design, sampling approach, data collection techniques, data analysis criteria, and how the research process unfolded.

Chapter four is the first empirical chapter that profiles the dairy value chain actors and the nature of their activities in the value chain. The chapter also details an analysis of the challenges related to the capacities and incentives of the value chain actors in achieving food safety. It also looks into the coordination of the value chain actors in food safety activities in implementing the existing food safety management system based on the Codex Alimentarius standards and the SPS agreement.

Chapter five is the second empirical chapter which analyses various aspects that limit enforcement of the Codex-based food safety regulation by regulatory agencies. 1) The clarity of roles, responsibilities, and the degree of coordination among regulatory agencies; 2) The performance of the regulatory agencies in the regulation of food safety in the dairy sector;3) Government attitudes towards the informal sector; 4) The existence and adequacy of the requisite capacities and incentives among dairy sector regulators; 5) The congruence between the formal dairy sector regulations and the cultural norms and beliefs about the food safety of raw milk.

Chapter six is the third empirical chapter which addresses two elements. First, the chapter assesses the overall effectiveness of the alternative policy approach in influencing knowledge in milk safety, milk handling practices, and milk quality among trained traders. Second, the chapter assesses how each of the composite direct and indirect policy measures contributed to the overall effectiveness of the alternative policy approach.

Chapter seven is the conclusion chapter, which summarises the challenges faced in achieving food safety in Tanzania's dairy sector under the existing policy approach and the reasons for the

effectiveness achieved with the training and certification intervention. The chapter further summarizes the policy implications of the research outcomes, limitations of the research and recommendations for further investigation.

CHAPTER 2

2 LITERATURE REVIEW

2.1 INTRODUCTION

This chapter discusses available food safety regulation policy options and the adoption of the risk-based food safety regulation policy approaches, considered best practices globally. The chapter also discusses the shortcomings of policymakers and regulatory agencies that underpin the ineffectiveness of risk-based food safety systems—in which results in prevalence of informality. The chapter further explains the causes of informality and policy approaches to address it. This is followed by a review of the exit and exclusion of value chain actors from the formal sector under the Codex food safety regulation in Tanzania's dairy sector. The section argues that value chain actors lack incentive to comply with the regulatory systems or capacity to participate in the system. The section concludes with a review of implementation of the T&C intervention to address food safety regulation in Tanzania's dairy sector.

2.2 FOOD SAFETY REGULATION POLICY OPTIONS

Public intervention to any food safety challenges may range from doing nothing (leaving the market to devise the best solution) to direct regulation characteristic of the responsive regulation approach to formalization (Martinez et al., 2013). There are various options between doing nothing and direct regulation, including industry self-regulation, provision of information by the government, awareness campaigns by the government, co-regulation, and establishing incentive-based systems. Policy options are informed by the cost-benefit analysis, which considers the net effect of the chosen regulation. Governments may opt to do nothing where there is an unequal distribution of regulation costs; for example, the cost burden of regulation is prohibitive to low-income consumers and small businesses. The difficulty and prohibitive costs of enforcing specific regulations may result in the government doing nothing. The other extreme of policy regulation is regulatory action where markets fail to meet public health requirements endangering consumers. This may involve a direct ban of certain products or processes and the prescription of specific standards that food handlers must meet. On the other hand, incentives may be devised depending

on the risks posed by various products in the market. For example, animal source products that pose a more significant threat to FBDs receive greater attention from the public sector and attract heavier penalties for non-compliance. While there are multiple policy options for food safety regulation, the dilemma remains the adoption of the most effective options or combinations of options in different contexts with varied implementation capacities (Martinez et al., 2013).

2.2.1 THE HISTORY OF DIRECT AND INDIRECT POLICY MEASURES IN FOOD SAFETY REGULATION

Food safety regulation dates back to the early 20th century when the command-and-control approach prevailed. The command-and-control policy approach to food safety utilizes detailed standards which specify the food standards that must be complied with. The key features of a command-and-control approach to food safety are inspections and end-product testing. The approach is reactive rather than preventive in that inspections identify, and end-product testing confirms food safety failures. This approach is resource-intensive and, on its own, does not prevent the occurrence of FBDs. Governments set standards in command-and-control approaches. The regulators are also responsible for food safety, where they must ensure that standards are met. Scholars, however, argue that direct policy measures have little success in addressing food safety (Martinez et al., 2013; Yapp & Fairman, 2006).

Reforms in food safety regulation were instituted in the 1990s when the risk-based approach to food safety was introduced. The risk-based approach was driven by advances in food-borne illnesses epidemiology and a better understanding of risk assessment. Risk assessment is a component of risk analysis; a three-step approach that entails risk assessment, risk management, and risk communication. Risk assessment involves hazard identification and characterization to inform quantitative estimation of the adverse effects likely to occur in a population. Comparative risk assessment allows prioritization of the most significant risks for optimal resource allocation. Risk management entails making decisions on where to reduce risks. Determination of where and how risks are likely to occur enables adopting the most appropriate interventions to address the risks. Risk management also involves decision-making on the acceptable levels of risks which depend on public perceptions, social norms, and economic costs. On the other hand, risk

communication entails educating the public on what is known about hazards and their risks, the unknowns, and the rationale for interventions adopted for risk reduction (Unnevehr, 2015).

The risk analysis approach has been widely adopted in addressing food hazards along agricultural value chains. The policy has embraced a farm-to-fork preventative approach often characterized by the Hazard Analysis Critical Control Point (HACCP) approach to evaluating and controlling risks. The HACCP approach, first developed for food manufacturing firms in the 1960s, has been adapted for general application as a food safety regulatory tool. It is based on the principles of determining where food safety risks enter the value chain, where they are likely to reach unacceptable levels and specific control measures that need to be applied to prevent the occurrence of the risk. Focusing on critical control points allows for scientific management of risks. It optimizes economic efficiency by focusing control efforts where they will be most effective (Unnevehr, 2015).

A risk-based policy approach to food safety regulation requires food businesses to conduct a risk assessment to identify and control food hazards. Furthermore, the risk-based approaches allow co-regulation to yield better food safety outcomes than deterrence policies and adversarial strategies. Co-regulation is based on food safety culture and shared values among value chain actors and regulators (Martinez et al., 2013). The approach entails a mixture of efforts between the food business owners and the regulators where the business owners must adhere to standards set by the regulator and address non-compliance. In contrast, the regulator oversees the efforts of the business owners and imposes sanctions where necessary. Co-regulation is, however, dependent on the commitment and capability of business owners to achieve self-regulation and the regulator's ability to optimally execute the oversight role (Smith et al., 2016).

Generally, the implementation of risk-based food safety systems requires the availability of four main capacities. Human capital among all the individuals involved in food handling is the first of the four critical capacities. Human capital is stratified into basic food safety knowledge of what constitutes food safety hazards, appropriate food handling techniques, and technical expertise in preventing and controlling the hazards. Effective management and leadership along the supply chain are critical components of human capital required for an effective food safety system and often require coordination (Jaffee et al., 2019). The second capacity necessary for operating an

effective food safety system is the existence of adequate physical infrastructure. Physical infrastructure includes appropriate food processing facilities, sanitary market spaces, distribution networks, and adequate laboratory facilities. Infrastructure for providing potable water, sanitation, and electricity is also vital for achieving food safety. The third capacity entails management systems within systems handling food in record-keeping systems, staff training procedures, verification methods, and product recall procedures. These capacities must also be adequate in food testing laboratories and third-party verification bodies. The fourth capacity is formal institutions and cultural values, beliefs and norms that dictate the actions of food safety system stakeholders. They include regulations and their implementation and social cues and pressures.

The four critical capacities necessary to operate an effective risk-based food safety system encompass functions undertaken by value chain actors and other industry stakeholders, especially regulators and other public bodies. Appreciating the critical role of capacity in achieving the effectiveness of a food safety system is essential in understanding the factors responsible for the prevalence of food safety hazards and determining appropriate entry points for intervention (Jaffee et al., 2019).

Most LMICs countries have adopted the risk-based food safety systems, which are considered best practices in food safety but face major challenges in their implementation related to inadequacies, inconsistencies, inequities, and inefficiencies in the four critical capacities among value chain actors, regulatory agencies and the institutions that govern food safety (Vipham et al., 2018).

2.2.1.1 INADEQUACIES IN DATA

Establishing adequate food safety systems requires access to and utilization of adequate epidemiological data, both at policy and operational functions of food safety management at the national level (Vipham et al., 2018). Such data is rarely available in developing countries, relying on often understated estimates. However, the estimates are still valuable to governments and the private sector in deciding the most optimal points of food safety intervention along the value chain and determining the impact of implementing food safety systems. The lack of data can further lead to misconceptions, resulting in inadequate controls. For example, many abattoirs in developing countries rely on the inspection of animals for signs of zoonosis diseases such as brucellosis and bovine tuberculosis. Implementing such checks is an important measure but inadequate because it

is not usually accompanied by control measures for biological hazards such as Salmonella sp., which do not cause physical symptoms in livestock (Vipham et al., 2018). This presents a problem in the value chain actors' role in delivering food safety. The value chain actors, particularly the private sector actors, are responsible for establishing and enacting food safety management systems. However, in the absence of appropriate data and information to base food safety decisions on, the food safety management efforts are largely inefficient and unsuccessful (Vipham et al., 2018).

2.2.1.2 INADEQUACIES IN GOVERNANCE AND INFRASTRUCTURE

Most developing countries lack adequate microbiological and chemical testing infrastructure and resources to enforce food safety management systems, e.g., adequately trained inspection staff (Vipham et al., 2018). The lack of infrastructure is also evident in the private sector in inadequate market structure and physical structures, especially in the informal sector. Further, the food sector in many developing countries is mainly heterogenous and includes a large informal sector with numerous small-scale actors, making it highly challenging for the government to enforce food safety regulations successfully (Grace, 2015). It is difficult to develop food safety management systems that adequately accommodate the diversity of such a food sector. Other factors that further complicate food safety regulation in LMICs is the lack of potable water and electricity in the informal food markets (Vipham et al., 2018).

2.2.1.3 INADEQUACIES IN VALUE CHAIN COORDINATION AND LABORATORY CAPACITIES

Food safety is the responsibility of multiple value chain actors instead of a single stakeholder. Cooperation is needed between enterprises, government, consumers, and civil society. The role of government entails verification that the private sector is implementing adequate food safety management systems, defining safety standards, providing target metrics, guiding the private sector to achieve the desired food safety standards, and informing consumers when food safety management systems have failed to expose food safety risks (Waite & Yousef, 2010). Surveillance for food-borne illnesses is the government's responsibility. In contrast, monitoring for food-borne hazards in food value chains is the responsibility of both the private sector and the government. Academic and research institutions also engage with governments and the private sector to inform the development of robust food safety management systems (Vipham et al., 2018). However, such meaningful engagement between the private and public sectors in agricultural value chains is often

limited, especially where the private sector is small and constrains its activities. The lack of engagement between the two sectors, characteristic of developing countries, is often detrimental, resulting in limited acceptance and sustainability of food safety policies and regulations (Vipham et al., 2018).

The success and sustainability of food safety management systems are further influenced by the institutional and human capacity within the private and public entities. However, technical capacity in developing countries is often limited, especially regarding food safety laboratory testing capacities in terms of availability of requisite equipment to test for chemical and microbiological hazards, adequately trained and skilled staff, and availability of laboratory consumables and reagents. The lack of such capacity hinders the achievement of science-based data and information necessary for appropriate decision-making concerning food safety in developing countries.

2.2.1.4   INCONSISTENCIES IN STANDARDS, REGULATIONS, AND CERTIFICATION

Market structures contribute to variations in food safety systems globally. For example, formal and informal markets exist, varied market standards, export food production, and domestic food production, among others (Vipham et al., 2018). Such inconsistencies exist both within and across countries and are driven by trade agreements, government priorities and consumer willingness, and the ability to pay. Food safety control in developing countries is often characterized by numerous inconsistencies in their approaches to addressing food safety hazards, usually at a scale larger than that experienced in developed countries. The discrepancies generally include the existence of multiple agencies with overlapping mandates, standards inconsistent with the country's value chain situation, and standards and regulations often based on the capacities and context of developed countries (Grace, 2015). Such discrepancies often result in a lack of clarity and limited compliance levels among the value chain actors.

While most developing countries have adopted risk-based food safety systems, which are globally recognized as best practice approaches to food safety, they lack the requisite management framework for these risk-based approaches, which is a two-step framework. The policy level sets food safety targets. In contrast, the operational level ensures that the targets are met. Furthermore, developing countries have little coordination in managing food safety management systems.

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However, the risk-based management systems are largely unachievable without well-coordinated approaches to standards and regulations and concise communication of food safety expectations among food sector stakeholders (Unnevehr & Ronchi, 2015).

2.2.1.5 *INEQUITIES*

Food affordability, especially among the impoverished in developing countries, remains an important issue for consideration. However, food safety interventions can negatively impact equity in developing countries by imposing harsh economic implications on domestic value chains and compounding poverty and food insecurity (Vipham et al., 2018). In setting national food safety objectives, governments must recognize that different population groups face varied barriers to achieving food safety, including access to financial resources, social norms, information access, and education level. For example, implementing risk-based food safety management systems has financial implications for the targeted businesses, which impact the businesses differently depending on size. The capital costs of establishing a food safety management system are often substantial and burdensome for small firms, which incur a higher unit cost of adoption than larger firms (Unnevehr, 2015). The population groups value different outcomes differently and are driven by varied incentives. For example, women in Asia and Africa are responsible for household duties, including food preparation, consumption and children's healthcare making them key influencers in household hygiene and child health outcomes (Grace et al., 2015). There is also evidence indicating that women are more likely to use their income to make purchases that will benefit the entire household including the provision of more nutritious foods and healthcare for children compared to men. These findings indicate that women are more concerned with child health outcomes and could inform food safety interventions in their food safety messaging for women. (Vipham et al., 2018).

2.2.1.6 *INEFFICIENCIES*

The gaps identified above indicate that agri-food systems in developing countries are inefficient. Misconceptions, lack of adequate information, and misplaced controls lead to unproductive value chains and consequent wastage of resources. The resulting inefficiencies are costly to consumers, governments, and the agricultural sector in general. While accurate economic cost of global FBDs is not available, estimates indicate that it is high. These costs could only get higher if aggregated with the costs of food loss, failure to meet standards, and poor governance. The inefficiencies that

characterize the food safety systems in developing countries are immense but must be addressed within the shortest time possible to address the numerous costs of such inconsistencies (Vipham et al., 2018).

Ineffectiveness of the risk-based food safety management systems results in the prevalence of informality, which is explained by arguments of exit and exclusion of value chain actors owing to poor governance and inadequate economic development and social pressure. The exit and exclusion approach allows investigation of the root causes for informality from both the demand (consumers) and supply (producers and traders) sides of the informal sectorrelated to their capacities, coordination and incentives to engage with the formal rules of the game, in this case, the policy regulations to food safety.

2.3 CAUSES OF INFORMALITY AND POLICY OPTIONS TO ADDRESS IT

To address informality and its related food safety challenges in Tanzania's dairy sector, it is crucial to contextualize the origin and drivers of informality and the negative consequences of informality, such as poor food safety outcomes. In this section, two themes are addressed. First, the causes of informality are discussed. The discussion is informed by the four dominant theories of informality by entrepreneurs (modernization theory, structuralist theory, neo-liberal theory, and the institutional theory of informality) and four prevalent theories of participation in the informal economy by consumers (rational economic actor, social actor approach, formal markets failure and unintentional purchases). The theories collectively explain how informality occurs by excluding and exiting entrepreneurs and consumers from the formal economy. It is argued that informality is driven by economic segregation, deregulation, burdensome state regulation, a lack of trust in state intentions by the entrepreneurs, the illegitimacy of governance institutions, the poor performance of the formal sector and social and cultural values.

Second, policy options to address informality and its negative consequences are discussed. It is argued that formalization is the most viable option for addressing informality, but the formalization approach must be appropriate for the context to achieve the desired results. The formalization approach must align with relevant stakeholders' existing capacities and incentives to succeed.

2.3.1 CAUSES OF INFORMALITY

The macro-level root causes of informality relate to economic development and the adequacy of institutional governance (execution of formal rules of the game and their alignment with social norms and values). In contrast, micro-level causes of informality relate to poverty, lack of access to finances and resources (physical infrastructure and skills), lack of knowledge (R&D), coordination and limited access to markets (ILO, n.d.).

The state of economic development and rules of the game drive informality in two ways. First, by necessity (exclusion), where other choices are unavailable or unsatisfactory to the entrepreneurs. Second, exit by choice where the benefits of informality outweigh the consequences of informality. Exit also occurs when the societal norms, values, and beliefs which influence decision-making are incongruent with the codified rules of the game (Perry et al., 2007; Williams & Bezeredi, 2018). Initially, (Gallin, 2001; Portes et al., 1989; Sassen, 1997) argued that informality is purely driven by necessity, but (Cross, 2000; Gërxhani, 2004; Maloney, 2004; Snyder, 2004) subsequent claims indicated that informality is solely driven by choice. (Snyder, 2004; Williams, 2007, 2008, 2009; Williams et al., 2009), however, found that informality is driven by a combination of choice and necessity. It is argued that necessity and choice can co-exist, and they often shift places over time, often from the necessity to choose (Perry et al., 2007). The four dominant theories explain the choice and necessity drivers of informality among entrepreneurs, and the four theories that explain consumer participation in the informal economy are discussed in detail below.

2.3.1.1 DRIVERS OF INFORMALITY AMONG INFORMAL MARKET ENTREPRENEURS

2.3.1.1.1 THE MODERNIZATION (ECONOMIC DEVELOPMENT) APPROACH

For most of the twentieth century, it was widely believed that the formal economy was rapidly expanding and informality a diminishing remnant of a modernizing economy. Informal entrepreneurship was depicted as a remnant of an old mode of economic production and associated with the underdevelopment of economies (Geertz, 1993; Lewis, 1966). From this perspective, informality is perceived as more significant in less developed countries and less modernized economies, commonly measured by indicators such as GDP per capita. The informal sector, on the other hand, diminishes with economic development and modernization.

Three arguments about the causes of informality arise from the modernization theory. First, the theory argues that informal economies shrink with a country's advancement in economic growth. Second, sporadic population growth and limited industrialization in developing countries result in increased unemployment and subsequent engagement in informal activities by the unemployed to generate income. It has indeed been proven that informality tends to increase with an increase in unemployment, a phenomenon experienced in many developing countries where population growth has resulted in the formal sector's inability to absorb all available labour (Chaudhuri, 2000; ILO, 2002). Increased rural-urban migration in the absence of adequate industrialization is the third phenomenon that expands the unemployment rate, fuelling growth in informality.

However, contrary to the argument that the informal economy is a residual of modernization, it is evident that the informal sector in general and informal entrepreneurship is extensive and rapidly expanding in most regions of the globe in both developed and developing countries (ILO, 2002; Jütting & de Laiglesia, 2009; Schneider & Williams, 2013). It has been found that the informal economy does not necessarily shrink with economic development, and in some instances, it has grown alongside modern economies. These perspectives suggest a complex structural association between the formal and informal economies beyond a trade-off. This has refuted the modernization explanation that the informal sector is a diminishing remnant of an outdated mode of production that exists in isolated regions of the globe and the emergence of alternative explanations for its persistence and expansion globally.

2.3.1.1.2   STRUCTURALIST APPROACH

The structuralist approach argues that the informal sector is driven by subcontracting and outsourcing informal workers in the formal capitalist industries in the deregulated global economy. Such subcontracting and outsourcing integrated informal workers into formal supply chains, yielding downward wages and social protection pressure. Therefore, informal entrepreneurship is unregulated, low-paid, and driven by necessity among individuals excluded from formal employment (Huang et al., 2020; Taiwo, 2013). Viewed from this lens, the informal sector is driven by a lack of social protection and under-regulation of work and, therefore, the direct outcome of poverty. In this context, informality is seen to be more dominant in countries that lack adequate interventions to protect workers from poverty (Huang et al., 2020).

The structuralist theory of informality views informality as a strategic move by the capitalist structuring rather than the inability of the formal sector to create job opportunities for the population. From the structuralist perspective, informality is an intentional strategy by capitalists to reduce labour costs and increase production efficiency. The main driver of informality is globalization because it encourages subcontracting of labour, which fuels the expansion of informality when combined with economic liberalization and deregulation. The informal economy is thus linked to the formal economy as a working arrangement in the capitalist economic development paradigm.

The structuralist theory, therefore, gives a different dimension from the modernization approach to the causes of informality. First, it suggests that the informal economy is likely to expand with the modernisation of the economy. This view contradicts the modernization theory. Second, the theory suggests that informality is expected to expand with the increasing globalization of a nation's economy due to the increasing sub-contracting of labour in globalized economies. Overall, the structuralist theory implies that the informal economy is a product of modernization and globalization of economies.

2.3.1.1.3   NEOLIBERAL APPROACH

Unlike scholars who view informality as necessity-driven and prevalent among poor populations, neoliberal scholars argue that the informal sector is driven by the choice of entrepreneurs to voluntarily exit the formal sector to avoid paying high taxes and engagement with an overburdensome state and a corrupt public sector. From this perspective, informal sector actors reject the bureaucracies of an over-regulated state to avoid the implicated time, cost, and formalisation efforts (De Soto, 1989; Perry et al., 2007). Therefore, informal entrepreneurship is seen as a response to over-regulation of the market, corruption of the public sector, and excessive taxation (De Soto, 1989). From this perspective, informal entrepreneurship is seen as a rational economic decision made voluntarily by entrepreneurs constrained by extreme state control of the markets (Williams & Kedir, 2018).

Informal entrepreneurs are perceived as rational and creative for creating income-generating opportunities for themselves and evading poverty in the context of prohibitive costs of legality. Research supports the neoliberal theory arguments and shows that countries characterized by high

tax burdens and regulations have a higher prevalence of informality (De soto, 1989; Perry et al., 2007). The Neoliberal approach is popular among development proponents who advocate for deregulation of economies to enhance free market forces. However, the deregulation approach is likely to deteriorate the quality of the work environment, as argued by the structuralist theory of informality.

2.3.1.1.4 INSTITUTIONAL THEORY APPROACH

The Neoliberal approach argues that entrepreneurs choose to operate in the informal sector because the benefits of informality outweigh the cost of punishment for operating in the informal sector. This theory has dominated the explanation of informal entrepreneurship for nearly half a century (Williams & Bezeredi, 2018). Based on this explanation, many governments invest in increasing the severity of punishments for noncompliance and the likelihood of detection for non-compliance (ILO, 2017; Williams & Krasniqi, 2018; Williams & Puts, 2017). However, evidence of the effectiveness of this approach is inconclusive. Some scholars have found that increasing the severity of the punishments and the likelihood of detection leads to a decline in informal entrepreneurship (DeBacker et al., 2015; Feld & Frey, 2004). Others find no association, while others find an increase in participation in the informal sector due to increased severity of punishment and the possibility of detection (Hofmann et al., 2017; Kaplanoglou & Rapanos, 2015). Undeniably, the most compelling reason for the abandonment of the neoliberal approach is the lack of participation in the informal sector by entrepreneurs even when the cost-benefit analysis suggests that they should (Kirchler, 2007; Williams & Krasniqi, 2018).

The social actor approach emerged to explain the phenomena, suggesting that entrepreneurs are more likely to participate in the informal sector if their tax morale is low, meaning a lack of underlying motivation to pay taxes (Alm et al., 2012; Torgler, 2011). The institutional theory draws inspiration from the social actor approach (Williams & Bezeredi, 2018). The institutional theory approach argues that society is characterized by formal and informal institutions where formal institutions are the codified rules and regulations of the game. In contrast, informal institutions are the social norms, beliefs, and values of what is right and acceptable (Helmke & Levitsky, 2004). Formal enterprises conform to the formal institution standards, while the informal enterprises adhere to the informal institutions' values, norms, and beliefs (Kistruck et al., 2015; Siqueira et al., 2016; Slavnic, 2009; Welter et al., 2015). Therefore, the social actor theory argues

that informality results from incongruence between the formal rules of the game and the societal norms, beliefs, and values. The greater the incongruence, the greater the intensiveness of informality.

Tax morale in parallel formal and informal institutions indicates the orientation of citizens' perception of the formal institutions. Where the citizens negatively perceive the formal institutions and, therefore, have low trust in government intentions, participation in the informal economy prevails (Williams & Bezeredi, 2018). Thus, low trust in government and low tax morale is associated with low tax compliance (Dell'Anno, 2009; Lima & Zaklan, 2011; Stark & Kirchler, 2017; Torgler, 2004, 2008). The other effect of low trust in government is the emergence of shadow economies (Halla, 2012; Torgler et al., 2008). Higher participation in informal economies has also arisen from low trust in government (Williams et al., 2015; Windebank & Horodnic, 2017). Other scholars have reported higher salary under-reporting due to low trust in government (Williams & Bezeredi, 2018). A strong correlation has been found between negative perception of the formal rules and citizens' participation in the informal economy, with Pearson r values between -.46 and -.66 (Torgler, 2011; Williams & Bezeredi, 2018). Torgler (2011) reported that in post-socialist societies, a decrease in tax morality by one unit caused an increase in informality by twenty percentage points.

As evidenced by the multiple theories of informality, informality is driven by various factors and cannot be fully explained by a single theory. The causes of informality are not divergent but rather complementary, with each having validity in explaining specific elements of informality. However, the common thread between the various theories of informality is that informality is caused by both inclusion and exclusion of value chain actors from the formal sector.

2.3.1.2   DRIVERS OF CONSUMER PARTICIPATION IN THE INFORMAL SECTOR

2.3.1.2.1   FINANCIAL GAIN EXPLANATION

A long-standing perspective for informal sector participation is that the participants are rational economic actors pursuing economic gains (Dollery, 2004; Davis, 2006; Horodnic et al., 2021; Sassen, 1997). This perspective is informed by the pivotal work of (Allingham & Sandmo) 1972 who present informal workers and consumers as rational economic actors who disobey the law where the benefit of non-compliance outweighs the risk of being caught or the penalty for not

complying with the law. Following this argument, the focus has been on altering the cost-benefit ration of being non-compliant by increasing the risk of detection or the price of non- compliance (Richardson & Sawyer, 2001; Williams & Renooy, 2013). However, alternative explanations to consumer participation in the informal market that look beyond the rational economic actor include the social actor / social redistributive rationale and the formal economy failure explanation.

2.3.1.2.2 SOCIAL ACTOR RATIONALE

The social actor rationale presents informal consumers as rational social actors rather than rational economic actors (Nelson & Smith, 1999; Round et al., 2008; Williams, 2004). This approach recognizes that informal work is often conducted for and by kin, friends, neighbours and acquittances for social and redistributive purposes. For example, giving an unemployed person money in a manner that does not insinuate a donation, which may result in a rejection of the money by the intended recipient. These transactions are therefore paid favours rather than profit-motivated market-like transactions (Williams, 2004).

2.3.1.2.3 FORMAL MARKET FAILURE

The third argument is the formal market failure approach. Proponents of this approach argue that consumers buy from the informal market because the formal economy fails to provide quality goods and services promptly and consistently, making the informal sector the feasible alternative (De soto, 1989; Maloney, 2004). The argument therefore is that the problem is not so much the informal sector but the formal sector, which unless the fundamental issues of poor delivery are addressed, will remain ineffective.

2.3.1.2.4 UNINTENTIONAL PURCHASES

The fourth argument is that consumers unintentionally make purchases from the informal economy where they are unaware of all legal requirements for the legality of entities and the entities compliance status (Horodnic et al., 2021; Williams & Kosta, 2021).

2.3.1.3 EXIT AND EXCLUSION OF INFORMAL ENTREPRENEURS' DEBATE

The exclusion lens is the most dominant in informality debates. Exclusion occurs along three major boundaries between formality and informality. Firstly, labour market segmentation prevents workers in the informal sector from joining the formal sector, which provides social benefits.

Secondly, it is argued that small firms are limited from being fully formal by the heavy burden of regulatory requirements (De Soto, 1989). Thirdly, firms may remain partially formal as a defence mechanism against tax burden and excessive regulation. On the other hand, consumers are forced to purchase goods from the informal market due tounaffordable cost of goods in the formal sector.

The second lens through which informality is perceived is the exit lens. Many workers and firms decide the optimal degree of engagement with institutions of the state based on the benefits perceived to come from formality and the efforts and capabilities of the state to enforce formality (Williams & Kosta, 2019). They often make the cost-benefit analysis of whether to formalize and often decide against it. This view implies that informality is driven by firms and individuals' massive opting out of formality and further suggests a brutal criticism of states' provision of service and their capability to enforce the law (Ohnsorge & Yu, 2021; Perry et al., 2007). Consumers also opt-out of formal market transactions where goods in the formal markets are less attractive compared to those in the formal market. For example, goods in informal markets are cheaper, meet consumer quality requirements, are easily accessible compared to those in the formal market, or the social values dictate consumers' engagement with the informal entrepreneurs.

These two lenses of informality by voluntary exit and exclusion are complementing rather than competing dimensions of informality. Countries differ immensely in institutions, history, and legal frameworks, and as such, exit mechanisms may be more important for some and exclusion more important for others (Perry et al., 2007).

2.4   POLICY OPTIONS TO ADDRESS INFORMALITY

Whether informality is driven by exit or exclusion, it indicates poor service delivery by the state at many levels. Burdensome market regulations and poorly designed social protection systems translate to poor delivery by the state in its mandated roles. In combination with the states' lack of capacity to enforce the law, this may intensify the tendency to opt out, rendering fulfilment of fundamental state functions more difficult (Ohnsorge & Yu, 2021; Perry et al., 2007). Several things can be done to enhance the incentives of entrepreneurs whose cost-benefit analysis places them on the border of formality and informality. A good balance is needed between incentives for compliance and punishment for noncompliance to have a significant impact. Further, the excessive regulations that cause market segmentation need to be reduced (Perry et al., 2007; Williams, 2016).

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However, achieving greater change through incentives requires a change to the deeply rooted culture of noncompliance, primarily propagated by a lack of trust in the state and the equity of its actions. Overcoming the culture of inequality probably requires improvement in state policies and institutions (Perry et al., 2007). Governments may also consider legalizing voluntary informality from the point that individuals and firms often make the rational decision to engage in the informal sector because of their cost-benefit analysis of the consequences of operating in the formal or informal sector.

Overall, the present stringent and burdensome regulations in food safety governance in Tanzania's dairy value chain poorly serves both individual value chain actors and firms and could benefit from extensive improvement. Hypothetically there are four policy options to addressing the informal sector and the unwanted consequences of informality; do nothing, deregulate, eliminate, or formalize the informal sector.

2.4.1 DO NOTHING

The first policy option to address informality is to do nothing. The rationale behind this approach is that the informal sector is a breeding ground for micro-enterprises and should be left alone. It is also based on the argument that informal firms are very different from formal ones, inferior in productivity and human capital. However, because informal businesses operate in different markets and have different customers, they do not threaten the formal ones in any way. According to this view, as the economy develops, informal businesses will be eventually displaced by new formal ones, run by new, more qualified people. Consequently, government policies should create efficient, formal firms and let the informal sector die (La porta & Shleifer, 2008).

The approach could be criticised mainly on two points: First, one could question the fact that informal firms operate in totally different markets and have different customers. Many authors have mentioned the weakness of any conceptualisation that ignores the interconnection between the two sectors (La porta & Shleifer, 2008).

Second and most important, the statement that the informal sector disappears as the economy develops has not been confirmed from the past five decades. Since independence in the 1960s, many developing countries have had phases of economic development, while the informal economies seemed to have a steady upward trend. Moreover, doing nothing negatively affects

formal businesses, informal businesses, consumers, and the government. Informal businesses notably lack access to credit and finance due to limited credit history, and they also face higher entry barriers in securing formal sector employment due to a lack of employment records. Formal businesses face unfair competition from informal businesses. The do-nothing approach results in a deregulatory culture enticing law-abiding entrepreneurs away from regulatory compliance. The approach ultimately results in over-casualization as more legitimate entrepreneurs join the informal sector to compete. On the other hand, consumers suffer a lack of guarantee where substantial goods and services are delivered, and ultimately there is no guarantee for health and safety standards of the products they consume. Governments suffer revenue losses through non-payment of owed taxes. Governments also lose regulatory control over work conditions and service providers in the country. Such occurrences may encourage a casual attitude towards the law in general. The negative impacts of the do-nothing approach are detrimental, and there is consensus that there is a need for intervention to address informality.

The do-nothing approach to informality is the reality of the government approach to the informal sector in Tanzania's dairy industry, which may explain the high prevalence of informality in the dairy sector (up to 95%) (Blackmore et al., 2020). Although the approach allows the numerous numbers of entrepreneurs who earn a living through their business engagement in the informal sector to continue generating income while providing an important source of nutrition for the numerous consumers that rely on dairy products from the informal sector, it fails to address the public health concerns that have the potential to negate nutrition benefits that result from consumption of unsafe products.

2.4.2 DEREGULATE THE FORMAL ECONOMY

One approach to intervening in the informal economy is deregulation of the formal economy based on the argument that informality is driven by over-regulation of the formal economy (De Soto, 1989; Sauvy, 1984). However, growing evidence suggests that deregulation does not enhance the formalization of informal entrepreneurs (Henrique De Andrade et al., 2013; Lyons et al., 2014; Lyons & Msoka, 2010; Rothenberg et al., 2016). Williams, (2006) and Williams et al. (2014) further argue that even if deregulation enhanced formalization, it would decline working conditions and widen inequalities compared to more regulated scenarios.

In the case of Tanzania, the informal dairy traders (those selling raw, unpackaged milk) are considered legal upon registration with the Tanzanian Dairy Board (TDB) and fulfil various requirements for the diverse value chain actors depending on the node of the value chain they operate. For example, under section 17 (1-2) of the Dairy Industry Act, Cap 262 of laws of Tanzania, traders must: 1) possess suitable milk handling equipment; adhere to hygienic milk handling practices; possess basic platform milk testing facilities. A transporter must have proof of permit of a milk container (TDB, n.d.). The traders must also obtain medical clearance from public health and a trade license from the trade office. However, even though the informal actors are required to comply with only these three requirements, the compliance levels are very low, proving that deregulation does not necessarily lead to higher compliance and that there is a need for better approaches to addressing informality and its related challenges.

2.4.3   ELIMINATION OF THE INFORMAL SECTOR

This approach seeks to eliminate informality. The informal sector actors are perceived as rational economic actors who will evade tax if the benefits outweigh the cost of being punished for noncompliance (Allingham & Sandmo, 1972). Change is sought by altering the cost/benefit ratio of those engaged in the informal sector (Allingham & Sandmo, 1972; Grabiner, 2000). This is achieved by elevating the informal sector's cost through an increased likelihood of detection and penalties paid by those caught. Behaviour change is achieved through punishing the bad behaviour of non-compliance. However, the practicability of this approach is questionable as it has been observed that punishing informality exacerbates informality in some instances. Furthermore, it is argued to be unreasonable to punish illicit trade with more punitive measures because it may result in alienation of informal sector actors reducing their willingness to comply and aggravating informality by reducing their belief in the fairness of the system (Murphy, 2005). This approach is also faced with the dilemma of whether eradicating the informal sector is rational given the sector's contribution to economic development and provision of goods and services in the absence of an adequate formal sector (Murphy, 2005). Indeed, eradicating the informal economy by any government is likely to diminish the entrepreneurial spirit they otherwise actively seek.

Some developing countries have adopted the eradication approach. The eradication approach to the informal sector is often characterized by the forced closure of informal businesses and harassment of the entrepreneurs by regulating agencies. The harassment entails confiscating their

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products and equipment, arrests and prosecution in a court of law, and paying bribes. Although harassment of informal dairy traders by authorities is not typical of Tanzania, there was an attempt to outlaw the sector in 1983, though the ban was never implemented (Kurwijila & Boki, 2003).

2.4.4 FORMALIZATION OF INFORMAL ENTERPRISES

Rather than do nothing, deregulate, or eradicate the informal sector, governments have another option: to formalize the informal sector (Renooy et al., 2004; William, 2008; Williams & Nadin, 2012). There are varied impacts of formalizing informal businesses for formal businesses, informal businesses, governments, and consumers.

The formal sector benefits from the formalization of the informal sector by eliminating perceived unfair competition from the informal entrepreneurs who do not comply with the industry regulations. It would further result in businesses pursuing regulatory standards about working conditions such as health and safety (Grabiner, 2000; Williams et al., 2015). On the other hand, informal businesses would be saved from exploitative work relationships with the formal sector (Williams & Windeband, 1998) to achieve the same levels of protection as the formal sector actors. They would also benefit by overcoming structural challenges by gaining access to capital through financing, technical support, and advice. Consumers, on their end,, would benefit from the formalization of the informal sector through legal recourse for poor products and services and assurance that adequate health and safety measures were adhered to in the production of the products they consume (Williams & Martinez-Perez, 2014). Governments would gain from the formalization of the informal sector through increased revenue collection, enhanced control over the quality of goods and services provided in the economy, and a better perception of the economy performance by citizens in general (Morris & Polese, 2014; Renooy et al., 2004).

In summary, the do-nothing option is not viable because it leaves the problems of informality unresolved. For formal businesses, unfair competition remains unresolved; the informal sector actors remain marginalised with no access to financing to address infrastructural challenges, governments remain without control over-regulation of the economic activities of the informal sector, and consumers do not guarantee the health and safety standards of the products that they consume. Deregulation is also inappropriate because it results in a decline in working conditions, and eradicating the informal sector is unacceptable because it represses government efforts to

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encourage entrepreneurship. On the other hand, eliminating the informal sector would negatively impact the livelihoods and nutrition of informal value chain actors. Considering the pros and cons of four available options for addressing informality and its negative consequences, formalization is the most promising approach.

2.4.4.1   FORMALIZATION POLICY APPROACHES

Formalization of the different categories of informal entrepreneurs can be achieved through direct and indirect policy measures. Direct policy control measures seek to achieve formalization by ensuring that the benefits of formalization outweigh the costs of informality. This is achieved by adopting measures to increase noncompliance costs and make formal entrepreneurship more beneficial and easier (Williams & Kedir, 2018). Unlike direct controls, indirect controls do not target behaviour change but instead focus on achieving a high trust, high commitment relationship between the state and its citizens (Williams & Kedir, 2018).

2.4.4.1.1   DIRECT POLICY MEASURES

The common approach to addressing the informal sector generally uses direct controls. This entails applying deterrence measures to detect and punish non-compliant behaviour and using incentives to make it easier and to take part in and reward good compliant behaviour (Williams, 2016).

Deterrent measures

As previously discussed, it is assumed that the informal sector entrepreneurs are rational decision-makers who evade tax when the benefits are greater than the cost of detection and punishment. Therefore, the strategy increases the risk and cost of participation in the informal sector and raises the penalties for those caught engaging in the informal sector (Job et al., 2007; Richardson & Sawyer, 2001; Williams, 2016). The approach is negative reinforcement which punishes non-compliance behaviour. However, recent literature reveals that punishment for bad behaviour and increased risk of being caught does not necessarily result in greater compliance (Richardson & Sawyer, 2001). On the contrary, it increases non-compliance due to a decline in trust between the state and citizens (Murphy & Harris, 2007; Tyler et al., 2007; Williams, 2001). Besides, punishing non-compliant enterprises has negative impacts of deterring entrepreneurship which the government champions for accelerated economic development. Given that punishing bad

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behaviour does not always translate to enhanced compliance and discourages entrepreneurship, the appropriateness of deterrent measures to formalization has been questioned, and alternative approaches have emerged in the form of incentive measures.

Incentive measures

Rather than punishing bad behaviour, there has been a shift towards measures that incentivize participation in the formal sector (William, 2008). In general, good behaviour is rewarded rather than taking it for granted. The incentive measures can take three forms: simplifying compliance by introducing direct and indirect tax incentives or providing support and advice to informal entrepreneurs on formalizing. Using direct and indirect tax incentives, it can also be made easier for customers to source their goods from the formal rather than informal sector (Williams & Kedir, 2018).

2.4.4.1.2 INDIRECT POLICY MEASURES

Informal entrepreneurs are not always rational economic actors with all available information; therefore, direct controls do not work as expected. They are often limited in their computation of costs, misperceive, or fail to perceive their actions' real benefits and costs. Furthermore, besides being influenced by personal interests and what is most beneficial to them, they are also influenced by cultural norms, beliefs, and values (Williams, 2016). Using sticks and carrots to promote behaviour change has therefore been replaced in developed countries by nurturing a high trust, high commitment culture between the state and the citizens, thereby influencing citizens to comply with formal requirements voluntarily. This entails regulators setting goal-oriented responsibilities for businesses to implement through their internal procedures and processes rather than emphasizing compliance with specific standards (Vickers, 2006).

However, it is important to acknowledge incongruence between formal sector codified laws, regulations, and policy and informal sector values, norms, and beliefs. Informal sector entrepreneurship occurs in a context where informal sector norms, values, and opinions differ from formal sector regulation, laws, and policies. The result is illegality in the formal sector, even though legitimate regarding informal values, norms, and beliefs. For example, the consumption of raw milk in some cultures is the norm because it is believed to be a pure commodity in its raw form. Any processing is perceived as unwanted interference with the purity of the raw milk. On

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the contrary, in the dairy sector regulation, milk is only considered acceptable for consumption if pasteurized to eliminate the chances of contracting food-borne illnesses from milk consumption. Therefore, addressing incongruence between formal and informal sector institutions is imperative to tackle informal sector entrepreneurship. This can be achieved by changing formal and/ or informal institutions through awareness creation and enhancing the inclusivity of marginalized sections of the population by adjusting the institutions of governance to be aligned with each other. Changing the informal institutions

It is important to address institutional incongruence, which leads to the proliferation of the informal sector. One approach is to alter entrepreneurs' norms, values, and beliefs regarding the acceptability of participating in the informal sector. This approach seeks to align the cultural values, norms, and beliefs with the codified laws and regulations of the formal sector. Such a shift is realized through improving knowledge among the informal sector actors. As detailed below, knowledge is improved through awareness of the costs of informality and the benefits of formalization coupled with normative appeals for formalization.

Improving knowledge

Two types of education are required to create awareness among informal sector actors. First, there is a need for education on what the current regulatory system requires of the entrepreneurs by providing easily consumable information regarding their responsibilities. The logic behind such awareness creation is that a significant proportion of non-compliance is unintentional, driven by a lack of knowledge and misinterpretation of ambiguous laws (Natrah, 2014). Therefore, one way of addressing unintentional non-compliance is providing information to value chain actors (Vossler et al., 2011).

The second type of education necessary for entrepreneurs is the value and benefits of regulatory compliance to drive innate motivation to comply. For example, some entrepreneurs evade paying taxes because they do not know what happens to them (Li et al., 2019). An option is to educate entrepreneurs about what happens to their taxes, which could be achieved by informing them of the government's current and potential public goods and services procured for them using their taxes (Bird et al., 2004; Saeed & Shah, 2011). A useful way of conveying the message that taxes

are being used to provide public goods and services would be displaying signs that read 'your taxes are paying for this project' on roads under construction.

Campaigns for raising awareness

Change of attitude toward informality could alternatively be addressed through campaigns to raise awareness. Through the campaigns, entrepreneurs could be informed of the risks and benefits of informality, and consumers could be informed of the risks and costs of informality. Entrepreneurs and consumers could further be informed of the benefits of formality (Williams, 2016).

Normative appeals

Entrepreneurs could be persuaded via normative appeals, which prescribe actions that should be taken or avoided to comply with regulatory requirements. However, the success of such appeals depends on the nature of persuasion made (Williams, 2016). An example of effective persuasion is helping entrepreneurs understand the benefits of regulatory compliance. For example, Chung & Trivedi (2003) examined the impact of normative appeals on entrepreneurs who were requested to generate a list of reasons they should comply compared to a control group that was not asked to generate the list. The treatment group of participants reported higher earnings for taxation purposes than the control group.

Changing formal institutions

Besides changing informal norms, values, and beliefs to align with the formal institutions, policy can also change the formal institutions to align with societal values, norms, and beliefs. This could be achieved in two ways. First, this could involve a change in internal processes in the formal institutions to improve the perception that procedural fairness exists and that there is procedural and redistributive justice among the entrepreneurs (Williams, 2016). For example, this may include the fair allocation of resources and opportunities to society and fairness in regulative procedures (Schnaudt et al., 2021). Second, the change could be a change in the products offered by formal institutions to include broader social and economic developments such as the provision of social protection for informal workers (William, 2008).

Procedural justice

This is about the degree to which entrepreneurs feel the government treats them with respect, responsibility, and impartiality which largely influences compliance (Braithwaite & Reinhart, 2000; Taylor, 2018; Wenzel, 2002). If entrepreneurs feel that tax administrators are treating them respectfully, impartially, and responsibly, they are likely to comply with the tax requirements (Hartner et al., 2008; Torgler et al., 2007). Respect, dignity, and having a say for rights enhance compliance among citizens (Gangl et al., 2013; Hartner et al., 2008; Murphy, 2005; Wenzel, 2002).

Procedural fairness

Procedural fairness is the extent to which entrepreneurs believe they are paying a fair share compared to others. Entrepreneurs who believe in procedural fairness develop trust in the authorities and are more likely to accept their decision and comply with their directives (Wenzel, 2004). Procedural fairness is one of the entrepreneurs' most significant determinants of tax morale (Kirchgässner, 2011; Molero & Pujol, 2012). On the contrary, if entrepreneurs feel that procedural fairness does not exist, noncompliance will be rife (Bird et al., 2004).

Redistributive justice

Redistributive justice refers to how entrepreneurs feel that they receive goods and services they are entitled to, considering the amount of taxes they pay (Richardson & Sawyer, 2001; Williams, 2016). Taxes are viewed as the price that entrepreneurs pay for the public goods and services provided by the government, and the test is whether the price corresponds to the value of goods and services offered by the government (Kirchgässner, 2011). Entrepreneurs often see themselves as justified in breaking their psychological contract with the state by being non-compliant if they perceive redistributive justice is unfair. Compliance may therefore be enhanced by ensuring fair redistributive justice to the entrepreneurs. Entrepreneurs will tend to be non-compliant if they believe the value of the public good and services they receive from the government are inadequate compared to the amount of taxes they remit. The government, therefore, needs to educate entrepreneurs on how their taxes are spent. Such education could help address the situation where entrepreneurs who do not fully comprehend how their taxes are spent end up being non-compliant

compared to more compliant entrepreneurs who understand how their taxes are spent and agree with such expenditure (Lillemets, 2009).

Changing the products of formal institutions

Based on the arguments of the theoretical explanations of informality, there is a need to widen the scope of the economic and social development agenda pursued by governments to address the root causes of informality. The modernization theory of informality argues that informality is driven by inadequate economic development, and therefore economic growth is required to deal with informality (ILO, 2014). On the other hand, the Neoliberal theory of informality argues that informality is driven by high taxation rates, corruption among state regulatory agencies, and excessive state interference in free markets. The way forward to addressing informality according to the Neoliberal approach is to reduce taxes, address corruption, and reduce the regulatory burden for entrepreneurs (De Soto, 1989; Nwabuzor, 2005; Schneider & Williams, 2013). The structuralist theory argues that informality is driven by inadequate state intervention in protecting welfare, resulting in poor working conditions for the workers. Therefore, the focus should not be on formalization but rather on the provision of social protection, reduction of inequality, and establishment of market interventions to advance the welfare of vulnerable groups (Slavnic, 2009; Taiwo, 2013). In recent evaluations, it has been found that informal entrepreneurship is less prevalent in wealthier countries with high-quality governance systems, lower levels of poverty, a greater level of social protection, adequate redistributive justice achieved through social transfers, and better state protection of workers in the labour market (Williams, 2016).

2.4.4.2 CHALLENGES OF FORMALIZATION

While formalization is the preferred approach to addressing informality, the formalization process negatively impacts informal sector actors. Some of the negative impacts of formalization include the lack of avenues for entrepreneurship for the entrepreneurs who cannot navigate past the entry barriers of participation in the formal sector. Secondly, the consumers of informal sector goods and services may be denied access to cheap products available in the informal sector as they are forced to pay the full market price for the products in the formal sector. Additionally, favourable conditions such as access to goods and services on credit for consumers may not be transferable to formal sector enterprises (Perry et al., 2007; Williams, 2016). Consequently, while formalization

may be the viable policy option to pursue, it is important to acknowledge that the other approaches may also have a supporting role. Doing nothing may be useful in preserving close social relations because these are susceptible to being lost in formal entrepreneurship. The deregulation approach may be useful when simplifying compliance and eradication when dealing with those who deliberately fail to comply. Conclusively, while formalization is the main desirable policy option due to its numerous benefits, the other policy options may be necessary to neutralize the negative effects of formalization.

2.4.4.3 *HYBRID POLICY APPROACHES TO FORMALIZATION*

Scholars acknowledge the need for indirect controls to address informality but also recognize that they are inadequate on their own (William, 2015; Williams & Renooy, 2013). When indirect and direct controls are applied simultaneously, better outcomes are realised in addressing informality. For example, the government may pursue formalization of the informal sector by enhancing tax morality by conducting public campaigns to create awareness and make public offices customer-oriented. This may be complemented by simplifying regulatory requirements and introducing incentives in the form of tax deductions. For those that fail to comply, the government may invest in increasing the probability of detection and tougher penalties for those caught. There is a consensus that direct and indirect policy control measures are necessary to address informality. However, there is a gap in identifying the most effective combination of the direct and indirect policy control measures in addressing informality. Some combinations already in use, for example, include inspection detection but are often preceded by campaigns informing stakeholders that the inspections will be carried out. Voluntary disclosure campaigns usually accompany harsher penalties. However, whether these combinations and sequences are more effective than other possible sequences and combinations is unclear, and research into the most feasible and effective combinations is necessary. Two approaches of possible sequences of combining direct and indirect policy measures have emerged: the responsive regulation approach and the slippery slope framework.

2.4.4.3.1 RESPONSIVE REGULATION APPROACH

Responsive regulation drives entrepreneurs to accept their obligations and embrace self-regulation within the confines of the law. The approach aims to win entrepreneurs' hearts and minds to cultivate a culture of commitment to tax morality so that they self-regulate instead of being

regulated by external authorities. The primary policy measures are indirect, where voluntary self-regulation is pursued followed by persuasion, and punitive measures are only applied to address non-compliance (Braithwaite, 2009; Job et al., 2007). The approach envisions a regulatory hierarchy with various options that the authorities can use to achieve regulatory compliance among entrepreneurs in the sequence of the least intrusive measures at the bottom of the hierarchy, which are applied first to the most intrusive at the top of the hierarchy, employed last. The expectation is that the regulatory authorities will not need to apply the coercive option at the top of the hierarchy to drive compliance among the entrepreneurs. Instead, it is expected that the indirect control measures at the bottom of the hierarchy will be predominantly used, and if they do not work with some groups, then intrusive measures can be escalated up the hierarchy until the policy measures that yield the desired response is achieved. Therefore, the approach recognizes varying attitudes towards compliance and applies varying policy responses, starting with self-regulation and moving towards punitive measures.

2.4.4.3.2 SLIPPERY SLOPE FRAMEWORK

The slippery slope framework distinguishes between voluntary compliance (associated with indirect controls) and enforced compliance (related to direct controls). Voluntary compliance occurs where the entrepreneurs trust the state, while enforced compliance happens where authorities have the power to make the entrepreneurs do what they were otherwise not going to do and in the manner that government authorities deem appropriate. In the absence of trust in the state and power among the authorities to coerce compliance among entrepreneurs, informality becomes rife (Williams, 2016).

Therefore, the approach proposes two possible pathways to address informality: increasing the power of authorities or enhancing trust in the state among the entrepreneurs. The direct policy approach addresses informality by increasing authority among the authorities, while indirect policy approaches seek to address informality by enhancing state trust among entrepreneurs. The two approaches are, however, not mutually exclusive and can complement each other. The slippery slope framework illustrates that the approach can be combined with policy measures to achieve behaviour change.

Studies showed that voluntary compliance was highest when authorities were powerful and trusted by the entrepreneurs, while enforced compliance was highest when the entrepreneurs were influential but not trusted (Wahl et al., 2010). The general outcome is that great trust and power among the authorities are vital in pursuing compliant behaviour.

2.5 OVERVIEW OF THE DAIRY SECTOR IN TANZANIA

Due to economic underdevelopment and poor governance, Tanzania's dairy sector is characterized by huge productivity and food safety gaps. However, dairy productivity has great potential for growth in the rich resource endowment that characterizes Tanzania (Michael et al., 2018). With the great potential for growth in dairy productivity in Tanzania, the food safety risks would also increase. Therefore, it is critical to address the current gaps in food safety governance in Tanzania to deal with the current challenges and mitigate future challenges that would emerge with an increase in dairy productivity. Therefore, focusing on Tanzania gives perspective on how informality and its negative consequences of inadequate food safety could be addressed in the context of high economic underdevelopment and underdeveloped governance institutions.

This section is presented in three sub-sections. The first sub-section explains Tanzania's dairy sector's potential for increasing dairy products in the context of available production resources and the growing demand for dairy products in the country. The second sub-section explains how poor governance in Tanzania's dairy sector and economic underdevelopment have resulted in the prevalence of informality and poor food safety outcomes. The third sub-section describes alternative policy approaches to address informality and how these approaches have been incorporated in an intervention to address informality and food safety in Tanzania's dairy sector.

2.5.1 TANZANIA'S DAIRY SECTOR'S POTENTIAL FOR GROWTH

Tanzania has low milk productivity and a low milk consumption rate compared to India and Kenya, where a food safety training and certification intervention developed by the International Livestock Research Institute (ILRI) was implemented (Johnson et al., 2015). However, Tanzania's cattle population is the third highest in Africa after Ethiopia and Sudan, and the country has extensive agricultural production land and rapidly growing milk demand (Michael et al., 2018). Therefore,

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there is immense potential for growth of the dairy sector which will contribute to the country's economic development and nutrition of millions participating in the dairy value chain.

2.5.1.1   *POTENTIAL FOR DAIRY PRODUCTION EXPANSION IN TANZANIA*

The current United Republic of Tanzania, formed in 1964, comprises the former colony of Tanganyika on the mainland, which gained independence in 1961, and the former protectorate of Zanzibar, which gained independence in 1963 (Alexopoulou, 2011). The constitution was changed in 1965 to establish a one-party system with socialist aspirations. This changed in 1992 when the constitution was amended again to establish a multi-party system. Despite the multi-party system, a single party still dominates Tanzania's politics. Chama cha Mapinduzi (CCM) has been in power for more than 30 years. CCM has an overwhelming majority in parliament, and the opposition is weak; therefore, government policies are largely unopposed (Kistemann, 2012).

Dodoma has been the capital of Tanzania since 1996, while Dar es Salaam (the former capital) is the largest city hosting most government institutions and trade centres, especially with its land-locked neighbours because it is a coastal town. Tanzania's other major cities include Arusha, Mbeya, Mtwara, and Mwanza (Alexopoulou, 2011). The population in Tanzania was estimated at 53.5 million in 2015, where 69% live in rural areas. The annual population growth rate between 2005-2015 was 3.2%, and the average population density was 56 inhabitants /km^2 (FAO, 2016).

Tanzania is in central Eastern Africa and borders the Indian Ocean to the East. It has eight border countries: Kenya, Rwanda, Burundi, Malawi, Uganda, Zambia, Democratic Republic of Congo, and Mozambique. Tanzania is the largest country in East Africa, occupying a total area of 945,087 sq. km. The total land area is 886,037 sq. km, while water occupies 59,050 sq. km (Agency, 2010). About a third of the country's total land area is suitable for agricultural production, and out of 88.6 million hectares of land resource, 60 million hectares are range land suitable for livestock rearing (Njombe et al., 2011). The expansive land suitable for livestock rearing is a strategic resource for expanding dairy production in Tanzania.

The country has varying topography characterized by high grasslands and mountain ranges to the south and near the coast. Land cover is dominated by grassland, woodland, and bushland, covering 80% of the total area (Nell et al., 2014). The coast and offshore islands have a hot and humid

tropical climate. At the same time, the plateau areas experience a hot and dry climate, and the climate in the highlands is temperate (Alexopoulou, 2011).

There are two types of rainfall seasons: Unimodal, where rainfall is experienced from October/November to April. It is experienced in the central, southern, and southwestern highlands. Bimodal, where rainfall occurs in two seasons, the short rains (vuli) experienced from October to December and long rains (masika) experienced from March to June. The bimodal rainfall is experienced in the coastal belt, north-eastern highlands, and Lake Victoria basin. Rainfall volume ranges from 500mm to 1000 mm, with the highest volume experienced at 1000-3000mm in the northeast of Tanganyika and the southern highlands. The average rainfall volume experienced in the country is 1071mm (FAO, 2016).

Most livestock is kept by smallholders and pastoralists who primarily keep cattle in arid, semi-arid, and highland zones. The cattle population is low in the humid and semi-humid zones. Dairy production in Tanzania involves both indigenous and exotic herds. The main cattle breeds in Tanzania are the short horn Zebu, the Boran from Kenya, and the Ankole from Uganda (Nell et al., 2014). The population of cross-bred cattle is relatively low at 3-4% (FAO, 2016). The improved dairy herds are kept by rural small-scale farmers (1-5 cattle), urban/ peri-urban small-scale farmers, and medium and large-scale farmers (Nell et al., 2014). In 2010, 70% of all milk was produced by indigenous dairy cattle in rural areas, while 30% was produced by improved dairy herds (Njombe et al., 2011). More than 1.2 million households in Tanzania keep dairy cattle, and milk production is mainly from smallholder farmers (Katjiuongua & Signe, 2014).

There is great potential for enhancing dairy production in Tanzania through genetic improvement of the dairy herd and enhancement of adequacy and effectiveness of the provision of artificial insemination services. It is one of the key strategies proposed by the Tanzania Livestock Masterplan to enhance dairy productivity in Tanzania (Michael et al., 2018).

2.5.1.2 POTENTIAL FOR CONTRIBUTION OF THE DAIRY SECTOR TO ECONOMIC GROWTH IN TANZANIA

The economy of Tanzania is generally weak, with a GDP of $21.4 billion (2009-2010 estimate) and a per capita income of $426 (World Bank, 2011). Tanzania is one of the world's poorest countries, with more than 36% living below the national poverty line (Agency, 2010). Tanzania was ranked 155th out of 188 countries for the human development index in 2004 and 125th out of

155 countries for gender inequality ranking. Eighty-four percent (84%) of children were enrolled in primary education, but only 33% were in secondary education. There was a higher proportion of female student enrolment in primary education but a higher proportion of male student enrolment in secondary education. Adult literacy was 79% in 2013, but male adult literacy was 84% compared to adult female literacy at 74% (FAO, 2016). In 2011, poverty affected 28% of the population, although mainly in the rural areas, where it affected 33% of the population and less in urban areas, affecting 16% of the population. In 2015, 56% of the total population had access to improved water sources, where 77% of this population was urban and 46% rural (FAO, 2016). Poverty is predominantly a phenomenon for the rural population. However, the number of urban poor, especially the unemployed and informal sector workers, is growing rapidly.

Agriculture has great potential to eradicate extreme poverty and hunger in low- and- middle-income countries where agriculture largely drives the economy (Alexopoulou, 2011). In Sub-Saharan Africa, economic growth, poverty alleviation, and food security depend on the performance of the agricultural sector. For example, Tanzania's economy is primarily supported by agriculture and services (tourism and mining). In Tanzania, agriculture contributed 31% of the national GDP, employed 67% of the active population in 2014 and continues to drive the growth of the economy (Katjiuongua & Signe, 2014). The role of livestock in poverty alleviation is perceived to be increasingly important. Globally, out of 1.3 billion individuals in extreme poverty, living on less than $1 daily, 45% fully or partially depend on livestock for their livelihoods. Moreover, over 70% of the rural poor benefit from traditional livestock systems (FAO, 2011). Therefore, the agriculture and livestock sectors are priority sectors. In contrast, the informal sector and small and medium-sized enterprises (SMEs) have gained important attention in poverty reduction efforts.

Since its independence, Tanzania's economy has relied on agriculture, generating more than 50% of GDP and employing more than 80% of the national workforce. Therefore, agriculture is a critical component of Tanzania's economy and continues to drive the growth of the national economy (FAO, 2016). The livestock sector in Tanzania is the second largest contributor to GDP after crop farming. Tanzania's cattle population is the third-largest in Africa after Ethiopia and Sudan, estimated at 18-22 million heads (FAO, 2016). This is attributed mainly to Tanzania's endowment with a large livestock base, land, and forage (Alexopoulou, 2011). The livestock sector

is crucial for the rural population in Tanzania, with at least 40% keeping livestock and a majority relying on the livestock as a major source of income (Katjiuongua & Signe, 2014).

Despite its great potential, the livestock sector in Tanzania contributes only 13-18 % of the total GDP; 40% from beef, 30% from milk, and another 30% from poultry and small stock production (SNV, 2010). Besides its GDP contribution, the livestock sector also contributes to national food security by providing eggs, meat, and milk. Besides this, the livestock sector is a source of cash for the 3.7 million people employed directly in the sector (Alexopoulou, 2011). The contribution of the dairy sector to economic development, poverty alleviation, and reduction of undernutrition in Tanzania is significant. The dairy sector contributed 1.5% of the 7% livestock sector in Tanzania's contribution to the country's Gross Domestic Product (GDP) in 2018 (ILRI, 2018). A global increase in dairy production is driven by multiple factors, including population growth, increasing per capita milk consumption, and rising overall profitability, especially in developing countries. For example, between 1995-2005, annual growth rates in production and consumption of meat and milk in low-and-middle-income countries averaged between 3.5% to 4%, while dairy production in Africa increased by 8 metric tonnes (MT)between 2005 and 2010 (Alexopoulou, 2011).

However, milk production is constrained by a lack of adequate feed supply throughout the year (lack of consistent supply of fodder and concentrates), which mainly affects the intensive and semi-intensive systems (Katjiuongua & Signe, 2014). Pastoralists and agro-pastoralists in arid and semi-arid areas rely on grazing pasture and dry crop residue for their livestock nutrition with no additional nutrient supplementation. The cattle suffer nutrient deficiencies, especially during drought seasons, and milk yield consequently declines. In the sub-humid areas, the animals are commonly grazed under coconuts and by the roadside, supplemented by crop residues from mixed farming. Concentrates are not used in these traditional systems. In the highlands, most smallholder farmers' animals are commonly fed on crop residues, roadside grazing, fodder, and occasionally concentrates, where they are available and affordable. Urban and peri-urban farmers feed their animals on hay, concentrates, and roughage. Medium and large-scale dairy farmers usually have fodder crops or improved pasture for grazing their animals, and feed is conserved usually as hay. Due to inconsistent cattle feeding regimes, milk supply is often cyclic, with high supply in the wet season and low supply in the dry season (Omore et al., 2015).

Like other developing countries, Tanzania is experiencing growth in demand for animal products driven by a growing population and increasing wealth in the urban areas (Katjiuongua & Signe, 2014). In response to the growing demand, dairy production in Tanzania has increased over the years. However, it has not kept up with the population growth. Between 1980 and 2007, dairy output grew by 4.4% per annum while the population grew by around 4.5%. Demand for dairy products is slowly increasing, with dairy comprising 50% of livestock products consumed in Tanzania (Katjiuongua & Signe, 2014). The demand is projected to increase substantially in the coming years with increasing wealth (Michael et al., 2018). Consumption of animal source proteins between 2001 -2007 generally increased in Tanzania, although disproportionately higher among the wealthy and urban dwellers than the poor and those living in rural areas (Katjiuongua & Signe, 2014). The consumption of animal products by Tanzanians is influenced by price. Animal products are four times more expensive than other agricultural products, and the high cost discourages poor households from consuming animal products (Katjiuongua & Signe, 2014). On the other hand, wealthier households consume more livestock products, especially in urban areas where almost all livestock products are purchased with only 2% from own production (Covarrubias et al., 2012). Per capita milk consumption in Tanzania is 45kg/ annum, which is low compared to other countries like Kenya (80kg/ annum) and a global average of 105kg/ annum. The government actively conducts initiatives such as the milk consumption promotion week implemented by TDB to enhance milk consumption (Njombe et al., 2011). However, it is projected that with the current milk production trend in Tanzania, demand will exceed production by 2022, and the government has devised different strategies to increase dairy production in the future. The strategies include improving the quality and availability of feed resources and the genetic performance of the dairy herd (Michael et al., 2018).

2.5.1.3 *IMPLICATIONS OF GROWING DEMAND FOR DAIRY PRODUCTS IN TANZANIA*

Owing to the great wealth of resources in terms of land availability and conducive climate for dairy production, and rapidly growing demand for milk and milk products, the government and development partners have realized the potential of the dairy sector in contributing to poverty eradication and provision of nutrition (Blackmore et al., 2020). Therefore, government and development agencies have numerous efforts to enhance the dairy sector's productivity and

marketing. Government strategy to improve dairy sector productivity as reflected in policy is commercialising dairy products' production, processing, and marketing.

Such an increase in milk production and consumption, especially in urban areas, has food safety implications and often would require that food systems be upgraded to match the increased production demands for milk safety (Grace et al., 2014). In the case of Tanzania, where milk production and trade are expanding in the urban areas characterized by increasing population and limited sanitation facilities, the food safety situation is declining (Katjiuongua & Signe, 2014). Urban dairy production releases animal waste into the environment without any treatment causing pollution and potential health risks. The increased informal sector raw milk trade in the urban areas further means a long milk value chain where most of the milk is sourced from the rural areas distant from the urban areas. The long-distance covered in milk transportation without a reliable cold chain and milk transported in inappropriate milk storage containers increase milk safety risks (Hatab et al., 2019).

Tanzania's informal economy is the second-largest in Africa, contributing more to the GDP than the formal economy (Schneider & Ernste, 2000). The informal sector accounts for most of all milk produced and traded nationally in Tanzania's dairy sector (fig. 2.1).
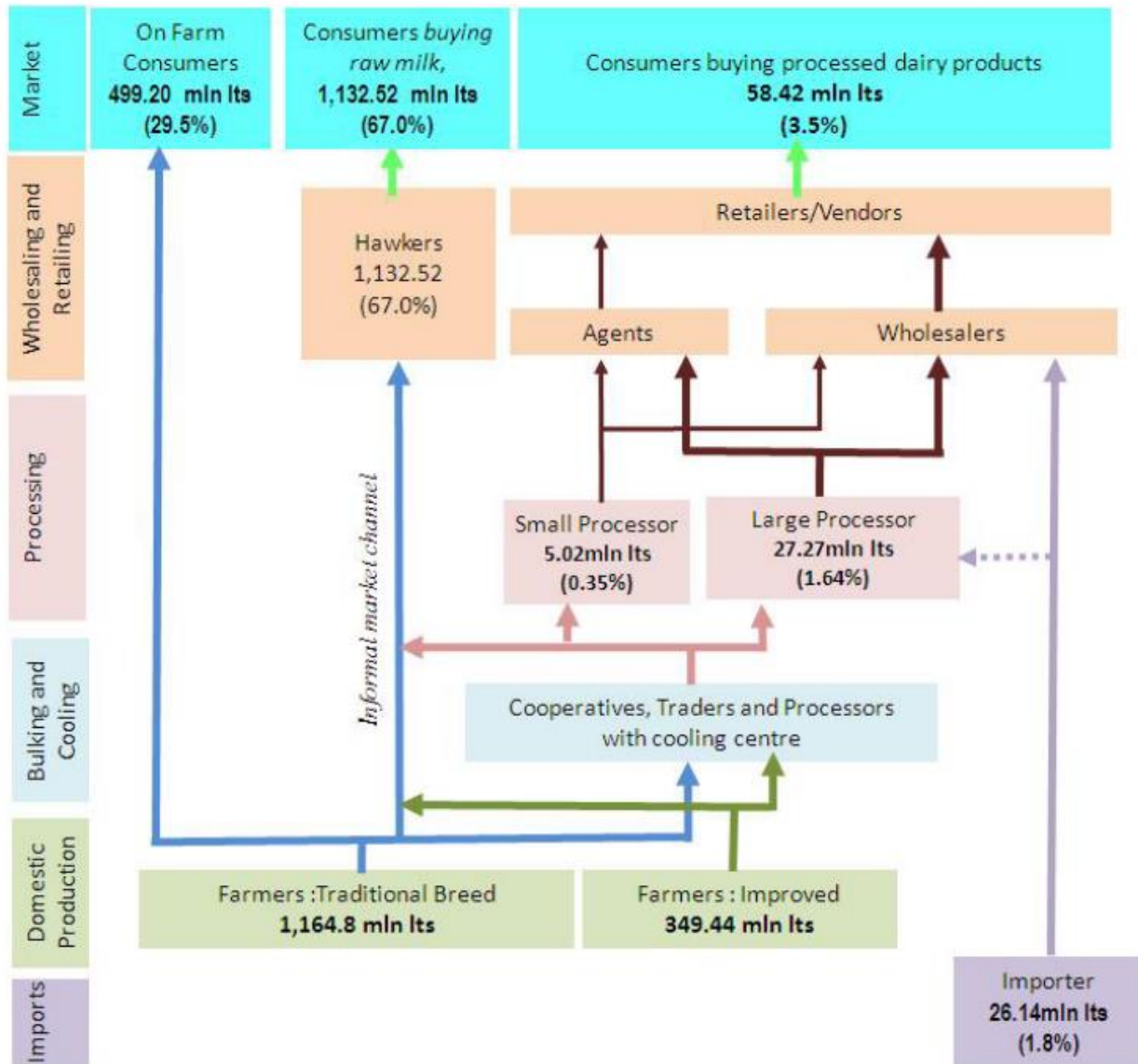
Figure 2.1:schematic diagram of the dairy value chain in Tanzania

Source**:** (NIRAS, 2010)

Policy to trade raw milk in a regulated environment has not yielded the desired results, and draconian measures against informality have not materialized in Tanzania. The penalties for traders selling raw milk without meeting the licensing and registration requirements are not severe compared to other countries like Kenya. Formal sector operators have called for more punitive measures against the informal sector traders, who pose unfair competition. Furthermore, the government recognizes that most electorates operate in the informal sector. Rather than excluding

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them from participating in the milk business through a strict requirement to operate in the formal sector, they allow trade in the informal sector.

Most informal sector actors participate in informal activities to increase their income, although a significant proportion of individuals engage in the informal economy for survival (Alexopoulou, 2011). Informal activities comprise traditional and modern activities. The low-class actors undertake traditional activities. They include survival activities such as hawking and sale of food. In contrast, modern activities such as the sale of merchandise from fixed premises are undertaken by the wealthier class who seek to increase their income.

Policy interventions in the informal sector tend to promote upgrading modern activities that can achieve formalization in the future (Lugalla, 1997). The very poor therefore fail to benefit from such policy interventions. For example, formalization is a priority development aspect for the government of Tanzania for which realization strategies outlined by the government include education, communication and campaigns, and training of informal dairy sector actors. However, there is no specific strategy to formalize the very small-scale traders who are often mobile and hard to reach for such formalization activities (Blackmore et al., 2020). The dilemma remains in achieving food safety in a sector dominated by small-scale resource-constrained value chain actors and resource-constrained regulators.

2.5.2 UNDERSTANDING INFORMALITY IN TANZANIA'S DAIRY SECTOR

To address the informal dairy sector challenges, it is important to contextualize the origin and drivers of informality and the negative consequences of informality, such as poor food safety outcomes. This section discusses how current policy in Tanzania has failed to address food safety regulation in Tanzania's dairy sector instead of accelerating the prevalence of informality. The discussion argues that current policy seeks to regulate food safety in the dairy sector through standards based on the Codex Alimentarius standards and the SPS agreement. However, state regulatory agencies and dairy value chain actors lack the requisite capacities, coordination and incentives to implement and enforce the codex Alimentarius standards effectively. These challenges have resulted in ineffective regulation of the dairy industry, mass exit, and exclusion of the dairy value chain actors from the formal sector (Roesel & Grace, 2015).

The drivers of informality have been broadly identified to include economic underdevelopment and inadequate governance institutions at the macro level, which translates to market segmentation, capacity deficiencies, deregulation, overregulation, incongruence between the codified rules of the game (regulations, standards, procedures, and policies), and societal norms, values, and beliefs, lack of trust in public institutions and poor coordination in food safety activities. This section explains how voluntary exit and involuntary exclusion of dairy value chain actors from the formal sector dairy sector has unfolded in Tanzania through the various categories of economic underdevelopment and poor governance detailed above.

2.5.2.1 EXCLUSION BY LABOUR MARKETS SEGMENTATION

Milk production in pre-colonial times is associated with agro-pastoralists and pastoralists in the savannah areas of Tanzania. The emergence of a new dairy sector dates to 1921, when large farms supplied milk to government civil servants (Kurwijila et al., 2012). A few white settlers started dairy farming in the Arusha and Iringa highlands between the 1st and 2nd World Wars. Between 1932-1935 the Mpwapwa Livestock Research Station developed the Mpwapwa breed for the semi-arid regions with higher potential for milk production. However, most animals were kept at the research stations, and little effort was put into spreading the breed to local farmers.

Like in other developing countries, during colonial times, discriminative policies and regulations, such as restrictive taxation policies, restricted Africans in Tanzania to the rural areas while the colonizers used the cities as centres for trade and administration (Alexopoulou, 2011). With time, more Africans started migrating to the urban areas as cheap labour for the European-owned enterprises resulting in a rural-urban migration trend. A rising African population resulted in growth in unemployment rates, but discriminative policy in trade and access to finance yielded first-class markets for Europeans and second-class markets for Africans (Lugalla, 1997). Unemployed rural migrants started to engage in petty trade activities such as selling food in the streets (Alexopoulou, 2011). After decolonization, internal migration increased, resulting in rapid urbanization and greater unemployment. However, public services were inadequate to serve the growing population, resulting in the uptake of informal housing and self-employment among the people migrating from rural areas to urban areas. The informal economy has since been growing, although not steadily, depending on the dominant policies and perceptions of informality.

After independence, Tanzania adopted a socialism policy and established parastatals in the dairy sector to enhance economic development. The initial dairy development plan was developed in the early 1970s and implemented through a World Bank credit to establish large-scale parastatal dairy farms, plants, and communal dairy units in the villages. Between 1961 and 1965, the dairy sector was under three zonal dairy boards, Mara Creameries for the Mara region, Coastal Dairies of Dar es Salaam and the Coast, and the Northern Dairies for Kilimanjaro and Arusha. The boards were responsible for, among other things, collecting milk from farmers, processing, and marketing of milk and milk products. The National Dairy Board was constituted in 1965 through parliament Act No. 32 (Cap. 590). The board was charged with broader responsibilities that included advising the government on issues related to the dairy sector, registration and licensing of milk producers, processors, importers, and vendors, and setting milk prices. The Tanzania Livestock Development Authority (LIDA) was established through an Act of parliament in 1974 while still retaining the Dairy Industry Act. Tanzania Dairies Limited (TDL) was established in 1975 under LIDA as its subsidiary company to handle milk and milk products processing. The government disbanded all milk processing companies formed under the Companies Ordinance before creating LIDA, and their assets and liabilities were transferred to LIDA. Emphasis switched to smallholder dairy development in 1982 with the support of donors, including the Netherlands and Switzerland. This happened simultaneously with economic reforms, which entailed government withdrawal from dairy production, processing, and marketing, followed by market liberalisation (Nell et al., 2014).

Between 1985 and 1995, most parastatals were privatized, and the fixed milk price policy was abandoned. As a result of the reform, foreign and local investors joined the dairy sector as producers, processors, or marketing agents but lacked proper regulation. Within this period, the informal sector thrived (Blackmore et al., 2020). Most of the processing capacity was in the hands of TDL up to 1990, and milk was collected from producers for the processing plants in Musoma and Tabora and state-owned dairy farms. The main raw materials for milk processing were butter oil and skim milk powder donated by World Food Programme (WFP) and the European Union (EU) (Nell et al., 2014). WFP and EU donations declined towards the end of the 1980s, and TDL started to make losses. TDL-affiliated plants were privatized in the 1990s, and many new locals and foreigners seized the opportunity to establish small to medium-sized processing plants.

However, many private processors were unprofitable due to competition from the informal sector, low milk prices for farmers, which discouraged them from supplying them with raw milk for processing, and a decline in milk powder donations that most factories depended on for reconstituting their milk. Consequently, most of the processing plants closed, and by 2009, the processing capacity in Tanzania had declined by 80% (Alexopoulou, 2011).

Literature indicates that development policies in Tanzania between 1967-1980 limited the growth of the informal sector (Alexopoulou, 2011). In contrast, the government adjustment policies in the early 1980s and the agreement with the International Monetary Fund on adopting the "Economic Recovery Programme" in 1986 resulted in increased cost of living and stagnant wages forcing people to search for secondary income sources (Lugalla, 1997). The Tanzanian informal economy grew from less than 10% in the late 1960s to over 20% after the mid-1980s (Bagachwa & Naho, 1995). In the past, Africa's agriculture was characterized by state control in prizing and marketing. However, many countries in Sub-Saharan Africa, including Tanzania, had very low economic performance in the 1970s and 1980s, so they had no choice but to accept economic reforms designed by the Multilateral Financial Institutions (Alexopoulou, 2011). These reforms entailed broad changes in the rules of the game, including liberalization of trade, deregulation of financial markets, privatization of public firms and liberalization of prices. Concerns over the socioeconomic impact of the reforms on the welfare of the people started to emerge in the late 1980s and early 1990s as inequalities deepened.

Besides the economic structural adjustments of the 1980s, the Tanzanian government and its partners prioritized the development of the dairy industry in the mid-1970s. Consequently, improved dairy cattle, milk collection centres, and processing were taken up by state-owned Tanzania Dairies Limited (TDL). However, in the 1990s, state-owned firms, including those in the dairy industry, started privatising to increase private investment. The result was the closure of many processing units or a drastic reduction in their processing capacity. In 15 years, the dairy processing sector shrunk by more than 80% creating voids in milk supply filled by the informal sector (NIRAS, 2010). The dominance of the informal milk trade in Tanzania was therefore driven by a lack of adequate control over milk marketing; the private processors were unable to replace the parastatals effectively in milk collection, processing, and marketing, prompting the proliferation of the informal market as producers sought a stable market for their milk.

2.5.2.3   EXIT AND EXCLUSION BY ECONOMIC UNDERDEVELOPMENT

The Tanzania Dairy Board (TDB) was established in 2005 (Dairy Industry Act of 2004) to regulate and coordinate dairy sector development. However, a vacuum remained in the coordination and development of the dairy industry in Tanzania (Alexopoulou, 2011). The current Tanzania dairy policy is contained in the National Livestock Sector Policy (2006). The national dairy policy emphasizes smallholder farmers due to their potential for poverty reduction (Twine & Katjiuongua, 2015). The policy aims to enhance the welfare of dairy value chain actors, including farmers and consumers. Various strategies operationalize the National Livestock Sector Policy, including the Agricultural Development Strategy launched in 2017, the overall strategy for livestock policies nationally. The guidelines generally advocate for genetic improvement of the dairy herd, enhanced provision of technical support services and technology adoption, increased investment in production, processing, and marketing, establishing dairy organizations, and strengthening the dairy board (Nell et al., 2014).

The government of Tanzania generally seems to acknowledge the importance of the dairy sector in providing livelihoods for the many value chain actors that are involved in it and its contribution to nutrition for the many consumers of milk and dairy products, making it a sector of interest in facilitating poverty reduction in the country (Njombe et al., 2011). Government priorities for dairy sector development include enhancing production, expanding processing capacity, and reducing the importation of dairy products (Katjiuongua & Signe, 2014).

While policy seems to encourage commercialization of the dairy sector through enhancement of processing capacity, it does not directly pursue the elimination of the informal sector, instead seeking to gradually achieve formalisation through awareness creation. The sale of raw milk, synonymous with informality, is legal in Tanzania, contrary to most other developing countries where it is illegal (Blackmore et al., 2020).

Among the issues addressed by the dairy policies and regulations in Tanzania is the sale of raw milk, which is legal upon registration with TDB and fulfilment of various requirements for the various value chain actors depending on the node of the value chain they operate. For example, under section 17 (1-2) of the Dairy Industry Act, Cap 262 of laws of Tanzania, traders must: 1) possess suitable milk handling equipment; adhere to hygienic milk handling practices and possess

basic platform milk testing facilities. A transporter must have proof of permit of a milk container (TDB, 2018). Dairy traders must also obtain a medical certificate from the public health office and a trading license issued by the ministry of trade through the local government authority.

The regulations further specify that dairy premises must be located away from environmentally polluted locations or industrial activities that could potentially cause milk pollution. The premises must also be suitably designed with an appropriate layout to facilitate sanitary production of milk and milk products, possess adequate physical space for storage and facilitation of sanitary operations, and ensure there is no occurrence of contamination with spoilage and pathogenic microorganisms. The premises are also required to have adequate lighting and ventilation. The TDB has powers to appoint dairy inspectors and analysts to enforce the regulations above under the Duties and Powers of Inspectors and Analysts Regulations of 2007. The appointed inspectors and analysts execute functions and exercise powers authorized by the TDB. The functions and powers delegated to the inspectors include entry into dairy premises without notice, ensuring that the operations in dairy premises comply with the established standards for dairy premises, and suspending operations if not compliant. The inspectors are also authorised to confiscate milk rendered unfit for human consumption, detain vehicles transporting unsafe milk and initiate legal proceedings for non-compliant enterprises. On the other hand, analysts are charged with milk sampling for testing, testing the milk, and relaying the test results to the registrar.

The sale of raw milk is also regulated regarding controlling zoonotic diseases. For example, section 10 of the Dairy Industry Regulations states that 'no person shall sell or distribute to the public any milk for human consumption unless such milk has been pasteurized, sterilized or subjected to such treatment to render it safe for human consumption.' The Tanzania Food, Drugs and Cosmetics Act 2003 (Cap 219) prohibits the sale of any milk from a cow that has had tuberculosis or is recovering from tuberculosis, mastitis, or any other zoonotic disease.

Policy relating to raw milk handling and food safety among formal dairy processors in Tanzania is based on the standards established by FAO/WHO Codex Alimentarius Commission and the sanitary and phytosanitary measures established by the World Animal Health Organization (OIE) regarding food safety (Grace, 2017). Tanzania Bureau standards and regional standards issued through the East Africa Community, which govern food safety in raw and pasteurized milk and

milk products, are based on the Codex and OIE codes of practice, guidelines, and standards. The federal government controls food safety regulations in Tanzania, but the enforcement function rests with the local government. The Codex and OIE-based standards for milk and milk products in Tanzania's dairy sector are limited because it is challenged by a lack of capacity among regulatory government agencies and the dairy value chain actors.

Capacity deficiencies among dairy value chain actors and government agencies

In Tanzania, the four requisite capacities in implementing risk-based food safety systems are either lacking or inadequate among value chain actors and regulators, similar to many other LMICs. Even in developed countries, these capacities are not always adequate because investment in their establishment by governments depends on their priority. For example, in a study conducted in 10 developed and developing countries (Thailand, Vietnam, Australia, Canada, Hong Kong, China, Indonesia, Philippines, Japan, and Russia), it was reported that the lack of technical capacity and infrastructure were the main hindrances to the success of risk-based food safety management systems (Food safety magazine, 2019).

Developing countries in SSA are characterized by complex, fragmented, and underfunded food safety systems (GFSP, 2019). Tanzania's food safety management system does not work well with limited capacity within the local and federal government agencies. The dairy board cannot carry out capacity building for their technical staff as required, and the number of technical staff serving the board is limited (Blackmore et al., 2020). Further, in a previous study, Tanzania was found to have low laboratory capacity and workforce capacity for testing food samples and food-borne disease diagnoses (Grace, 2015).

Besides technical capacity for inspection and laboratory analysis, food safety management systems need accurate evidence of food safety risks to inform decision-making, which is often lacking in most developing countries (Jaffee et al., 2019).

The dairy value chain in Tanzania is predominantly small-scale, characterized by a lack of adequate herd health management, inadequate sanitary infrastructure for milk handling, inadequate cold chain in the milk value chain, and milk quality testing facilities. The dairy value chain actors also lack knowledge in good production and milk handling practices (Omore et al., 2015). This thesis advances an argument on how the capacity inadequacies among value chain actors limit

their ability to meet the Codex and OIE food safety requirements resulting in exit and exclusion from formal dairy sector regulation.

Herd health management and pre-milking hygiene practices contribute to milk safety. It is therefore important to minimize contamination at the production level by maintaining the hygiene of animal facilities, herd hygiene, and overall herd health to avoid infections such as mastitis, proper cleaning and disinfection of milk handling equipment, good use of antibiotics and pesticides, and minimizing microbial contamination of feed (Paraffin et al., 2018). Producers' proper knowledge of herd health management, either through formal education or consultation with specialists to address specific occurrences, is paramount in achieving success in milk safety at the production node. It is further critical that producers access necessary infrastructure such as cattle dips for herd health management.

Lack of adequate knowledge and access to necessary inputs and infrastructure often results in inadequate herd health resulting in contamination of milk with pathogenic (disease-causing) bacteria from the udder of unhealthy animals, the environment (human handler, air or water supplies), or milking equipment (Tremonte et al., 2014). Various microorganisms, including *E. coli*, Campylobacter, Listeria, and Salmonella, which cause food-borne illnesses, are shed through milk and faeces. The bacteria count in milk from an unhealthy cow is high. Mastitis, an infection of the mammary glands, is a predominant illness among dairy animals causing high bacteria in milk (Tremonte et al., 2014). Pathogenic bacteria that cause mastitis occurs when bacteria enter the teat and colonize mammary tissue (Gomes et al., 2016). Mastitis pathogens are categorized into coliforms, streptococci, and staphylococci, spread from infected quarters to uninfected quarters of the same or different animals, animal handlers, and individuals who handle or consume unpasteurized milk (Tremonte et al., 2014). In a 31-year retrospective study for aetiology and temporal distribution of bovine mastitis in Dar es Salaam, Tanzania, 88% of quarter samples were positive for mastitis, with the predominant mastitis pathogens being staphylococcus, streptococcus, and *E. coli* (Kivaria & Noordhuizen, 2007). Such a high prevalence of mastitis indicates poor herd health management practices among dairy producers in Tanzania.

The teat end is a critical control point for organisms that cause food-borne illnesses, such as those that cause mastitis, and infection can be prevented by adopting appropriate hygiene and animal

health management practices (Garcia et al., 2019). Animal treatment practices in Tanzania have been identified to include deworming, vaccination of animals and spraying of milking sheds with insecticides, and are often not adequate to contain important diseases in milk safety, such as mastitis, which is widely reported by farmers (Ledo et al., 2019; Ngasala et al., 2015). Risky practices have also been reported among producers where milk from sick animals at the household level is sold to unsuspecting traders and consumers, posing the risk of consumers contracting food-borne diseases (Häsler et al., 2018). Producers also sell milk from animals under treatment exposing consumers to disease-causing pathogens and the potential risk of occurrence of antimicrobial-resistant pathogens, which can potentially affect consumers or other animal populations (Ledo et al., 2019).

Beyond the farm level, milk safety is best addressed through a risk-based system along the value chain while focusing on cost-effective preventive and control measures, providing capacity-building support, value chain coordination, and improved market incentives (Unnevehr, 2015). A policy and legislative framework for food quality and safety, adequate infrastructure, and well-trained inspectors are necessary to implement the standard and acceptable practices among value chain actors (Lemma et al., 2018). Literature, however, indicates hostile operation conditions for informal dairy sector actors, including a lack of access to basic infrastructure, including lack of clean water supply, toilets, and electricity (Blackmore et al., 2020). The poor conditions experienced in informal markets related to poor sanitation, lack of refrigeration, improper storage, and lack of access to potable water are predisposing factors to food safety challenges. Such inadequacies also make it impossible for the dairy value chain actors to comply with the requirements of the risk-based food safety systems.

Poor sanitation in Tanzania's dairy sector is reflected in milk hygiene practices which are very basic and not necessarily done correctly, resulting in milk of low microbial quality (Ledo et al., 2019; Scoder et al., 2013). For example, plastic containers are widely used for milk storage by the value chain actors instead of the recommended aluminium cans. The plastic containers are usually narrow neck and difficult to clean, likely compromising microbial milk quality (Ngasala et al., 2015). The cleaning routine among dairy value chain actors in Tanzania, in some instances, has been reported to include the use of cold, dirty water and the wiping of containers with dirty towels

instead of the use of hot potable water and soap for cleaning and subsequent air drying (Scoder et al., 2013).

Further, minimizing initial microbial load and preventing growth is critical in managing milk quality. Therefore, value chain actors need to detect milk quality and have access to advisers to guide them in managing their milk quality challenges (Lemma et al., 2018). Dairy value chain actors in Tanzania have varied skill levels in conducting platform tests, with some able to carry out organoleptic tests. In contrast, others can use a lactometer (Ledo et al., 2019). The knowledge gap in milk testing and access to proper equipment to assess milk quality hinders milk testing at the source for the traders, increasing the chances of acquiring low-quality milk and passing it on to the consumer (Johnson et al., 2015; Sikira et al., 2013).

Additionally, although producing good quality clean milk from healthy animals is key to delivering safe and high-quality milk, controlling milk contamination with microorganisms and their growth at all points of the value chain is a critical determinant of milk quality. Milk excreted from a healthy animal is sterile. Natural microbial inhibitors in milk, such as lacto peroxidase and lactoferrin, prevent bacteria from multiplication for 3-4 hours after milking (FAO, n.d.-a). Cooling milk to 4˚c within this period preserves the original quality of milk before processing or consumption. Cooling can be achieved through mechanical refrigerators or bulk cooling tanks, but these may not be affordable to small-scale farmers in developing countries. In the absence of a cold chain, lacto peroxidase, a naturally occurring enzyme in milk approved by Codex Alimentarius, can be used to preserve milk quality (Lemma et al., 2018). With lacto peroxidase, raw milk shelf life is extended by 7 -8 hours at 30˚C and 15-20 ˚C, milk can be stored overnight, allowing for collection once a day, reducing losses associated with the cost of collection and spoilage (FAO, n.d.-b). However, most raw milk consumed in Tanzania is stored at room temperature and transported for long hours at high temperatures, contributing to spoilage and pathogenic bacteria in milk (Häsler et al., 2019; Ledo et al., 2019).

Raw milk in the Tanzania dairy value chain has been found to have total bacteria count higher than recommended in Tanzania standards for raw milk and even unsuitable physiological properties, including bad odour (Ngasala et al., 2015; Scoder et al., 2013). Furthermore, public health important pathogens including *E. coli 0157:h7*, Salmonella, and coliform have been detected in

milk samples drawn from various points of the value chain, including producers, milk collectors, and different types of retailers (Hyera, 2015; Joseph, 2015; Lubote et al., 2014). Most raw milk in Tanzania is often of poor microbiological quality, it is consumed quickly, and boiling is common practice before consumption (Njombe et al., 2011). However, while boiling eliminates most pathogenic bacteria from milk, the boiled milk still carries the risk of consumer exposure to pathogenic bacteria through possible recontamination, presence of stable heat toxins produced by bacteria, presence of heat-tolerant psychotropic bacteria such as Listeria, antimicrobial residues, aflatoxins, and other chemicals (Kilango et al., 2012). There is evidence of contamination of boiled milk samples with foodborne pathogens in Tanzania, proving that food-borne risks are not negligible (Häsler et al., 2018). Some traders also ferment milk and sell it as sour milk; traditional fermentation of milk inhibits the growth of pathogenic bacteria, including S. aureus (Roesel & Grace, 2015). Fermentation also reduces staphylococcal contamination 15 times more than in raw milk, but other bacteria in milk may be likely to cause illness (Roesel & Grace, 2015).

Due to the nature of hazards which may originate from the producers or initial handlers and multiply down the chain towards the consumer, supply chain coordination is often required to achieve food safety (Trienekens, 2011). Such coordination allows verification that risk reduction practices are practiced throughout the supply chain. The verification may require new institutions such as third-party audits and certifications, improved testing of hazards, and diversion of hazardous products to lower-risk uses (Jaffee et al., 2019). In Tanzania, dairy value chain coordination is the responsibility of the Tanzania Milk Processors Association (TAMPA) and Tanzania Milk Producers Association (TAMPRODA), both established by TDB and are working with TDB in the coordination of the dairy value chain activities. The following section discusses the mandates of the two associations and their role in coordinating food safety in the dairy sector.

Tanzania Milk Processors Association (TAMPA)

TAMPA, an association for milk processors, was instituted in 2003. The core function of the association is to advocate for milk processing and trade issues to achieve a good business environment for the private sector dairy stakeholders. The association also promotes the consumption of processed milk and lobbies for the welfare of its members through the engagement of the government, NGOs, and other private sector associations. The association is represented in

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TDB through the annual council, where issues that affect the private dairy sector actors are addressed. The association can influence decisions about the development of the dairy sector and has, for example, managed to negotiate for the elimination of levies on milk and milk products. The association has not been involved in any direct activities to ensure compliance with food safety by the members.

Tanzania Milk Producers Association (TAMPRODA)

The association was established through the efforts of TDB in 2002 and registered with the Ministry of Home Affairs in 2004. It was established to facilitate the development of a stakeholder-driven milk production sector in Tanzania to commercialize milk production in the country. The intention was to collectively engage dairy farmers to facilitate the exchange of information among them and advocate for their interests. However, the association is weak and has not benefited the welfare of the producers much. The association has also not been involved in any direct activities to ensure compliance with food safety by the members.

2.5.2.4   EXIT AND EXCLUSION BY OVERREGULATION OF THE DAIRY SECTOR IN TANZANIA

In Tanzania, food safety regulation is characterized by more than 17 food laws and more than 18 institutions and regulatory product boards responsible for standards-setting and food safety management, which are poorly coordinated (Kussaga, 2015). The multiple regulations and regulatory agencies are too burdensome for the small-scale, informal sector actors (Urassa, 2014). Some informal sector actors often avoid formalization to escape the high cost of legal compliance (De Soto, 1989). Other informal sector actors do not comprehend the multiple legal compliance requirements due to poor information availability to interpret the legal requirements compared to their formal sector counterparts. As a result, the informal sector actors are excluded from the formal sector by an imbalance in information flow(Williams & Krasniqi, 2018). Usually, the formal sector uses the imbalanced information flow and, therefore, low compliance levels with regulation among the informal sector actors to taint the informal sector's image in the authorities' eyes. With the tainted image of the informal sector, the formal sector pushes the agenda to have the informal sector banned even though the formal sector actors' main reason for intolerance of the informal sector is because they are a great source of competition (Roesel & Grace, 2015). In the section below, the thesis discusses the state of multiple regulations by multiple agencies resulting

in incoherence and ineffectiveness of governance, overburdening of value chain actors, and ultimately exit of value chain actors, either to avoid the burden of compliance or exclusion of the very small-scale value chain actors who cannot afford compliance.

The multiple state regulatory bodies in Tanzania's dairy sector

The Ministry of Livestock and Fisheries Development (MLFD) is the key regulator of the dairy sector in Tanzania (Nell et al., 2014) through the Tanzania Dairy Board (TDB). Other government agencies authorized to regulate certain aspects of the dairy sector include public health officials, the Tanzania Bureau of Standards (TBS), the Business Registration and Licensing Agency (BRELA), and the Government Chemist Laboratory Authority (GCLA). Others include the National Environment Management Council (NEMC), Occupational Safety and Health Authority (OSHA), Tanzania Revenue Authority (TRA), and Ministry of Industry and Trade (MIT). The dairy sector in Tanzania is further regulated by Tanzania Industrial Research and Development Organization (TIRDO), Small Industries Development Organization (SIDO), Fire and Rescue Agency (FRA), Weights and Measures Agency (WMA), and the National Atomic Commission (NAC). The regulating agencies implement relevant standards and regulations while the local government authority enforces the laws (Grace, 2012).

During TDB's legal framework formulation, stakeholders were wary of the potential overlap between TDB's functions and other government agencies authorized to regulate various aspects of the dairy sector. There was an attempt to separate the roles of the various government agencies in the regulation of the dairy sector (Nell et al., 2014). For example, TDB was made responsible for quality assurance down the value chain, while Tanzania Food and Drug Authority (TFDA) (which has now been dissolved) was responsible for quality assurance during processing, after processing, and at the retailing stage. However, the regulatory roles of the multiple agencies still overlap (Grace, 2012). Examples of duplicated roles among the regulatory agencies include inspection of dairy processing premises, implemented by TBS, TDB, OSHA, NEMC, zoo-sanitary department, and LGA. Product testing is conducted by TDB, TBS, and GCLA. Issuance of trade/ product permits and licenses is done by TBS, TRA, LGA, BRELA, public health, NEMC, OSHA, MLFD, TDB, MIT, weights, and measures.

The next section provides details of the milk safety regulatory responsibilities mandated to the various regulatory agencies authorized to regulate milk safety. The section also demonstrates the overlap mentioned above in the functions and lack of coherence resulting in inefficiency in the regulation of the dairy sector and overburdening of the dairy sector actors prompting their exit or exclusion from the formal dairy sector.

Tanzania Dairy Board (TDB)

The board was instituted in 2005 under Dairy Industry Act 2004 as the key national dairy development body responsible for regulating and developing the dairy industry in Tanzania (TDB, n.d.). In light of market liberalization, the participants of the second dairy development forum of 1998 held in Arusha resolved to establish a stakeholder-based autonomous dairy development board (Nell et al., 2014). However, the board has not achieved autonomy as intended during its establishment, and some decision-making is controlled by the Ministry of Livestock and Fisheries Development (MLFD). The board is governed and reports to the Ministry of Livestock and Fisheries Development through the board's Chairman. The board further operates alongside the annual council comprised of various dairy sector stakeholders, which sits under the minister and is responsible for promoting a sustainable dairy sector and scrutinizing the board's performance. The board is the annual council's executive arm, which implements the council's decisions (The Dairy Industry Act, 2004).

Functions

The dairy board is mandated to develop, regulate, and promote the dairy industry. The board is specifically charged with organizing, regulating, developing, and promoting the efficient production, marketing, distribution, and supply of dairy produce (The Dairy Industry Act, 2004). The board is also required to improve the quality of dairy products and promote the development of the private sector. The board has facilitated the establishment of stakeholder associations, i.e., Tanzania Milk Processors Association (TAMPA), Tanzania Milk Producers Association (TAMPRODA), and the Dairy Development Forum (DDF), which is a platform through which the board engages with various stakeholders, including farmers, private sector, and policymakers to discuss issues affecting the dairy industry (Njombe et al., 2011).

Tanzania Bureau of Standards (TBS)

The Bureau was established by Parliamentary Act No. 3 of 1975 as the National Standards Institute and became operational on 16th April 1976. Subsequently, it was renamed the Tanzania Bureau of Standards under Act No. 1 of 1977. On 20th March 2009, the Standards Act No. 3 of 1975 was repealed and replaced by the Standards Act No. 2 of 2009. The bureau is under the Ministry of Trade and Investment (MIT).

Functions

The Bureau is mandated to undertake quality control of products of all descriptions and promote standardization in industry and commerce (The Standards Act, 2009). Key roles include developing standards, quality control of all processed products, and issuing the mark of quality. Other functions include testing and calibration, registration of products and premises, and certification for management systems, including ISO and HACCP. The bureau is also authorized to issue a license for product manufacturing or processing to manufacturers and inspect manufacturing ingredients, products, processes, and records within manufacturing premises for compliance with relevant standards. Additionally, the bureau has the authority to recall products that do not meet the established specifications (Section 22, 24, and 25, standards act, 2009). Regarding the dairy sector, the bureau is responsible for establishing quality and safety parameters through a technical committee, issuing the mark of quality compulsory for milk processors, and general regulation of processed milk and milk products.

BRELA

The agency was established in 1999 under the Government Executive Agencies Act No.30 of 1997under the Ministry of Industry and Trade (The Government of Tanzania, n.d.-a).

Functions

BRELA is an executive business administration and regulation agency tasked with registering businesses and companies, including formal and informal dairy enterprises, issuing patents and industrial licenses (The Government of Tanzania, n.d.-a).

Public health office

Structure

The public health office is under the Ministry of Health, Community Development, Gender, Elderly, and Children (The Government of Tanzania, n.d.-b).

Functions

The public health office is mandated to make by-laws prohibiting the sale of food (including milk and dairy products) that has been adulterated and ensuring that food is transported, processed, and stored under sanitary conditions and fit for human consumption.

Local Government Authority (LGA)

Tanzania's local government authority is recognized by article 145 of the constitution, supported by the Local Government (District Authorities Act)1982 and the Local government (Urban Authorities Act)1982. The Ministry for Regional Administration and Local Government is responsible for local governance. There are three types of urban authority in mainland Tanzania: the city, municipal, and town councils. The rural areas are characterized by two levels of authority: district and village councils (The Government of Tanzania, n.d.-c). Decision-making is centralized in the national government through the regional and local government ministries. The decisions from the ministry are cascaded to the various local government offices in the country.

Functions

The local government authority partners with the central government to consolidate the delivery of key services to the citizens at the local level. The local government authority in Tanzania collaborates with various national government agencies that regulate the dairy sector (BRELA, TDB, MLFD, TBS, and public health) to deliver to citizens locally.

The East African Community (EAC)

The East Africa Community is a regional inter-governmental organization comprising six members (Kenya, Rwanda, Republic of Burundi, United Republic of Tanzania, South Sudan, and the Republic of Uganda) (East Africa Community, n.d.). EAC headquarters are in Arusha, Tanzania. The community was established through its treaty of 1999. The community constitutes heads of state, a council of ministries, and East Africa Community institutions.

Functions

One of the EAC functions is establishing an enabling environment for livestock production and trade among member states. The community particularly plays a role in harmonizing policies, regulations, legal frameworks, and guidelines to enhance livestock production and trade in livestock products among the member countries (East Africa Community, n.d.). It further facilitates intraregional trade by addressing regional infrastructure issues that affect trade among the member states. The community also addresses livestock production and trade issues at the international level. EAC does not have dairy-specific regulations but a harmonised standard governing East Africa's raw milk trade. The standard is an important guide in the raw milk trade among the member states. The standard, for example, facilitates the importation of raw milk from countries such as Uganda by dairy processors in Kenya during the dry season when in-country milk supply is limited. While the regional policies and standards supersede existing national policies and standards, the community's harmonization efforts are often delayed by some member states' delayed implementation of the regional standards and policies.

2.5.2.5   RULES THAT GOVERN THE DAIRY SECTOR IN TANZANIA

In addition to the multiple regulatory agencies that regulate the dairy industry in Tanzania, the governance of the dairy industry is further characterized by multiple rules of the game enshrined in various regulations, policies, standards, and procedures (Urassa, 2014). The numerous regulatory instruments specify different requirements that the dairy sector entrepreneurs must comply with. Small-scale processors and traders are disproportionately affected by the regulatory requirements compared to large-scale processors. Such variance is caused by the prohibitive initial investment cost for establishing a food safety system to comply with regulatory requirements. The costs may constitute establishing a food safety control system, investment in equipment to reduce the risk of monitoring outcomes, and training personnel in new procedures related to the food safety management system (Unnevehr, 2015). The high initial investment cost may be prohibitive for small-scale processing firms as they incur a higher per-unit investment cost than the large processors. Consequently, small firms and individual entrepreneurs may be unable to comply with the food safety requirements or opt out of the formal regulatory system if the cost of compliance diminishes their profit margin significantly and instead operate informally (Unnevehr, 2015).

The rules of the game that govern the dairy sector in Tanzania promote commercialization of the sector as reflected in the overarching dairy sector policy document; the National Livestock Policy, 2006 and other legal documents that enact the livestock policy, including the Livestock Sector Development Strategy (MLFD 2010), Livestock Sector Development Programme (MLFD, 2011) and Tanzania Livestock Master Plan (2018). The dairy sector commercialization strategies detailed in these policy documents entail genetic improvement of dairy herds, enhanced provision of technical support and promotion of uptake of technology, encouragement of investment in production, processing, and marketing of milk and milk products, supporting the establishment of dairy sector stakeholder associations and empowering TDB to regulate the sector effectively. The various instruments of regulation address milk safety as a constituent of dairy sector commercialization. Various departments implement these instruments within MLFD and other authorized government agencies whose mandate includes regulation of the dairy sector (table 2.1).

Table 2.1:Formal rules that govern Tanzania's dairy sector

Agency	Rules (Act/ Regulation / standard/policy)	Specific areas of regulation in the dairy sector
TDB	Dairy industry Act 2004	Provides for regulating and advancing dairy production, processing, and marketing.
	The Dairy Industry Regulations of 2007	Specifies the requirements for registration of dairy stakeholders with the dairy board.
MOALF	Dairy policy (2006) developed in collaboration with the MOALF	Details the overall strategy for enhancement of productivity and marketing of the dairy products to drive commercialization of the sector
	The Livestock Identification, Registration, and Traceability Act	Details the identification and traceability of farm animals and their products. The Act further addressed control of livestock movement and the registration of their premises.
	The Animal Diseases Act	Details the recommended actions on diseased farm animals and livestock products from diseased animals.
LGA	Local government Bi-laws	Enforces the regulations on behalf of the regulating agencies

Public health office	Public Health Act 2009	Details the responsibilities of the public health office in enforcing food safety among food processors (manufacturers, retailers, hotels, and any other outlet handling food).
TBS	The Tanzania Bureau of Standards Act (2009)	Sets out functions of Tanzania Bureau of Standards (TBS) 14 including preparing standard; management of standard marks; inspecting commodities; recall of defective commodities.
	2009 Standards (Tested Products) Regulations	Describes procedures for test product certification (a product for which the TBS has not issued a standard but which otherwise complies with the appropriate standard)
BRELA	Business activities registration act, 2005	Established Business Registration Centres which provided for the registration of businesses

Regulation of food safety in Tanzania's s dairy sector is characterized by a plethora of requirements enacted by multiple regulatory agencies, as detailed in the sections above. In a previous study, dairy sector entrepreneurs in Tanzania reported that the cost of compliance with the numerous legal requirements is burdensome and mostly prohibitive for small-scale enterprises. The entrepreneurs often incur expenses related to familiarizing the regulatory requirements, paying an expert to facilitate compliance, and meeting compliance reporting requirements (Urassa, 2014). Besides the hefty compliance costs, there is the burden of dealing with at least eighteen government agencies that conduct compliance checks frequently, each consuming time for the entrepreneur during the inspection checks (Urassa, 2014). As a result of the burdensome regulatory environment in Tanzania's dairy sector, many entrepreneurs cannot operate within the legal framework by choice or circumstance, leading to the proliferation of informality in the sector.

It is clear from both theoretical and empirical literature that the multiple regulations and regulatory agencies are burdensome to the dairy value chain actors in LMICs, resulting in widespread non-compliance and proliferation of the informal sector. The literature, however, does not demonstrate the extent of the burden on value chain actors. This research weighs in on the compliance requirements implied on the value chain actors in Tanzania's dairy sector by the multiple regulatory authorities to demonstrate the nature and extent of the regulatory burden that value chain actors are meant to deal with to comply with food safety regulations.

2.5.2.6   *EXIT BY LACK OF TRUST IN PUBLIC INSTITUTIONS*

Trust in public institutions influences value chain actors' willingness to comply with formal rules. This section references the perception of the Tanzanian citizens on fairness and effectiveness of the taxation regime and how it influences their compliance in remittance of taxes to the government to demonstrate how such perception generally affects the occurrence of informality. Tanzania has implemented significant reforms in its tax system to develop more reliable development financing options rather than relying on foreign aid. However, growth in public sending has outpaced revenue growth, implying an expanding tax-spending gap (IMF, 2000, 2012).

However, the Tanzanian government's self-sufficiency fiscal approach presents several possibilities for the country. First, the government will have more predictable financing for development investments and hopefully move away from the current state dependence on foreign aid and vulnerability to changes in foreign aid flow(Halla, 2012; Molero & Pujol, 2012; Torgler et al., 2008). Second, the government will have a greater incentive to engage with the electorate and be more accountable by becoming less dependent on aid (Torgler et al., 2007). Third, as more people pay more taxes to the government, they will become more interested in seeking accountability from the government on how their taxes are spent and seeking ways to engage meaningfully with state officials regarding their welfare (Halla, 2012; Torgler et al., 2008). The tax reforms may result in adequate demand for accountability, ensuring that the social contract between the state and the citizens is honoured.

Regarding the opinion of citizens on the fairness and effectiveness of the taxation regime in Tanzania, the majority believe that state authorities are justified in making people pay taxes. Additionally, a significant proportion of citizens are comfortable paying higher taxes and receiving more goods and services from the state instead of paying less taxes for fewer goods and services from the state. Citizens also feel that state officials make tax evasion difficult, indicating that it is difficult to avoid paying taxes (Rose, 2013).

However, citizens have limited information on their requirements by the taxation system, and they increasingly perceive the tax authorities as corrupt, situations likely to undermine tax implementation and enforcement efforts by the state (Rose, 2013).

Literature is not clear on the extent of trust that dairy value chain actors have in the government and its intentions. This research sought to understand government attitudes towards the informal dairy sector. The question was asked to both regulatory agencies and value chain actors.

2.5.2.7 *EXIT BY INCONGRUENCE BETWEEN FORMAL RULES AND CULTURAL NORMS AND BELIEFS*

Literature indicates a clear preference for raw milk among consumers in Tanzania, contrary to the government's clear orientation to expanding milk processing to achieve the development of the dairy sector (Leksmono et al., 2006; Roesel & Grace, 2015). While (Chege et al., 2015; Roesel & Grace, 2015; Wegerif & Martucci, 2019) indicate incongruence in culture and formal rules on the perception of milk safety, the literature does not explain why specific individuals prefer to consume milk raw. The question of why consumers drank their milk raw was asked in key informant interviews and survey questionnaires to address this gap.

2.5.2.8 *CRITICAL EVALUATION OF THE LITERATURE ON THE DRIVERS OF INFORMALITY IN TANZANIA'S DAIRY SECTOR*

Lugalla (1997)argued that economic segregation during Tanzania's colonial era and the formal sector's inability to employ rural migrants in the urban areas drove the emergence and proliferation of informality. This argument is logical in explaining the effect of entry barriers where the formal institutional requirements restrict the participation of certain categories of entrepreneurs who lack adequate resources to meet all the compliance requirements of formal systems. The argument aligns with that presented by Urassa (2014), who indicates that the heavy burden of multiple regulations on the dairy sector in Tanzania results in an extensive financial burden for the resource-constrained informal value chain actors. The value chain actors are consequently eliminated from the formal sector because it is beyond their reach, or they opt out because the benefits of non-compliance outweigh the costs of compliance. The logic presented by the two approaches is that economic underdevelopment and the resulting widespread poverty and rational economic evaluation of the benefits and costs of participation in the informal economy drive informality among value chain actors.

The argument for the inability of value chain actors to participate in formal economic activities because they cannot afford the compliance requirements is further advanced by Unnevehr (2015) and Jaffee et al. (2019), who also expand the discussion to the inability of regulatory institutions to implement and enforce the formal regulations due to lack of technical capacity and

infrastructure. These scholars argue that economic underdevelopment results in inadequate technical capacity and infrastructure investment among value chain actors and regulatory agencies, translating to failure in effective hazard and risk identification.

The argument that economic underdevelopment has resulted in capacity deficiencies to implement risk-based food safety systems is the most relevant in this study. It explains the root causes of the poor performance by the value chain actors and regulatory agencies in implementing risk-based food safety systems. While the argument is critical in explaining capacity deficiencies as root causes for poor performance, existing literature does not systematically explain the nature, extent, and drivers of the shortcomings of the four critical capacities among value chain actors and regulatory agencies in Tanzania's dairy sector. Addressing these gaps in existing literature would be critical in informing policy and investment decisions. This research seeks to address this gap.

The economic underdevelopment fails to address poor governance as a driver of informality. The poor governance argument is advanced by Alexopoulou, (2011), Nell et al. (2014) and Blackmore et al. (2020) who argue that deregulation of financial markets, trade liberalization and privatization of dairy production, processing and marketing in the period between 1985 and 1997 under the IMF economic restructuring reforms, resulted in poor governance of the dairy sector. The poor governance led to inefficiencies in regulating private milk processors and milk traders, resulting in partial compliance among formal processors and the proliferation of informal trading of raw milk. Rose (2013) advances the poor governance argument from the perspective that citizens lack trust in government institutions about their intentions for their welfare. Therefore, citizens are not keen to comply with formal regulations. Citizens in Tanzania generally perceive tax authorities as corrupt and have limited knowledge of the tax requirements ; situations that collectively determine tax morale among citizens. However, there is a gap in how the value chain actors and regulatory agencies perceive the legitimacy and effectiveness of the regulatory agencies in enforcing the regulations. This research seeks to address this gap which informs how the effectiveness and legitimacy of the regulatory agencies incentivize or disincentivize compliance by value chain actors.

The other argument that explains informality is the incongruence between formal rules and informal values, norms and beliefs about milk safety. Literature indicates incongruence between

formal policy emphasis on milk pasteurization and consumers' preference for raw milk. The dominant consumer preference for raw milk is explained by taste preference for raw milk compared to pasteurized milk and consumers' inability and unwillingness to pay for the extra cost of pasteurized milk. Literature indicates that the consumer demand for raw milk and lack of trust in branded products is a crucial incentive for trader participation in the informal sector. However, there is a gap in nature, extent and drivers of the consumer demand for raw milk incentives as a root cause of the poor implementation of the risk-based food safety regulation among value chain actors and regulatory authorities. This research seeks to address this gap.

The M4P framework was applied in identifying the value chain actors in the dairy sector relevant to the food safety regulation debate. These formal rules govern food safety regulation and regulatory agencies responsible for their implementation and enforcement. The M4P framework was further used to investigate the nature, extent and drivers of the capacity and incentives challenges faced by the value chain actors and regulatory agencies in the implementation of the formal rules that govern food safety regulation. The application of the M4P framework is explained in detail in chapter 3.

2.6 IMPLEMENTATION OF AN ALTERNATIVE POLICY APPROACH TO FORMALIZATION IN TANZANIA'S DAIRY SECTOR

An alternative policy approach (training and certification (T&C) intervention) which embraces both direct and indirect policy measures, was developed and piloted in Tanzania as a potential pathway for formalization and improvement of food safety in the informal dairy sector. The T&C intervention was launched in Tanzania in 2010 to address food safety risks and achieve regulation and formalization of the industry.

The alternative policy approach (T&C intervention) acknowledged the prevailing capacity gaps among value chain actors and government agencies to implement a risk-based food safety system effectively. Therefore, the approach sought to address capacity challenges related to inadequate knowledge of food hazards and their control and prevention through training in appropriate milk production and handling practices (Johnson et al., 2015). The intervention also sought to drive commitment to food safety among the value chain actors through the training, which addressed the misconceptions about safe milk production, handling, and processing. The assumption was that

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once the value chain actors understood the implication of handling milk correctly from a scientific point of view, they would be driven to pursue milk safety voluntarily. The approach further sought to address the pervasive culture of noncompliance. It sought to improve the relationship between state and informal sector value chain actors from one hostile state towards the informal sector, which they regard illegal to mutual trust between state and the value chain actors. The state was expected to certify trained traders and recognize them as legal in conducting their business activities upon successful training and certification (Johnson et al., 2015).

The alternative policy approach also incorporated the use of sticks and carrots enforced by government authorities to encourage formalization among informal sector actors and punish those who deliberately opted not to comply with the legal requirements. The training was designed with the assumption that the agents are well-intentioned but ill-informed, therefore, some of the promoted behaviour changes would have direct benefits, such as reduction in milk spoilage which would encourage adoption of the training and certification by peers. Institutions such as branding were also expected to be created and incentivize participation (Grace, 2015). Another major incentive in training was that certification or any other form of legal recognition would reduce costs associated with illegality (e.g., fines or bribes) (Johnson et al., 2015). Entrepreneurs who completed the training and certification would be registered with TDB as legal traders. Those who failed to complete the training and certification would be denied registration with TDB as legal traders risking harassment and even closure of premises by the authorities. Additionally, entrepreneurs who excelled in maintaining recommended food safety standards would be rewarded with physical branding of their premises as retailers of safe milk to advertise them, earning them a greater customer base and ultimately better profits.

For the incentives and disincentives of training and certification to be realized, the government needed to commit to establishing and enforcing a legal requirement for training and certification of traders before their registration with TDB as legal traders. The government would benefit from implementing such a legal requirement by gaining control over food safety in the informal dairy sector and collecting revenue otherwise not remitted by the informal sector actors. The T&C policy approach overall sought to achieve behaviour change and commitment to food safety among target value chain actors (traders). The behaviour change and commitment to food safety among traders were sought by influencing their knowledge of food safety hazards, controlling and preventing

them, and enhancing trust in the state regulators among the traders. The intervention also rewarded the training and certification uptake through registration with TDB as legal traders. For those enterprises that excelled in the recommended practices, their premises were branded to advertise the sale of safe milk. The intervention further sought to punish the lack of uptake of the intervention by traders through their denial of registration with TDB as legal traders. The design of the T&C intervention is aligned with the slippery slope framework, where the direct and indirect policy measures work in a complementary manner to address informality and challenges related to informality.

The direct and indirect policy measures of the training and certification intervention implemented in Tanzania's dairy sector were organized sequentially under the behaviour change theory framework. The training and certification were the intervention inputs (activities). At the same time, the other direct and indirect policy measures were conditions (underlying assumptions) that needed to be realized for the training and certification to be effective in changing milk handling practices and, eventually, milk safety. Other conditions necessary for the effectiveness of the training and certification were also outlined in the theory of change (Fig. 2.2).

Training and certification theory of change for traders
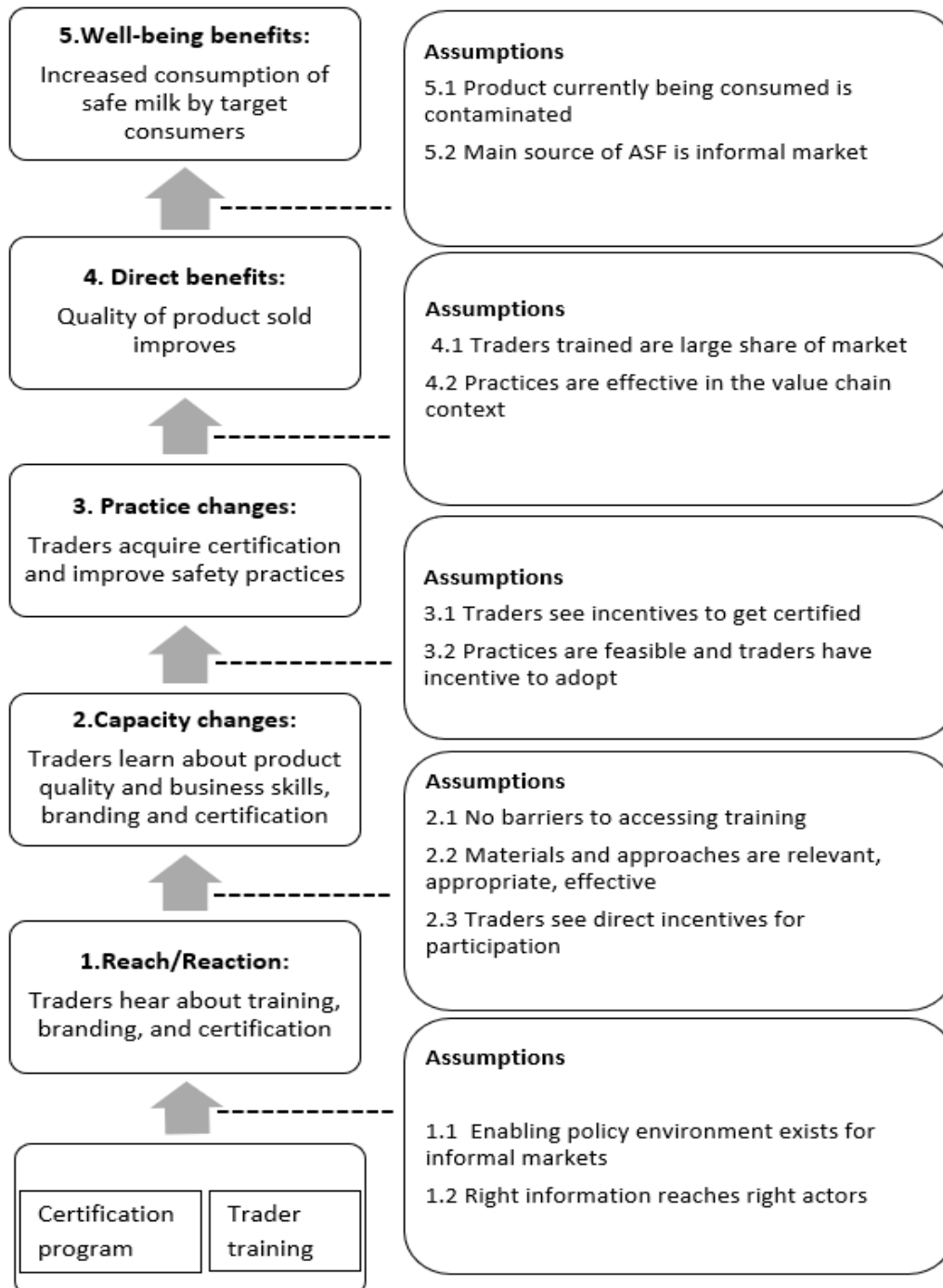
Fig. 2.2: T&C intervention trader theory of change (modified from Johnson et al., 2015)

The T&C intervention was initially piloted in Tanzania by TDB in collaboration with ILRI in Mwanza and Arusha in 2010, where between 75-100 traders were trained by 20 Business Development Service Providers (BDS) providers (Cherono et al., 2012; Johnson et al., 2015). There was further training between 2013 and 2015 in 30 villages and four districts in Morogoro and Tanga, where an additional 15 business development providers, 14 government inspectors, and 69 traders were trained (Mlay, 2011). One of the BDS providers who participated in the 2010 pilot in Arusha continued to offer the training independently up to 2017.

Key T&C intervention players in Tanzania included BDS providers, milk traders, and the Tanzania Dairy Board (TDB). The BDS providers were inducted on how to conduct the training, accredited by the TDB, and offered training services at a fee. Public promotion campaigns facilitated by the TDB followed the accreditation of the BDS providers to stimulate end-user demand for their services. The BDS providers issued certificates of competence in milk handling to trained traders in collaboration with the TDB. Informal traders could use the credentials to apply for a trade license. The training covered hygienic milk production, milk handling, and simple milk quality tests. TDB conducted frequent inspections among accredited BDS providers and trained traders to assess compliance with recommended practices. Traders who demonstrated exceptional performance would be branded with a seal of quality by the regulator. A more detailed description of the intervention and the rollout can be found in Cherono et al. (2012)).

Although interventions that combine direct and indirect policy measures are recommended to achieve food safety regulation in the informal sector, there is insufficient evidence on their overall effectiveness in addressing food safety regulation in the informal sector in the long term and the contribution of individual direct and indirect policy measures to the overall success of the alternative policy approach. Building on existing food safety systems may be easier than starting afresh, but broader evidence on the effectiveness of food safety interventions is necessary to address FBDs urgently, given their high significance in public health. There is an opportunity to improve food safety through value chain innovations, technologies, and restructuring of food safety governance, but these approaches' feasibility and effectiveness in various contexts are not well understood.

2.6.2 LITERATURE REVIEW OF EXISTING EVIDENCE ON THE EFFECTIVENESS OF T&C INTERVENTION

After implementing the T&C intervention in the dairy sector in Kenya and India, short-term and middle-term improvements in behaviour and financial benefits were reported. However, the intervention implementation and its benefits ceased in the long term in Kenya. In India, the intervention has been successfully scaled (Alonso et al., 2018; Grace et al., 2019; Lindahl et al., 2014).

In Nigeria, the T&C intervention provided butchers in the Bodija market training, equipment, and motivation to produce safer meat. A short-term evaluation showed that the training and certification successfully improved the butchers' knowledge and practices and the microbiological quality of meat. In the absence of institutional changes and means of reinforcing the training among the food handlers, the intervention was not sustainable in the long term. Appropriate hygiene technologies also did not persist in the long term. This outcome is not uncommon due to challenges experienced in managing common business resources among poor value chain actors, poor cooperation and coordination, and incentives for mismanagement. Despite the diminished positive effects of training nine years after it was initially implemented, the butchers still remembered the intervention, demonstrating that informal sector actors respond positively to trustworthy information on improving food safety (Grace et al., 2019).

The case study of Nigeria also demonstrated how the upgrade of interventions could be complex if context and governance complexities are not considered. The butchers met the establishment of a modern abattoir with resistance because the new location inconvenienced their access to customers even though the different location probably had better sanitary provisions (Grace et al., 2019).

The T&C intervention, which combines direct and indirect policy measures to address food safety regulation in the informal sector, has shown positive outcomes in the short term during the pilot stage. However, there is inadequate evidence on the effectiveness in the long term and the contextual factors that result in varied intervention effectiveness in different contexts of implementation. This research investigates the long-term effectiveness of the intervention (4 years after implementation) in Tanzania and how realization of each direct and indirect policy measure influenced its overall success.

Bridging the gap between theoretical approaches and their applicability in the field is the main challenge in food safety. Two critical areas of intervention in food safety are the provision of infrastructures such as sanitary facilities in markets and behaviour change among value chain actors of identified essential points of control to reduce health risks. The T&C intervention was anchored on the uptake of affordable technologies among value chain actors. The intervention also sought to drive behaviour change through value chain actors in appropriate production and milk handling practices, providing an enabling environment and adequate incentives for value chain actors and regulatory agencies (Johnson et al., 2015). While infrastructure provision is relatively easy to achieve, behaviour change is often difficult to achieve even in the presence of change in knowledge achieved through training initiatives.

Even though training alone is ineffective in causing behaviour change, it is important to enhance the target audience's knowledge. Training needs to be delivered optimally to achieve the desired outcomes. Traditionally in food safety training, trainers ask technical experts what should be communicated to the audience and are ineffective in addressing food safety. Recent approaches suggest understanding the targeted population's beliefs to understand what individuals know about risk and what they believe they should know to inform the design of more effective communication (Isa et al., 2017; Mohanty et al., 2019; Salas & Cannon-Bowers, 2001). Besides the content of training delivered, the mode of delivery influences training outcomes. The lecture-type delivery is commonly used in training, especially in low-and-middle-income countries, but it is often ineffective. Alternative approaches that have been found to yield better outcomes in delivering training include the adult learning principles(Merriam & Bierema, 2013; Merriam, 2017). There has been little effort in incorporating principles of adult learning in food safety curricula, even if it has been shown that people retain information better when engaged in problem-solving and hands-on learning, which helps them assimilate, practice, and use the information in innovative ways.

Besides the quality of training content and mode of training delivery, it is important to assess the context in which behaviour change unfolds to understand why it is still challenging to achieve even where the target population gains knowledge. Training alone has been demonstrated as not adequate to bring about behaviour change, and where long-term effects have been achieved,

societal incentives such as recognition by the authorities and consumers for selling safe milk were involved (Grace, 2015). Various other factors influence the achievement of behavior change, including the capacity to perform the behavior change at an individual and institutional level (UW ERC, 2009). There are various types of capacities; technical (knowledge and ability to perform functions to the required standards), financial (availability of money to perform relevant functions), physical (structures, assets, human resources or outreach to perform functions), strategic (vision, governance, and networks to perform operations) and personal, or cultural attitudes to shape performance (The Springfield Centre, 2015). In addition to these, there has to be an enabling environment in the broader market system supporting change (policy and legislation), uptake of the intervention by non-competing players, and evidence of ownership of the intervention by the implementing partners (policy champions and supportive leadership) for sustainability to be achieved (Bayulgen, 2020; Qiu et al., 2018). Policy champions who are individuals ready to invest their resources in the proposal are responsible for prompting important people to pay attention, coupling solutions to problems, and coupling both problems and solutions to politics. They motivate people, draw attention to specific policy issues, and ensure they are constantly on the agenda. The policy champions character in innovation, and collaboration is crucial in driving policy change (Bayulgen, 2020). The presence and adequacy of the factors of intervention effectiveness discussed here were assessed to determine how they influenced overall T&C intervention effectiveness.

The theory of change framework was used to determine the intervention effectiveness by assessing the extent of achievement of the T&C intervention outcomes. The theory of change framework was also applied in the assessment of the influence of contextual factors on the intervention effectiveness through an evaluation of the extent of realization of the underlying assumptions of the intervention theory of change assumptions. The approach is explained in detail in chapter 3.

2.7 SUMMARY

The dairy value chain actors and regulators face challenges in implementing the conventional Codex food safety systems and lack adequate capacity and incentives to successfully implement the risk-based food safety regulation. The economic implications of acquiring the capacity to implement the risk-based regulation for both the value chain actors and regulators are too

burdensome. This has resulted in the exit and exclusion of the dairy value chain actors from formal food safety regulation because they cannot afford it. The regulation also takes up too much of their profit margins, and the government has inadequate capacity to enforce it. Consumers purchase raw milk in the informal sector because it is more affordable and meets their taste preferences. It is clear that implementing the Codex food safety system in Tanzania's dairy sector has been unsuccessful, resulting in the proliferation of informality and consumers' exposure to food safety risks. However, there is limited evidence of the nature, extent and drivers of the capacity and incentive deficiencies among value chain actors and regulatory agencies as root causes for the poor performance of the risk-based food safety regulation in Tanzania's dairy industry. This research assesses the nature, extent and drivers of the capacity and incentives deficiencies among value chain actors and regulatory agencies.

Furthermore, the literature indicates that alternative policy approaches are needed to address food safety regulations in the informal sector. Policy approaches that combine direct and indirect measures targeting behavior change and enhancing trust between regulators and value chain actors are recommended. While such policy approaches have been demonstrated to achieve positive food safety outcomes in the short term, there is a dearth of knowledge about their long-term effectiveness and how contextual factors influence long-term effectiveness in different contexts. This research assesses the long-term effectiveness of the intervention in Tanzania and how contextual factors influenced the extent of effectiveness achieved.

CHAPTER 3

3   ANALYTICAL FRAMEWORKS AND METHODOLOGY

3.1   INTRODUCTION

Informality is primarily the outcome of voluntary exit and exclusion of entrepreneurs from the formal economy. Therefore, it is imperative to conduct a detailed investigation of the nature, extent, and drivers of challenges that dairy value chain actors and dairy regulatory authorities face in achieving food safety regulation in the dairy sector. The investigation aims to reveal the root causes of the exit and exclusion of value chain actors from the formal sector and the proliferation of informality. The research also analyzes the effectiveness of the alternative policy approach implemented to address informality and food safety in Tanzania's informal dairy sector. The analysis takes into consideration the capacities and incentives available in the context of implementation. Further, the research assesses the extent of realization of the underlying assumptions of the alternative policy approach and their contribution to its overall effectiveness.

This chapter seeks to undertake two broad tasks. First, it explains how two analytical frameworks were applied to determine the challenges of achieving food safety regulation in the informal dairy sector and to examine the effectiveness of the T&C intervention and drivers of its extent of effectiveness. Second, the methodology for the remainder of the thesis is presented.

3.2   ANALYTICAL FRAMEWORKS

The study applies the Making Markets Work for the Poor (M4P) (Springfield Center, 2008) and theory of change (Mayne, 2015) analytical frameworks to identify the dairy value chain actors and regulatory agencies. The M4P framework is further applied to characterize the nature of dairy value chain actors' transactions. Additionally, the M4P framework is applied to detail the nature, extent, and drivers of the challenges facing value chain actors and dairy sector regulators in achieving food safety regulation. Finally, the M4P framework is used to assess the effectiveness of the alternative policy intervention to address milk safety and how each of the direct and indirect policy measures (underlying assumptions) contributed to the overall intervention effect of the intervention.

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3.2.1 THE M4P FRAMEWORK

The M4P approach is based on the argument that economic poverty is caused by the structure of the market systems in which the poor engage. It argues that when markets work efficiently, producing equitable outcomes for the poor, they are a powerful avenue for economic growth and poverty reduction (Ruffer, T. & Wach, E., 2013; The Springfield Centre, 2015). The M4P approach seeks to improve the livelihoods of the poor sustainably. It allows analysis and influencing of the market systems that the poor engage in as entrepreneurs. It influences the market systems to enable the entrepreneurs to earn higher margins, increase their trade volumes and improve their access to markets. Influencing the markets further enables consumers to gain better access to goods and services, access goods and services at lower prices, and have a wider choice of goods and services available to them. Workers, on the other hand, gain higher wages and better working conditions (De Ruijter De Wildt et al., 2006).

The M4P approach is grounded on market exchanges and the motivations for such exchanges with emphasis on understanding and working with such motivations. The approach seeks to apply market systems concepts by recognizing the centrality of human interaction and exchange to social and economic development where exchange is governed by a wider system of complex social, political and economic institutions (DFID & SDC, 2008). These include formal regulations, implicit rules, mechanisms of reputation and coordination, instincts and structures of cooperation and feelings of solidarity. Markets therefore only function as part of social, political and cultural context. The M4P draws on various strands of economic thinking in its understanding of market systems as complex social and political as well as economic constructs. See (DFID & SDC, 2008) for further details on the various economic theories that inform the M4P approach to understanding market systems.

The approach works to identify the underlying causes of why markets do not work for the poor rather than identifying the symptoms of market systems that do not work for the poor. This is achieved by investigating the alignment of key market functions and players and the incentives and motivations of those players, in order to understand why markets are currently suboptimal. It uses this understanding as the basis for trying to identify 'what might be' – to stimulate sustainable changes in market systems that are more pro-poor. Therefore, the M4P approach identifies behavior change, adequate capacities and incentives, and the right relationships among market

actors as the systemic changes necessary to improve market systems and ensure the changes are sustained in the long term (Ruffer, T. & Wach, E., 2013).

Systemic change entails transformations in the structure or dynamics of a system resulting in a change in behaviors of many people. Such change is driven by focusing on understanding where systems are failing to serve the needs of the poor and offering solutions to correct the failures. The approach also considers the nature of relationships in the market system and recommends interventions at the points of critical weakness in the existing systems (DFID & SDC, 2008).

The M4P approach seeks to achieve sustainable change by aligning key market functions and players with appropriate capacities and incentives to work more effectively. The M4P framework also recognizes the dynamic dimension of sustainability, which depends on the system's resilience to shocks and stresses and its capacity to evolve and innovate in response to changes in the external environment Ruffer, T. & Wach, E., 2013(Barker et al., 2016; Mutambara, 2015; Ruffer, T. & Wach, E., 2013). The dynamic component of sustainability is a function that is dependent on the credibility of the less conspicuous market functions and institutions.

To drive the systemic change desired in markets serving the poor, the M4P framework is applied as a diagnostic tool in assessing the underlying causes for the underperformance of market systems for the poor and as an evaluation tool to assess the impact and sustainability interventions recommended the diagnostic process. Intervention impact and sustainability are assessed by evaluating the extent of achievement of the intervention theory of change results chain and the underlying assumptions (Ruffer, T. & Wach, E., 2013).

3.2.1.1 THE M4P DIAGNOSTIC PROCESS

The diagnostic process is applied in determining how a market system works and why it fails to serve the poor before the implementation of an intervention to ensure adequacy. The aim is to determine the underlying causes of underperformance and the rules and functions that need to be addressed.

The diagnostic process entails four steps:

1. *Verification of the validity of the market system selected:* A viable market system should potentially impact many market players if intervened and should also be feasible to implement the intended systemic change.

2. *Mapping the market system structure and understanding its operations and dynamics to determine how the system is not working for the poor:* This step identifies the role of the target group in the market and the nature of disadvantage they face. It also identifies the supporting functions and rules hindering the core function and the players that set the functions or rules relevant to the poor's transactions (fig. 3.1). Further, it identifies relationships between major players, hidden transactions, how transactions have changed over time, major occurrences such as a new policy that have changed how the system works and how the behavior of key players has changed in response to system change.
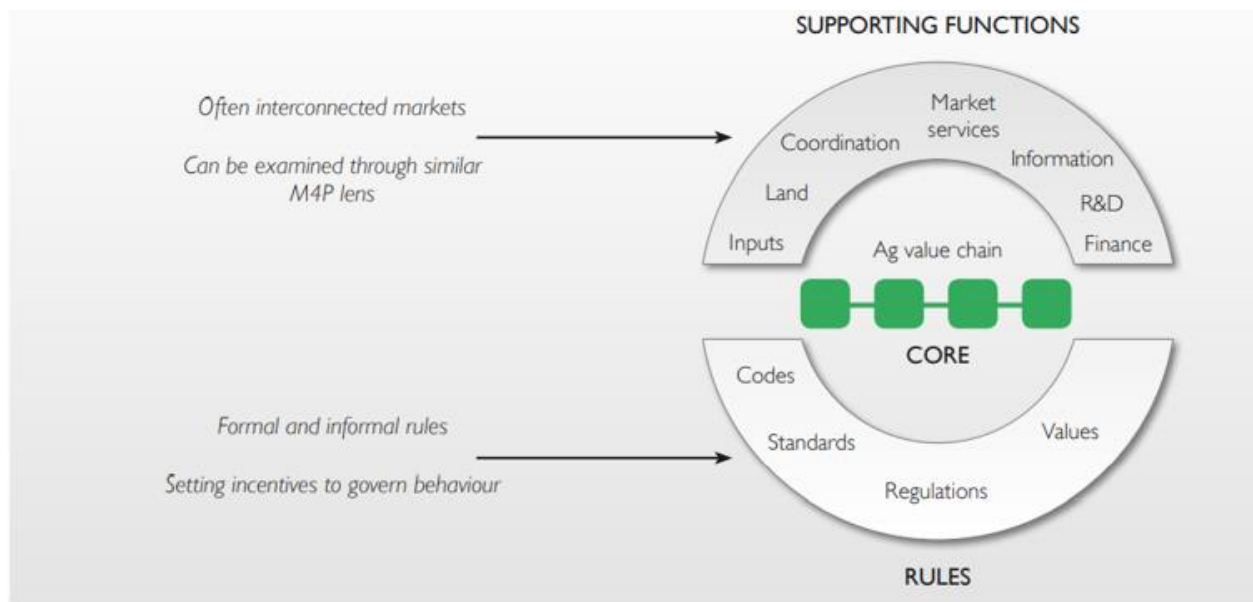
Figure 3.1:schematic of rules and supporting functions in agriculture market systems

Source: (DFID & SDC, 2008)

3. *Identifying system-level constraints; why the marketing system is not working for the poor:* Answers why market rules and supporting functions are underperforming and why pro-poor solutions have not emerged autonomously. The questions are answered by investigating how

the capacities and incentives of market players cause the market rules and supporting functions to be underperformed.

4. *Prioritizing root causes:* Prioritization is based on the opportunity for change presented, the feasibility of being addressed, and its importance compared to others.

3.2.1.2   APPLICATION OF THE M4P DIAGNOSIS IN TANZANIA'S DAIRY SECTOR

As a diagnostic tool, the M4P framework was used to identify the role of dairy value chain actors and regulatory agencies in the dairy sector. It was further applied to diagnose the nature and extent of challenges that value chain actors and regulatory agencies face in achieving food safety regulation in the dairy sector. The framework was also applied to identify the formal rules and supporting functions that hinder the achievement of milk trade in the informal sector, the players that set food safety standards and regulations. Additionally, the framework was applied to identify the nature of relationships between major players, hidden transactions, and how transactions have changed over time. The M4P framework was finally applied to explain the underperformance of dairy value chain actors and regulatory agencies by investigating their capacities and incentives and the reasons for their existing capacities and incentives.

3.2.1.3   THE M4P FRAMEWORK IN THE ASSESSMENT OF INTERVENTION EFFECTIVENESS

The M4P framework envisages achieving large-scale impact and sustainability of interventions by achieving systemic change in market systems (The Springfield Centre, 2015). Systemic change is assessed by evaluating the extent of achievement of the intervention results chain and the underlying assumptions (Ruffer, T. & Wach, E., 2013). The M4P framework has been criticized as an analytical tool where it has been used to assess change by outcome assessment without assessing the extent of realization of the underlying assumptions that explain the extent of achievement of expected outcomes (Ruffer, T. & Wach, E., 2013).

To overcome this challenge, the theory of change framework was used to assess the achievement of the expected outcomes and the realization of the underlying assumptions. The results chain and underlying assumptions underpinning an intervention are defined in the intervention theory of change. Evaluating the extent of achievement of the intervention's results chain and underlying assumptions constitute a theory-based evaluation.

3.2.2 THEORY-BASED EVALUATIONS

Theory-based evaluation is a collection of methods that work with an explicit theory – logical model or theory of change that supports the development intervention under evaluation. Two distinct components characterize them: the conceptual part concerned with developing the theory of change or logical model to guide the evaluation and the second part of collecting evidence to determine whether and how an intervention produced the desired changes. Theories are made explicit and then used to demonstrate how intended outcomes were achieved. They are designed to answer the question of what worked (by assessing the change brought about a development intervention) but also how and why it worked (by examining the processes that led to the change) (Rogers, 2014), elements which are not typically addressed by experimental designs. They examine broader contributions to change, such as actions of other interventions and the wider socio-economic environment.

Theory-based approaches to intervention evaluation explain what about the intervention or context caused the results. Where expected results were not achieved, it explains what about the intervention did not work. Was the theory of change wrong, or was its implementation failure? Answering these questions is instrumental in improving intervention design or implementing it in different locations (Cojocaru, 2009).

Two key elements distinguish theory-based approaches from traditional evaluation approaches. Context matters: Theory-based approaches to evaluation pay attention to the context of the intervention. Contextual factors can contribute to or hinder the achievement of the objectives. Contextual factors include the interests of the implementers of an intervention, cultural beliefs, values and norms of the target population, and related supporting legislation. These factors are vital in making causal inferences in intervention evaluation. In a theory of change, context is defined as an explicit stand-alone item or discussed as part of the intervention assumptions (INTRAC, 2017).

Mechanistic causation: For most interventions, there are multiple causes for the observed results. Other economic and social factors and other interventions may contribute to observed results; rather than establishing the single one-to-one cause for results, the focus shifts to assessing whether the intervention has contributed to the observed results in light of the multiple influencing factors.

Theory-based evaluations explain the contribution of intervention to observed results rather than determining causation through comparison to a counterfactual. Theory-based approaches also identify and assess any significant contextual factors influencing intervention outcomes (Coryn et al., 2011).

3.2.3 PRINCIPLES OF THEORY-BASED EVALUATIONS

A theory-based evaluation can be used for many evaluation types, ranging from impact, case-based, and realist evaluation. Theory-based evaluations can be used with single cases, e.g., single policy change or multiple cases, e.g., farmers receiving livelihoods support or organizations receiving capacity-building support. They can be used in any sector and with any kind of work. Theory-based evaluations are, however, applicable where there are predicted results to assess. There is no specific method for carrying out a theory-based evaluation, and the method depends on the nature of the intervention being assessed (Coryn et al., 2011).

The steps in the theory-based evaluation include a collection of information at the various levels of the theory of change or logical framework to see whether or how far the desired changes have occurred. This is followed by exploring the links between changes at the various levels to test the assumptions and confirm or reject the theory linking the levels. The approach also embraces assessing unexpected or negative outcomes influenced by the development intervention being evaluated (INTRAC, 2017).

There are four variants of theory-driven evaluations based on the component of the conceptual framework that the evaluation is focused on. The four variants are theory-driven process evaluation, intervening mechanism evaluation, moderating mechanism evaluation, and outcome evaluation. The first three variants of theory-based evaluations allow the tailoring of theory-based evaluations to focus on one element or chain of the intervention rather than a comprehensive theory-based evaluation investigating the entire intervention (Coryn et al., 2011).

Outcome evaluation allows for comprehensive evaluation of the entire intervention. However, whether a theory-based evaluation is comprehensive, entailing the assessment of the entire intervention program or for specific elements, the value of theory-based evaluations is that it not only allows for investigation on whether the intervention was efficacious but also explains the intervention's underlying causal mechanisms (INTRAC, 2017).

The information generated from theory-based evaluations is targeted for causal generalizations derived from local causal knowledge and should provide useful information for policymakers and other decision-makers in development. Theory-based evaluations are therefore not only conducted for summative purposes but also knowledge generation. Theory-based evaluations are perceived to be empirically and analytically powerful and allow for better evaluation questions to be asked, better answers provided and overall better evaluations achieved (Rogers, 2014).

Consequently, theory-based evaluations are perceived to be ideal in providing information that can be used for intervention replication and improvement, which is unlikely to be achieved with other types of evaluations. Theory-based evaluations are anchored on three fundamental elements: 1) formulation of the explicit theory of an intervention detailing the expected interaction between inputs, mediation processes, and outcomes 2) measurement of the various components of the intervention theory, and 3) analysis of data to determine the extent to which the anticipated interaction happened (INTRAC, 2017).

In the short term, data may only be available to address the causal chain partially, but in the long term, data becomes available to allow evaluation of the entire intervention program. Some scholars have argued that theory-based evaluations require the application of sophisticated analytical techniques entailing modelling to evaluate the intervention theory of change entirely but Coryn (2005) and Donaldson (2007) argue that theory-based evaluations are method neutral and therefore suited for qualitative methods, quantitative methods, or both.

The core principles of theory-based evaluations that distinguish them from other forms of evaluation are that theory-based evaluations are explicitly based on a program theory which informs formulation of questions asked in the evaluation of the program, unlike other types of evaluations where formulation of questions is not guided by an existing program theory (Coryn et al., 2011).

Theory-based evaluations are characterized by five core principles: 1) formulation of theory, 2) formulation of theory-guided questions, 3) theory-based evaluation design, planning, and execution, 4) theory-guided construct measurement, and 5) causal description and explanation with emphasis on causal explanation. The applicability of each principle to any theory-based evaluation depends on various factors, including the nature of the intervention, the evaluation process, and

intended users. Therefore, the quality of an evaluation cannot be judged by applying all or any specific combination of the core principles. The application of the core principles is more situational rather than absolute criteria.

3.2.3.1 THEORY OF CHANGE APPROACH IN THE EVALUATION OF INTERVENTION EFFECTIVENESS

There are various theory-based approaches to evaluation, including logic model, logical frameworks, realist evaluation, outcome hierarchies, and theory of change (Rogers, 2014). The theory of change approach explains how long-term outcomes are achieved through a sequence of intermediate outcomes. The theory of change is developed using backward mapping where the long-term outcome is determined, and then the required processes, short term, and intermediate outcomes needed to actualize it are mapped. During the process, the assumptions that need to be realized and the contextual factors that will influence the theory of change are made explicit. The theory of change components are often presented in a diagram or narrative (Breuer et al., 2016). The theory of change approach to evaluation is useful in identifying intermediate outcomes used as indicators of success in lieu of the overall impact where the evaluation is conducted before the expected impact is achieved. The theory of change also evaluates implementation aspects and contextual factors that influence intervention outcomes (Rogers, 2014).

The theory of change is method neutral and does not prescribe specific evaluation methods such as randomized control trials (RCTs) or qualitative interviews (Sharpe, 2011; Cornell & Kubisch, 1998). The theory of change differs from psychological or physiological theories, which describe why change occurs, although they may inform the theory of change. Theory of change differs from other theory-driven approaches despite having similar origins. For example, logic models contain the inputs, processes, outputs, and outcomes of an intervention but do not specify the causal pathway through which change occurs, as detailed in the theory of change (Breuer et al., 2016; Cornell & Kubisch, 1998). Similarly, log frames were developed to summarize discussions with stakeholders but have been reduced to a results-based management tool. Realist evaluation is based on scientific realism and focuses on the interaction between context, mechanisms, and outcomes of an intervention. The realist evaluation is often applied ad hoc and seeks to uncover theories underlying an intervention. Such theories are often more abstract than the theories developed through the theory of change and logic models (Blamey & Mackenzie, 2007; Lam et al., 2021).

The development of the theory of change was influenced by Freirean's thinking on creating social change through individual empowerment (De Silva et al., 2014; Rogers, 2014).

A theory of change serves as a monitoring and evaluation tool to assess the extent of achievement of expected impact (Mayne, 2015). The impact is achieved through a package of intervention activities and the causal assumptions that drive the intervention's contribution to achieving the extent of outcomes intended (Mayne & Johnson, 2015). More details on the components of a theory of change are found elsewhere (Mayne, 2015). The results/impact derived from implementing an intervention is determined through ex-post assessment of a theory of change. This entails testing the ex-ante causal hypothesis to gather evidence on change results and the accuracy of the assumptions.

3.2.3.2   CHALLENGES OF THEORY-BASED EVALUATIONS

It is not possible to completely prove a theory of change, although it can be disproved. At best, theory-based evaluations can provide a plausible case demonstrating the changes that have occurred and how the intervention has contributed to the change. The theory will then be assumed to hold unless contradictory evidence emerges, in which case it will need to be revised or abandoned (INTRAC, 2017).

3.2.3.3   THE THEORY OF CHANGE FRAMEWORK IN EVALUATING THE T&C INTERVENTION

The research followed the generic stepwise assessment of the intervention theory of change outcomes and their underlying assumptions (Fig. 3.2). It assessed the ToC outcomes to determine the reach and effectiveness of the intervention in changing food safety awareness, capacities, and food safety behavior among informal sector milk traders. Further, it assessed the ToC assumptions to determine the adequacy of the training material, delivery mode, market, and political incentives in influencing the effectiveness of the intervention (Table 3.1).

Training and certification theory of change for traders
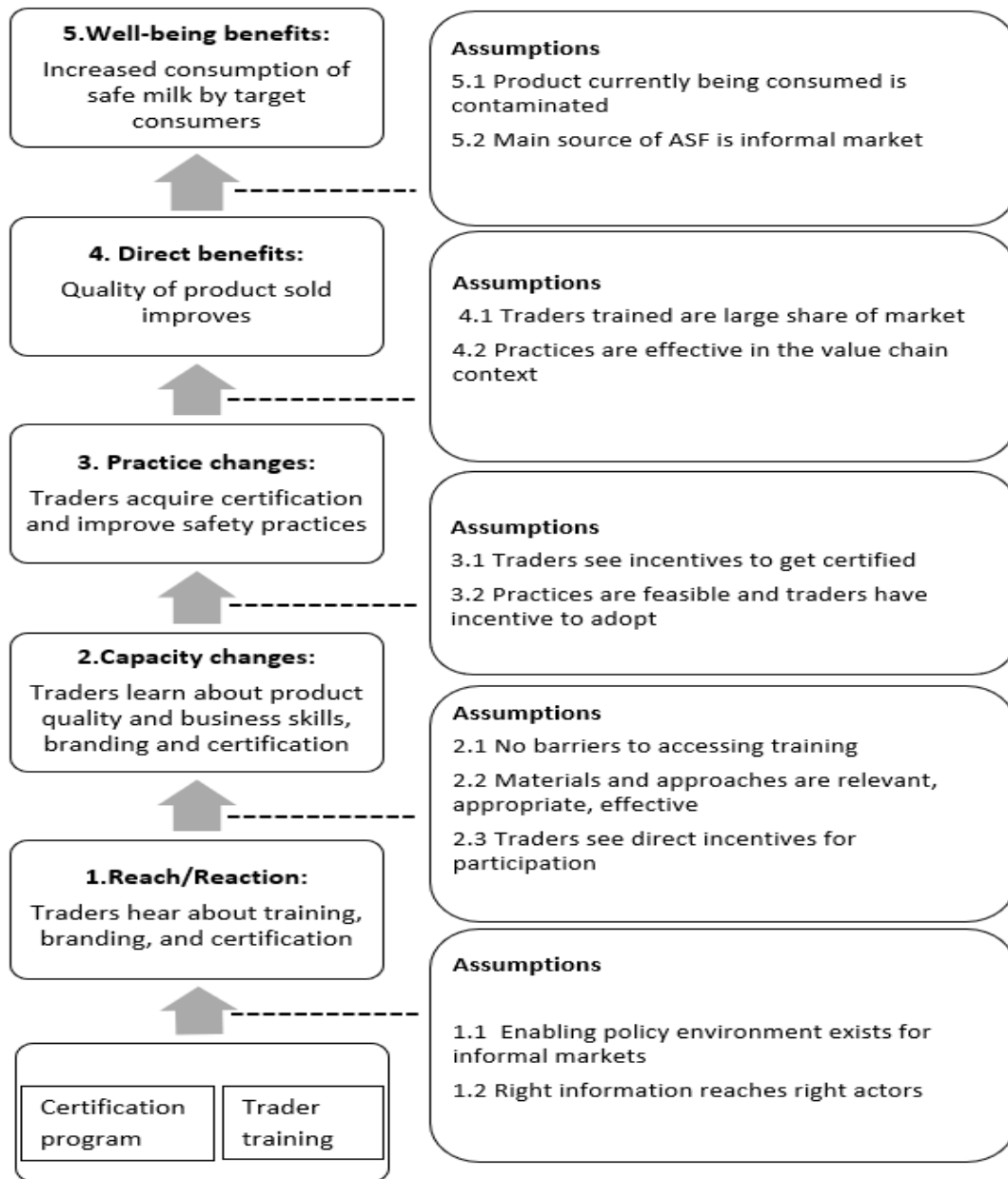
Fig. 3.2:Training and certification theory of change for traders (adapted from Johnson et al., 2015).

Table 3.1: Step by step level results chain and evaluation criteria for a behavior change theory of change

The generic ToC assessment steps	Outcome and underlying assumptions elements assessed in T&C theory of change
Getting to reach: will the inputs delivered reach the intended target group with the right reaction?	**Outcome: Traders hear about training and certification** The research assessed whether the scheme reached the target group and the extent of realization of the following two ToC assumptions that supported the outcome: *Assumption: An enabling policy environment exists for informal markets* Under this assumption, the research assessed the position of current national policy about informal milk trade. *Assumption: Right information reaches right actors* The research assessed whether TDB carried out a sensitization campaign to inform the informal sector traders about the existence of the intervention as foreseen in the intervention design and alternative approaches used by BDS providers to recruit traders for participation in the scheme.
Getting from reach to capacity change: will the input delivered and their reach result in the intended capacity change? .	**Outcome: Traders learn about product quality, business skills, and certification** The research assessed change in target group knowledge in the concept of milk safety and quality using standard terms that define milk organoleptic properties. These include normal color (creamy white determined by sight), freshness (sweet flavor and no off-flavors determined by smell and tasting), good thickness (determined by assessing for creaminess by sight or using a lactometer), and nothing added (determined by sight and lactometer test). We also assessed the extent of realization for the three interventions detailed below. *Assumption No barriers to accessing training.* The research assessed two aspects: (1) what could have been the limiting factors for participants to get involved: distance, timings, travel costs, and revenue loss? (2) Were there any participation criteria such as the location of training and training costs set by the training facilitators that limited the traders' attendance? *Assumption: Materials and approaches are relevant, appropriate, and effective.* The research assessed (1) Does the training content cover important aspects for the traders? (2) Is the training delivered adequately, i.e., by trained individuals with adequate academic qualifications and the most optimal method? *Assumption: Traders see direct incentives for participation.* The research assessed the following (1) Does the intervention design have clear incentives for the traders to participate in the training? (2) What are these incentives? (3) How explicit are they? (4) How important are they for

	the traders? (5) How can they outweigh the potential challenges that vendors may face to participate?
Getting from capacity change to behavior change: will the capacity change lead to the intended behavior changes?	**Outcome: Traders acquire certification and improve safety practices** The research assessed change in hygiene practices in milk handling and milk quality testing practices among the target group and the extent of realization for the two assumptions below: *Assumption: Traders see incentives to get certified* The research assessed: what were the direct benefits for the traders who participated in the training compared to those who were not trained (more profitability, less harassment, larger customer base) *Assumption: Practices are feasible, and traders see the incentive to adopt* The research assessed: Are the added costs to adopt the new practices reasonable for the profit margins that the traders make?
Getting from behavior change to direct benefits: will the behavior change lead to the intended direct benefits?	**Outcome 4: Quality of product sold improves** The research assessed for change in milk quality using a proxy (milk spoilage rate) among the target group and the extent of realization for the two assumptions detailed below: *Assumption: Traders trained are a large share of the market* The research assessed: what proportion of the study participants participated in the training and certification? *Assumption: Practices are effective in the value chain context* The research assessed; (1) What positive impacts were realized from the training? (2) What impact was expected but not achieved? (3) Was improvement of milk quality achieved among trained traders?
Getting from direct benefits to well-being changes: will the direct benefits lead to the intended well-being benefits? Adopted from: (Mayne, 2017)	**Outcome: Increased consumption of safe milk by target consumers** The research did not assess this outcome or the realization of the two assumptions detailed below: *Assumption: Product currently being consumed is contaminated* *Assumption: The main source of ASF is the informal market*

3.3 RESEARCH DESIGN AND METHODOLOGY

This section describes the methodology adopted for exploring the enablers and constraints to policy approaches to address food safety in Tanzania's informal dairy sector. It begins by discussing the research methods and key data collection techniques used. The section then discusses the research design and details how the overarching question for the study was addressed. This section also provides information on my data sources.

3.3.1 RESEARCH PHILOSOPHY AND METHODS

The study adopted a pragmatic philosophical approach. Pragmatism scholars argue that social science inquiry cannot access reality by utilizing a single scientific method (Maxcy, 2003). A major underpinning of pragmatism epistemology is that knowledge is based on experience, where one's perception of the world is shaped by experiences and encounters of the world (Kaushik & Walsh, 2019). However, the knowledge is socially shared since it is created from socially shared encounters. Pragmatic epistemology does not view knowledge as a reality but is constructed to manage one's existence better and engage with the world (Goldkuhl, 2017). The epistemology of pragmatism is based on Dewey's inquiry theory, which he describes as the investigation of some components of reality to create knowledge in the interest of change or improvement (Kaushik & Walsh, 2019).

Inquiry, therefore, is the controlled transformation of a problematic situation to one that is sufficiently integrated with appropriate action or knowledge. This is achieved by understanding our actions and the consequences of such actions and therefore gaining control over our actions as opposed to applying a trial-and-error approach to determining the course of action in uncertain situations (Morgan, 2007). Inquiry is the conscious response to uncertain situations where the suitable course of action is uncertain. Pragmatisms consider different courses of action and consequences before taking action to inform coherent decision-making.

In line with this philosophical approach, the study adopted mixed methods in this research to take advantage of the richness of data provided by combining qualitative and quantitative research methods. As opposed to positivism, which alludes to objective knowledge acquisition by examining empirical evidence, testing hypothesis, and constructivism, which argues that knowledge is relative, and reality too complex, pragmatism argues that knowledge acquisition is a continuum rather than mutually exclusive poles of subjectivity and objectivity (Goles & Hirschheim, 2000).

Post positivism supports quantitative research and deductive reasoning, while constructivism supports qualitative research and inductive reasoning. On the other hand, pragmatism supports abductive reasoning that goes back and forth between deductive and inductive reasoning (Morgan, 2016). Therefore, as a paradigm, pragmatism adopts independence in methods used to research without commitment to any particular research method. Researchers instead address their research questions with the most suitable research method available to them in the context of the principle of 'what works' (Tashakkori & Teddlie, 1998). Scholars maintain that pragmatism explains the philosophy of social science research and, in particular, mixed methods research.

The study used a parallel convergent mixed methods grounded theory approach as the research design to abductively explain the failure of food safety policy approaches to address food safety and informality in Tanzania's dairy sector. While the grounded theory is traditionally used as a qualitative research design, an emerging approach is to use mixed methods in the grounded theory research design, which is referred to as mixed methods grounded theory. The mixed-methods grounded theory approach is instrumental in constructing a causal explanation of why an intervention is or is not effective in a specific context and provides a foundation for replicability of intervention in other contexts (Creamer, 2018).

Grounded theory, in interventions research, typically identifies the core intervention activities and the underlying conditions explaining why interventions achieve desired effects. The grounded theory further explains anticipated and unanticipated outcomes of the intervention. Additionally, grounded theory explains the contextual individual and environmental conditions that influence the intervention's outcomes and elements that influence the intervention's negative and positive outcomes (Guetterman et al., 2019; Holton & Walsh, 2020). Using mixed methods is critical in decoding the complexity that characterizes individual human behaviour and the multi-layered environmental conditions that influence interventions' outcomes, which is rather difficult to understand using a single research method (Creamer, 2018).

This research seeks to examine: 1) the challenges faced by dairy stakeholders in achieving food safety in the dairy sector through conventional policy options, and 2) the effectiveness and success factors of an alternative policy approach to addressing food safety and informality in the dairy sector based on the direct and indirect policy measures.

Six main categories of data were needed to achieve these objectives:

1. The infrastructural, technology and human capital, coordination, challenges faced by dairy value chain actors and regulating agencies in implementing and enforcing the convention food safety policy options in Tanzania's informal dairy sector, respectively;

2. The nature of the relationship between dairy value chain actors and regulatory agencies;

3. The nature of the relationship between formal and informal dairy value chain actors;

4. The extent of congruence between formal rules and cultural norms and beliefs about food safety;

5. The degree of success achieved in achieving the outcomes of an alternative policy approach pilot intervention in Tanzania's informal dairy sector and;

6. Factors that contributed to the success (or lack of it) of the alternative policy approach intervention.

The types of challenges faced by value chain actors and regulatory agencies, nature of relationships, congruence between formal rules and cultural norms and beliefs, and success factors of the alternative policy approach intervention is best understood through qualitative inquiry. Such a qualitative inquiry is based on the value of qualitative data in unravelling complex causal relationships and enabling a holistic interpretation of the processes that influence the outcomes of policy engagement. On the other hand, intervention effectiveness could be best understood through a quantitative approach which allowed the quantification of anticipated intervention outcomes. Quantitative data was collected through a survey tailored for the different categories of value chain actors.

Qualitative approaches were therefore used to answer the questions on how and why the current policy approach to addressing food safety in Tanzania's dairy sector has underperformed and how and why the alternative policy approach has achieved the degree of success determined. Qualitative research involves an in-depth investigation of a phenomenon through techniques such as participant observation, documentary analysis, and interviewing (Kabongo et al., 2020; Ragin, 1994). The key data collection techniques for the qualitative inquiry were documentary analysis and key informant interviews.

Document analysis entailed a detailed review of governance instruments such as policies, standards, Acts, and grey literature. Document analysis was complemented with interviews. Interviewees included national and regional policymakers, international donor organizations staff, dairy processing companies, and representatives of dairy sector organizations. In total,

14 interviews were conducted over a month in 2019 in Tanzania. The interviews were stopped after the 14th interview when now new themes were generated from additional interviews.

Semi-structured in nature (appendix 3), the aims of the interviews were two-fold. The first was to understand the underlying factors of failing to address food safety under the conventional policy approach in the dairy sector. The second was to understand the underlying factors that shaped the degree of success achieved with the alternative policy approach intervention to address food safety and informality in the dairy sector. Respondents were assured of confidentiality, and all information collected would not be used for any other purpose other than research. Consequently, statements that appear as direct quotes from respondents have been acknowledged, but no direct attribution to the sources by actual name occurs.

For quantitative data, a structured questionnaire (appendix 2) adapted for the various value chain actors was administered. The questionnaire was used to collect information on the challenges faced by value chain actors in achieving milk safety under the conventional policy approach to food safety. It also captured the value chain actors' experience in implementing the alternative policy approach intervention to food safety and its impact on their achievement of food safety.

The questionnaire had a mixture of closed and open-ended questions and was administered electronically using CS PRO software. Given the study's exploratory nature, the research did not aim to reach statistical validity for the quantitative arm but to be illustrative, including all types of value chain actors operating in the area. Surveys were conducted among informal dairy sector value chain actors, specifically producers, intermediaries, vendors, and consumers. The term 'traders' refers to both vendors and intermediaries in this study. The survey sample included 82 consumers, 83 retailers (or "vendors"), 24 middlemen, and 20 producers. The sample size was limited to the value chain actors accessible and willing to participate in the study within the scope of the project's available resources.

3.3.2 STUDY DESIGN AND DATA

This section provides details on the case study site in Arusha, Tanzania and how the six sets of data required to achieve the objectives of this study were collected and analyzed.

Tanzania was unique from other countries where the intervention was implemented in the informal dairy sector. It is characterized by a relatively new dairy sector with tremendous

productivity and food safety governance gaps, compared to Kenya and India, where the intervention was also implemented. These two have more developed dairy sectors with more advanced productivity and governance structures. Furthermore, the nature of the relationship between the regulators and the informal sector actors in Tanzania's dairy sector is unique.

Unlike Kenya, where the government adopts a punitive stand against the informal dairy sector, the government of Tanzania adopts a mixture of the do-nothing approach and deregulation of the informal sector, where the informal sector actors need to comply with only three requirements. The third policy approach in place in Tanzania's dairy sector is a formalization of the informal sector, although this is limited by the lack of adequate capacity among the value chain actors and policymakers, and therefore it has not been implemented.

The focus on Arusha in Tanzania was driven by the fact that the T&C intervention was launched in the urban and peri-urban Arusha region of Tanzania in 2010 by TDB (Tanzania Dairy Board), ILRI (International Livestock Research Institute), and Austroprojekt association (a local NGO in Tanzania) before spreading to other regions in Tanzania. Arusha also had the widest reach in piloting the T&C intervention. Four districts in Arusha were included in the surveys (Arusha city, Arusha DC, Meru, and Monduli) based on high milk trade activities and their status as urban (Arusha city & Arusha DC) and peri-urban (Meru and Monduli) settings.

The other reason for selecting Arusha was its potential for scaling up the intervention because of its dairy production and marketing conditions. Arusha is characterized by intense dairy production areas in the country and could demonstrate potential for scaling the intervention at scale. Arusha has high production in dairy; it has 78,638 heads of improved cattle breeds coming second after Kilimanjaro, which has 161,984 heads of cattle (Katjiuongua & Signe, 2014) and comes second after Shinyanga in milk production volumes during the wet season (Gelan et al., 2012).

Nationally, Arusha and Kilimanjaro contribute about two-thirds of milk production. Milk production and marketing in Arusha is done in the informal sector in urban and peri-urban settings, allowing for assessing production challenges among producers, uptake, and impact of the training and certification among informal sector dairy traders. All the surveys were carried out in Arusha. Key informant interviews were conducted in multiple locations; Arusha, Dodoma, and Dar es Salam where the key informants were located.

The nature of this study makes the case study approach most suitable. First, it seeks to answer the question: what challenges milk safety in the informal dairy sector in Tanzania, and why the training and certification intervention has failed to sustain long-term improvement in food safety practices and milk quality. Second, the study is about an intervention that took place in the real-world context and would benefit from observing the unfolding of events and examining a case study. Such conditions make a case study approach most appropriate for this study (Yin, 2009).

Case study as a research strategy encourages the utilization of multiple sources of evidence and research methods (Yin, 2009). Furthermore, the case study strategy allows an in-depth examination of one or more cases to comprehend how an intervention was implemented, the causal processes, outcomes, and the contextual conditions that influenced the outcomes. The case study approach is beneficial in documenting how and why an intervention achieved or failed to achieve one or more intended outcomes and providing insights why the intervention may achieve different outcomes in other contexts (Yin, 2009).

The first task was to engage the informal dairy value chain actors (producers, traders, and consumers) on the challenges they faced in achieving milk safety along the value chain and their experience implementing the T&C intervention. Dairy sector officials in Arusha were engaged to obtain lists of registered producers and traders intended to be randomized in sampling. This, however, proved difficult because although the producers and traders are supposed to register with the livestock department at the local government level, they struggled to provide an extensive list to be used in the study. This is because the value chain actors did not register with the livestock office as required.

This strategy failed, and a different sampling strategy was used. The producers, traders, and consumers were approached directly in their premises, homesteads, or along the streets and requested to participate in the study. Snowballing was also used for the identification of more value chain actors. The study respondents identified recommended other potential respondents to the researcher. The traders were particularly elusive to participate in the study because they thought the researcher was working with the government to identify them and punish them because many informal traders operated without complying with the requisite regulatory authorizations.

Nevertheless, a substantial set of original data from 20 producers, 107 traders, and 82 consumers were collected. The dataset gives a true reflection of the challenges experienced by informal value chain actors in achieving food safety and their experiences in implementing the T&C intervention.

The second task was to obtain the views of policymakers, development practitioners, dairy value chain actors associations, and the formal dairy sector processors on three issues. First were their views on the challenges that informal dairy value chain actors faced in achieving food safety. The second was their views on the technical and financial capacities of institutions that govern the dairy sector and how they enable or constrain the achievement of food safety in the informal dairy value chain. The third was their experiences in implementing the T&C intervention.

Enlisting target individuals to engage in the interviews from the various categories of key informants was conducted with the help of some dairy sector experts in Tanzania. The process went well, and representatives from each category were identified. Most of the respondents were engaged in person except for a few who were inaccessible physically. The few who could not manage one-on-one interview sessions were engaged over the phone.

3.3.3 DATA CREDIBILITY

Two strategies were employed to ensure that the findings were an accurate representation of the participant's experience with the dairy sector food safety regulation: data triangulation by collecting data from dairy value chain actors, regulators, and development partners and providing evidence of the participants' experiences through quotation of their statements throughout the analysis.

3.4 DATA ANALYSIS, FIELDWORK CHALLENGES, AND ETHICAL CONSIDERATIONS

3.4.1 DATA ANALYSIS

Beyond the data collection, analysis and presentation of the data were conducted to illustrate the challenges faced by value chain actors and policymakers resulting in inadequate food safety in the informal dairy sector, the effectiveness of alternative policy approach and the influences of the extent of effectiveness the intervention. When seeking to understand the challenges faced by informal sector value chain actors in achieving food safety regulation, there are several

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points to consider, affecting the capacity of the value chain actors to meet food safety regulatory requirements.

One must consider the adequacy and access of infrastructure (cold chain, milk storage/ transport equipment), technology (milk testing technology), information, credit, and extension services. Access to these factors is critical for value chain development, which includes the adequacy of food safety, among other things. The analysis assessed adequacy and access of the above factors at various levels of the informal dairy value chain as they affect animal health management, milk handling at milking, transportation and storage stages, and milk treatment before storage, which collectively affects the capacity to achieve food safety among the value chain actors. The nature of leadership and coordination in accessing the above factors and the nature of the relationship between formal and informal dairy value chain actors are also critical in achieving food safety among dairy value chain actors and were assessed in this study.

The second aspect that was examined was the performance of the dairy regulatory agencies in regulating food safety against their mandates and the underlying causes for their poor performance. To understand the performance of the regulatory agencies, the degree of compliance by dairy value chain actors with the regulatory requirements implemented by the various regulatory agencies was assessed. To understand the underperformance, the agencies' technical and financial capacities, coordination among dairy regulatory agencies, and incentives (accountability) were assessed. Further, the nature of the relationship between the regulatory agencies and the informal sector actors and government perception of the informal sector was assessed to determine government intention towards the dairy value chain actors.

The third aspect of empirical analysis of the study entailed the determination of the effectiveness of the T&C intervention. Following the behavioral theory of change framework, four aspects of the intervention implementation were considered—these included intervention's reach by trained traders in the study, which was expressed as a percentage. Reach is the extent to which the target audience comes into contact with the intervention (Seguin et al., 2018). Reach is also defined as the number of unique individuals affected by an intervention program (Robles et al., 2014).

It is further broken down to direct reach, which denotes the number of individuals who directly contact the program, and indirect reach, denoting where individuals have indirect contact with the program. Reach represents the absolute number and proportion of individuals willing to

participate in an intervention and how representative participants are compared to the population (Shaw et al., 2019). Moore et al., (2015) recommend that evaluations include a quantitative assessment of reach, for example, in terms of the proportion of individuals who are aware of or have come into direct contact with the intervention.

The other aspect of intervention effectiveness that was examined was the impact of the training on the knowledge levels of the trained traders. A comparison of the terms used by trained and untrained traders to refer to food safety and quality was conducted to determine if a difference occurred because of participation in the training. The third aspect that was considered in examining the effectiveness of the intervention was the difference in milk handling practices between trained and untrained traders. Lastly, the difference in milk spoilage as reported by trained and untrained traders was assessed as an indicator of the effectiveness of the intervention in addressing milk safety.

The fourth aspect of the empirical analysis assessed the degree of realization of the intervention theory of underlying change assumptions, which needed to be realized for the intervention to be effective. These assumptions are a combination of incentives (rewards) for value chain actors participating in the training and certification and implementing recommended behavior and practices and punishment that would be affected for those who failed to participate in the training and therefore fail to implement recommended behaviour and practices that are meant to safeguard milk safety. Besides the incentives and penalties, an enabling policy environment and championing the intervention are critical in achieving intervention success and sustainability. All these success factors of the intervention were detailed in the underlying assumptions of the intervention's theory of change and were examined individually.

For all the four themes of the empirical analysis, both qualitative and quantitative data from the key informant interviews and surveys were convergent. The two data sources complemented each other to enrich the findings that were reported. For quantitative data, descriptive statistics were used to explain situations under examination, while for the qualitative data, line-by-line thematic analysis was used to explain situations under investigation.

3.4.1.1 QUALITATIVE AND QUANTITATIVE DATA ANALYSIS

Qualitative and quantitative data were analyzed separately and concurrently. Quantitative data from surveys with value chain actors was analyzed for descriptive statistics to define the

demographics of value chain actors. Descriptive statistics were also generated for the T&C intervention to determine intervention reach and the extent of achievement of intervention outcomes.

Qualitative data, both from surveys and key informant interviews, on the other hand, was subjected to thematic analysis for the generation of relevant themes. The thematic analysis process entailed six steps. First, the interview transcripts were read through to understand the contents of the transcripts. Second, initial codes were generated in NVIVO for the key informant interviews data (appendix 1). Summaries for the survey transcripts were generated in excel. The third step entailed extracting themes by collating the initial codes from NVIVO and excel into more comprehensive themes. The fifth step was reviewing the themes. The broad themes were reviewed for an accurate representation of the research evidence and coherence. Some adjustments were made to the themes from the review process, which entailed adding, removing, or moving the content to more appropriate themes. The fifth step entailed naming and description of the themes. In this step of the thematic analysis, the aspects of data represented in the themes were identified, and the story in each of the themes was described coherently in a narrative. The sixth step of the thematic analysis entailed collating the individual thematic narratives into a cohesive story about the challenges of food safety regulation and contributing factors to the extent of the success achieved with the T&C intervention.

3.4.2 FIELDWORK EXPERIENCES

The dairy value chain actors (producers, traders, and consumers) were keen to share their opinions on the nature of challenges they faced, government attitude towards them, and their experience with implementing the T&C intervention. Getting a hold of the mobile milk traders was however difficult because they only showed up at the points of milk sale during their trading hours. However, once the research was introduced, they showed much enthusiasm in voicing the nature of challenges they encountered in their operations. The other value chain actors (producers, consumers, and milk traders operating from fixed premises) were easily accessible. Some traders were unwilling to participate in the research because it consumed their working hours. However, the majority of the traders were happy to participate in the research. The value chain actors that participated in the research provided rich material for the research.

The key informant interviewees were mostly easily accessible except a few unwilling to participate in the research. Except for the few, the key informants provided relevant research material and documents.

This research has been complex for three reasons: logistic difficulties, credibility, and potential bias of the information used. The research found divergence in opinions and their interpretations. Therefore, besides facing obstacles in collecting material, there were challenges in interpreting them. Multiple sources of evidence were employed to enhance the robustness of the evidence and its interpretation.

3.4.2.1 LOGISTICS DIFFICULTIES

The data collection period in 2019 was a campaign period in Tanzania, and the environment was politically charged. Traversing Arusha and Dar es Salaam with responses from key informant interviews and surveys on the effectiveness of dairy sector regulation posed a threat to respondents' exposure. The precaution was taken in the recording, storage, and transfer of the research material.

The political environment restricted the research work in other ways too. Some of the key informants who worked within government ministries provided selective feedback. Others were reluctant to participate in the research given the sensitivity of the subject matter. The respondents have therefore been anonymized in the research to maintain their confidentiality.

3.4.3 RESEARCH AND ETHICAL APPROVALS

Ethical approval to conduct the research was obtained from ILRI Institutional Research Ethics Committee (Ref: ILRI-IREC2018-21/1), the University of Pretoria Ethics Committee (Ref: 19334495 (HUM002/0919)), and the Tanzania Commission for Science and Technology (COSTECH) (Ref: 2019-51-NA-2019-312).

The research respondents were issued a consent form (appendix 4) before the commencement of the interviews. They were given time to read through the consent form and obtain any clarification needed from the enumerators. The respondents who were happy to participate in the research were asked to sign the consent form. They were also informed of their right to answer only what they were comfortable with and to withdrawal from the research at any point. After reading the consent form, the participants who were not willing to participate in the research were thanked, and engagement stopped at that point.

Data collected from the surveys and key informant interviews were stored in password-protected computers accessible only to a small research team. Furthermore, pseudonyms were used in reporting research findings to protect the identity of the respondents (appendix 5). The data will only be utilized for research purposes.

3.5 Chapter Summary

In this study, a two stages analytical approach was adopted. First, the M4P framework is used as a diagnostic tool to identify the dairy value chain actors and assess the nature, extent, and drivers of challenges that the dairy value chain actors and regulators face in achieving food safety within the current regulations that govern the dairy sector. The M4P approach was adopted to diagnose the challenges faced in achieving food safety among value chain actors and regulators because it allows for identifying the root causes rather than symptoms and offers immense chances of achieving sustainability in addressing the challenges.

Second, the theory of change framework is used as an evaluation tool to assess the effectiveness of an alternative policy approach intervention. The intervention effectiveness is determined by examining the extent of achievement of the results chain outcomes. The intervention evaluation further determines how the individual direct and indirect policy measures (which constitute the causal pathway and address various contextual factors) contributed to the overall effectiveness of the intervention in achieving the results chain outcomes. The theory of change approach to the assessment of the intervention effectiveness was adopted for two main reasons.

First, the approach allows an investigation into the intervention's effectiveness, but it also allows an investigation into how and why the intervention achieved its level of success. Second, the theory of change approach generates knowledge about intervention effectiveness and sustainability factors, improving the intervention in the current context or informing design and implementation in another context.

Further, a pragmatic mixed-methods grounded theory approach was adopted in the study combining qualitative and quantitative methods, which were used in parallel to complement and enrich the empirical analysis. The study used surveys, key informant interviews, and document review data collection techniques. For the research strategy, a case study design was adopted to allow for in-depth investigation of the implementation and effectiveness of the

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alternative policy approach, which took place in the real-life setting, making the case study design appropriate to allow an investigation of how it unfolded.

4 VALUE CHAIN ACTORS AND CHALLENGES FACED IN ACHIEVING MILK SAFETY

4.1 INTRODUCTION

The objective of this chapter is five-fold. First, it profiles the informal value chain actors in the informal sector by the nature of their transactions and demographics. Second, the chapter profiles the formal processors by the nature of their operations. Third, the chapter demonstrates the nature of relationships between the formal processors and informal value chain actors. Fourth, the chapter demonstrates the importance of the informal sector and its business dynamics. Fifth, the chapter explores the nature, extent, and drivers of challenges faced by informal sector actors in achieving milk safety.

The argument presented is that there is very limited integration in the value chain. The functions are widely disaggregated, although there is some degree of interaction, especially in the sourcing and distribution of raw milk. Value chain actors are characterized by varying degrees of resource availability and technical capacity. The informal dairy sector actors particularly lack adequate capacities and incentives to achieve milk safety. The chapter draws on primary data from a survey of value chain actors and key informant interviews from dairy sector stakeholders.

4.2 CHARACTERIZATION OF THE INFORMAL DAIRY VALUE CHAIN ACTORS IN TANZANIA

The informal dairy value chain in Tanzania is comprised of various nodes relevant to the food safety debate, namely the production, the marketing and distribution, and the consumption nodes (Katjioungua & Nelson, 2014). The production node comprises producers and service providers. The marketing and distribution node comprises intermediaries and vendors, while the consumption node comprises consumers. This section characterizes the value chain actors that engage in the three informal value chain nodes by the nature of their transactions and demographics. The section also addresses the informality of vendors and intermediaries.

4.2.1 THE PRODUCTION NODE

The study shows that small scale producers who participated in the study predominantly kept improved dairy cows at a small scale, with the number of animals being kept ranging from one to ten, with an average of 2.85, as highlighted in fig. 4.1. These findings are consistent with the characteristics of urban and peri-urban smallholder dairy producers in Tanzania who keep 1-5 cows per household (Ibrahim et al., 2018). Small-scale production is often driven by the small-scale size of farms owned by most farm owners in developing countries. Besides, they are often resource-constrained with limited options and lack access to markets, but they engage in agricultural production on their small-sized parcels of land (Rapsomanikis, 2015). They engage in multiple and often informal agricultural activities, which include livestock and crop production alongside other informal economic activities to supplement their income from agricultural production.
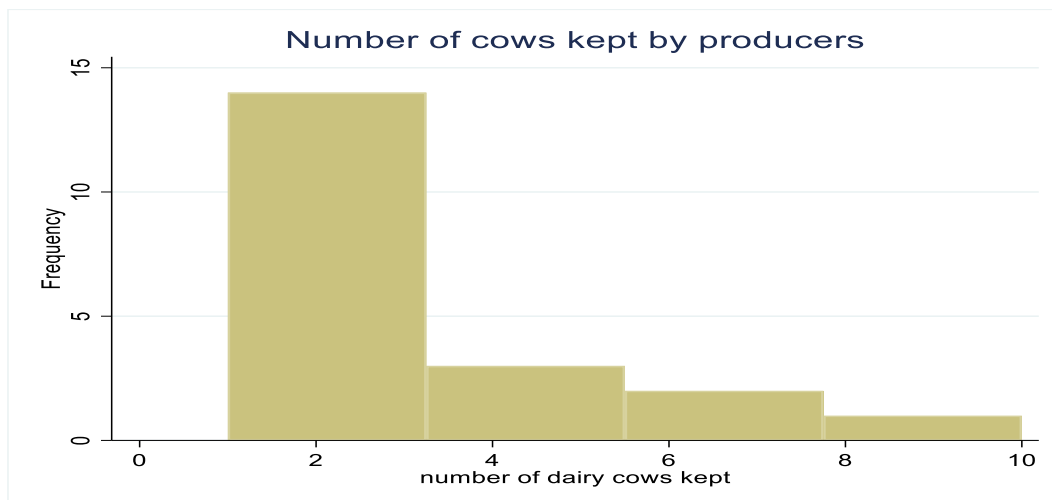
Fig. 4.1:Number of cows kept by producers

Dairy producers worked with service providers who supplied production inputs, extension services, and capacity building in good production practices. In the study, private veterinarians operated retail outlets where they stocked the dairy production inputs and provided consultation for animal health services. Service providers were qualified veterinary practitioners who retailed agrovet and other farm inputs. They predominantly sold drugs for animal treatment and vaccines. They also provided artificial insemination services. The nature of operations by the service providers is explained by interview excerpts below:

> *I sell agro vet and farm inputs, provide veterinary services and vendors' training on appropriate milk handling, and produce good animal husbandry (Dan, Arusha 2019).*

We sell agro vet inputs, including drugs for animal treatment and vaccines. We also supply agro vet inputs to smaller agro vets and offer advisory services to farmers (int., Heather, Arusha, 2019).

However, one of the service providers indicated that they were challenged in making sales by the existence of low-quality cheap products that producers preferred due to their low cost. Counterfeit low-quality inputs were driven by inadequate regulation of the quality of inputs, as discussed in the next section of this chapter. Service provision was further challenged by poor access of service providers by producers who are geographically distant from the service providers. Producers also lacked adequate financial resources to pay for inputs and consultation. One of the service providers stated,

Fake agro vet inputs are prevalent in the market and sold at a lower price. Farmers without knowing how to identify the fake drugs prefer to buy these; it is unfair competition for us (int., Heather, Arusha, 2019).

Generally, service provision in the dairy sector at the study site was inadequate due to the existence of counterfeit products often preferred for their low cost by resource-constrained producers. The service providers were also not easily accessible to the producers because they were scarce and located long distances away. The findings are similar to the reported inadequate service provision in the dairy sector nationally (Michael et al., 2018; Nell et al., 2014). The local government authority and the private sector are the major stakeholders in delivering livestock extension services in Tanzania. However, the provision of extension services is challenged by lack of collaboration among stakeholders, poor linkage in research and extension to farmers, inadequate expertise, and inadequate incentives, facilities, and infrastructure (Nell et al., 2014). For example, research and training in livestock production in Tanzania is provided by a limited number of government institutions which are often ineffective due to lack of appropriate infrastructure, unmotivated staff, and inadequate teaching resources (Katjioungua & Nelson, 2014).

Service provision by the private sector is further limited by poor demand by smallholder producers who have no incentive to acquire professional extension services. Extension services are a reserve for commercial producers for whom they make economic sense.

Annual milk production among the dairy producers in the study ranged between 150-1500 litres with an average of 427.5 litres which translates to 150 litres per cow annually. The finding differs from the existing literature in Tanzania, which indicates an annual production rate of

179 litres per cow per annum (Michael et al., 2018). The difference could be due to the small sample size of producers in the study that does not represent the population. Producers in the study indicated that various factors constrain dairy production. They cited a lack of access to capital for investing in production and lack of access to veterinary services. They further cited the lack of a good road network for allowing them to access both input and output markets and poor quality of feeds as the challenges they face in dairy production. The producers also cited seasonality in the availability of fodder, and poor quality of animal feed concentrates as one of the challenges they face in dairy production. These challenges are typical of small-scale dairy production in contexts where the dairy sector is underdeveloped and inefficient.

The consequence of fluctuating milk supply for the producers was fluctuating milk prices. The price declined in the rainy season when milk supply was high and peaked in the dry seasons when milk supply was limited. Although the raw milk market was challenging for producers, the informal sector offered better milk prices than formal processors. Consequently, 75% of the producers indicated that they preferred to sell their milk in the informal sector than 25% who sold to formal processors either directly or through cooperatives or milk collection centres (fig. 4.2).
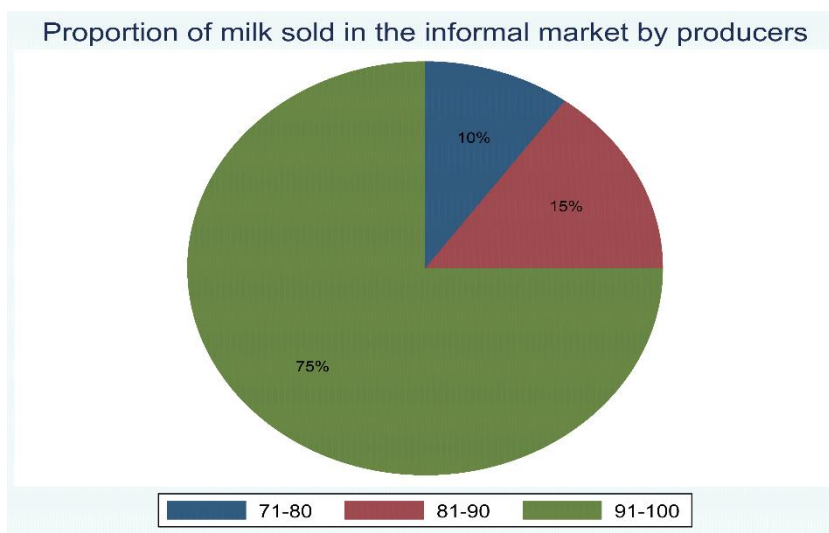
Fig. 4.2: Proportion of milk sold in informal markets by producers

Other reasons cited by producers for their preference to sell milk in the informal sector, besides price, included convenience because the buyers collected milk from the farm. There were also other reasons, including timely payment, payment in cash, and reliability of the buyer. As highlighted in Table 4.1, the weight of these reasons differed, with some preferences not being influential compared to others. For example, only 5% valued the stability and reliability of the

customer. This was likely to happen when the market was highly contested and relied on certain individuals. Convenience and timely payment, however, emerged as very important.

Table 4.1:Reasons for preference for type of buyers by producers

Advantages of type of buyer	%
Convenience – they come to the farm	30
Higher prices	30
Timely payments	15
Cash payments	15
Stability/reliability	5
Other	5
Total	100

While there was a clear preference for informal marketing among dairy producers in Tanzania, they sold their milk through various channels, often more than one. The predominant channels were direct consumers and retailers, followed by direct consumers. The third channel for milk sales by producers was to retailers locally. Other less popular channels for milk sales used by the producers were intermediaries and processors. The channels are presented in fig. 4.3. Adopting multiple milk marketing channels was a reasonable strategy because the buyers often bought small quantities and had multiple suppliers. The adoption of multiple buyers guaranteed a market for the producers. The choice of the marketing channel by producers is dependent on the quantity of milk available, the reliability of the buyer, and the distance covered. Preference is often given to buyers who collect milk from the farm and pay cash daily to enable producers to access cash for important transactions such as paying for food, health care, and school fees. The trading channels are similar in Kenya's dairy sector, as Roesel & Grace, (2015) reported. The nature of milk marketing activities by the small-scale milk producers reflects the typical characteristics of the smallholder farmers, where economic activities are for survival.

Type of buyer for dairy producers
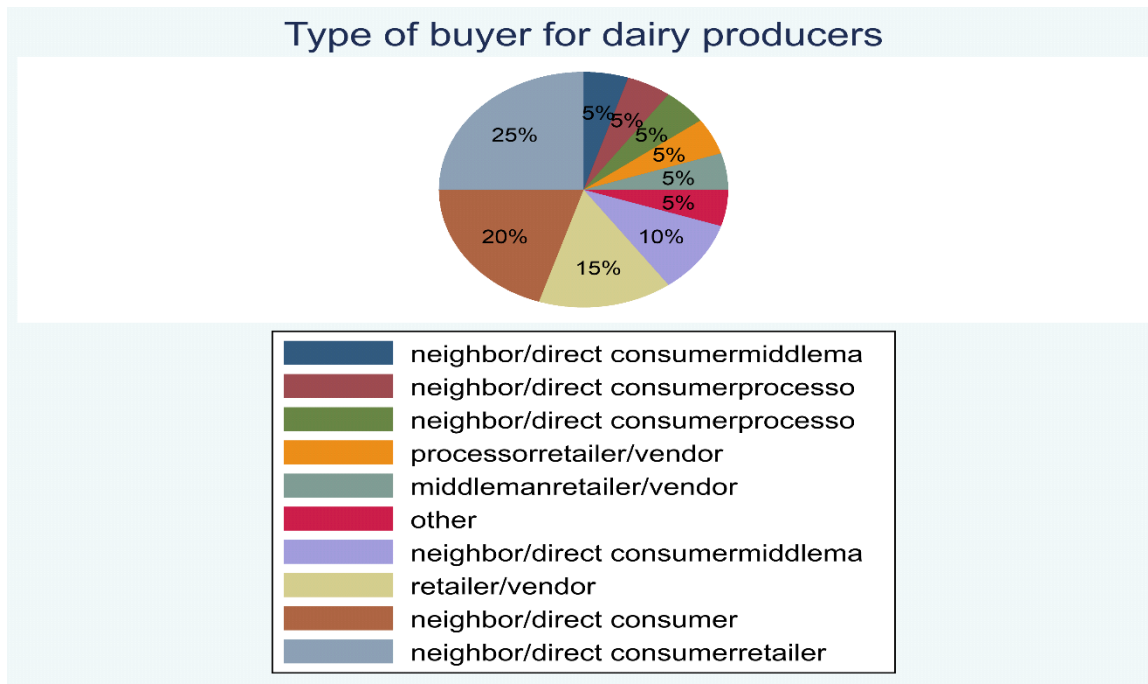
Fig. 4.3: Type of milk buyers engaged by producers

4.2.2 INFORMAL MILK MARKETING AND DISTRIBUTION NODE

Informal milk marketing and distribution comprise three types of transactions. The first type of transaction is the direct sale of milk to consumers by producers. The second type of transaction is the sale of milk to intermediaries and vendors by producers. The third type of transaction is the sale of milk by intermediaries to vendors (retailers) (Njombe et al., 2011). The nature of transactions of the intermediaries and vendors is discussed below.

4.2.2.1 MIDDLEMEN

Some of the milk sold in the informal markets in urban and peri-urban Tanzania originates from pastoralists who are often far removed from the urban and peri-urban settings (Nell et al., 2014). Aggregation and transportation of the milk from the herders to the urban areas are therefore necessary. Intermediaries play the aggregation role and often use bicycles and motorcycles to ferry milk to the urban areas. Some middle and large-scale intermediaries use vehicles for milk transportation (Dillmann & Ijumba, 2011). The role of intermediaries in the study area was somewhat limited compared to other scenarios in the region. A possible explanation for the limited involvement of middlemen in the dairy value chain is the study area's urban/peri urban nature. The milk was produced close to where it was sold, and therefore the middlemen were not necessary. Producers also indicated that they deliberately avoided selling their milk through intermediaries to avoid price exploitation by the intermediaries. The decision by producers to cut off middlemen is not unexpected because the middlemen are

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known to offer producers low prices and sell to retailers at higher prices than they would get it for from the producers.

The scale of operation of the intermediaries is generally small, reflecting on the status of small-scale operations in the informal markets. Intermediaries traded in milk ranging from 15 -6000 litres per month with a mean of 1254 litres per month. Thirty-three percent (33%) of the intermediaries were very small, transporting their milk on foot, on donkeys, bicycles, or using public transport. Another thirty-three percent (33%) were small-scale using a motorbike to transport their milk, and seventeen percent (17%) were medium-scale using large vehicles to transport milk, and had employees helping them run the business.

Thirteen percent (13%) of the intermediaries operated fixed premises, and 4% were large scale transporting their milk in more than one vehicle or large vehicles such as trucks and had multiple employees. Furthermore, ninety-six percent (96%) of intermediaries indicated that they sourced their milk from smallholder farmers mainly for the convenience of location, indicating that the intermediaries operated on a small scale and had limited capacity to source milk from distant locations. The small-scale nature of operations by the intermediaries indicated their milk trade activities were a means of survival for those who depended 100% on it for income generation. Those that engaged in the intermediary's role alongside other economic activities sought to supplement their other livelihood sources. The intermediary's reliance on informal economic activities for survival and income supplementation is typical of informal sector actors (ILO, 2002).

4.2.2.2 *VENDORS*

In Tanzania, milk in the informal sector is retailed by mobile vendors or vendors operating from fixed premises, including kiosks, restaurants, general merchandise shops, and supermarkets. The general merchandise shops (52%) were the dominant retailers in the study, followed by mobile vendors (26%). Milk bars and restaurants were less popular points of raw milk retailing (table 4.2). The dominance of general shops merchandise in milk retailing could be explained by the fact that the sale of raw milk at the general merchandise shop was made in combination with other products under a single set of licenses. This was more economical than the other retail points (mobile sellers, milk bars, and restaurants), requiring specific milk sales licensing.

Table 4.2:Types of dairy vendors

Vendor type	frequency	%
Shop	43	52
Mobile seller	22	26
Milk bar	10	12
Restaurant	8	10
Total	83	100

4.2.3 DEMOGRAPHICS IN MILK PRODUCTION AND INFORMAL MARKETING

The dominant gender involved in production activities of feeding, milking and taking care of the animals was female, whose proportion was 60% compared to male producers (40%). The findings are similar to existing literature, which indicates the established cultural norm of women taking up these tasks, but often marginalized in cattle ownership, decision making about production , and commensurate income from sale of milk (Muteshi, 1998; Tavenner & Crane, 2018). Addressing production constraints at this node would require a gender disaggregated approach to address the inequalities in cattle ownership, decision making about production and equitable distribution of proceeds of milk sale.

Producers were predominantly middle-aged, with fewer youth involved in the milk production. As highlighted in table 4.3, the predominant age of producers was 35-64 years, accounting for 90% of the producers, while the age group ranging from 15-34 years accounted for only 10% of producers. This may be explained by the by lack of financial resources among the youth to acquire land and the initial investment cost required to acquire cattle and production inputs (Rapsomanikis, 2015). Furthermore, there are quicker returns on investment in the dairy value chain's trading node than production, whose returns are much slower to earn.

Table 4.3:Age distribution of producers and traders

Producers			Intermediaries			Vendors		
age	Freq.	%	age	Freq.	%	Age	Freq.	%
15-24	1	5	15-24	6	25	15-24	9	10.98
25-34	1	5	25-34	3	12.5	25-34	20	24.39
35-44	4	20	35-44	5	20.83	35-44	21	25.61
45-54	5	25	45-54	4	16.67	45-54	21	25.61
55-64	5	25	55-64	5	20.83	55-64	9	10.98
64 and above	4	20	64 and above	1	4.17	64 and above	2	2.44
Total	20	100	Total	24	100	Total	82	100

Due to long distances covered in sourcing milk, the odd hours of early morning, and the mode of transport used (bicycles and motorcycles), the intermediaries' node of the value chain is usually dominated by young men (Sikira et al., 2018). In this study, the intermediaries were fairly spread among age groups between 15-64, with the highest participating age group being 15-24 years at 25%. The age group above 65 years had very limited participation in milk trade with a representation of 4% (table 4.3). The males (63%) dominated the intermediaries node compared to female intermediaries, who were 37%. The dominance of young men in this value chain node is a logical outcome given the heavy lifting needed in bulk milk during collection. Furthermore, the unusual business operating hours limit participation by women and the elderly making it a niche segment for the youth. Additionally, this node of the dairy value chain requires minimal investment compared to the production or processing nodes, making it attractive to the youth, who are often resource-constrained.

Women dominate the milk-vending node of the dairy value chain where they circumvent the patriarchal limitations in cattle ownership, production decision making and unaccommodating means of transportation and handling bulk milk (Katjioungua & Nelson, 2014 ; Sikira et al., 2018). In the study, 53% of the vendors were female compared to 47% male vendors. The predominant age group of vendors was 25-54 (table 4.3). The majority of the female vendors sold milk from milk bars and kiosks where they were involved in milk processing, which entails boiling. Boiling the milk which is a form of food preparation is a cultural norm associated with women in Tanzania. It makes their participation in this node socially acceptable, and they are therefore able to generate income from their engagement in the milk processing and sale at this node.

However, while it is socially acceptable for the women to engage in milk processing and sale from fixed premises, those that engage in hawking activities at this node risk jeopardizing their reputation and also face security risks (Tavenner et al., 2021). Furthermore, with the growing trend towards commercialization of dairy value chains, there is the risk of tipping the power dynamics of market participation from women to men. A previous study indicates that commodities previously labelled as feminine have been masculinized with introduction of commercial marketing (Tavenner & Crane, 2018). Whether women will remain key participants in milk marketing is dependent on the rate of commercialization of the dairy sector and action by development practitioners in safeguarding the equitable participation of women. Social embeddedness situates power derived from social relations arising from intersectoral

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differences of gender, race, age, generation, class, disability as something not limited to an individual but something that structures entire value chains and industries (Tavenner & Crane, 2019). These systems of social relations are continually constructed and reconstructed through social interactions with some more prone to change than others. For example, the role of milk trade easily changes from feminine to masculine with commercialization of milk but control over income generated from milk sales has remained with men (Tavenner et al., 2021).

The specialization of dairy value chain activities by gender and age in Tanzania reflects typical gendered power relations in individual lives, social practices, institutional arrangements and cultural ideologies often dictated by the interaction of age, race, gender, wealth, class, marital status and ethnicity differences of the various categories of value chain actors (Tavenner & Crane, 2019). Despite calls for women to participate and benefit from livestock value chains globally, there are widespread and significant challenges for their entry and beneficial participation in the commodity chains. One theoretical explanation for this phenomenon is that both economic choices and commodities themselves are embedded in complex networks of social relations, cultural values and gendered norms which in most cases privilege men's control over certain commodities, especially once they enter the formal market(Tavenner et al., 2021). In many cultures, livestock and crops are often associated with men and women leading to gendered positionality of species. The gendered meaning attached to livestock tend to be reinforced in the commoditization of their products such as milk when they enter the formal markets. Evidence has shown that the commercialization of livestock products that were previously ascribed feminized gender usually become masculinized once marketed in bigger markets and for larger profits (Tavenner & Crane, 2018). For example, a study in Western Kenya revealed that milk as a formally traded commodity cannot be separated from entrenched gender norms around cattle ownership and masculinized headship roles. The socio-cultural gender norm of evening milk belonging to women is used as an entry point for their participation in commercial milk marketing. However, where milk is marketed formally and proceeds bulked in larger payments, married women lose out on their independent income stream regardless of them being registered as hub members (Tavenner et al., 2021).

4.2.4 *Informality among vendors and intermediaries*

The intermediaries and vendors who participated in the study fell along a spectrum of informality regarding fulfilling legal requirements. The intermediaries and vendors were

required to register with TDB, obtain a trading license from BRELA through the local government authority and obtain a medical clearance certificate from the public health office. However, only 48% of the intermediaries had the BRELA trade permit, 13% were registered with TDB, and 17% had the medical clearance certificate. Reasons cited for the low legal compliance among the intermediaries included lack of knowledge on obtaining the license, high licensing cost, and not knowing where to obtain the license. In this case, non-compliance with the legal requirements among the intermediaries was driven by circumstances of unaffordability and a genuine lack of knowledge in the legal requirements and how to fulfil them.

The degree of compliance with regulatory requirements varied among the various categories of vendors. For TDB registration, only one mobile vendor out of 51 vendors in the various categories was registered. For the medical clearance certificate, none of the 20 mobile vendors who responded had one while all five milk bar operators had one, 15 out of 27 general merchandise shop operators had one, and 3 of 7 milk bar /restaurant operators had it.

For the trade license, 9 of 10 milk bar operators had one, only 4 of 20 mobile vendors had one, all 21 general merchandise shop operators had one, and 5 of 7 milk bar or restaurant operators had one. Reasons cited by the vendors for lack of the necessary licenses again included lack of knowledge on how to meet the licensing requirements, lack of knowledge on where to obtain the licenses, and high licensing costs. Some vendors reported having to pay bribes if found without the licenses by the authorities, while others indicated that there were no consequences.

The poor compliance with legal requirements by the intermediaries and vendors reflects the poor compliance with legal requirements that have been reported in the dairy sector in Tanzania in general (Urassa, 2014). Besides unaffordability and lack of knowledge of the legal requirements among the intermediaries, poor compliance could be explained by a lack of incentive among the intermediaries and vendors. In the study, most of the intermediaries (54%) and vendors indicated no consequences of not having the licenses.

4.2.5 Informal milk consumption node

Most milk consumed in Tanzania is raw, commonly consumed at the farm level and through the informal market channels (Nell et al., 2014). In the study, 96% of the consumers consumed raw milk. The most cited reasons for preference of raw milk over processed milk among consumers were freshness (55%), availability (11%), price (8%), and taste (8%). The other

reasons cited for raw milk preference were safety, convenience, nutritional value, packaging, and cleanliness of retail outlets. The preference for raw milk among consumers in developing countries is widely recognized, usually for affordability, traditional taste, and freshness (Roesel & Grace, 2015). This indicates incongruence between the formal rules, which recommend consumption of pasteurized milk, which is deemed safe, and consumers' preference for raw milk, which they believe is safer and provides the preferred traditional tastes.

Per capita, milk consumption in Tanzania is, however, still low compared to the recommended rate. The milk consumption rate in Tanzania is approximately 45l/person/annum (Katjioungua & Nelson, 2014) compared to the WHO-recommended 200l/person/annum. In the study, the minimum amount of raw milk reported to be consumed per household per week was 1 litre, while the reported maximum weekly consumption was 21 litres. The mean weekly consumption was 5.6 litres, which translates to an average annual consumption of 291 litres per household.

The reported milk consumption rate is low at 291 litres per household per annum compared to the recommended 200l per capita per annum. There is still a gap in the milk consumption rate in Tanzania, and the government has strategized various approaches such as genetic improvement of dairy animals and better breeding through artificial insemination to increase milk supply (Michael et al., 2018). There are also efforts to enhance consumption among the consumers by creating awareness through milk consumption week campaigns and school feeding campaigns implemented by TDB.

4.3 Characterization of the formal milk processing node

Demand for pasteurized milk and other dairy products is rapidly increasing in Tanzania. It is projected to grow with expanding urbanization and a growing middle class that demands safe food (Michael et al., 2018). TAMPA confirmed that there had been increasing demand for processed milk and other dairy products in the recent past. However, they also indicated that the existing 220 small and large processors had not met the demand for processed milk and milk products. The majority of all processed milk consumed in the country is imported, indicating a shortage in processed milk supply locally. This was seen as providing opportunities for suppliers as highlighted below:

It is expected that demand for milk is going to increase progressively with the growing population. However, there is already a deficit in milk supply for the current population; up to 60% of milk consumed is imported into the country; there is an opportunity to supply the milk locally (int., Tom, Arusha, 2019).

The failure of the local processors to satisfy the local market demand for pasteurized milk and dairy products is driven by the poor performance of the dairy processors, who often operate below-installed capacity. Findings from the study indicate that the current installed processing capacity is 757,000L, but only 220,000L is actively utilized. Some processors were operating below their break-even capacity, as highlighted in the excerpts from interviews below:

The processing capacity has been increasing recently but slowly, although majority of the processing capacity is underutilized. For the large processors with UHT production, the economic operating capacity is 25,000L per day, while for other processors, it is 30-40% of their installed capacity (int., Tom, Arusha, 2019).

We have installed a processing capacity of 1000L, but we are currently processing 150 L daily. Our breakeven production volume is 300L/ day (int., Margaret, Arusha, 2019).

Some of the challenges experienced by the processors in meeting the demand for processed milk and milk products include an inadequate supply of good quality raw milk. The supply is meagre in the dry season when milk yield at production is low. The processors sourced raw milk from cooperatives or smallholder farmers who came together in groups under simple written contracts. However, the processors faced milk supply shortages in the dry season when traders often prefer to sell their milk to intermediaries who offer higher prices. Raw milk supply was therefore not consistent, as explained below:

During the dry season, when milk is scarce, we often have to source milk elsewhere because the milk supplied by the cooperative is not enough. Some cooperative members sell their milk to intermediaries who offer higher prices in this period (int., Margaret, Arusha, 2019).

One of the processors indicated that they utilized up to 70% of their processing capacity in the wet season when raw milk supply is relatively high. However, the processing capacity declines up to 10% in the dry season when there is low raw milk supply. The shortage in raw milk supply is occasioned by inconsistent availability of rainfed fodder and pasture which are heavily depended on but whose availability declines especially in the dry season (Nell et al., 2014).

Besides the shortage of milk supply, milk processors reported encounters with milk of poor quality, which limited their production of quality pasteurized milk and milk products. Poor milk quality was caused by farmers adding water to milk when the yield was low to fulfil the contract terms. The processors further indicated that altered feeding regimes during the dry season when there are scarce animal feed sources also contributed to compromised milk quality. The situation is explained by interview excerpts below:

> *The quality of raw milk sometimes is not good, and milk may smell depending on what the cow was fed (int., Elisha, Arusha, 2019).*

> *Raw milk supplied by middlemen is sometimes not of good quality for processing (int., Taylor, Arusha, 2019).*

> *Milk adulteration is done by some farmers jeopardizing its processing quality; when milk supply is low, the producers often add water or goat milk to their milk to increase volumes which compromises the quality of milk for our use (int., Margaret, Arusha, 2019).*

This was not a surprising finding; milk adulteration with water and other additives to increase milk volume is common among suppliers of raw milk in LMICs. Such behaviour is often driven by the desire of suppliers to sell more because payment is based on milk volume rather than milk quality (Grace et al., 2010).

Another dimension to operating below installed capacity among Tanzania's dairy processors is the lack of technical personnel. The dairy sector in Tanzania lacks qualified technicians to operate the plants locally. Consequently, the sector was forced to import skilled labour from Kenya. The sector also struggled in acquiring dairy processing equipment locally and had to source from Kenya. The study informed: *'The lack of technical operators in dairy processing locally forces dairy processors to outsource expertise from Kenya' (int., Tom, Dar es Salaam, 2019).*

The importation of labour and equipment needed for dairy processing in Tanzania makes the venture expensive and logistically complicated. The high cost of imported labour and poor supply of good quality raw milk partially explain the processors' inability to utilise installed capacity and be competitive. The outcome is a lack of local processors to meet local demand for pasteurized milk and milk products. The local milk and milk products are also expensive compared to imported ones. The lack of technical capacity, adequate supply of raw milk and milk processing equipment is systemic in Tanzania's dairy sector. Addressing production gaps would need these to be addressed, but given their nature, they can only be addressed in the long term. Meanwhile, the informal sector will continue to

offer affordable products, so the safety of products supplied in the informal sector must be addressed.

4.4 Nature of relationships among the different value chain actors

This section of the chapter discusses the nature of relationships among various dairy value chain actors. First, it analyses the nature of the relationship among large-scale and small-scale processors. Second, it explores the nature of the relationship between formal processors and informal milk traders. The argument presented is that the power dynamics among small and large processors favour market dominance by the large-scale processors while diminishing the small-scale processors. It is further argued that a competitive but positive relationship exists between formal processors and informal sector traders.

4.4.1 Power dynamics within the processing node

The power dynamics among the small-scale (less than 50,000 L daily installed processing capacity) and large-scale processors (above 50,000 L daily installed processing capacity) propagated market segmentation and disadvantaged the small processors in conducting business. The study findings indicate specialization in production among the small-scale processors producing yoghurt, fermented milk, cheese, ghee, and butter. None of the small-scale processors who participated in the study produce fresh milk, although fresh milk consumption is dominant compared to other dairy products. A small processor stated, '*We produce cultured milk, yoghurt, cheese and whipping cream' (Taylor, Arusha, 2019).*

One of the reasons cited for the small-scale processors' preference for producing other products other than fresh milk was their prolonged shelf life compared to fresh pasteurized milk. The small-scale processors did not have established distribution channels like the large-scale processors, which meant a delay in the sale of their products and a higher probability of spoilage losses. They often sold their dairy products directly to consumers and retail shops that did not have a cold chain to preserve milk and milk products. The market segmentation is explained by interview excerpts below:

> *We sell our products to retailers and household consumers with the largest consumer base (int., Elisha, Arusha, 2019).*

> *Our main customers are retail shops, supermarkets, and hotels (int., Margaret, Arusha, 2019).*

> *We sell to both wholesalers and retailers, including hotels, schools, retail shops, and supermarkets (int., Taylor, Arusha, 2019).*

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The dominance of the larger processors has been reported in other studies where they dominate the production of pasteurized milk and cultured milk "mtindi' the most popular processed dairy product in Tanzania. The other dairy products, including yoghurt, ghee, cheese, and butter which are the specializations for the small processors, have a small market share, and the locally produced are dominated by imports (Lunogelo et al., 2020).

The small processors further expressed concern over the dominance and stiff competition from the large-scale processors who have the financial capacity to produce niche products and advertise aggressively, which is difficult to achieve for the small-scale processors. The competition concerns were the same among small-scale processors and highlighted from the excerpts below:

> *Formal sector bigger processors with similar products are the biggest competition because they have the financial capacity to market and distribute their products better than us making them unequal competition (int., Taylor, Arusha, 2019).*

> *The most important competitors are the formal large processors with similar products, e.g., ASAS dairy, because they have the financial capacity to advertise and package their products in more appealing packages and smaller units (int., Elisha, Arusha, 2019).*

> *The formal bigger processors, including Tanga Fresh and ASAS dairy, are the most significant competitors (Margaret, Arusha, 2019).*

Besides market segmentation and competition from the larger processors, the small processors indicated that the multiple licensing was financially constraining. Consequently, some smaller processors could not pay for all the needed licensing and were only partially compliant with the food safety regulations. Others were forced to stop the production of some products because they were required to pay TBS a licensing fee for the production of each product. Besides, the complexity of the multiple regulations meant it was too difficult for the small processors to interpret them. Consequently, some small-scale processors who could not afford to engage a professional to interpret the regulations failed to comply due to a lack of understanding of the requirements. The sentiments over financial burden constraints were similar among the small processors, as illustrated by interview excerpts below:

> *The multiple regulating agencies (TRA, TBS, local government, NEMC) are financially constraining for small processors with limited revenue (int., Elisha, Arusha, 2019).*

> *We face a financial burden from multiple regulatory agencies with varied requirements. The agencies include BRELA, OSHA, and Public Health, and TBS. The most burdensome is the TBS mark of standardization for every product processed (int., Margaret, Arusha, 2019).*

The burden of multiple regulations and the necessity for the engagement of experts in interpretation and compliance is recognized as a major cost item for dairy processors (Urassa, 2014). However, it is often unachievable among the small-scale processors who are resource-constrained (TAMPA, 2011).

The private sector formal processors operate under the Tanzania Milk Processors Association (TAMPA). However, there was limited participation by the small-scale processors in the association, which limited the chance of having the unfair power dynamics addressed. Out of approximately 200 recognized processors in Tanzania, only 82 were members of TAMPA. Twenty-five (25) of the registered members were medium-size processors, 51 small-scale processors, and 6 were large-scale processors. However, out of the 82 registered, only 20% were active members and contributed the membership fee, which was the major funding source for the association operations. The 20% active members were predominantly the large-scale processors who then dominated decision making.

4.4.2 NATURE OF RELATIONSHIP BETWEEN FORMAL PROCESSORS AND INFORMAL TRADERS

A positive relationship was reported between dairy processors and the informal sector traders despite the competition for raw milk supply between the two groups during the dry season when milk supply was limited. The informal sector traders often supplied the formal processors with milk collected from the producers. A processor stated,

> *We have a positive relationship; the informal sector actors sometimes supply milk to us. However, we sometimes disagree on the accuracy of milk volumes sold to us because they lack standard units of measurement (int., Margaret, Arusha, 2019).*

However, there was a market competition between formal processors and informal sector traders for products such as cultured milk sold to the same clientele. Due to the competition, different groups are highly suspicious of one another, with accusations that one group believes that the other group is spreading false claims about its processes. One of the small-scale processors complained:

> *The informal traders spread false claims about formal processors; for example, they incorporate harmful chemicals in their products to deter consumers from purchasing their products (int., Elisha, Arusha, 2019).*

These accusations partly explain the nature of the competition between the two groups and the small advantage that informal processors may be enjoying. In other informal markets, informal traders can sell their products at relatively lower prices than their formal sector competitors, who have to pay regulatory compliance costs. Thus, the informal dairy market in Tanzania

poses unfair competition to the formal sector actors. However, there is no tension in their relationship, as seen in other countries such as Kenya. There is high tension between the formal and informal sectors in countries like Kenya. There are also deliberate efforts to eliminate the informal dairy traders due to vested interest in the sector by powerful government officials who own a significant proportion of the formal dairy industry (Roesel & Grace, 2015). While some degree of competition was acknowledged, it is understood to be only limited to the point of sourcing since the two groups served different clientele.

While the informal traders enjoy some advantage over formal processors in not having to pay compliance costs, there is an interesting dynamic about the milk market in Tanzania. The price of raw milk was disproportionately low compared to processed milk. The net effect of the disproportionate pricing was low-profit margins for the producers and traders in the informal sector compared to the profit margins earned by processors. The price range for a litre of raw milk was Tshs 700-2000, while the price range for a litre of processed milk was Tshs 1000-7800. The considerable difference translates to a sense of absence of justice in the distribution of benefits among the raw milk traders, which encourages their lack of compliance with food safety regulations. The informal traders feel disadvantaged in terms of their income and therefore are justified not to pay for licences required for legal compliance. The study informed:

'*It is too difficult to meet the requirements/standards. This work has no profit; I only get Tshs 20. It's something no one can do' (int., Cyril, Arusha, 2019).*

4.5 IMPORTANCE AND DYNAMICS OF INFORMAL DAIRY PRODUCTION AND MARKETING

Despite the small scale of production and marketing in the informal sector, the activities are often crucial for producers and traders and contribute significantly to the national economy. Tanzania's small-scale agriculture contributes 63% of total agricultural production (Rapsomanikis, 2015). Dairy production is significant as a source of livelihoods and nutrition among smallholder households. Producers generate income from the sale of milk, a high-value product, and enhance their nutrition security from milk consumption or purchase other food items with income from the sale of milk. For 65% of the producers who participated in the study, dairy production contributed 50 to 100% of their income, and 70% of the producers did not engage in other businesses beyond dairy production. This trend indicates the importance of dairy products as a significant source of livelihood for the producers.

Notwithstanding the low number of intermediaries in the study area, the business was still an important source of livelihood for the participating intermediaries. The milk trade business contributed over 50% of livelihoods to 80% of the intermediaries. Engagement in informal trading activities is an easy means for income generation for individuals who would otherwise not find formal employment to earn a living (Tshuma & Jari, 2013). Informal sector actors engage in informal trade to make a livelihood or supplement their other sources of income (Lugalla, 1997). Informal sector trade was important both as a sole source of income for intermediaries and a supplementary source of income (fig. 4.4)
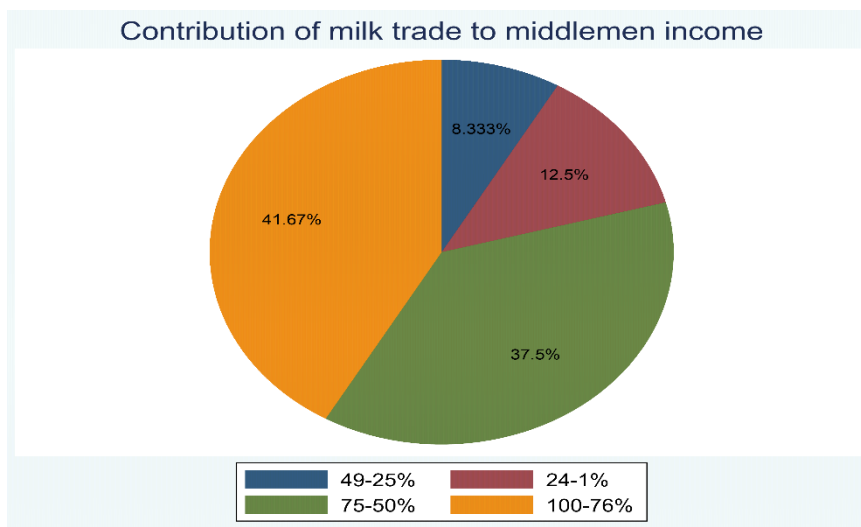
Fig. 4.4: Contribution of milk trade to middlemen income

The milk trade was also an important business for the vendors. It contributed 76-100% of livelihoods for 20% of vendors, 50-75% for 19% of vendors, 25-49% of livelihoods for 34% of vendors, and 1-24% of livelihoods for 27% of vendors (fig. 4.5).

While milk trade contributed to vendors' livelihoods, it contributed relatively less than that made to producers and intermediaries' livelihoods. This could be partly explained by the fact that vendors reported engaging in other milk-related activities. Five out of 20 vendors were involved in milk production, and another 4 out of 20 were involved in milk transportation. The other reason for the milk vending business's lower contribution is that 73% of the vendors sold milk alongside other merchandise in general shops, restaurants, kiosks, and milk bars.
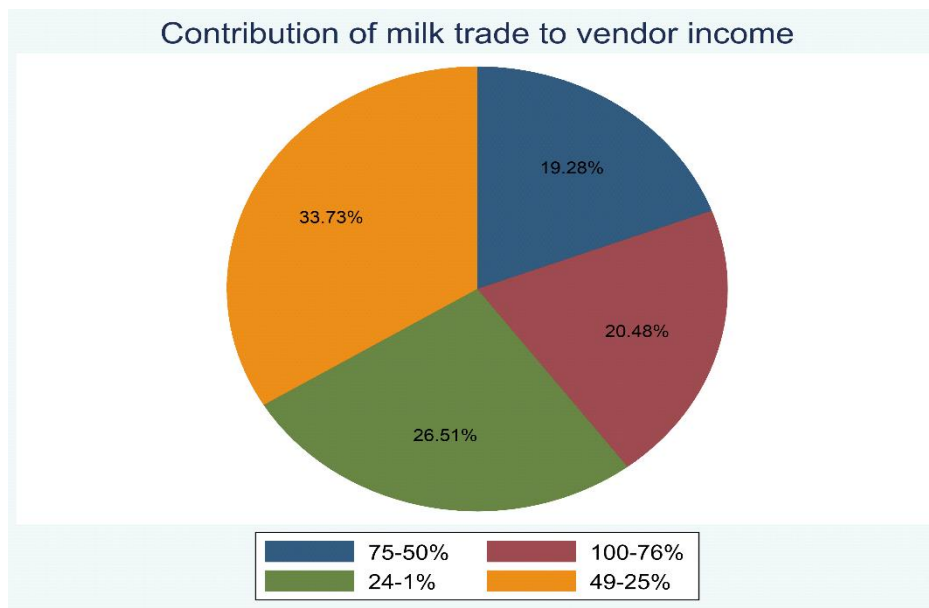
Fig. 4.5: Contribution of milk trade to vendor income

The importance of informal dairy production and marketing is emphasized by the long-term engagement of producers and traders in the production and trade activities. In the study, 60% of the producers, 38% of intermediaries, and 36% of vendors had been in operation for more than ten years (table 4.4). The availability of a ready market for raw milk in the informal market and processing was a key driver for the producers staying in business in the long term. While milk production is done at a small scale, the existence of a ready market guarantees a steady flow of income regularly (Nell et al., 2014). The legality of the raw milk trade in Tanzania, as discussed in chapter 7, is a crucial driver for the long-term engagement of intermediaries and vendors in the informal milk trade. The intermediaries and vendors have a clear advantage in conducting their businesses. They often do not incur any legal compliance costs and do not get harassed or penalized for it. They, therefore, retain most of the revenue that they gain from milk sales which makes the business lucrative for long-term engagement. The finding is similar to existing literature which argues that informal milk trade is legal in Tanzania, and traders do not get harassed by the authorities for engaging in informal milk trade (Blackmore et al., 2020).

Table 4.4: Duration of operation of producers, intermediaries, and vendors

Producers			Intermediaries			Vendors		
Years in operation	Freq.	%	Years in operation	Freq.	%	Years in operation	Freq.	%
1-3 years	6	30	1-3 years	4	16.67	1-3 years	19	22.89
4-6 years	1	5	4-6 years	5	20.83	4-6 years	14	16.87
			7-9 years	4	16.67	7-9 years	4	4.82

less than 1 year	1	5	less than a year	2	8.33	less than a year	16	19.28
more than 10 years	12	60	more than 10 years	9	37.5	more than 10 years	30	36.14
Total	20	100	Total	24	100	Total	83	100

4.5.1 MILK TRADE DYNAMICS

While milk was an important economic activity for the traders, it was not without challenges, as highlighted by the study outcomes. Forty-six percent (46%) of middlemen sold less milk in the recent past than before; 21% sold more, while 25% sold the same quantity. Fifty one percent (51%) of vendors sold less milk in the recent past than the other 22% who sold more, 20% who sold the same quantity as before, and 6% who had been in the business for less than a year and could not report a decline or improvement in business. Additionally, seventy-five percent (75%) of intermediaries indicated it was harder to do business in the recent past (within the last year) compared to the past (more than 10 years ago).

Reasons cited for the decline in milk sales included a decline in demand for milk and a low milk supply due to a reduction in milk production. The middlemen and vendors argued that there had been a growing trend of lack of pasture caused by more frequent dry seasons and consequently poor milk productivity. The finding is similar to previous studies, which have found the declining availability of fodder in Tanzania's dairy sector (Lunogelo et al., 2020). The trend is not unusual given the evident adverse effects of climate change that are currently being experienced and its particularly unfair effect on pasture-fed livestock. It is projected that some regions in Sub-Saharan Africa will not be able to sustain livestock production in the future due to climate change which will result in prolonged dry periods and consequently a lack of pasture (Nalianya et al., 2020). Climate change is already being felt among livestock keepers in Tanzania.

Another reason for the decline in milk sales reported by intermediaries was a decline in milk demand among customers, which they attributed to hard economic times. Such an outcome indicates that consumers in Tanzania reduce expenditure on milk when disposable income shrinks relative to the cost of living (Joel et al., 2014). This aligns with Tanzania's low milk consumption culture, where the per capita consumption rate is as low as 47 liters/ annum compared to other countries like Kenya, where the per capita consumption rate is 120 litres/annum. The WHO recommended per capita consumption rate is 200 litres/ annum. Tanzania, therefore, lags behind the recommended milk consumption rate and the consumption rate of other developing countries.

Competition from the growing number of intermediaries and vendors in the business and the lack of prompt payment by clients have also cited reasons for a declining business environment. The claim for a growing competition can be explained by individuals' ease of joining the business. An initial investment in informal milk trading is minimal. Furthermore, the regulatory requirements are minimal, and traders are not harassed for noncompliance. The venture has minimal entry barriers, and the returns are realized quickly, so it attracts many business people.

The general indication was that the milk business was declining for vendors and intermediaries. This, however, contradicts the general trend of increasing milk demand in Tanzania driven by a growing population and increasing wealth, especially in urban areas (Michael et al., 2018). The unexpected result may be unique to the study area, which is not as urbanized and populated as other urban areas such as Dar es Salaam. Literature indicates that Dar es Salaam offers the biggest market for dairy products in Tanzania (Lunogelo et al., 2020).

4.5.2 DAIRY SECTOR DEVELOPMENT PRIORITIES FOR THE FORMAL AND INFORMAL SECTORS

In a bid to address the performance of the dairy sector in Tanzania, various development stakeholders have invested in its development. The indication was that the development stakeholders invested in areas with high potential for dairy production to achieve the long-term goal of commercialization of dairy sector operations.

One of the development stakeholders who participated in the study focused on enhancing milk productivity and its marketing with a bias in high potential regions where commercialization can be achieved. They had a project in the Kilimanjaro region where producers were being trained in farm management and hygienic milk production at the study time. The producers were selling their milk to large processors through 22 cooperatives. Kilimanjaro is one of the highland regions in Tanzania with high dairy production. Others include Arusha, Kagera, Iringa, Mbeya, and Tanga (Ibrahim et al., 2018).

Another development stakeholder indicated that they worked with the Tanzania government to enhance livestock production and marketing. Value chain actors of interest to them were dairy farmers, dairy processors, and partners in delivering input supplies and AI services. Some of their successful engagements in Tanzania's dairy industry included establishing many AI providers across Tanzania. They had trained 439 AI service providers, 300 of whom were active and profitable. They had also revived and modernized the national AI centre in Arusha.

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It is currently producing and distributing quality straws. As a result, AI numbers improved from 1000 per month to 5000 per month. Between Oct 2016- Aug 2019, more than 100,000 cows were inseminated, and 27,186 calves were born: 50% were female calves.

However, the development stakeholders indicated that they faced challenges in the implementation of their development activities. For example, despite the success achieved by the development stakeholder in enhancing the availability of AI services, they indicated that there was low demand for AI services among the dairy producers and consequently poor uptake of the AI services. A service provider informed: '*There is a low demand for AI; target between Oct 2016-Aug 2019 was 800,000 but only inseminated 100,000*' (int., Luke, Arusha, 2019).

Similar challenges of supply and uptake of AI services have been reported in other studies. Lunogelo et al. (2020) indicated that between 2016-2021, the projected demand for heifers is 80,000 against the 11,000 in supply.

Reasons cited for low demand include farmers' perception of AI as expensive (30 USD) and intermittent supply of liquid nitrogen from government nitrogen production plants, which is dilapidated. The unaffordability of AI services results from the dominance of small-scale producers who are resource-constrained. Poor maintenance of the nitrogen plant, on the other hand, can be explained by poor management of the facility and lack of resources among responsible government agencies. Literature indicates the low quality of publicly provided AI services, but there is a dearth of evidence on the performance of AI in terms of conception rate and cost of services (Katjiuongua & Signe, 2014).

Other challenges cited by the development stakeholders were lack of interest in pursuing dairy farming commercially, lack of capital, and poor access to extension services. A development partner indicated:

> *Farmers are not very keen to take up dairy farming as a business, and those who are keen often need sponsorship to get started. Dairy farmers also lack access to extension services occasioned by their lack of organization and a voice. Leadership in cooperatives is weak and membership low; cooperatives cannot deliver efficient services to farmers. Furthermore, multiple regulations are burdensome for processors (up to 18 agencies), and therefore, they do not facilitate the provision of extension services to producers. Kilimanjaro Dairy Innovative platform was launched on 03.10.2019 to lobby for enabling environment for milk processors (int., Collins, Arusha, 2019).*

Targeted value chain actors' poor reception of technology reflects the incongruence between values, beliefs, and interests that govern the traditional informal sector with the principles promoted by modern production systems. The poor AI uptake is typical of producers who believe that insemination by the bull is more successful, even though they claim is not valid, and there are other risks associated with insemination by the bull, such as the spread of disease, which could be avoided through AI. Such differences in values and beliefs must be addressed adequately to ensure success in the uptake of technology to increase efficiency in traditional systems. Interventions such as training and enforcement strengthened through appropriate incentives and punishment for non-compliance are some available options to address knowledge gaps.

Policy indicates that the government's position in dairy development in Tanzania is to achieve commercialization. This position is reflected in the development activities that development stakeholders have taken up. While the commercialization of the dairy sector is useful in creating economic opportunities, focusing on achieving commercialization without establishing strategies to gradually commercialize the informal sector could also potentially result in neglect of the existing and dominant informal sector with the likelihood of its expansion and persistence the challenges that characterize it.

Therefore, governments need to acknowledge the existence and importance of the informal sector, the challenges that informal actors experience in delivering goods and services of acceptable standards, and devise a reasonable strategy to address these challenges and even commercialize the informal sector. The following section discusses informal dairy sector actors' experience in achieving milk safety through food safety regulation.

4.6 CHALLENGES IN ACHIEVING MILK SAFETY IN THE INFORMAL DAIRY SECTOR

This section of the thesis details the infrastructure and technical capacity challenges experienced at the different nodes of the dairy value chain by various value chain actors. The challenges constrain the achievement of microbial and chemical safety of milk in Arusha. Like other food value chains, food safety in the dairy value chain needs to be addressed systematically from production to consumption.

However, the dairy production node in Tanzania is characterized by a lack of technical knowledge and infrastructure among producers necessary for the achievement of food safety

(Omore et al., 2015). Further, the milk marketing node in Tanzania is characterized by a lack of basic sanitation and infrastructure required to achieve basic food safety. For example, potable water necessary to clean milk handling equipment is rarely available. The food systems also lack effective cold chains to facilitate optimal handling of highly perishable commodities such as milk. The ultimate point of concern for milk safety is the point of consumption. However, most consumers of milk and milk products in Tanzania consume raw milk whose safety is not guaranteed (Roesel & Grace, 2015).

The argument presented here is that lack of financial resources to access technical know-how and infrastructure necessary among the value chain actors limits their ability to achieve food safety. It is further argued that inadequate government investment in food safety capacity building and provision of requisite infrastructure among value chain actors contributes to the failed state of food safety in the informal dairy sector.

4.6.1 MILK SAFETY CHALLENGES AT THE PRODUCTION NODE

At the farm level, producers implemented various practices to ensure milk safety. Twenty-three percent of the milk producers practiced treatment of animals to maintain good health, 25% kept milking areas clean, 23% cleaned milking containers regularly, 19% washed hands, 6% used special containers, 2 % kept milk cold, and the other 2% avoided mixing morning and evening milk. Some producers also reported cleaning the cow's teats properly before commencing milking. While the named practices should contribute to milk safety at the farm level by preventing the proliferation of pathogenic and spoilage bacteria, producers reported that they experienced various challenges, which compromised the achievement of milk safety. Poor animal health, for example, translates to food safety hazards where zoonotic diseases could be transmitted to consumers through the consumption of contaminated animal products.

There was evidence for poor animal health management practices among dairy producers in the study. For example, a producer indicated that the occurrence of animal disease was the most challenging thing that he faced on his dairy farm. Service providers also indicated that disease control was poor among producers due to producers' poor uptake of vaccination of animals. The poor uptake of vaccinations was attributed to a lack of proper understanding among producers of the great significance of vaccination in disease control. The occurrence of brucellosis, an important zoonotic disease, was reported by consumers who indicated that they fell ill after consuming milk purchased in the informal sector. In a previous study in Kigoma,

Tanzania, the animal and herd seroprevalence of brucellosis was 30% and 77%, respectively (Swai et al., 2021). This indicates that the disease is endemic and extensive locally.

Brucellosis is one of the most common zoonoses that causes immense losses in dairy herds and poses threats to human health. In Tanzania, it is one of the six most critical zoonotic diseases of public health concern (Swai et al., 2021). While WHO and OIE recommend measures and strategies to address brucellosis, only some developing countries have implemented these strategies. Developing countries are particularly lagging in eradicating brucellosis because the recommended measures and strategies are expensive, time-consuming, and labour intensive (Zhang et al., 2018). Their implementation is therefore complicated in resource-constrained countries like Tanzania.

Livestock vaccination, testing, and slaughtering programs have been used to control brucellosis in livestock. Such programs have not been implemented in developing countries due to a lack of resources for investment in herd health management (Cash-Goldwasser et al., 2018). For example, in the study, the management of dairy herd health was reported to be complicated by milk producers. They indicated difficulty in accessing veterinary officers for consultation. They also had limited access to drugs for vaccination and treatment of their animals due to the high cost of the drugs and the long distances they had to cover to reach the agro vet shops, which were mostly located in the urban areas and were few. They reported the following:

> *There are few veterinarians to treat the cattle, so sometimes you carry on with untreated cattle, which is a disadvantage to the producer (int., Pamela, Arusha, 2019).*

> *We are constrained by the high cost of treating cattle and acquiring enough feeds (int., Tony, Arusha, 2019).*

Another dairy producer said he was challenged in raising transport costs to access veterinary services. Agrovet service provider who participated in the study confirmed limited reach to farmers in village settings. He indicated that there are no service providers in the villages and the producers are geographically far from agro vet establishments in urban settings. He observed: *'Farmers suffer poor extension services at ward and village levels' (int., Heather, Arusha, 2019).*

Agrovet service providers also indicated that they offered a limited range of services, with the predominant ones reported being the treatment of sick animals, vaccination, and provision of AI services. They indicated:

> *We engage in the sale of drugs and vaccines and advise on administering them to animals, treating sick animals, and vaccination of animals (int., Heather, Arusha, 2019).*

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Our services include the sale of drugs for animal treatment, vaccinations, provision of AI services, and advice on poultry husbandry (int., Dan, Arusha, 2019).

The limited number of animal health services meant that animal producers could only access a fraction of animal health care services. These findings are consistent with other study findings, which identified services provided by veterinary officers as limited to prescription of drugs, treatment of sick animals, and vaccinations. Services such as farmer education on disease prevention measures and follow up after treatment which is crucial in the management of animal health, are rarely offered among producers due to lack of resources by the government (Ledo et al., 2019; Matthew et al., 2016; Sudda et al., 2017).

Therefore, it is not surprising that service providers indicated that producer demand, particularly for animal vaccination services, was low. They argued that producers were not fully aware of the benefits associated with the vaccination of their animals. A service provider indicated:

Vaccination is insufficient at the village level, mainly due to a lack of demand by the producers. They lack knowledge on the importance of vaccinations (int., Heather, Arusha, 2019).

Animal producers who have access to veterinary officers and, therefore, reliable sources of information are more likely to procure vaccination for their animals. This is compared to those who do not have access to veterinary officers (Ledo, 2017).

Besides disease control and management, other animal management practices at farms influence the overall health outcomes of animals. For example, proper management is required for the teat end, which is a critical control point for organisms that cause foodborne illnesses such as those that cause mastitis and infection. Such infection can be prevented by adopting appropriate hygiene and animal health management practices (Garcia et al., 2019). An unhygienic environment could potentially expose cattle udder and teats to disease-causing bacteria and are also a potential source of milk contamination (Ledo et al., 2019).

In the study, keeping milking areas clean was reported to ensure milk safety by farmers. The adequacy of the reported hygiene practices was not assessed, but cattle kraals and milking sheds were observed to have dung, which potentially exposed the cows to disease-causing organisms. The findings were similar to previous studies where substandard animal management practices were identified among farmers in Tanzania with wooden and sandy floors for the cattle cleaned by dung removal with a hoe, limiting adequate cleaning in case of wet dung (Ledo et al., 2019). The use of substandard animal rearing units directly reflects the lack of financial resources

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among the livestock keepers. While the hygienic practices could be enhanced within the basic infrastructure used by producers, a lack of knowledge on how to achieve it and its importance hinder the adoption of good hygiene practices.

Proper cleaning of the udder and teats of cows before milking is also an essential step in preventing milk contamination with dirt and microorganisms that could be present in the udder and teats (Scoder et al., 2013). The cleaning also prevents potential infection of the teats and udder and, therefore a critical step in animal health management. Producers indicated that they cleaned the udders and teats of the animals before milking to ensure milk safety.

While the study did not assess the effectiveness of the cleaning in the study, the cleaning is done inappropriately in other studies limiting its effectiveness in safeguarding milk safety. Ledo et al. (2019) found that 36% of farmers did not clean the udder and teats after milking. In another study, farmers skipped pre-dipping of teats even though pre-dipping with an effective disinfectant and cleaning with a clean towel is more effective than any other teat care (Elmoslemany et al., 2010).

The provision of information on good animal husbandry practices among dairy producers in Tanzania is mandated to TAMPRODA. TAMPRODA, an association for milk producers, was established by TDB to facilitate the production of safe and good quality milk by producers. The association is mandated to facilitate access to high-quality inputs by producers, access to extension services, and capacity building in good animal husbandry practices, among other things. The association was, however, largely ineffective at the time of the study due to various reasons. The association lacked adequate financial capacity and did not have adequate representation at the local level to implement capacity building among its members. Furthermore, members were largely illiterate, which limited the impact of capacity-building efforts. The association was also unable to facilitate the acquisition of hybrid cattle for its members. This disincentivized the members' uptake of good production practices.

The association also faced competition from other producer groups, often facilitated by civil society organizations. These groups often get funding that is appealing to the producers but is unsustainable beyond the funded period. Overall, the producers did not benefit from the collective provision of information and services by TAMPRODA. The producers lack access to vital technical production information with limited supply of inputs and service providers and an ineffective TAMPRODA. This explains the poor hygiene practices among dairy

producers during milking. TAMPRODA representatives acknowledged poor technical capacity in good production practices and poor access to quality inputs among their members:

> *Producers lack knowledge in proper feeding regimes, animal management, and hygienic practices and lack access to quality inputs, i.e., feeds, drugs, and supplements (int., Leila, Arusha, 2019).*

The ineffectiveness of TAMPRODA was further driven by poor strategy in its establishment. The association was established to facilitate the commercialization of dairy production in Tanzania. Therefore, the association members sold their milk predominantly to the processors, which is aligned with government efforts to achieve commercialization of the dairy sector through increased production, processing, and marketing. However, an interesting twist is that 70% of the association members were pastoralists, while farmers who kept hybrid cows constituted 30% of the association membership. The pastoralists predominantly sold their milk to processors who offered a lower milk price. This can be explained by the fact that the pastoralists kept many animals and usually had high milk volumes. The implication is that even with small profit margins per unit of milk sold, they still made reasonable profits. Furthermore, milk is a secondary commodity among pastoralists, so they are not keen to pursue high prices. On the other hand, the producers who kept hybrid cattle sold their milk predominantly to direct consumers and informal traders who offered better prices for the milk. From this discussion, it is clear that the commercialization strategy at the production node is off tangent due to milk price disincentives among producers and poor coordination in service provision for optimum production outcomes.

Another dimension to the ineffectiveness of TAMPRODA is the lack of government commitment in supporting the association. The association was supposed to get support from TDB in the provision of services to the members. However, the only support they got from the government was the facilitation of vaccination drives and occasional training of producers in good animal husbandry practices.

Given the poor performance of TAMPRODA in the facilitation of commercialization of production, there have been efforts to merge TAMPRODA with TAMPA, the association that represents dairy processors, as discussed earlier. Such a merger would support the production of good quality milk and a ready market for the milk. Association representatives stated:

> *The intention was to establish a National Dairy Association to represent producers and processors. It is a positive move that will benefit both the processors and producers. TDB and DDF are driving the initiative, and there is good progress so far (int., Tom, Arusha, 2019).*

Merging with TAMPA will ensure the representation of producers at the local level and, therefore, their access to extension services and good quality production inputs (int., Leila, Arusha, 2019).

4.6.2 MILK SAFETY CHALLENGES AT THE MARKETING AND DISTRIBUTION NODE

After extracting milk from the cow, poor hygiene practices often contribute significantly to the contamination and cross-contamination of milk of good microbiological quality. Milk handlers, therefore, have to ensure appropriate milk handling practices to avoid milk contamination during handling. Cleaning milk storage containers regularly was reported as a measure to ensure milk safety by producers (23%), intermediaries (54%), and vendors (49%) in the study.

If done adequately, regular cleaning of milk storage containers could prevent contamination and cross-contamination of milk. However, it was observed that producers often used cold water to clean plastic containers used for milking and milk storage, and the water was not always clean. Such practices threaten milk being contaminated due to poor hygiene in the milking and storage containers used. The plastic containers were preferred because they are cheap and readily available. However, the plastic containers are often original packaging of industrial chemicals and detergents and non-food grade, which makes them unsuitable for food handling. Furthermore, they have a hard-to-clean corner where milk films often deposit, making them critical points of milk contamination (Scoder et al., 2013). Lack of access to potable water and knowledge in proper cleaning procedures contribute to the poor cleaning routine (Ledo et al., 2019).

In addition to observing hygiene in milk handling, it is also critical to maintaining the recommended temperature during milk transportation and storage. The recommended temperature for milk storage after extraction from the cow is 4 degrees Celsius. Only a small proportion of the value chain actors indicated that they kept milk cold as a food safety measure. The proportion of value chain actors that kept milk cold by refrigeration to preserve quality was 2% among producers, intermediaries, and vendors. The cold storage used by the small proportion of value chain actors was not consistent but was instead characterized by frequent power outages.

One percent (1%) of vendors also dipped milk in cold water to cool it without refrigeration. Five percent (5%) of producers, 24% of intermediaries, and 40% of vendors reported that frequent electricity disruption challenged their efforts to preserve milk quality. Further, 17 middlemen (out of 24) stated that they faced difficulties maintaining quality and milk safety, with the most common difficulty being the lack of cold storage (11 out of 17 middlemen, or

65%). Four intermediaries mentioned facing fluctuations in electricity supply, presumably affecting the ability to keep milk cold for those who have access to refrigeration.

Thirty (30) out of eighty-two (82) vendors mentioned that they faced difficulties maintaining the safety and quality of milk. These include frequent power cuts (12 responses), not having a refrigerator (3 responses), and milk being adulterated (2). Agrovet service providers indicated that lack of cooling facilities among traders results in the milk of poor quality. The value chain actors clearly lacked the capacity to maintain a milk cold chain during milk storage and transportation due to inadequate electricity supply. Some government authorities also indicated that dairy value chain actors lacked cold storage facilities.

The findings were similar to previous research findings, which established that cold storage of milk in Tanzania is challenged by inadequate electricity supply whose coverage is limited to 11% in the rural areas even though they provide 70% of all milk produced in Tanzania (Kilongozi, 2017). Frequent power outages and long transport distances further limit the supply of milk to the markets by producers in the rural setting, which are located far from urban areas but produce majority of the milk in the country (Katjioungua & Nelson, 2014).

Value chain actors who did not preserve milk quality by cooling used other preservation methods such as boiling, which 21% of producers, 8% intermediaries, and 14% vendors practiced. Other methods used for milk preservation by the value chain actors were the quick sale where milk was sold within the 3-4 hours after acquisition, which was practiced by 26% of producers, 54% of intermediaries, and 18% of vendors (18%). Some value chain actors stored the raw milk at room temperature and did not use quality preservation techniques. The proportion of value chain actors who did not use any techniques to preserve milk quality was 4% of intermediaries and 10% of vendors, while 1% of vendors dipped milk in cold water for preservation.

The dominant method used for milk preservation by the value chain actors was boiling. However, ultimately most milk was stored at room temperature. The findings were consistent with findings of another study that reported farmers, traders, and milk bar operators stored milk at temperatures of 35°C to 37°C. Only a few used stainless-steel containers and Mazzican, which are food-grade plastic milking and storage containers (Ledo et al., 2019).

Even though the milk preservation techniques adopted by the value chain actors as discussed above worked most of the time, milk spoilage was still reported across all the value chain actors, although at low rates. Most producers, intermediaries, and vendors experienced 1-10%

weekly spoilage for milk that was not sold fast enough. A spoilage rate of 30-40% at farm level due to lack of refrigeration was also reported in a previous study in Tanzania, with most spoilage experienced with evening milk stored at room temperature and sold the following day (Kilongozi, 2017). Although low, the reported incidences of milk spoilage could be because of the high multiplication of bacteria at room temperature and poor hygiene along the value chain for milk that is not sold promptly (Millogo et al., 2015).

Determination of the initial microbial load and determination of the presence of pathogens in milk at the point of purchase is critical in helping value chain actors source milk of good quality and therefore prevent rapid deterioration and transfer of poor-quality milk up the value chain. However, on-farm pathogen diagnosis in developing countries is challenged by various factors. There is a shortage of skilled technicians, lack of cold chain, humidity, high temperatures, presence of dust which the tests have to tolerate, lack of resources, and cost implications. Furthermore, there is a lack of market incentives for improved microbial quality among dairy producers (Grace et al., 2016). Indirect tests are instead commonly used on farms, while most direct tests need laboratory analysis. While the indirect tests cannot confirm the presence of pathogens, they are easy to do and can indicate the presence of pathogens, including zoonotic pathogens. The indirect tests include organoleptic tests, acidity tests, and somatic cell count tests (Bilkis et al., 2013).

Consistent with existing literature, most value chain actors in the study (producers, middlemen, and vendors) lacked access to milk testing equipment. They instead relied on organoleptic tests (sight (72%), taste (5%), and smell (5%)) to assess milk quality and safety. Others (7%) used methods such as pouring milk on the ground to determine density by how fast it flows, and 11% used lactometers to determine density. The study findings are consistent with existing literature where value chain actors depended on organoleptic tests to determine milk quality and safety (Ledo et al., 2019).

Organoleptic tests allow for basic assessment of milk quality and inform elimination of milk that is off. However, the value chain actors are unable to assess key aspects of milk quality and safety. They are limited in the identification of zoonotic bacteria in milk, presence of AMRs, aflatoxin, and other potentially harmful substances due to lack of testing equipment (Grace et al., 2016). For example, one of the respondents indicated there is reconstituted milk powder by some dairy processors due to a limited supply of raw milk. Milk powder reconstitution does not cause harm to the health of consumers, but consumers are not aware of the actual

ingredients in the processed milk that they consume. Essentially, such action denies the consumers their right to choose because such action by the processors is not detected in the absence of consumer access to relevant technology.

Lack of access to technology for assessing milk quality also affects the quality of milk obtained by traders and consumers. Fifty-four percent (54%) of value chain actors (intermediaries, vendors, and consumers) faced challenges in obtaining good quality milk at the point of purchase. They were not able to assess milk quality at source reliably. This finding is similar to existing literature, which indicates that the lack of knowledge in milk testing and access to proper equipment to assess milk quality hinder milk testing at source for the traders. The consequence is an increase in chances of acquiring low-quality milk while sourcing and carrying it down the value chain up to the consumer (Johnson et al., 2015; Sikira et al., 2013).

In summary, hygiene practices by milk handlers were not adequate to facilitate milk safety. The cold chain was not maintained for milk preservation during transportation and storage. There was also a gap in capacity to test milk quality at source by value chain actors. This increased chances of acquiring low-quality milk at the source and distributing it along the value chain to the consumer level. Value chain actors should be facilitated to access credit facilities (Alonso et al., 2018) to enable them to acquire milk-testing equipment and control quality right from the sourcing point. Furthermore, it is critical to facilitate testing for zoonotic bacteria in milk at the farm, given that consumption of raw milk in Tanzania is prevalent (Grace et al., 2016). The lack of access to clean water, electricity supply, and milk testing equipment are all related to the economic underdevelopment state of the country and, therefore, the lack of government investment in requisite infrastructure to address food safety.

4.6.3 MILK SAFETY CHALLENGES AT THE CONSUMPTION NODE

The majority of consumers in the study (55%) preferred raw milk for its perceived freshness, which they said made it ideal for consumption by children. Ninety percent (90%) of the raw milk consumers boiled it before consumption, while 10% did not subject the milk to heat treatment. Raw milk consumption without heat treatment has been reported in other studies (Grace et al., 2014), indicating a lack of knowledge or appreciation of the potential health risks that could arise from the consumption of raw milk. A few consumers indicated that they have previously suffered from either brucellosis, diarrhoea, vomiting, or inflammation from milk consumption, although it is challenging to associate illness with milk consumption. Such

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incidences confirm the existence of public health concerns in raw milk obtained from the informal sector.

Consumers expressed concerns in milk safety related to poor hygiene of the milk handling equipment, lack of testing equipment resulting in the purchase of poor-quality milk. There were also concerns about consumers' inability to determine the presence of zoonotic pathogens in the milk they consume. These issues emerged from interviews:

> *Cleanliness of containers and the personnel is quite an issue; changing suppliers is usually based on that (int., Clara, Arusha, 2019).*

> *We lack equipment for testing milk quality and safety and, therefore, cannot determine milk quality at the point of purchase (int., Jaden, Arusha, 2019).*

> *The lack of tests makes it hard because we may buy milk from a certain place but find it spoiled. We have been continuously buying milk from the same place, and when we don't face any health issues, we are sure that the milk is safe (int., Kayan, Arusha, 2019).*

> *The major challenge is to get the right vendor and to satisfy oneself that the milk he sells is not adulterated in any way (int., Keith, Arusha, 2019).*

While the consumers were aware of the existence of poor-quality milk in the market, they lacked a proper way of determining milk quality at the point of purchase. The raw milk they purchase is not packaged and branded under any regulatory framework; therefore, it does not contain information on milk quality testing. There are also no reliable rapid tests that they could use to ascertain milk quality at the point of purchase. The consumers are therefore helpless in determining milk quality and rely on trust relationships with milk suppliers.

While consumers preferred raw milk for its original taste and affordability, they acknowledged its potential public health concerns. However, the consumers were constrained in purchasing pasteurized milk as a substitute due to its high cost. One of the respondents indicated that price was a hindrance to their ability to purchase good quality milk. He stated, *'The challenge is when milk is of good/high quality/safe the price becomes high, which shoots from Tshs 1200 to Tshs 1400' (int., Pius, Arusha, 2019).*

4.7 CHAPTER SUMMARY

The dairy value chain is predominantly informal, along with the production, marketing, and consumption nodes. The formal sector competes with the informal sector for the dairy market.

The formal and informal sector actors had a positive relationship with the informal sector supplying the processors. However, the formal processors were cognisant of the slight advantage enjoyed by informal traders in not paying regulatory compliance costs. Among processors, there was segregation by the scale of operation where the large-scale processors had access to premium markets and could develop niche products differentiated by branding and marketing. The smaller processors, on the other hand, had limited capacity for high-end branding and advertising. They produced for the mass market.

The informal value chain actors at all nodes of the value chain experience various challenges. They had inadequate infrastructure, technology, service provision, and access to technical know-how on how to achieve milk safety. At the production node, the producers lacked access to veterinary officers for consultation in animal health management. They also lacked access to good-quality production inputs due to prohibitive costs and the infiltration of poor-quality inputs. Producers also lacked knowledge in good hygiene practices and incentives to implement them during milking, which compromises milk quality and safety at the milking stage. Inappropriate hygiene practices challenged milk safety during transportation and marketing. Milk handling during transportation and marketing was characterized by inadequate cleaning of milk handling equipment and milk storage at room temperature instead of the recommended temperature of 4°c. The lack of utilization of a cold chain was caused by the lack of capacity to invest in requisite infrastructure at the government and investor level.

Milk testing by both traders and consumers to ascertain quality and milk safety at the point of purchase was limited by the lack of capacity to acquire the appropriate technology and infrastructure to enable such testing. At the consumption node, some milk consumers consume raw milk without subjecting it to any form of heat treatment exposing themselves to potential zoonotic illness, which could be controlled through simple heat treatment regimens such as boiling.

The current government strategy for the improvement of the dairy sector is to achieve commercialization. The intention is to enhance production through genetic improvement of the dairy herd and production support through TAMPRODA. The high-volume milk is sold to formal milk processors to produce competitive pasteurized milk and milk products. This strategy has been unsuccessful because the capacities and incentives of the producers, TAMPRODA, and processors are misaligned with it. Therefore, the informal sector has continued to thrive, although it is also characterized by immense capacity and incentive

deficiencies to achieve food safety. The capacity deficiencies experienced at the different levels of the dairy value chain in Tanzania were related to a lack of financial resources at the individual and federal government levels due to economic underdevelopment. Addressing economic underdevelopment is a long-term goal. Approaches that will consider the available capacities among value chain actors under the current level of economic development are required to address food safety in the informal dairy sector.

CHAPTER 5

5 FOOD SAFETY REGULATION ENFORCEMENT CHALLENGES

5.1 INTRODUCTION

Developing a modern food safety system requires a specific level of food safety capacity in terms of knowledge, technical skills, resources, food safety policy, regulations, and standards among relevant institutions (government agencies and testing laboratories). Such capacities allow the institutions to execute their functions properly, effectively, and sustainably to ensure food safety (Jaffee et al., 2019). However, most of these capacities are often lacking or inadequate in developing countries due to limited government investment in food safety (Jaffee et al., 2019). The result is often poor performance of the food safety governance institutions and consequently poor food safety outcomes.

This chapter examines the performance of the participating regulatory agencies against their food safety regulation mandates. It also examines the nature of challenges they face related to technical capacity, clarity and coordination of roles and mandates, ability to base decision making on credible scientific evidence, availability of infrastructure, applicability, and acceptability of the food safety standards. Primary data is used to assess the regulatory agencies' performance and the nature of challenges they face in executing their mandates.

5.2 ROLES AND MANDATES OF PARTICIPATING REGULATORY AGENCIES

This section details the mandates and roles of five national and one regional regulatory agency participating in the study. The section also examines the food safety regulatory requirements imposed by the different regulatory agencies among dairy sector actors and their execution. It further details the food safety regulation instruments that govern the dairy sector in Tanzania. Finally, it examines the effectiveness of food safety regulation in Tanzania's dairy sector.

5.2.1 THE TANZANIA DAIRY BOARD (TDB)

The Ministry of Agriculture, Livestock, and Fisheries govern the dairy sector through the Tanzania Dairy Board (TDB). The TDB has a mandate to develop, regulate, and promote the dairy industry. The day-to-day functions of the board include registration of all dairy stakeholders, inspection for compliance with dairy industry standards among dairy value chain actors. The board is further charged with promoting commercial processing, marketing,

distribution, and consumption of dairy products. This is achieved by planning and facilitation activities such as the annual national milk week and milk consumption campaigns in schools.

At the time of the study, the TDB was issuing registration certificates to small-scale milk traders at a fee. The traders paid Tshs 5000 at the registration date and paid the annual renewal fee of Tshs 500 for the subsequent five years after the initial registration. The issuance of the registration certificate took two days if all the requirements were met. The traders were required to have appropriate milk handling equipment, carry out platform tests, and demonstrate the ability to achieve adequate hygiene practices. According to sources closer to the process, the purpose of issuing the registration certificate to milk traders was to ensure that the trader's capacity to achieve milk safety was assessed and demonstrated to be adequate. The registration also facilitated the development of a database of traders for their traceability.

5.2.2   TANZANIA BUREAU OF STANDARDS (TBS)

The bureau is mandated to develop dairy industry quality standards (for both formal and informal dairy sectors) through a technical committee. The bureau also issues the mark of quality, which is compulsory for all dairy processors. Further, the bureau inspects for compliance of processed dairy products with the dairy products standard's requirements.

While the bureau develops standards for both the formal and informal sectors, it only enforces the standards in the formal sector—the inspections conducted by TBS target formal processing plants and all processed milk and dairy products. Before the dissolution of TFDA, TBS inspected for milk quality compliance while TFDA inspected for milk safety compliance. The bureau does not inspect dairy products in the informal sector for compliance with the quality standards. Instead, TDB is responsible for inspection of compliance with dairy sector regulations in the informal sector. TBS and TFDA are the custodians of the main public food safety laboratories in Tanzania. The regulatory arrangements are explained by an excerpt from the interviews: '*Inspections are carried out for pasteurized milk among dairy processors; none for raw milk. Raw milk standards are implemented by TDB and inspections too*' (int., Mike, Arusha, 2019).

Their food safety regulation mandates are limited to the formal dairy processors, reflecting government strategy in food safety regulation. The focus has been the commercialization of the dairy sector, which includes enforcement of the Codex standards among formal processors. The laboratories, although not adequately equipped, allow for testing of milk and milk products for compliance with the standards. The government has not invested in such infrastructure for the informal sector, and neither are the milk products traded in the informal sector subjected to

testing in the established public laboratories. The only testing is done in dairy cooperatives, which supply raw milk to both the formal and informal dairy sectors, is simple platform tests. These are simple tests such as the alcohol test, which is used to determine the microbiological quality of milk. However, the platform tests do not allow for the profiling of important microbiological characteristics, such as the presence of pathogenic bacteria (Grace et al., 2016). There is a disconnect between government investment in food safety and the dairy sector's readiness to consume such investments, resulting in poor food safety outcomes.

5.2.3 THE BUSINESS REGISTRATION AND LICENSING AGENCY (BRELA)

The agency issues trade licenses to milk processors and traders both in the formal and informal sectors. It also inspects the validity of the trade license among traders through representatives at the local government authorities. The agency does not issue any license for producers selling raw milk at the farm level, but traders and processors involved in the raw and processed milk trade are required to obtain relevant trade licenses. The agency issues trade licenses to informal sector milk traders at the cost of Tshs 50,000 for those with fixed premises, while those operating as mobile vendors are expected to pay a daily rate of Tshs 500. However, it was reported that the situation changed in 2019 for mobile traders. They were given the directive to obtain a single annual trade license from BRELA through the local government authority at Tshs 20,000 if their annual revenue did not exceed Tshs 2000000.

The directive was given the year preceding the national elections year. Sitting governments commonly employ such tactics to gain legitimacy among the electorates (May & Jochim, 2013). The small-scale informal traders are part of the poor majority electorates, and such a move likely to make them feel that their grievances are recognized and addressed is likely to be used to gain political mileage. Politicians usually advance short-term policy changes within the short period that they are in government. Adopting this approach fails to engage with the messy process of figuring out how policy implementation will unfold in the future. The result is the establishment of unsustainable and sometimes contradictory policies in the long term.

5.2.4 PUBLIC HEALTH OFFICE

The public health office is mandated with both policy formulation and implementation of the regulation. The public health office issued medical clearance certificates to milk traders in the informal sector and workers working in milk processing firms upon confirmation that they are medically fit to handle food safely. The cost of acquiring the public health certificate ranged from Tshs 5,000 to Tshs 200,000, depending on the size of the business. Besides the fee, there were other requirements to be met before issuing the certificate by the public health office. The

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applicant was required to have TRA clearance and clean premises. Issuance of the public health certificate took two days if all requirements were met. The period that traders and processors had to wait to acquire their certificates was reasonable. The cost requirement and clearance with TRA is what some of the traders and processors struggled with. Traders were exceedingly unwilling to interact with TRA to avoid identification and possible tracing in the future. They felt that TRA was aggressive in collecting revenue from them. One of the traders stated, '*TRA is keen to get revenues but health officers only interested in ensuring milk safety' (Mokaya, Arusha, 2019).*

The office is further mandated to conduct periodic inspections among milk traders and processors for compliance with set standards. One of the critical aspects of inspection in milk handling premises is the layout of the premises. The layout of the premises is important in facilitating the proper flow of production activities on the production shop floor. The public health officials also inspected premises for compliance with hygiene standards and TBS and TFDA food safety standards. Milk traders and processors that did not comply with public health standards were given a 30-day window to comply, and upon compliance, they were cleared to continue with operations. The enterprise failed to meet recommended amendments within the prescribed period; the business was forced to close. Interestingly, the public health office enforces TBS and TFDA standards, yet the two regulatory agencies also enforce the standards. The effect is over-regulation of the dairy traders. The inspections, which often result in fines from multiple agencies for non-compliance, were the most burdensome for small scale traders and processors.

Besides issuing medical certificates and inspections for compliance among milk traders and processors, the public health officials also conducted capacity building among milk traders and processors. The capacity building entailed educating traders and processors on public health standards and how to achieve them. The capacity building, especially among informal traders is a positive and unique approach. It helps address the knowledge and practice gaps of inappropriate milk handling at no additional cost to the traders and government. The public health office sets itself apart from other agencies who, instead of contributing to capacity building among the informal sector actors, often harass them for non-compliance.

5.2.5   THE LOCAL GOVERNMENT AUTHORITY

The local government in Tanzania facilitates the execution of work related to enhancing dairy production and milk hygiene by livestock officers and dairy technicians deployed to the local government by the MOALF. The livestock and dairy officers visit dairy producers and educate them on appropriate techniques and hygiene practices during milk production and handling.

The local government collaborates explicitly with TDB in appointing dairy inspectors to the local government authority, who then carry out the functions of registration, capacity building, and inspection of dairy traders on behalf of TDB.

The local government authority has also been involved in installing milk cooling tanks at milk collection centers in the milk-producing areas, although a lack of adequate financing has greatly challenged this. The livestock officers were required to inspect the milk for platform tests compliance at the milk collection centers. However, it was reported that the livestock officers lacked the necessary equipment to carry out the tests. The authority was further involved in providing milk handling equipment for the dairy value chain actors and facilitating safe milk consumption campaigns. Given that the local government is the ultimate government agency mandated to deliver services at the local level, they interact more with the traders than any other regulatory agency. However, efforts by the local government to support the achievement of food safety in the dairy sector are limited by a lack of adequate financial resources, as detailed above.

Besides its agency through the MOALF, the local government authority enforced regulations and standards of the various agencies authorized to regulate the dairy sector. Since 1996, the local government authority in Tanzania has been responsible for enforcing food safety regulations (Grace, 2012). The authority confirmed their involvement in inspecting dairy premises to comply with public health requirements, TDB requirements, and the trade license acquisition. Where the premises did not comply with any relevant regulatory requirements, the authority affected a fine of Tshs. 50,000. The enforcement of standards and regulations of other agencies by the local government authority adds to the burden of multiple regulations among the traders and processors, as discussed earlier.

5.2.6 THE EAST AFRICAN COMMUNITY (EAC)

The East African community is mandated to harmonize milk standards for raw and pasteurized milk to facilitate trade among the member states. It did not engage in the day-to-day food safety regulation of milk traders and processors.

Fig. 5.1: Summary of the mandates of dairy regulatory agencies

The most dominant mandates among the six agencies were developing food safety policy/ regulations, issuing practice certificates, and inspection for compliance with various standards and regulations (fig.5.1). Besides the policy implementation roles by the various agencies discussed above, the agencies also took part in policymaking. The agencies participated in the formulation of food safety policy at varying degrees. Some of the regulatory agencies were entirely responsible for the formulation of policies, while others contributed to the formulation of policies alongside others. For example, the local government was fully responsible for formulating by-laws, while TBS was fully responsible for formulating food safety standards. TDB, on the other hand, collaborated with TBS in the formulation of dairy food safety standards. One of the regulatory agencies fully charged with policy formulation indicated, '*We developed the raw milk standard which processors utilize at the point of purchase of raw milk' (int., Mike, Arusha, 2019).*

The findings agree with the literature, which indicates that many countries in SSA assign food safety responsibilities to multiple ministries, especially the ministries of agriculture and health, although responsibilities differ. In some countries, food safety standard setting is assigned to the National Bureau of Standards, while inspection and compliance functions are assigned to other agencies. Trade and commerce ministries are often involved in food safety due to the great importance of trade in economic development. Complexity is even greater with further fragmentation of the food safety agencies, which extend into agencies that carry out food safety functions at the local level (GFSP, 2019).

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5.3 REGULATORY INSTRUMENTS GOVERNING THE DAIRY INDUSTRY

Each of the five national regulating agencies participating in the study indicated that they enforced multiple acts or policies concerning food safety in the dairy sector. Among those mentioned by the regulatory agencies included the Public Health Act 2009, Local Government By-laws 2010, Dairy Industry Act 2004, Dairy Industry Regulations 2007, Milk Import and Export Regulation 2012, the National Livestock Policy 2006, the Animal Health and Disease Control Act 2003 and the Food and Nutrition Act (1973). At the regional level, it was reported that harmonized standards for raw milk, pasteurized and powder milk, are implemented at the national level by EAC member countries. The harmonized standards facilitate transnational trade among the member states.

5.4 REGULATION EFFECTIVENESS

The study sought to understand how the regulatory agencies and dairy sector traders perceived compliance with the regulations among the traders and the effectiveness of regulation in ensuring food safety in the dairy sector. The traders and regulatory agencies generally reported low compliance levels with the regulatory requirements and poor effectiveness of the food safety regulation in ensuring food safety in the dairy sector.

For example, compliance with the medical certificates acquisition among informal sector traders who participated in the study was low, with 83% of intermediaries and 71% of vendors indicating that they did not have the certificates. The regulatory agencies also reported poor regulatory compliance among the dairy traders. For example, one of the regulatory agencies reported that only 5% of the small-scale traders were registered as legal traders. Another regulatory agency indicated that milk trade licenses constituted only 1% of all the trade licenses they issued. The traders often employed tactics such as collaborating with general merchandise shop operators to avoid paying regulatory costs. The trade license, for example, was mostly taken up by traders who intended to obtain loan facilities and those with established milk processing investments, for which they required the trade license to operate legally. A regulatory agency representative stated:

> 'Milk traders constitute less than 1 percent of all trade licensing. The majority of milk traders do not take up trade licenses. Instead, they use other general store retailers as the point of sale for their milk. Traders in the dairy sector that have trade licenses are the ones that operate small industries where they pack milk. Other milk traders who apply for the trade license are those interested in accessing financing for their business' (int., Rufus, Arusha, 2019).

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The implications for the trader's lack of compliance with regulatory requirements were their exclusion from formal financial lending due to lack of identity as legal entities. Such exclusion is often perceived as unfair treatment of the system's informal actors, encouraging their further exit from the regulated formal sector (Perry et al., 2007).

The informal traders' lack of trust in government intentions ultimately results in a lack of government legitimacy among the traders. Under such circumstances, it becomes challenging for the traders to have the incentive to comply with the legal requirements. Therefore, rather than pursue regulatory compliance, the informal actors rebel against the government. Such reaction is driven by the trader's feeling oppression and alienation by the prevailing governance systems (Halla, 2012). The mistrust in government intentions came across in the study. A regulatory agent stated,

> *'Compliance with regulations is poor among traders. They see regulations as a way of eliminating them and will resist. Traders put many advocacies to fight government regulations (e.g., UNDATA (for milk traders in Uganda), they may even go to court although they may not be equally organized in all the countries' (int., Humphery, Arusha, 2019).*

However, there were efforts among the regulatory agencies to enhance compliance among the traders by educating them about the importance of their compliance. Education of traders on the regulatory requirements seeks to address the lack of compliance due to the lack of information on the regulatory requirements among traders. However, it is inadequate to address non-compliance due to lack of information on the benefits of compliance among the traders. The majority of the small-scale traders (who are the majority in numbers in the informal sector) are informal because the cost of compliance is unaffordable to them. Therefore, even with information on the potential benefits of compliance, they are unlikely to comply due to cost restrictions.

The regulatory agencies further argued that the food safety regulatory system was largely ineffective in achieving food safety in the dairy sector. They argued that the regulatory system was only effectively implemented among the large-scale processors who had the requisite capacity to implement it and met all the regulatory requirements. The regulatory system effectively safeguards food safety by implementing the requisite conditions by the large-scale milk processing plants. This included establishing proper building layout and acquiring appropriate milk handling equipment before licensing as legal processors. Furthermore, there were follow-up inspections for processor compliance with sector standards and regulations in-process and finished products. However, the dominant small-scale processors struggled to meet

the compliance cost and were often partially compliant. The following interview excerpt can explain the compliance situation:

> *'The business owners are not proactive in obtaining the licenses, which challenges milk safety and revenue collection. This could be attributed to the fact that the licenses are expensive for the majority of the small traders' (int., Rufus, Arusha, 2019).*

There were plans to facilitate the small processors to achieve better compliance through reduction of the inspection cost. While such an intervention would reduce the compliance burden for the small processors, it is just one aspect contributing to prohibitive compliance costs. A lot more would still need to be done to reduce compliance costs among the small processors. One of the regulatory agencies detailed the strategy for reduction of compliance costs for small-scale processors in the interview excerpt below:

> *'The agency plans to increase compliance among the small processors through a reduction in the cost of inspection for small processors where they will be inspected for free for the first two years of operation; then they will be charged 25% in year 3, 50% in year 4, 75% in year 5 and 100% in year six onwards' (int., Mike, Arusha, 2019).*

The informal traders were also largely non-compliant with the regulatory requirements, which they attributed to high compliance costs. One of the traders stated, *'With the kind of economic hardships we experience, why follow up for permits and licenses that are even more costly' (int., Tanya, Arusha, 2019).*

Revenue generation for the regulatory agencies emerged as a key interest in the regulation of the dairy sector. The traders expressed frustration with the aggressive nature of revenue collection from them by regulatory agencies. One of the traders stated,

> *'There are many follow-ups by the government regulatory bodies that result in too much pressure on us. The agents do not care whether you have sold or not. What they want is their money (revenue)' (int., Tyrese, Arusha, 2019).*

There were, however, contradicting claims about the effectiveness of regulation in revenue generation for the regulatory agencies. Some indicated that the regulation was effective in revenue generation for the agencies, while others argued that poor compliance levels inhibited revenue generation for the regulatory agencies. Lack of control over most informal dairy sector traders by the regulatory agencies was reported to limit revenue generation from the value chain actors by the regulatory agencies. The interview excerpts below explain the perception of the effectiveness of revenue generation:

'The licensing system helps generate revenue for the government but does not effectively promote milk safety' (int., Maya, Dodoma, 2019).

'The licenses are important to promote the achievement of food safety. However, revenue generation from the issuance of the licences is limited due to low uptake. The low uptake of licenses is large because licensing costs are burdensome to the traders' (int., Rufus, Arusha, 2019).

Revenue collection seemed to override the food safety regulation agenda among the regulatory agencies. The agencies sought to collect revenue from the dairy traders and processors through licensing fees and fines charged for non-compliance. In the regulatory mandates of the various agencies discussed earlier in the chapter, all the agencies charged licensing or registration fees. They also charged fines for noncompliance with regulatory requirements. The overriding interest in revenue generation among the regulatory agencies over achievement of food safety regulation is discussed further in chapter 7. In this context, the training and certification requirement for registration as legal traders failed to be enforced by TDB, and instead, any traders who could afford the registration fee were registered. The aggressive revenue collection was a strategy to fund the annual budgets of the multiple regulatory agencies that the central government grossly underfunds.

Another reason cited for the ineffectiveness in regulating Tanzania's dairy sector was the lack of information on the regulatory requirements among the dairy value chain actors. There were multiple requirements by each regulatory agency for the value chain actors to be licensed or registered and remain compliant in the long term. This resulted in vagueness and lack of clarity in all the legal obligations among value chain actors, further contributing to non-compliance among the value chain actors. Large processors who have adequate resources engaged experts in the interpretation of the legal requirements and achieving compliance. On the contrary, the small-scale processors and informal traders lack such resources and therefore fail to comply with the legal requirements. To elaborate on the burden of compliance among the small processors, a regulatory agency representative stated, *'The licenses are not easily accessible by the relevant stakeholders because they lack knowledge on the requirements, they need to fulfil in order to obtain the licenses' (Maya, Dodoma, 2019).*

Incongruence between the formal rules and the cultural norms and beliefs of milk consumers also played a part in the dairy sector's poor effectiveness in food safety regulation. The formal rules require pasteurization or heat treatment of milk before sale to consumers, but consumers in the study preferred raw milk for various reasons. For some communities, such as the Maasai, mainly found in Kenya and Tanzania, raw milk and blood consumption is an acceptable norm

that many generations have practiced. For such communities, the only way they know how to consume milk is in its raw form. A consumer stated: '*It's our natural milk we Maasais' (int., Pete, Arusha, 2019).*

Other consumers believe that raw milk is pure, without chemicals, and therefore safer than pasteurized milk, which they believe contains harmful chemicals. The study informed: *'No chemicals added like preserved one and processed in industries' (int., Teresa, Arusha, 2019).* Some consumers also believed that raw milk was the ideal choice to feed their children, while science, which informs the formal rules, argues that pasteurized milk is safer and ideal for consumption by vulnerable groups of the population. A consumer stated: *'We purchase it for our child since it's advised to give children that kind of milk' (int., Viola, Arusha, 2019).* For others, they were simply used to taking fresh milk as opposed to pasteurized milk. One of the consumers stated: *'We are used to raw milk compared to processed milk' (int., Becky, Arusha, 2019).*

For others, it was an issue of the trust relationship they had with their raw milk supplier, who had supplied their milk for a very long period without problems. The dependence on such trust relationships was driven by the lack of reliable means of determining milk quality in the informal sector in the absence of branding for unpackaged raw milk. The study informed: *'We buy it because of the trust that we have towards the one who supplies us with milk, he has been the one serving us all those years 'til our son is now 21 years' (int., James, Arusha, 2019).*

As discussed above, multiple issues characterize incongruence between the milk safety standards promoted by formal regulation and what is considered safe in the informal sector. The findings are congruent with existing literature, indicating that some cultures, such as the Maasai in Kenya, consider raw milk consumption normal and safe (Chege et al., 2015). On the other hand, the government is keen to address informality and milk safety challenges through the commercialization of the dairy sector using strategies such as increased dairy productivity, milk processing, and marketing of processed milk and dairy products. However, the main drivers of informality who are consumers have a different perception of what constitutes quality and safe milk. Therefore, there is very little likelihood for the informal sector actors to be driven to achieve formal food safety regulation in the current state. Such disparities must be addressed to achieve success in improving food safety compliance in the informal sector.

5.5 ATTITUDES TOWARDS RAW MILK SALE IN THE INFORMAL SECTOR

It was also evident that the groups that were largely non-compliant with food safety regulation were the small-scale processors and the small-scale informal dairy traders. The study sought to

understand how the regulators perceived the informal dairy sector regarding food safety and their future strategy to address food safety in the informal sector, which is not adequately addressed in the current regulatory framework. The purpose of this assessment was to determine government intention for dairy traders who operated outside the formal regulation for food safety.

The sale of raw milk was mainly considered legal within East Africa, particularly among members of the East African Community (EAC). It was argued that the raw milk trade is legal in all East Africa countries and even between countries, although its sale was controlled in urban areas in some countries like Kenya. The sale of raw milk in East Africa is governed by the raw cow milk standard, which details the recommended microbiological and chemical quality of raw milk traded across the countries. Raw milk trade across East Africa allows milk processors in Kenya to source raw milk from Uganda, especially during the dry season in Kenya when milk supply is low. The importation of raw milk ensures continuity in milk processing in Kenya all year round. The EAC trade agreements facilitate such transactions. The explanations came from a regional authority:

> 'The sale of raw milk is legal (that is why it is sold in all rural areas); but some countries have set up some regulations to control its sale in urban areas' (int., Humphery, Arusha, 2019)

> 'Previously, Kenya used to put restrictions to prevent Brookside from importing milk, yet the processor needed raw milk during the dry season, but now the processor may be taking advantage of the EAC`s common markets protocol to import raw milk. Brookside also recently acquired a major processing plant in Uganda' (int., Humphery, Arusha, 2019).

In Tanzania, there was no consensus on the legality of the sale of raw milk. Those that perceived it as legal had two schools of thought. The first argument was that the sale of raw milk was legal upon fulfilment of some legal requirements. There was, however, a non-consensus on the specific legal requirements for raw milk trading. Those mentioned included the local government trade license, registration with TDB, licensing by TBS and TFDA. Literature, however, indicates that the legal requirements for raw milk trading are registration with TDB, acquisition of a medical certificate, and a local government trading license (Urassa, 2014). The TBS and TFDA licensing requirements are for milk processors rather than small-scale traders. The misinterpretation of the requirements by regulatory authorities indicates the complexity of the multiple legal requirements. With such a lack of clarity in the legal requirements among the custodians of the law, it can only be worse among the small-scale traders and processors.

The second school of thought about the legality of the raw milk trade in Tanzania was that no policy bans it. This argument was informed by the fact that even though the dairy policy promotes the commercialization of the dairy sector, which includes milk processing, it does not explicitly ban the raw milk trade. This argument was contrary to the illegality argument presented by some regulatory agencies and development partners. The proponents of the illegality of raw milk trade quoted the Dairy Act of 2004. A clause on milk treatment may have informed this argument. The Dairy Industry Regulations part III (10) (The Dairy Industry Registration of Dairy Industry Stakeholders Regulations, 2007) requires pasteurization or such treatment of milk.

The requirement is for every trader to heat-treat milk before selling it (which could include boiling). Therefore, if the traders heat-treat milk, are registered by TDB, and obtain the local government trade license, they could sell milk legally. Another explanation for the interpretation that raw milk sale is illegal is the government's position on dairy sector development. The government seeks to achieve commercialization of the dairy sector, and one of the strategies to realizing commercialization is encouraging milk processing. The sentiments came from the interviews;

> *'Dairy Act of 2004 prohibits the sale and consumption of raw milk, although its enforcement hasn't been achieved' (int., Collins, Arusha, 2019).*

> *'Policy encourages milk processing, but enforcement has not been achieved, so the sale of raw milk is prevalent' (int., Heather, Arusha, 2019).*

Misinterpretation of the regulatory requirements by some regulatory agencies and dairy development partners has resurfaced. It is evident that there is vagueness in the multiple regulatory requirements, which may be contributing to non-compliance by some small-scale processors and informal traders.

While the legality of the raw milk trade was contested among regulatory agencies and development partners, they all acknowledged its importance in providing nutrition and livelihoods for the value chain actors. Informal raw milk trade employed multiple value chain actors, including mobile traders, retailers operating fixed premises, and milk transporters. The informal activities are critical because they have no entry barriers allowing many individuals who are not in formal employment to earn a living (ILO, 2002). For example, the informal milk trade allowed easy market access for the traders in Tanzania, where consumers preferred raw milk compared to pasteurized milk.

The raw milk trade further allowed access to an affordable source of nutrition for the many low-income earners who otherwise could not afford the highly-priced pasteurized milk. A liter of raw milk retailed for Tshs 700-2000, while a liter of pasteurized milk retailed for Tshs 1000-7800. With such a massive price difference, the pasteurized milk remained largely unavailable to resource-constrained individuals. Therefore, raw milk was a good substitute, mainly because it was sold in small affordable units, allowing consumers to purchase what they could afford. The availability of milk in affordable units is especially important in Tanzania, where per capita milk consumption is currently low. Given the high nutritional value of milk, it is important to encourage increased milk consumption, especially among vulnerable groups, including children under five years, the old, and the sick. Availability of affordable milk is key in enhancing uptake.

While informal milk trade was recognized for its contribution to the livelihoods and nutrition of the numerous value chain actors involved, concerns for the safety of the milk were raised. One of the development partners indicated that the lack of quality control and assurance of the milk traded in the informal sector elicited public health concerns. Such concerns are not unexpected given that the raw milk traded in Tanzania is often poor-quality milk that processors have rejected. Furthermore, milk traded in the informal sector is not subjected to any quality control checks. The government of Tanzania requires that raw milk be subjected to platform tests (simple preliminary quality tests that indicate the acceptability of raw milk) at the collection points before it is retailed for purchase by consumers.

However, the platform tests were not conducted for raw milk because the equipment required for the tests was often lacking at the collection centers. One of the regulatory agencies indicated,

> *'At the milk collection centres, the livestock officers are required to inspect the milk for platform tests compliance. However, the livestock officers lack necessary equipment to carry out the tests. Ideally, if milk is found to be non-compliant, it should be discarded; no fines are implicated' (int., Maya, Dodoma, 2019).*

Besides the lack of equipment to facilitate raw milk testing at the collection points, there was the challenge of raw milk reaching traders through channels other than the collection points. For example, only 1% of vendors in the study obtained raw milk from a cooperative society (table 5.1) where milk was aggregated, and there was a chance for quality testing before sale. Most of the vendors (55%) obtained the raw milk they traded indirectly from smallholder farmers. Such milk was not subjected to any quality testing before sale to consumers. The

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danger of consumption of raw milk that is not quality assured is the possibility of the milk containing disease-causing pathogens that cannot be detected through the commonly used organoleptic tests (Grace et al., 2016).

Therefore, consumers of raw milk traded in the informal sector are potentially exposed to disease-causing pathogens that threaten their health outcomes. Contamination of raw milk with disease-causing pathogens is hazardous for vulnerable populations, including children under five years, the aged, and the sick. The immunity of these population groups is often low, leaving them susceptible to severe illness. They also need to consume nutritionally dense foods such as milk to enhance their health outcomes. Therefore, it is critical to ensure that the milk sold in informal markets, which is cheap, is also safe to ensure optimal health outcomes among the vulnerable population groups.

Table 5.1: Types of raw milk suppliers for vendors

Who do you typically buy milk from	Freq.	%
Smallholder farmer	55	68.75
Middleman	14	17.5
Another vendor	7	8.75
Own production	3	3.75
Smallholder cooperative	1	1.25
Total	80	100

In the absence of any objective testing of raw milk traded in the informal sector, it was clear that the public health concerns raised by regulatory agencies and development partners were not objective. The public health concerns cited included milk adulteration, milking cows under the withdrawal period after treatment, poor hygiene, and inappropriate milk handling equipment. The concerns cited are legitimate potential causes of milk contamination with pathogenic bacteria.

However, without proper microbiological testing, it is impossible to ascertain the nature and extent of risk they pose to consumers' health (Grace et al., 2016). The study's regulatory agencies and development partners, except TDB and TBS, did not conduct microbiological testing of raw milk. Their claims were based on random tests conducted by TDB, TBS, and Sokoine University, an agricultural university in Tanzania. The challenge posed by lack of reliance on credible evidence in food safety decision-making is the possibility of inappropriate and ineffective action. For example, eliminating informal traders when the food safety risk is

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not life-threatening and in the absence of viable alternatives would disrupt the provision of nutrition and livelihoods for vulnerable groups.

Despite the apparent public health concerns for raw milk consumption, most consumers preferred raw milk. It was argued that the consumers are well aware of the public health concerns posed by raw milk consumption and only preferred it for its affordability. The following arguments were presented from the interviews:

> *'Consumers' preference for raw milk is driven by the lack of adequate supply of pasteurized milk and it's too expensive for the ordinary consumer' (int., Mike, Arusha, 2019).*

> *'Raw milk indeed is the most preferred. However, consumers view processed milk as safer, i.e., treated' (int., Rufus, Arusha, 2019).*

> *'Raw milk is only preferred because it is readily available and cheap. However, consumers are aware of the health and safety risks of raw milk consumption and would prefer to consume quality processed milk if it could be accessible and reasonably priced' (int., Luke, Arusha, 2019).*

The implication here is that the consumers have to choose between failing to consume milk, which is 'safe processed milk' because they cannot afford it, or they consume 'unsafe raw milk,' which they can afford. The consumers clearly choose to consume raw milk, which is not always unsafe because they often boil it before consumption. While boiling eliminates most pathogens present in raw milk, it does not destroy heat-resistant spores and chemicals such as antimicrobial residues and aflatoxins. Boiled milk could also be cross-contaminated by raw milk in case of inappropriate milk storage (Roesel & Grace, 2015). Therefore, there is the chance of consumers getting ill from the consumption of boiled milk.

Development partners in Tanzania recognized the importance of informal milk trade in contribution to the nutrition and livelihoods of the traders and consumers of raw milk. They also acknowledged the public health concerns it poses to consumers. The development partners have consequently invested in the improvement of food safety in the informal sector. One of the development partners was working with informal milk traders to support them in various ways. They facilitated traders to acquire stainless steel milk containers, which are the recommended milk handling containers because they are easy to clean and are food grade. They also facilitated the milk traders to acquire lactometers for milk testing at the sourcing points to ensure that only good quality milk was introduced in the value chain.

The development partner also assisted the informal traders to connect with formal processors to secure a market for the traders and a steady raw milk supply. Such an intervention by the

development partner offered benefits of improved milk quality for consumers, better access to markets by traders, and improved raw milk supply for processors. However, the sustainability of such an intervention is not guaranteed. Because interventions implemented by development partners are often donor-funded, they are only active as long as donor funding is available. Beyond the donor-funded period, the intervention activities often cease, and often the benefits gained fade. These outcomes are driven by poor coordination among development partners and a lack of collaboration with the government to systematically and sustainably prioritize and address development issues systematically and sustainably. Greater collaboration is needed to prioritize development issues and address them systematically to achieve scalable and sustainable solutions.

The government had no strategy to empower informal sector traders but instead focused on facilitating the expansion of local dairy processing. The government employed a market protection strategy to facilitate growth in local milk processing. They imposed heavy taxation on imported milk and milk products to discourage flooding of the local market with cheap imports and instead allow local processors to produce for the local market. Such market protection policies may be challenging to implement, especially because Tanzania is a party to trade agreements by WTO and EAC. They may be in breach of the trade agreements of such trade organizations. The government is also seeking to enhance farmer access to processors through farmer organizations, which will allow for negotiation for better prices by the farmers. One of the development partners presented this proposition: *'The government is also pushing for farmer organizations to access markets and the processors to improve the price for raw milk' (int., Luke, Arusha,2019).*

The strategy to have farmers collaborate would enhance efficiency in bulking milk, partly solving the challenge of inadequate raw milk supply for processors. This would be a win in government strategy to commercialize the informal sector. However, the processors would have to offer better value for the raw milk than the informal traders for such a change to be effective.

Furthermore, the dairy processors would have to offer a consistent market for the producer's milk. Given that pasteurized milk remains too expensive for consumers, it is unlikely there will be a big enough market for pasteurized milk in the short and medium term. Therefore, the processors are unlikely to offer the producers the benefits of premium price and prompt payment offered by the informal traders. The struggle of achieving commercialization through

enhancing milk processing was already being encountered in Tanzania. One of the development partners argued,

> *'The informal sector challenges the cooperatives by offering better prices in purchasing raw milk from farmers, especially in the dry season when supply is low. This challenges the formalization strategy in which raw milk is supposed to be delivered to cooperatives by farmers and then sold to processors by the cooperatives' (int., Collins, Arusha, 2019).*

Therefore, the government should stop assuming that they can eliminate informal traders from the market through commercialization. Instead, they should devise a feasible way of integrating them in the development of the dairy sector.

The persistent government position to pursue milk processing may be explained by regulatory agencies' claim of public health concerns for raw milk. One of the regulatory agencies argued that the government only tolerated the raw milk trade for lack of feasible alternative sources of nutrition and livelihoods offered by the raw milk trade. They emphasized that the poor hygiene practices among traders and lack of appropriate milk handling equipment posed public health concerns. They explained that the government lacked adequate resources to address the knowledge and practices gaps through capacity building among the traders. The dilemma of resource unavailability within the government to address the food safety challenges among informal milk traders may explain their position to eliminate the traders. However, the elimination is not feasible due to the prevailing socio-economic dynamics. An approach between the two extremes of commercialization and elimination of informal traders may be more feasible.

5.6 CHALLENGES FACED BY THE REGULATORY AGENCIES IN EXECUTING THEIR MANDATES

As discussed in the section above, regulation of the dairy sector in Tanzania is not effective. The poor performance in the regulation of the dairy sector in Tanzania is driven by various factors related to multiple mandates, which entail both policy formulation and implementation, lack of autonomy, overlapping roles among the agencies with little coordination in their execution in the context of the multiple agency governance systems, and inadequate financial and technical capacity among the regulatory agencies. The nature of these challenges is discussed in detail in the sections that follow.

5.6.1 MULTIPLE MANDATES IN POLICYMAKING AND IMPLEMENTATION

In Tanzania, dairy sector regulation is characterized by a lack of clear separation of policy and operation roles in the ministry-agency relations within the various regulatory agencies and their

parent ministries. Ideally, policy-making and direct support for political leadership are meant to be a reserve for the ministries. On the other hand, regulating agencies are charged with policy implementation to enhance performance in the delivery of public service (Bach, 2017). However, in the case of Tanzania's dairy sector, the regulating agencies are engaged in both the policymaking and implementation roles, which diminished their effectiveness and efficiency in service delivery.

The regulatory agencies engaged in policymaking at varying degrees. Some of the agencies were charged with the formulation of policies, while others contributed to policymaking by giving their opinions on policies. Some of the regulatory agencies indicated:

> 'We collaborate with the MOALF to formulate dairy sector policy, e.g., the Dairy Policy of 2006, which guides livestock production and milk handling' (int., Maya, Dodoma, 2019).

> 'We formulate policy; for example, we developed the cow raw milk standard, which processors utilise at the point of purchasing raw milk' (int., Mike, Arusha, 2019).

The implications of engagement in both policy formulation and enforcement by the regulatory agencies are inefficiency. The regulatory agencies are resource-constrained, and taking up multiple roles adds to the existing resource constraints.

While the regulatory agencies were involved in policymaking, participation in policy-making by key dairy sector stakeholders who were expected to take up the policy was limited. For example, smallholder traders in the informal sector had limited representation in the annual council. The annual council is the decision-making body in matters related to dairy sector development. The limited representation of the smallholder traders in the annual council resulted in poor representation of their views in policy formulation and therefore limited commitment in uptake and implementation.

The annual council sits under the minister of Livestock and Fisheries and is responsible for promoting a sustainable dairy sector and scrutinizing the performance of the dairy board. The board reports to the council and is the executive arm of the council, meaning that it implements the council's decisions. The annual council comprises the various dairy sector stakeholders, although the informal traders were barely represented in the annual council. The only exception was small-scale traders from the Mwanza region, one of the high potential regions for dairy production in Tanzania. The reasons cited for the small-scale informal traders' poor representation were their lack of organization and, therefore, lack of voice in the board's decision-making. The lack of organization of informal traders was also reflected in the study

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where trader associations are non-existent. None of the traders who participated were a member of a traders association. On the contrary, the private sector processors dominated representation in the annual council and consequently had a huge stake in decision- making within the annual council, where decisions are arrived at via majority vote. The study was informed:

> *'Decision-making is through discussion of agendas proposed by the board members and voting by majority. Currently, the private sector is the majority member of the dairy board and therefore carries the decisions most of the time' (int., Keith, Arusha,2019).*

The poor representation of key stakeholders in dairy sector policy formulation was characteristic of non-inclusive policymaking where it is perceived as a function of a specific government administrative siloes. However, the approach often results in implementation difficulties due to poor policy uptake by important stakeholders who are not involved in formulation (Hudson et al., 2019). Therefore, policy formulation requires the engagement of all relevant stakeholders to reach inclusive common decisions that the multiple stakeholders will effectively implement.

However, even though the private sector dairy processors had significant influence in decision-making within the annual council, implementation of decisions by the dairy board was reported as not completely autonomous. As a result, some processors indicated that their concerns were not always addressed adequately. It was reported*: 'Our issues are not addressed very effectively; there are often delays in implementing our views/ opinions' (int., Tom, Dar es Salaam, 2019).* The dairy board was not autonomous in decision-making, with some directives coming from the MOALF. Therefore, even decisions arrived at by the annual council were not always executed in their original state. Instead, there was often interference from MOALF.

5.6.2 LACK OF AUTONOMY IN DECISION MAKING AMONG THE REGULATORY AGENCIES

Granting regulatory agencies management autonomy is considered critical in enhancing the efficiency and effectiveness of the agencies in delivering public services. Additionally, literature on regulatory agency argues that agency autonomy in restricting politicians' interference with agency decisions is the solution to achieving reliable commitment, avoiding conflict in policy, and addressing the uncertainty of the political environment (Bach, 2017; Hudson et al., 2019). However, managerial autonomy was not achieved among the regulatory agencies, and in all instances, decision-making occurred at the ministerial level, and instructions for action were conveyed to the agencies. The process can be understood from the following excerpts from interviews:

'Decision-making is by the central government through the ministry of Local Government Authority. Through the Assistant Minister, the Minister passes the decisions, then to the permanent secretary, who relays them to the various departments' (int., Maya, Dodoma, 2019).

'The board is still not autonomous, with some decision-making controlled by the MOALF' (Toby, Arusha, 2019).

'Decisions are made from the top and communicated down the structure for implementation except for standards development, which the standards officers lead. The institution is semi-autonomous and only gets government funding for salaries, but other institution operations are self-funded' (int., Mike, Arusha, 2019).

'Ward heath officer reports to a District Health Officer who reports to a district medical officer who reports to the district executive director. Directives come from the District Executive Director and are passed down the command chain' (int., Jayne, Arusha, 2019).

The lack of autonomy in decision-making among the regulatory agencies limits their effectiveness in enforcing the regulations at the local level in a manner that is responsive to specific localities. Centralized decision-making is counterproductive in regulation implementation and enforcement. Literature indicates that what works in one locality does not necessarily work in other contexts (Hudson et al., 2019). Regardless of whether the system of governance is centralized or dispersed, there is a need to achieve local universality where regulations are customized to suit the local context of implementation (Sausman et al., 2016).

Besides the lack of managerial autonomy among the regulatory agencies, the political class's interference in implementing the sector regulations and policies also emerged as a major problem. According to an official, the implications are that*: 'Political interference limits our ability to exercise power because some of the stakeholders have strong political affiliation' (int., Toby, Arusha, 2019).* The lack of autonomy was prevalent among the regulatory agencies, and the great interest often justifies state interference that the state has in developing the agricultural sector, which is perceived as a pillar for economic development. For example, during the establishment of the dairy board, the board was intended to be autonomous and entirely funded by dairy sector stakeholders. However, it became impossible to eliminate the state because of its great interest in developing the dairy sector as a pathway for economic development and poverty eradication.

The lack of separation of policymaking and implementation for the regulatory agencies and a lack of managerial autonomy limited the efficiency and effectiveness of the agencies in accomplishing their service delivery mandate. The ministries, however, maintained control

over the performance of the agencies. The regulatory agencies operated under performance indicators set by the ministries and were evaluated periodically for their performance in meeting set targets. The position can be understood from the following interview excerpts:

> 'Annual performance is reported to the MOALF, and the institution's overall performance is further assessed by the treasury registrar' (int., Toby, Arusha, 2019).

> 'Annual targets are set by the ministry and passed over to the employees, which are then assessed at the end of the year' (int., Jayne, Arusha, 2019).

The study further established from key informants that the TBS officers responsible for inspections have annual targets set by their supervisors, and the targets are stratified based on the amount of revenue generated from the inspections. The larger processors with a broader range of processes and products for inspection pay more than the smaller processors with fewer processes and products eligible for inspection, and therefore the larger processors are inspected more frequently than the small processors.

The use of such specific performance targets for the regulatory agencies by the parent ministries has two dimensions on how it affects the performance of the regulatory agencies. On the one hand, it ensures that the regulatory agencies prioritize achieving goals that are top of the agenda for the government of the day. On the other hand, such control on performance areas limits the scope of action by the regulatory agencies. The problem with the latter outcome is that it creates rigidity among the regulatory agencies, exacerbating failure to adapt to local contexts in the implementation and enforcement of the law. The result is inefficiency in the enforcement of regulation.

5.6.3 POOR COORDINATION AMONG THE REGULATORY AGENCIES

Besides the lack of separation of policymaking and implementation roles and lack of decision-making autonomy among the various regulatory agencies, poor coordination among the agencies also hindered good performance. For example, the various agencies' licensing, registration, and inspection activities were conducted with little or no collaboration among the regulating agencies. The lack of coordination limited the potential benefits of collective action in achieving better food safety regulation in the dairy sector. While literature indicates the existence of up to 17 agencies involved in regulating food safety in the dairy sector, the most frequently cited collaboration by the regulatory agencies was working with TDB (fig. 5.2).

The local government worked with the board to appoint dairy inspectors at the local government level who effected the registration and inspection activities on behalf of TDB. TBS

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collaborated with TDB, where TBS assisted TDB in developing standards to regulate both the formal and informal dairy sectors in Tanzania. TBS also collaborated with TDB, MOALF, NEMC, and the Atomic Energy Agency to conduct periodic inspections of dairy processors. They jointly inspected for compliance with the regulatory requirements. Through trade officers at the local government authorities, BRELA collaborated with TDB to recruit traders for participation in the milk consumption day campaigns. TDB, on the other hand, worked with DVS to control the import of safe milk and milk products and offer capacity building among dairy value chain actors in zoonotic diseases.
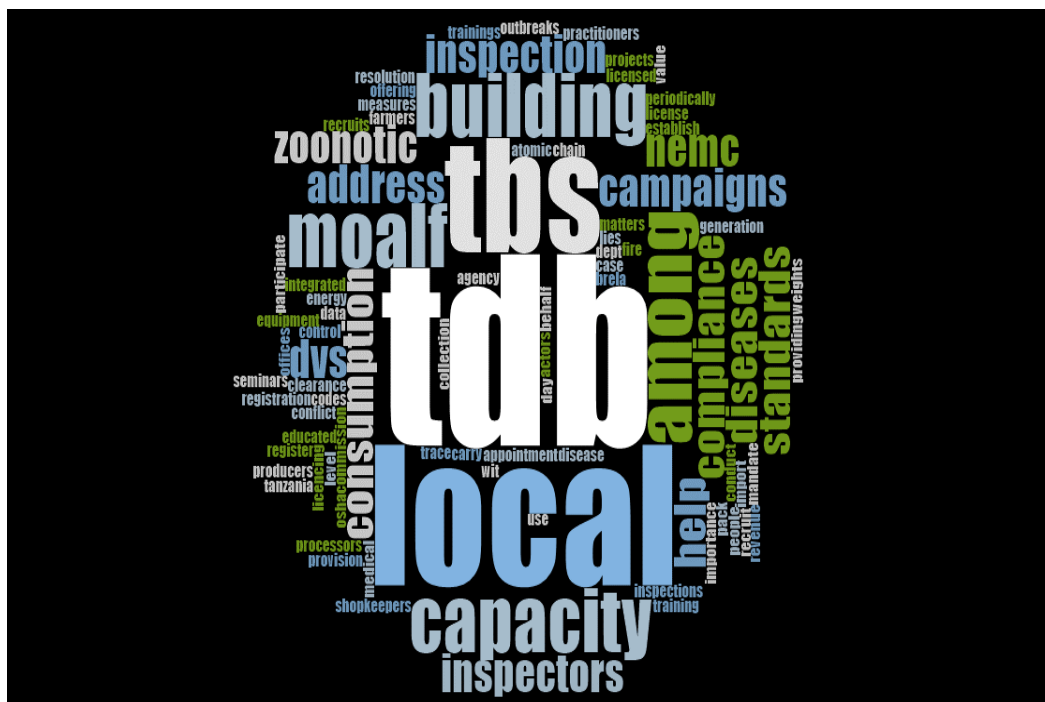
Fig. 5.2: Frequency of collaboration among regulatory agencies

Such lack of collaboration results in duplication of regulatory activities by regulatory agencies who are already resource-constrained. The affected milk traders and milk processors on the other hand are faced with the burden of multiple agencies, who often have a different perspective in dealing with non-compliance.

5.6.4 POOR INFRASTRUCTURE, FINANCIAL, AND TECHNICAL CAPACITY DEFICIENCIES AMONG REGULATORY AGENCIES

The regulatory agencies also expressed challenges related to financial and technical capacity and inadequate access to appropriate infrastructure to execute their food safety regulation mandates. In terms of financial capacity, all the regulatory agencies that participated in the study indicated that they were underfunded. The national government partially funded the

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annual budgets of the regulatory agencies, but the proportion of the annual budget funded by the national government was limited. Alternative activities for revenue generation did not yield adequate financial resources to finance the activities of the regulatory agencies resulting in inefficiency and ineffectiveness in service delivery. Other sources of revenue for the regulatory agencies included donor funds, issuance of licenses, and fines from non-compliance. However, the processes of funding were not without challenges, as indicated from the excerpts from interviews:

> 'The organization is funded in 2-3 ways: mandatory partner state contribution - each gives the same amount each year, but these contributions are not always remitted in time, donor grants --e.g., USAID, EU, China, etc. The donor determines the priority sector to fund. Health, trade, customs, and agriculture are among the preferred funding sectors; health receives more funding than agriculture, loans-- procured by partner states for regional projects, especially infrastructure, energy, and transport. The African Development Bank (the main one) assesses the applications and determines which projects to fund. The organization also writes proposals independently or with partners in the region' (int., Humphery, Arusha, 2019).

> 'The central government funds office overhead costs. Other operational costs at all levels of the office are funded through revenues generated through service provision. Development partners fund activities that they are involved in' (int., Maya, Dodoma, 2019).

> 'The central government funds certain initiatives such as mass vaccinations. Another source of funding is revenue generated from levy collection activities. The funds are usually insufficient, but the available funds are directed to development activities as much as possible to benefit the citizens' (int., Jayne, Arusha, 2019).

> 'The central government provides approximately 10% of the total annual budget. Own revenue generation from registration fees of dairy actors, inspection fees, and permits to carriers and importers of milk. This contributes 90% of the board's financial resources. The amount is insufficient to cater to the Boards annual budget and covers up to 40% of the annual budget. Efforts to cover the deficit include registration of dairy stakeholders who are charged registration fees and levies, collaboration with partners who are like-minded and therefore fund the board activities, gifts, and donations although it is now difficult to get donor funding for government institutions; large projects funded through the central basket' (int., Toby, Arusha, 2019).

> 'The central government funds salaries. The institution's own revenue generation funds other operation costs. If the agency generates revenue that exceeds their annual expenditure, the excess is remitted to the Ministry' (int., Mike, Arusha, 2019).

> 'Central government allocates about 20% of the overall budget; 80% is raised through its revenue-generating activities, including the issuance of licenses. Expenditure of own generated revenue authorised by the local government' (int., Rufus, Arusha, 2019).

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The inadequacy of the financial resources for the regulatory agencies was cited by all the regulatory agencies that participated in the study as a major challenge in the execution of their mandates in the regulation of food safety in the dairy sector. The fact that inadequate financing was cited as a key operational challenge by all the regulatory agencies shows how much the lack of resources constrains them in executing their regulatory mandates. For example, one of the agencies explained that they had very limited reach to the traders for registration and compliance inspection purposes. The limited reach to the traders was explained to be driven by a lack of adequate financial resources to fund such operations of the board. The inadequate financing is typical of the multiple and ineffective regulatory agencies that characterize governance in developing countries (Grace, 2015). The lack of financial resources among the regulatory agencies limits their capacity to effectively acquire the requisite technical capacity and infrastructure to implement food safety systems.

As a consequence of inadequate financial capacity among the regulatory agencies, the agencies indicated a lack of adequate technical capacity-constrained them. The lack of adequate technical capacity translated to inadequacy in competent staff necessary to execute the regulatory functions of the agencies effectively. For example, one of the regulatory agencies explained that they had a limited number of technical staff recruited to register milk traders and processors and inspect for compliance. The shortage of technical staff was caused by inadequate financing of the regulatory agency, which did not have funds to finance salaries for the technical staff. Besides the lack of financial resources to recruit staff, ineffective bureaucracy within the agencies was reported to cause delays in the appointment of dairy inspectors at the local government level.

The dairy inspectors were appointed and paid by the regulatory agency to act on its behalf at the local government, but bureaucratic processes between the agency and the local government put off the appointment. The inadequacy of technical staff negatively impacted the agencies' performance because the limited staff was often overwhelmed with excessive workload. The existence of adequate technical capacity is critical in implementing food safety systems (Jaffee et al., 2019), whose absence will result in poor performance, as seen in Tanzania.

Lack of adequate infrastructure, including equipment for testing milk quality, sanitary physical markets, and vehicles to facilitate movement of staff in pursuit of their day-to-day activities, challenged regulatory agencies' effectiveness. The study was informed:

> *'We are constrained by a lack of infrastructure, i.e., vehicles to inspect'* *(int., Rufus, Arusha, 2019).*

'We lack equipment for extension officers and means of transport to reach their clients' (int., Maya, Dodoma, 2019).

'The local government is not very keen on regulating the milk trade; there are no designated areas for the sale of milk in the market compared to other food products, which have been allocated specific areas of operation in the markets. Longido is an exception and has a designated area for milk sales' (int., Toby, Arusha, 2019).

The lack of infrastructure is a direct result of the scarcity of financial resources among the regulatory agencies. The government fails to put up public infrastructures such as potable water, sanitation, and proper physical market structures without adequate financial resources. The government also fails to provide funding among individual regulatory agencies to acquire agency-specific infrastructure such as testing equipment. The net effect was the inability of the agencies to implement food safety systems because food safety prerequisites such as hygiene and quality monitoring could not be met.

5.6.5   LACK OF RESEARCH AND DATA ABOUT THE DAIRY INDUSTRY

Another challenge that hindered effectiveness and efficiency in regulation of the dairy sector was the lack of research about industry dynamics and related data to inform regulation strategies. There was very limited risk assessment for raw milk among the dairy sector regulatory agencies. One of the critical components of food safety risk assessment entails identifying and profiling food safety hazards within the value chain. This would entail rigorous and systematic microbiological testing to identify and profile pathogenic microorganisms in raw milk. However, there was very limited microbiological testing in raw milk in Tanzania's dairy sector. The testing was conducted sporadically by TDB and TBS, the main custodians of public food safety laboratories in Tanzania. Sokoine University, an agricultural university in Tanzania, also conducted random investigations on raw milk. While evidence in milk safety was random and scattered, the regulatory agencies relied on this information to make decisions about the safety of raw milk. The situation could be explained by excerpts from interviews detailing sources of evidence for the claim of poor food safety of raw milk by regulatory agencies:

'My insights are informed by research conducted by TDB in collaboration with Sokoine University of Agriculture on milk safety and quality' (int., Toby, Arusha, 2019).

'Attitude based on personal insights. the office does not conduct individual research regarding the informal sector' (int., Jayne, Arusha, 2019).

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'Attitude are based on reports from institutions of higher learning and TDB test results. The local government does not carry out independent research' (int., Maya, Dodoma, 2019).

Besides the lack of credible evidence to inform decision-making, access to the limited existing data was constrained. There was no coordinated collection, management, and important data sharing among the various ministries and regulatory agencies. One of the regulatory agencies reported: *'We lack access to credible data due to lack of proper management' (int., Maya, Dodoma, 2019).*

The impact of making food safety decisions without relying on credible evidence is inappropriate policy action. This could be overreacting by imposing punitive and destructive measures while the risk is not life-threatening. The other extreme is an implementation of policy measures that are inadequate in addressing prevailing food safety risks. Both scenarios are common in food safety systems in developing countries (Grace, 2015).

The challenges faced by the various regulatory agencies result in threats and weaknesses (table 5.2), which need to be addressed to enhance effectiveness of the regulatory agencies. The regulatory agencies are also characterized by strengths and opportunities (table 5.2), which could be tapped into to enhance performance.

Table 5.2: SWOT analysis of regulatory agencies

Regulatory agency	Strengths	Weaknesses	Opportunities	Threats
TDB	• Efficient in the process of registering traders • Mandated to enforce food safety regulation in both formal and informal sectors	• Inadequate financial capacity • Inadequate technical capacity • Frequently changing leadership and priorities • Unaffordable initial and subsequent annual registration fees for informal traders • Multiple mandates in policy formulation and regulation enforcement	• Engaging livestock officers at the local government level to undertake registration of traders and enforcement of milk safety regulation on behalf of the board • Provision for alternative code of conduct and self-regulation approaches without hefty cost implications	• Incapacitated to reach all traders for registration and food safety regulation • Political interference limiting execution of mandate • Lack of ownership of policy and commitment to uphold it by value chain actors

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	Strengths	Weaknesses	Opportunities	Threats
		although limited in capacity • Poor representation of informal actors in policy making decisions • Lack of capacity to generate credible data to inform decision making	for the traders to enhance food safety	
TBS	• Has capacity and mandate to develop quality and food safety standards for both the formal and informal sectors • Performance centrally managed at the ministerial level which keeps the officers accountable	• Enforcement of standards limited to the formal sector and none for the informal sector whatsoever • Inadequate laboratories • Inadequate financing and technical capacity • Lack of capacity to generate credible data for decision making	• The bureau could engage the informal value chain actors during formulation of policy for the informal sector to enhance policy ownership and commitment to comply with it	• Inability to achieve its mandate of safeguarding food safety in processed dairy products due to poor policy uptake, implementation and enforcement among formal processors and handlers of raw milk in the informal sector
EAC	• Possesses mandate and capacity to develop regional policies for food safety regulation of dairy products	• Inadequate technical and financial capacity	• Potential to harmonize regulation of food safety in both formal and informal dairy sectors among member states	• Poor uptake and implementation of policy by member states which limits achievement of its mandate and relevance
BRELA	• Has functional representation at the local government authority that allows for the issuance of trade licence to	• Lack of capacity to reach all small-scale informal sector dairy traders	• Awareness creation among the traders on the importance of regulatory compliance and the	• Political interference which limits execution of licencing mandate • Low compliance with informal

	both formal and informal traders		resulting benefits such as access to formal lending facilities • outcomes. • Reduction of compliance costs to encourage trader compliance	traders comprising only 1% of all trade licences issued. • Lack of legitimacy among traders who did not trusts the agency intentions from a lack of access to formal lending facilities
Public Health Office	• Mandated to engage in public health policy formulation, issuance and inspection of medical certificates to formal and informal traders • Effective in the process of issuance of the medical certificate; issued in 2 days if all requirements were met • Actively involved in capacity building of informal traders.	• Inspection mandate overlapped with those of TBS and TFDA • Lack of autonomy in decision making • Inadequate financial and technical capacity	• Capacity building of value chain actors in appropriate milk handling practices to achieve milk safety	• Cost of acquisition of the medical certificate unaffordable to traders • Low compliance 71% vendors and 83% intermediaries non-compliant threatening their mandate to safeguard public health for consumers
Local Government Authority	• Provides capacity building in good production practices • Has established cooling infrastructure in communal	• Inadequate financing • Inadequate infrastructure • Bureacratic process in selection of agencies from other	• Has potential to harmonize food safety activities through the agents from various regulatory agencies that	• Bureaucratic processes in engagement of agents from the various regulatory agencies could potentially threaten their mandate to

	milk collection centres • Has the capacity and mandate to enforce regulation on behalf of national agencies at the local level • Ability to coordinate functioning of the various agencies represented at the local level	government agencies	work under them	localize service provision

5.7   CHAPTER SUMMARY

The dairy sector regulation in Tanzania was characterized by multiple regulatory agencies responsible for policy formulation and implementation. Furthermore, the agencies' mandates often overlapped, and there was very little coordination among the agencies. The agencies reported the ineffectiveness of the regulatory system in ensuring food safety, especially in the highly fragmented informal sector. Besides the overlapping mandates and poor coordination, the regulators cited lack of autonomy and adequate evidence about raw milk food safety risks as contributing to poor effectiveness in food safety regulation.

The challenges cited above were fundamentally driven by a lack of adequate financing to fund the operation and capital costs of the regulatory agencies. Consequently, they were all aggressive in revenue collection in the form of license fees and penalties for noncompliance because the revenue collection was the largest contributor to their budget money. The inadequate financing impacted negatively on the availability of technical capacity and requisite infrastructure among the regulatory agencies. The two elements are fundamental for food safety governance, and their inadequacy translated to ineffective food safety regulation in the dairy industry. Their inadequacy among the regulatory agencies in Tanzania negatively impacted their performance in implementing the Codex food safety standards.

Achieving effectiveness in implementing the Codex food safety standards by the regulatory agencies in Tanzania would require adjustments in the governance of food safety regulation. There is a need for better clarity in the roles of regulatory agencies, greater cohesion and coordination among the regulatory agencies, greater horizontal integration of relevant stakeholders in policy formulation, and better resource allocation. While the governance structures are easier to adjust, the financial allocation is hard to change. Like other developing countries, Tanzania has other more urgent development agendas such as education and health care that compete for financial resources. Without guaranteeing increased resource allocation in food safety, it is more viable to pursue alternative food safety systems that are not resource-intensive.

6 T&C REACH, EFFECTIVENESS, AND DRIVERS OF SUCCESS

6.1 INTRODUCTION

Chapters 4 and 5 detailed the challenges faced by the dairy value chain actors and regulators in achieving food safety in Tanzania's dairy sector. The inefficiency of food safety regulation in the dairy sector has resulted in the proliferation of informality. In the informal sector, value chain actors operate outside of food safety regulations or only comply partially with the food safety regulations. The informal sector is characterized by a lack of adequate infrastructure (potable water, physical structures, cold chain, and equipment for testing milk quality, among others) and inadequate skills in identifying and mitigating food safety hazards. Therefore, food safety hazards are common in informal food markets and may pose the risk of food-borne illnesses among consumers.

The burden of food-borne illnesses has recently been high, especially in developing countries where food is predominantly traded in the informal sector. As a result, there has been growing investment in policy interventions in developing countries to address food safety concerns and regulations in the informal markets. One such policy intervention is the (T&C) of milk traders implemented in Tanzania's informal dairy sector. The intervention combines direct and indirect policy measures to address food safety and regulation of informal traders.

This chapter seeks to determine the effectiveness of the intervention. The intervention effectiveness is assessed by the extent of reach among the target audience (traders), change in milk safety knowledge among traders, changes in milk handling practices among traders, and improvement in milk safety after traders. The study also assesses the contribution of individual direct and indirect policy measures to the effectiveness of the intervention. The direct and indirect policy measures were integrated into the intervention theory of change as activities or assumptions. This chapter utilizes primary data and policy document review for the intervention assessment. The chapter also references the T&C intervention theory of change by Johnson et al. (2015) for the intervention activities, anticipated intervention outcomes, and underlying intervention assumptions.

6.2 TRAINING AND CERTIFICATION REACH

The study assessed the direct reach of the T&C intervention by determining the proportion of informal milk traders in the study who had participated in the training and certification. Among the study sample, 15% and 17% of vendors and intermediaries had attended the training, as highlighted in Table 6.1. Mobile vendors who are very small-scale traders had the highest proportion of trained individuals at 45%, compared to milk bar vendors, restaurant vendors, shops, and intermediaries, as represented by Table 6.1. The BDS providers who delivered the training to the informal traders also indicated that they engaged very small numbers of the traders. One of the BDS providers had only trained 20 traders between 2010 and 2017, while a second BDS provider trained five in 2010. The small proportion of traders who had participated in the intervention is indicative of poor intervention reach. Poor intervention reach implies that many informal milk traders were not exposed to the intervention activities. The untrained traders, therefore, missed the intervention's opportunity to improve their knowledge in milk safety and hopefully improve their milk handling practices.

Table 6.1: Milk trader types and their participation in training and certification

Type of dairy trader	No. of responses	% of respondents attending training
milk bar (n=10)	10	0
mobile seller (n=22)	20	45
Shop (n=43)	42	5
Other (restaurant) (n=8)	7	14
Total vendors (n=83)	**79**	**15**
medium-size middlemen (larger vehicles,) (n=6)	5	40
very small-scale middlemen (motorbike) (n=8)	8	13
very small-scale middlemen, (walking) (n=9)	9	11
Unknown (n=1)	1	0
Total middleman (n=24)	**23**	**17**

Trader participation in the T&C required disseminating the right information about the intervention and its benefits to the right people through the right channels. In Tanzania, the intervention targeted small-scale traders for two reasons. First, they handle the largest proportion of all milk traded in Tanzania through a very long value chain and therefore have

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greater potential for selling contaminated milk to consumers. Second, for their perceived lack of knowledge and capacity to achieve milk safety. The T&C in Tanzania was designed with a sensitization campaign component for the small-scale traders. The TDB was supposed to conduct information dissemination sessions among the traders, informing them of the existence of the training and certification and its purpose to improve the overall milk quality in the sector (Cherono et al., 2012).

The intervention envisioned information dissemination through traders associations for easy access of traders. The sensitization was meant to clarify that the intervention intended to improve milk quality standards through capacity building among the milk traders. More importantly, it provided clarity that the intervention did not seek to identify and punish the traders who were poor performers in achieving milk safety. The successful implementation of the sensitization campaigns would encourage traders' uptake of the T&C, knowing that the regulators support the initiative (Johnson et al., 2015).

Dissemination of information on T&C of the traders, however, was limited. The campaigns were implemented in the early stages of intervention implementation when donor funding was available to mobilize the traders. However, beyond the donor-funded period, the dissemination campaigns ceased. Two explanations emerged for the discontinuation of the information dissemination campaigns. The first explanation was difficulty in reaching the traders individually because trader associations did not exist. Milk vendors in Tanzania were not affiliated with trader associations (table 6.2). The reason cited by traders for lack of affiliation with trader organizations was the lack of existence of such organizations. One of the vendors explained, *'There are no such associations currently; they were once there, but I do not know where they disappeared to' (Matthews, Arusha, 2019).*

Table 6.2: Vendors affiliation to milk traders' associations

Are you a member of any association representing vendors' interests?		
	Freq.	Percent (%)
No	5	100
Total	5	100

The lack of trader associations meant that the traders operated at an individual level. Because they are numerous and geographically scattered, they were difficult to access for information dissemination.

The second reason cited was the lack of funding within TDB for the dissemination activities. Two reasons were cited for the lack of budgetary allocation within TDB for the dissemination campaign activities. The first reason was a general lack of adequate financial resources within TDB to fund the board activities. As previously discussed in chapter 6, the dairy board could only raise 40% of their total annual budget. The central government-funded 10% of the board's annual budget. The remaining 90% budget was funded through the board's revenue collection activities, including registration fees, penalties for non-compliance, disposal of assets accumulated by the board, donations, and gifts from development partners. However, efforts to register dairy sector actors and collect related registration fees were significantly constrained by a lack of adequate staff to coordinate the registration activities.

The board had five permanent technical staff nationally at the time of conducting this study. Further, the five-year term for 72 contracted dairy inspectors at the local government had expired the previous year prior to the study period. The lack of technical staff meant that the board could not execute registration and inspection activities on a large scale. The net effect of the limited registration and inspection activities was limited revenue collection. Donations from development partners were also challenging for the board to secure because development partners preferred to work with the national government.

The second reason cited for the lack of funding for the T&C and related activities of sensitization campaigns by TDB was the lack of support of the initiative from the board's management. A regulatory agency explained that the board's leadership had a high rate of turnover where the leadership changed hands every five years. With the frequent change in leadership, the priority activities also changed frequently, with each leadership administration having different priorities. Where leadership did not prioritize milk safety, the T&C were not allocated funding. The study informed:

> *'Implementation of the T&C intervention was challenged by a lack of support from management who did not embrace the initiative. The lack of policy that supports the scheme has made it difficult to secure funding, especially with the frequent change in leadership' (int., Toby, Arusha, 2019).*

Establishing a policy that requires budgetary allocation for the intervention activities may secure consistent budgetary allocation for the intervention. Such a policy would shield the

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intervention from the neglect in budgetary allocation driven by selective prioritization of investment by the management. Due to the limited duration of leadership, there is a tendency among leaders in public offices to support development agendas that are popular among the electorate to gain a political advantage (Hudson et al., 2019). Development agendas that are less popular among the electorate, even if important such as the T&C intervention, often receive no support.

The lack of adequate financial capacity within TDB, therefore, limited delivery of the T&C sensitization campaigns. Furthermore, it limited TDB's activities to promote milk safety among informal dairy traders. Away from the T&C intervention, TDB initiated the provision of lactometers and milk storage equipment, which was disrupted by inadequate funding of the board. One of the traders stated,

> 'TDB provided us with lactometers and promised to provide us with stainless-steel milk handling containers, but they have never delivered the stainless-steel milk handling containers' (int., Sharon, Arusha, 2019).

While the intervention uptake among the traders in the study was limited, various stakeholders took up the intervention for dissemination. The traders indicated that they had received training from private providers, government extension workers, NGOs, other traders, ILRI, and the Tanzania Dairy Board (TDB). With the wide range of training providers at the implementation stage, there is room for uptake of other modes of dissemination of information, including the use of media outlets by NGOs or private providers with endorsement by TDB to give legitimacy to the sensitization campaigns. One of the development partners suggested using government-owned media outlets to disseminate information about the T&C to potential recipients as an alternative to the sensitization campaigns. The development provider argued that using state media would facilitate wider coverage of information dissemination at no additional cost to the government. In the future, the utilization of government media outlets may be explored for the cost-free dissemination of sensitization information to traders.

Uptake of the T&C intervention further required an enabling policy environment so that traders would be willing to be identified and participate in the intervention activities freely without fear of being penalized (Johnson et al., 2015). Results indicated no enabling environment for the informal dairy sector. There were no deliberate efforts to support the government's informal sector, and neither was the sector illegal. The current approach to informal dairy sector governance is neglect, leaving issues such as milk safety unaddressed and exposing consumers to potential public health risks from consumption of unregulated milk and milk products.

Power relations among the various categories of traders, consumer groups, and regulators are important in formulating and disseminating messages about the T&C (Johnson et al., 2015). In Tanzania, the informal dairy traders had a positive working relationship with the regulators. Most vendors and intermediaries indicated that they did not experience harassment or support from the regulators, while a few indicated they were harassed for non-compliance (table 6.3). The traders cited harassment from traffic officers during milk transportation, while others argued that the regulatory agencies were very adamant about their revenue. However, some traders felt that the government did not offer any support for their businesses because the government rarely interacted with the informal sector.

Some of the responses by the traders about the nature of their relationship with the government were:

> *'The government has a positive attitude to my business but insists on cleanliness and environmental protection' (int., Yvette, Arusha, 2019).*

> *'There are no disturbances from the government because we are at the lowest level to be followed upon' (int., Jake, Arusha, 2019).*

> *'I have not experienced any conflict or assistance from the government' (int., Donna, Arusha, 2019).*

Table 6.3: Middlemen and vendors assessment of government attitude towards the informal sector

Middlemen			Vendors		
Government attitude	Frequency	%	Government attitude	Frequency	%
No harassment	5	23%	No conflict	18	38%
No support	5	23%	No support	14	30%
Do not know	4	18%	No conflict if licensed	11	23%
Keen on sale of milk from Al containers	2	9%	Public health advises on hygiene	2	4%
Penalized for non-compliance	2	9%	Heavy taxation	1	2%
Harassment for being informal	1	5%	Interacts with vets for vaccinations	1	2%
Insist on production and sale of milk	1	5%	Total number of responses	47	100%
Takes bribe	1	5%			

Training through TBS	1	5%			
Total number of responses	22	100%			

The traders further indicated that the attitude was largely consistent among the various informal dairy sector regulators, including TDB, local government, and public health (table 6.4).

Table 6.4: Vendors and middlemen assessment of variation of attitude among government agencies

Vendors			Middlemen		
Variation of attitude between government agencies	**Frequency**	**%**	**Variation of attitude between government agencies**	**Frequency**	**%**
No	69	86%	No	21	91%
Yes	11	14%	Yes	2	9%
Total number of responses	80	100%	Total number of responses	23	100%

A few traders reported having received support in achieving food safety compliance from the regulatory agencies. For example, TDB provided the traders with lactometers for testing milk quality and promised to provide aluminum milk handling cans, although the aluminum containers were yet to be delivered at the study time. Some traders also indicated that they got support from public health officers who offered them advice on achieving adequate hygiene levels. While there was some extent of support from the regulatory agencies, it was limited by inadequate funding among the agencies.

Furthermore, such support was limited to milk traders who operated from fixed premises while the mobile traders were left out. Therefore, the messages for the sensitization campaigns in the case of Tanzania only needed to emphasize the already popular position that the government had no intention to identify and punish the non-compliant traders. Instead, the government sought to facilitate their capacity building to enhance food safety. The message would be more readily acceptable in Tanzania compared to contexts where informal traders are harassed by the government authorities and therefore view the authorities as their enemies.

While the authorities were not hostile towards informal traders, the regulatory instruments were vague on the legality of the raw milk trade in Tanzania. Consequently, their interpretation was ambiguous by the dairy stakeholders. For example, some dairy regulatory agencies and

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development agencies that took part in the study thought raw milk was illegal, while others indicated it was legal. The varied perceptions can be understood from the interview excerpts below:

> *'The sale of raw milk is legal; there is no specific law that prohibits its sale. Milk traders operating in fixed premises or milk collection centres must have the general local government trade license, but the local government issues no specific license for milk trade' (int., Maya, Dodoma, 2019).*

> *'The sale of raw milk is illegal, but the sale happens, and no action is taken. The reasons for the existence of the raw milk trade include inefficient milk processors who operate below capacity and cannot fulfil the market demand. Processors further offer a low price to farmers who otherwise fetch better prices for their milk from the informal sector' (int., Mike, Arusha, 2019).*

The sale of raw milk is legal if the trader is registered with TDB and has a local government business permit. These requirements are enshrined in the Dairy Industry Act, Regulations (2007) part II (4&5) and second schedule (3) of the regulations, section IV (11) of the Business Activities Registration Act (2005) and the Public Health Act 2009, part V (138). The Business Activities Registration Act states:

> *'Each business operating in Mainland Tanzania shall be required to obtain a certificate of registration from the Business Registration Centre within the local authority where the business is located' (p 8).*

The Public Health Act addresses issues around health compliance and licensing of operations. It states:

> *'For the purpose of compliance with public health matters, a person shall not engage in food manufacturing within the area of the Authority without being registered by the licensing authority' (p 72).*

These issues also emerged during the study. A majority of the participants confirmed the legality of raw milk trading upon acquisition of the business permit, registration with TDB, and acquisition of medical clearance certificate from the public health office as highlighted from responses below:

> *'The sale of raw milk is legal as long as the milk passes platform tests conducted by dairy inspectors, and the traders are registered with TDB and licenced to trade by the local government' (int., Toby, Arusha, 2019).*

> *'Milk traders operating in fixed premises or milk collection centres must have the general local government trade license, but the local government issues no specific license for milk trade' (int., Maya, Dodoma, 2019).*

However, some regulatory agencies indicated additional requirements for vendors to have a license from the Tanzania Bureau of Standards (TBS) and Tanzania Food and Drug

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Administration (TFDA). The argument for licensing by TBS and TFDA aligns with the requirement for milk processors to be licensed by a food regulatory body as indicated in the second schedule (5) of the regulations (The Dairy Industry (Registration of Dairy Industry Stakeholders) Regulations, 2007).

Other regulatory agencies stated that the raw milk trade is illegal in Tanzania. A clause may inform the position that raw milk trade is illegal on the Dairy Industry Regulations part III (10) (The Dairy Industry (Registration of Dairy Industry Stakeholders) Regulations, 2007), which requires pasteurization or such treatment of milk. The requirement is for every trader to heat-treat milk before selling it (which could include boiling). Therefore, if the traders heat-treat milk, are registered by TDB, and obtain the local government trade license, they could sell milk legally. Therefore, while the law does not expressly ban raw milk trade in Tanzania, its legality is ambiguous depending on the interpretation adopted by individuals.

6.3 EFFECTIVENESS OF THE T&C INTERVENTION AND REALIZATION OF UNDERLYING ASSUMPTIONS

Besides intervention reach, the study assessed the extent of effectiveness achieved in the implementation of the intervention. Training effectiveness measures how much a training program has achieved on specific outcomes, including potential positive and negative effects, quality of life, and economic outcomes (Shaw et al., 2019). Training effectiveness in a broad context indicates the extent to which intervention components such as trainee characteristics, training design, delivery, and the working environment were satisfactory for the training participants. Intervention effectiveness also indicates whether training objectives were achieved and whether training content was transferred to training recipients (Vaessen et al., 2020). These aspects could be assessed using a combination of trainee reaction, learning performance, behavioral changes, and organizational performance. The study assessed the effect of training on traders' knowledge in milk safety and quality, the effect of training on milk handling practices among traders, and the effect of the intervention on milk quality, which was determined using milk spoilage rate as a proxy.

6.3.1 EFFECT OF TRAINING ON KNOWLEDGE OF TRADERS IN MILK SAFETY AND QUALITY

The training was designed to provide knowledge and skills to enable the training participants to become certified and apply better food handling practices (Johnson et al., 2015). To assess the potential effect of receiving training on the understanding of milk quality and safety, traders participating in the survey were asked to list the top three attributes they associated with milk

quality and milk safety, respectively, in order of importance. Table 6.5 reports the proportion of participants that reported each characteristic among their top three. Largely, trained and untrained vendors reported similar characteristics when depicting the meaning of milk quality and milk safety (table 6.5).

Table 6.5: Meaning of milk quality and milk safety among trained and untrained traders

Meaning of milk quality (n untrained =86) (n trained =16)		
	%	%
Freshness (smell)	29	12.5
Freshness (taste)	37	31
Good thickness/consistency (by sight)	8.1	6.3
Good thickness/consistency (other testing)	42	56.3
Normal color (sight)	34	12.5
Nothing added	14	12.5
Meaning milk safety (n untrained =86) (n trained =16)		
	%	%
Freshness (smell)	19.8	31.3
Freshness (taste)	25.6	18.8
good thickness/consistency (by sight)	7	12.5
Good thickness/consistency (other testing)	4.7	18.8
Normal color	10.5	25
Nothing added	17.4	18.8

Traders were further asked to list other attributes associated with milk quality and safety beyond the ranking options in the table above. The popular attributes used to describe milk quality among untrained traders were unadulterated milk, good thickness, and clean storage containers. Interestingly, trained traders also associated milk quality with unadulterated milk, milk stored in clean containers, and milk that has passed the lactometer test. On the other hand, milk safety was described by untrained traders as milk from a hygienic milking process, boiled milk, and milk with no foreign objects. Trained traders similarly associated milk safety with milk from a hygienic milking process, boiled milk, and milk from a cow not under treatment.

The findings essentially mean no difference in milk safety knowledge between trained and untrained traders for the parameters tested in the study. The findings are similar to those from other studies where such training has been found to have not affected the knowledge levels of the training recipients in the long term (Park et al., 2010). However, such findings are not popular in the pre and immediate post-training assessments, which are common in evaluating food safety training. In most pre and immediate post-training evaluations, positive changes among the training recipients are usually reported. However, the positive changes in knowledge

immediately after training tend to fade with time, especially where follow-up training sessions are not offered (McFarland et al., 2019). For example, in a meta-analysis on food safety training effectiveness based on pre and immediate post-training assessment, change in knowledge was assessed in 26 out of 31 studies and was the most reported outcome (Young et al., 2015). In these training evaluations, training significantly affected increased knowledge in food safety and hygiene across different settings such as schools, restaurants, households, fresh produce, foodservice operators, and multi-settings.

For the training to improve the knowledge and skills of the training participants, three conditions needed to be in place. First, trainers needed to access the training and content to be relevant and relatable to the training recipients (Johnson et al., 2015). Time management factors such as starting time and ending time needed to be considered in implementing training initiatives (Rae Leslie, 2000). Furthermore, training locations and the nature of the surroundings needed to be convenient for the training participants for their effective participation in the training sessions (Pike, 2003). Careful consideration of these dimensions enhances the quality of the training delivered to the participants and the effectiveness of the capacity-building efforts (Khair, 2013).

In the study, forty-two (42%) of the vendors who reported having attended the training indicated that they faced challenges in attending the training. The most critical challenges reported included bad timing of the training activities where they were scheduled at times that were peak milk trade hours. The requirement to pay transport costs to access the training venue, which was often at inconvenient locations, further challenged traders' attendance at the training. Additionally, the high training fees charged by BDS providers were prohibitory for most of the traders. The BDS providers confirmed this in interviews where they indicated that the traders often lacked time to attend the scheduled training sessions because they conflicted with the timing of their business engagements. According to a service provider:

> 'Most traders fail to attend the training for all the days that are planned. Some traders missed training days, which meant that they lost essential training. Others simply have no time for this training. Some vendors have shunned training, while others register but do not consistently attend' (int., Dan, Arusha, 2019).

The failure to attend training offered by BDS providers has serious implications for the effectiveness of the programme. One BDS provider raised the issue of effectiveness due to lack of vendor participation:

'Poor availability of vendors who would instead attend to their business activities rather than attend the training and even for those that attend the training, their concentration is disrupted when it is time to attend to their business activities' (int., Dan, Arusha, 2019).

Besides the poor attendance by traders, poor delivery of the training further impacted negatively on the effectiveness of the intervention. The T&C intervention in Tanzania was designed and delivered in a traditional, lecture-type approach, which is less effective at fostering knowledge acquisition and retention (Alaagib et al., 2019; Belfield et al., 2001; Ebert-May et al., 1997; Fyrenius et al., 2005; Wolff et al., 2015). The instructor dictated learning instructions and scheduled the training sessions even though traders had other responsibilities besides attending the training. Better outcomes have been achieved through alternative approaches such as adult learning, where the instructor facilitates self-learning and respects that training attendants work around other responsibilities (Arogundade, 2011).

The second condition was that the training materials and approaches were relevant, appropriate, and effective. The literature points to various elements for effective training outcomes. Some of the factors considered as the most important in affecting training outcomes include training objectives, training materials, and training methods (Mitchell, 1998; Pike, 2003). Researchers argue that content relevant to the target audience influences their reaction to the training activities and their overall performance in the area of training (Shaw et al., 2019).

The BDS providers and relevant government officers expressed satisfaction with the training material content, which they thought adequately addressed relevant concerns about milk safety among the traders. There were, however, concerns regarding the language barrier. During the early stages of the pilot, training materials were written in English, while most of the value chain actors used Kiswahili as the language of communication. One of the service providers observed:

'There is a serious language barrier, which hampers the effectiveness of the intervention, despite the good intentions. The available training materials are written in English, while most of the target group are fluent in Swahili' (int., Dan, Arusha, 2019).

Local facilitators often provide training in Kiswahili to solve the language issue, but the fact that the materials were in English certainly limited the benefit that the materials could bring to the trainees. It was only later that the training materials were translated to Kiswahili, and therefore more adequately utilized by both the BDS providers and the vendors.

The trainer also has a role in making the learning effective or ineffective (Mitchell, 1998). The trainer plays several roles, including technical trainer or instructional designer (Khair, 2013). The trainer's overall goal is to help achieve behavior change in the trainee through learning, motivating and encouraging the trainees to learn, and setting performance standards to enhance learning effectiveness (Khair, 2013). Characteristics of the trainer that are important in achieving training effectiveness are knowledge of the subject matter, possession of effective training skills, and the right attitude towards the trainees (Khair, 2013). Furthermore, the trainer should take the role of a leader to achieve training objectives by being a good speaker and listener (Rae Leslie, 2000).

The T&C intervention training was conducted by qualified BDS providers who had adequate dairy technology qualifications and had been inducted on how to deliver the training effects to the training recipients (Cherono et al., 2012). The BDS providers who participated in the study were qualified veterinary officers, one working with the Ministry of Livestock, Agriculture, and Fisheries while the other ran an agrovet venture privately.

Besides the quality and relevance of capacity building content, content delivery approaches influence capacity building outcomes (Bellows et al., 2016; Goga & Muhe, 2011; Hainsworth et al., 2014; Somassè et al., 2013). The financing model hindered training delivery in Tanzania, where traders were expected to pay for training. Their inability or unwillingness to pay for training made the venture unprofitable for the BDS providers. The lack of profitability incapacitated the BDS providers in replacing their training materials, such as milk testing equipment, essential for good training delivery. This may be explained by the intervention targeting the very small-scale traders with resource limitations. Furthermore, their participation in the T&C did not translate into higher revenues (through more milk sales or higher prices for their milk). However, the traders still had to pay for the training, meaning the cost of participation exceeded the benefits for the small-scale traders. The BDS providers stated,

> *'There was a major problem with the mode of financing adopted for the training, which limited its profitability as a business. Most traders could not pay for the training, and I would only get a little profit when the number of those trained was high. However, the profitability of the training was low compared to other services provided' (int., Dan, Arusha, 2019).*

> *'For the few traders I trained, I did not make any profit because none of the vendors paid for the training. Instead, the traders expected to be paid for attending training, as is usually the case when they participate in donor-funded activities' (int., Heather, Arusha, 2019).*

Explanations provided for non-payment of the training fees by traders included a lack of clarity on the expectation to pay for the training after the pilot period. During the pilot period, the training fee was financed by the donor. The traders expected subsequent training sessions to still be facilitated, but they were expected to pay long-term. The issue of traders expecting payment for attending training also emerged. It is not uncommon for intervention beneficiaries to receive small tokens, whether monetary or material items, as a form of appreciation for participating in pilot projects. However, this creates the undesirable requirement for a reward for participation in development initiatives even though the beneficiaries are expected to gain long-term benefits from the development initiatives. Such dependence on handouts is likely to impede commitment to intervention for long-term benefits by beneficiaries.

Furthermore, the cost of training varied among the BDS providers, and for some, it was much higher than the recommended limit by TDB. TDB capped the training at TSHs 10,000 for the entire training session, but some BDS providers quoted much higher fees. The BDS providers stated,

> *'The training cost per trader included refreshments and transport costs for the vendors, valued at Tshs 30,000, and the trainer's profit valued at Tshs 10,000. The total amount charged to each trader was Tshs 40,000' (int., Heather, Arusha, 2019).*

> *'The training cost charged for each trader was Tshs 3000 in 2010, but the cost had risen to Tshs 5000 by 2017. No other costs were involved' (int., Dan, Arusha, 2019).*

The significant variance in the amount charged for the training may have caused a lack of trust in the BDS providers among the traders and, therefore, reluctance to pay the training fee. This is reflected in the number of traders trained by the different BDS providers. The BDS provider who charged a high fee had trained five traders, while the one that charged less had trained 20. The non-payment of the training fee seems to be driven by three factors. First, it did not make economic sense for the small traders. Second, there was no clarity in the financing strategy beyond the donor-funded period, and third, the limits established for the training fee were not observed.

BDS providers further indicated a lack of incentive among the traders to take up the training costs because the incentives for traders to take up the training were not obvious. One of the BDS providers indicated that they struggled to explain the benefits of participation in the training to the traders. It was difficult because the vital intervention incentive was the issuance of a certificate recognizable by TDB, which would protect them from harassment anticipated

in the future. This translated to the absence of immediate incentives for the traders to participate in the T&C. The harassment that the certificate was meant to protect the traders from was only anticipated to happen in the future, but it did not affect their ability to conduct business when the T&C was being offered.

The third condition that needed to be realized for change in knowledge to be achieved among trained traders was that traders needed to see direct incentive to participate in the T&C. Traders who participated in the T&C reported improved milk quality, a broader customer base, and acquisition of value addition skills (table 6.6). The benefits resulted from improved hygiene in milk handling among trained traders, improvised milk cooling under shade, and not purchasing milk from cows under treatment. The findings of positive impact from the T&C have also been reported in Kenya, India, and Nigeria, where the intervention has been implemented in the dairy and meat industries, respectively (Grace et al., 2019; Johnson et al., 2015). While the direct benefits were realized, they did not seem enough to incentivize other traders' uptake of the intervention. The intervention uptake was only 15%, as discussed earlier.

Table 6.6: Positive impacts of training among trained traders

Positive impacts of training (n=33)	%
improved handling of milk	36%
milk quality	30%
cleaner premises	12%
value-added skills	6%
customer loyalty	3%
Other	12%

6.3.2 EFFECT OF TRAINING AND CERTIFICATION ON TRADERS' MILK HANDLING PRACTICES

In the T&C intervention, acquisition of milk safety through training was expected to change the traders' milk handling practices (Johnson et al., 2015). In the study, both trained and untrained traders declared implementing various practices to ensure milk safety, but there were no differences in practices between trained and untrained traders except for washing hands, special containers, and lactometers.

A higher proportion of trained vendors reported washing hands, while using special containers was more commonly mentioned among untrained vendors than trained vendors (table 6.7). On the use of methods for milk quality testing, untrained vendors appeared to rely more frequently

on basic organoleptic tests than trained vendors. The use of technology such as lactometers was more common among trained than untrained traders (87% and 24%, respectively) (table 6.7).

Table 6.7: Milk handling practices among trained and untrained traders

Practice	(%)	(%)
Hygiene practices to ensure milk safety among trained and untrained milk traders (n untrained =86) (n trained =16)		
cleaning containers regularly	(92%)	(94%)
keeping milk cold	2%	0%
keeping premises clean	24%	25%
using special containers	34%	19%
washing hands	29%	56%
not mixing morning and evening milk	1%	0%
Methods for measuring milk quality among trained and untrained traders (n untrained =86) (n trained =16)		
Lactometer	24%	87%
Sight	64%	31%
Smell	23%	31%
Taste	27%	19%

Additional practices used by vendors to protect milk safety included boiling, filtration (used to detect foreign objects), not keeping milk for many hours (i.e., selling milk fast), checking the milk's quality at the source, and rejecting low-quality milk. These methods of measuring milk safety – clot on boiling, milk filtration, and fermentation – were popular among untrained traders. Interestingly, trained traders also used similar methods: clots on boiling, milk filtration to check for foreign objects, and pouring milk on the ground to see how it flows to determine density.

Generally, the training did not have an evident influence on the recipients' food safety practices. The change in practices seems to fade with time. Previous studies, which assessed the short-term benefits of the T&C intervention in Kenya and India, indicated a positive change in food handlers' practices, improved milk quality, and enhanced economic gains. The benefits

were sustained in the long term in India, but a study in Nigeria indicated that the benefits diminished nine years after the implementation of the intervention (Alonso et al., 2018; Grace et al., 2019; Johnson et al., 2015; S. Kaitibie et al., 2008; Lapar et al., 2014; Lindahl et al., 2014, 2018). In the study, it was impossible to confirm a positive change in trained traders' milk handling practices which faded over time because there was no evaluation of the training effectiveness immediately after the training.

To understand why behavior change is not always achieved with food safety training, it is important to understand the dynamics of behavior change. Behavior change theory indicates that adequate incentives drive successful behavior change. On the other hand, incentive is shaped by attitude towards risk and reward, e.g., gaining or losing money, status, reputation, opportunity, assets, or resources (The Springfield Centre, 2015). Incentives may be materially oriented (the desire to get something or not lose it, e.g., money, food, market share, or freedom). They may also be socially oriented (need to belong to or not be rejected by a group with shared values) (The Springfield Centre, 2015). Incentives can be achieved at various levels, including individual, society, and institutional, and are influenced by external factors like national policy and transnational networks. The existence of public demand for the proposed change, for example, is a strong incentive for long-term behaviour change. Such public demand could be achieved through the influence of interest groups and the coalitions they form to mobilize in favor of or against particular behaviour (Bayulgen, 2020).

For traders to change their milk handling practices, two conditions needed to be met. First, traders needed to see incentives to get certified, and secondly, the promoted practices needed to be feasible and generate economic benefits (Johnson et al., 2015). The certification of traders as a requirement before registration with TDB was designed into the intervention to incentivize traders' uptake of the intervention (Johnson et al., 2015).

However, respondents indicated that the traders were not required to be trained and certified for TDB registration. Instead, any trader who was able to pay the TDB registration fee was registered without the T&C. There were no negative consequences for failure to be trained and certified among the traders. They, therefore, chose not to participate in the T&C for which they would have to incur training costs and commit time to. It was expected that TDB would also benefit from making the T&C mandatory before registration by achieving greater control in food safety regulation in the informal sector.

TDB, however, had not implemented or enforced the requirement by the time of this study, and the traders do not see the need to implement it. Only 2% of all vendors who participated in the study were registered with TDB. This outcome indicates TDB's lack of control over the informal dairy sector, including food safety regulation. The lack of capacity by TDB to execute their regulatory mandates over the traders resulted in a lack of legitimacy of TDB in the eyes of the traders. Such lack of legitimacy was driven by the fact that TDB could not enforce its authority to register dairy traders. Reasons cited for the lack of enforcement of the requirement were the lack of support for the intervention by management. Lack of support by the management resulted in a lack of adequate inspectors to implement and enforce the requirement for training and certification among traders. The lack of legitimacy encouraged non-compliance among the traders because they could get away with it. The outcome was a failure to achieve the intended effects of employing carrots and sticks to drive compliance. A good combination of effective carrots and sticks must consider the interests and capacities of the key stakeholders in the context of implementation and be appropriately aligned with them.

The second condition was the feasibility and practicability of recommended practices. Some practices that did not have additional cost implications to the traders and were beneficial to the traders in preserving milk quality and increasing their economic gains were adopted. For example, a BDS provider reported better milk handling practices among trained traders, which included placing milk under shade to keep it cool. Furthermore, traders did not purchase milk from producers whose animals were on withdrawal period after treatment or animals producing colostrum.

On the other hand, some practices that had cost implications and required drastic changes in the traders' existing practices were not feasible. For example, the use of stainless steel/ aluminum containers for milk handling was impractical due to the high cost. The recommended stainless steel/ aluminum containers were also difficult to transport on bicycles, motorcycles, and public transport, which are the common means of transport for the traders. The use of lactometers for milk testing was also limited among traders who cited unaffordability.

Consumer demand for safe milk was further anticipated to drive uptake of the training and certification by traders. While research on consumer perception for food safety in developing countries is limited, evidence from the few studies that have been conducted indicates that consumers attach great importance to food safety (Johnson et al., 2015). In Kenya and India, reported cases of food safety scares in the meat and dairy value chains, respectively, resulted

in a section of the consumer population adjusting their product purchase habits. While some consumers indicated that they continued to obtain the food products for their nutritional benefits and trust in their suppliers, some stopped consumption (Johnson et al., 2015; Rich & Wanyoike, 2010).

In the study, 91% of consumers reported milk safety as very important to them. Furthermore, sixty percent (60%) of consumers indicated that they would be willing to pay more for milk from a vendor displaying a certificate for training in safe milk handling. Further, consumers demonstrated reasonable knowledge in food safety where the predominant descriptions of safe milk by the consumers were boiled milk, milk obtained in a clean milking environment, and milk that has not stayed long before consumption.

However, the consumers reported being challenged in determining milk safety at the point of purchase. They did not have a way of identifying safe or unsafe milk, and therefore, they relied on trust relationships with their suppliers. Eighty percent (80%) of consumers indicated that they preferred to shop from a small number of retailers rather than shopping around. Reasons cited by consumers for preference of a small number of retailers were convenience in accessing milk and trustworthy relationships with the retailers. The findings indicate a significant concern for milk safety and a reasonable level of knowledge in milk safety among consumers. However, consumers were challenged by the inability to objectively determine milk safety which diminished their demand for milk safety. Consequently, the incentive for milk traders in the informal sector to change their milk handling practices was lost.

Branding milk enterprises that adhered to the recommended milk handling practices resulting in adequate milk safety was further designed into the intervention. The branding component intended to assist milk consumers in identifying enterprises that sold safe milk. This would incentivize the uptake of recommended milk handling practices by trained traders (Cherono et al., 2012). In the study, 54% of the consumers indicated that they had previously bought labelled dairy products from the main dairy processors in Tanzania, including ASAS dairy, AZAM, and Tanga Fresh. They argued that the most sought-after information from the labels was the product expiry date.

The findings are aligned with the common global trend where large-scale company brands are trusted by consumers due to perceived higher quality, although this is not always supported by evidence (Johnson et al., 2015). However, half of the consumers considered labels important, while the other half did not consider labels important. The implication here is that the branding

would not be a great incentive to promote practices among trained and certified traders. Furthermore, the branding component of the intervention never took off in Tanzania. This was confirmed by consumers who indicted having not seen any branded enterprises selling raw milk.

6.3.3 DIRECT BENEFITS OUTCOME: QUALITY OF PRODUCT SOLD IMPROVES

This outcome assumed that the trained traders are a large share of the market (Johnson et al., 2015), but only 15% of all traders interviewed in this study indicated having participated in the training. This proportion is only illustrative as the sample size was not representative of the population. However, the small proportion of trained traders in the study sample indicates that contrary to the intervention intentions, the trained traders were a small market share.

Improvement of milk quality was also based on the assumption that practices effectively improve the quality and safety of the milk in the market (Johnson et al., 2015). While trained traders and some key informants reported improved milk quality, the study did not measure milk safety. The rate of milk spoilage was used as a proxy to determine the extent of the positive impact of the training among trained traders in improving milk quality.

There was no difference in milk spoilage rate between trained and untrained traders, with a majority of both trained and untrained traders experiencing 1-10% milk spoilage (table 6.8). Similar findings of change in practices among training participants resulting in improved milk quality in the short term, but the benefits fading in the long term have been reported in other studies (Alonso et al., 2018; Grace et al., 2019; Lapar et al., 2014; Leksmono et al., 2006). This trend confirms the notion that refresher trainings must support sustained behavior change.

Table 6.8: Weekly milk spoilage rate among trained and untrained traders

Proportion of milk getting spoiled each week (n untrained =86) (n trained =16)	Untrained	Trained
0%	27%	31%
1-10%	54%	44%
11-20%	7%	12.5%
21-30%	6%	0%
41-50%	5%	0%
91-100%	1%	12.5%

6.4 Perceptions on how the intervention can be improved

The study sought to understand the reasons behind the intervention's failure to address the food safety challenges in the informal dairy sector. Further, the study sought to understand the perceptions on what could be done differently in its implementation to achieve greater effectiveness in addressing food safety challenges and the prevalence of informality.

Most of the intervention's underlying assumptions were not realized, which means they were not suitable for the Tanzanian context. The lack of realization of the intervention's underlying assumptions resulted in implementation challenges and failure to achieve the anticipated outcomes. In Tanzania, the intervention's reach and effectiveness were negatively affected by poor intervention delivery and lack of capacity and incentives among traders and regulators, which were assumed to be present in the intervention design. Intervention reach was limited by lack of information dissemination by TDB due to lack of financial capacity to fund the activities and lack of trader organizations. Second, there was no enabling policy environment to facilitate voluntary uptake of the intervention by the traders.

Intervention effectiveness in changing traders' knowledge, behaviour, and ultimately milk safety was hampered by various factors. First, delivery of the intervention was hampered by poor attendance by traders, low demand for the training, and lack of profitability from the training for the BDS providers. The traders lacked capacity and incentive to pay for the training, and the lack of profitability disincentivized proper delivery by the BDS providers. The critical intervention incentive, which was the T&C requirement among traders before registration as legal traders by TDB, was not enforced. TDB could not enforce even registration, and therefore, traders were not incentivized to take up the T&C. Furthermore, consumer demand was lacking as an incentive for the T&C uptake due to the lack of viable means of determining milk safety at the point of purchase.

Recommendations to enhance intervention reach and effectiveness included alternative financing of the training and information dissemination activities to address the capacity challenges among traders and TDB. One of the development partners argued that the government should finance the training fees rather than the traders. The argument advanced here is that the traders could not afford the additional financial burden due to their small scale of operation. Government, however, would afford to take up such costs if committed to the food safety agenda. However, due to competing development priorities in developing countries, government financing for food safety training may not be forthcoming. The development partner was cognizant of this reality and recommended support by private sector

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dairy processors and other SMEs in financing the training activities. This would transform the implementation of the intervention into a public-private partnership which is a feasible approach to development if well managed.

Another recommendation by one of the BDS providers was to limit the number of BDS providers allowed to conduct the T&C. The BDS provider argued that limiting the number of BDS providers would reduce competition and enhance the venture's profitability. While such a move may enhance profitability among the BDS providers, it may also limit the scaling of the intervention in case demand outdid the number of the authorized BDS providers. For this reason, it would be more reasonable to let the market dynamics of demand and supply play out naturally.

Institutionalization and strict enforcement of the T&C among traders were further recommended. This can be explained by the interview excerpts below:

> *'There should be a district-level following up to ensure all traders are registered, trained, and certified' (int., Dan, Arusha, 2019).*
>
> *'The dairy board should recruit adequate dairy inspectors to conduct the training and enforce it. The initiative should also be institutionalized to enhance its acceptability and support by the leadership. The board should make it compulsory for traders to get trained, certified, and registered before operating as milk vendors' (int., Toby, Arusha, 2019).*

However, given the capacity challenges among the regulatory agencies as discussed in chapter 6, such institutionalization and enforcement may be challenging to realize. In the absence of adequate capacities for institutionalization and enforcement, self-regulation is a viable option that has been successful elsewhere (Jaffee et al., 2019). However, a food safety culture among value chain actors and their trust in government intention need to be addressed to achieve self-regulation (Garcia et al., 2007).

One of the regulatory agencies further suggested capping the training fees charged for the training at Tshs 10,000 to ensure affordability by the traders. However, enforcement of the capped rate would be a challenge. TDB had imposed a cap on the training amount at Tshs 10,000 in the previous period of intervention which the BDS providers did not observe. Again, this boils down to the lack of enforcement capacity by TDB, which was supposed to inspect compliance among the BDS providers but did not due to a lack of financial resources and staff to commit to such activities.

The study further sought opinions on how to address informality and the food safety inadequacies in the informal dairy sector beyond the scope of the intervention. One of the recommendations was capacity building among value chain actors by providing appropriate milk testing and milk storage equipment among traders. This would enable them to conduct milk quality tests at milk collection centers to avoid the acquisition of poor-quality milk in the first place and move it down the rest of the value chain. Furthermore, they would be able to preserve milk quality through the use of appropriate storage equipment. However, the provision of such equipment may be unsustainable, and the facilitation of the traders to access affordable financing for their acquisition may be more viable (Alonso et al., 2018). The intervention assumed that traders would be willing and able to acquire the requisite milk handling equipment, but the study findings indicate the lack of capacity by traders and the need for their facilitation to acquire them.

Besides the provision of equipment among informal traders, there were recommendations to educate the traders on the benefits of regulatory compliance to induce better regulation of the informal milk traders. Such awareness creation may enhance compliance by creating an understanding of how revenues are used to enhance the welfare of the citizens. It may also be useful in enlightening the traders of the potential health burden that unsafe milk may cause, which may stimulate empathy and, therefore, greater compliance.

Capacity-building among the regulatory agencies was also recommended. Facilitation of the regulatory agencies to acquire additional technical staff was widely suggested. The argument was that additional technical staff are required to enhance implementation and enforcement of the regulatory requirements currently underachieved. There were also recommendations for providing milk testing equipment among the regulatory agencies to facilitate the smooth execution of inspections for milk quality. Additionally, there were recommendations for establishing laboratories at the local level to enhance comprehensive milk testing nationally. Currently, advanced milk testing is only conducted at the TBS and TFDA national laboratories, which are limiting. It was also recommended to refurbish dilapidated milk collection centres and equip them with requisite infrastructure such as cold storage. While all these suggestions are sensible, they require government investment in food safety regulation in the dairy sector. Two things may influence such investment decisions by the government. First is evidence of the importance of such investment, and second is the availability of resources to commit to food safety. Both are not strongly available in Tanzania, which may prevent government

investment. There is, therefore, a need for the continued provision of solid empirical evidence and exploring alternative options to financing food safety.

Another interesting approach suggested was collective action by dairy value chain actors to allow the pooling of resources and better access by the regulatory agencies. It was argued that producers could access extension services and inputs in collective groups to allow the production of good quality milk. Additionally, they would easily implement self-regulation within the groups and even acquire the necessary infrastructure to formalize. The argument can be understood from the interview excerpts below:

> *'Dairy farmers should establish associations where quality will be assured collectively, and the processors will be willing to buy at a higher price. TDB and MOALF should also educate farmers on how to produce high-quality milk and safe milk, facilitating the farmers to work together' (int., Mike, Arusha, 2019).*

> *'There is a need to enable the informal traders to start small-scale processing collectively, and milk packaging e.g., the Mronga women group in Kilimanjaro, has evolved from informal traders to processing and packaging' (int., Collins, Arusha, 2019).*

> *'Self-regulation through trader associations should be encouraged, although there is a tendency to exploit the members within associations, e.g., overcharging them and forcing them to comply' (int., Humphrey, Arusha, 2019).*

Government subsidy in milk processing costs and elimination of small non-compliant processors and informal traders was also recommended for improving milk safety in the informal dairy sector in Tanzania. These recommendations reflected a dairy sector commercialization mindset. The proponents of this idea have no regard for the provision of nutrition and livelihoods that the informal sector plays. They assume that forceful elimination of the informal sector would guarantee formal processing thrives. However, they ignore the drivers of informality, which primarily is lack of capacity and incentives among the informal value chain actors. The argument can be understood from the interview excerpts below:

> *'The government should subside operation costs for milk processors to encourage increased milk processing' (int., Toby, Arusha, 2019).*

> *'The very small vendors selling from plastic containers should be eliminated from the business, and only those able to obtain stainless still/ Aluminium cans should be permitted to trade. Traders are not keen on getting formalized due to the many bureaucratic processes involved, heavy taxes, and license fees associated with formal milk processing. Formalization should only target vendors looking for growth and expansion in the formal industry; otherwise, such initiatives should avoid involving vendors who are in the business short term. Additionally, the vendors should provide the necessary information on the benefits*

of formalization to get their commitment. The successful ones would be role models to their peers' (int., *Collins, Arusha, 2019).*

6.5 CHAPTER SUMMARY

An assessment of a pilot T&C scheme among dairy traders in Tanzania revealed that the intervention had limited reach among the target audience. Change in knowledge among trained traders compared to untrained traders was not evident; there were mixed results in differences in practices among trained and untrained traders and no difference in milk spoilage rate between trained and untrained traders. It was impossible to determine whether the limited impact observed four years after the pilot activities were due to the intervention not being practical or because any positive impact realized in the short term may have faded-out over time. A short-term assessment of the intervention outcomes was not conducted in Tanzania upon completion of the pilot. It is also important to note that, while the ultimate and most important outcome to explore would be the difference in the safety of milk sold by trained and untrained traders, the study did not measure the safety of milk at the time of the study. Milk spoilage, as reported by participants, was instead used as a proxy for milk safety.

The study findings indicate a mixture of the effectiveness of direct and indirect policy measures applied in the T&C intervention. Direct policy measures applied a combination of incentives for the targeted traders and TDB, the intervention implementing government agency, and penalties for non-compliant traders. The key incentive for both the traders and TDB was making the training and certification compulsory for traders before they could be registered with TDB as legal traders. This incentive was supposed to be implemented and enforced by TDB, but it was not because it was overtaken by TDB's need for revenue collection, prompting them to register any trader who was willing and able to pay the registration fee to TDB. This indicated incongruence between government interests and priorities and those of development partners. Therefore, key stakeholders must support the sticks and carrots designed for such interventions in the context of an application. Other options may be an application of indirect policy measures that will drive the commitment of the citizens to voluntary behaviour change and which could sustain self-regulation among the value chain actors. The other incentive applied to the traders was achievement of direct gains from adopting recommended behavior change. However, the feasibility of behavior changes varied where the trader has adopted behaviour with no additional cost implications and rejected those with prohibitive cost implications. The direct benefits to traders' incentives were taken well but would need to be

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complemented with additional features such as facilitating traders to access credit facilities to fund some of the recommended behaviour changes.

The indirect policy measures also had mixed degrees of success. Training content used in training the traders was adequate and delivered by qualified individuals, but the mode of delivery was not optimal. The adjustment would need to be made to the funding responsibility of the training, which was burdensome for traders. The training approach would also need to be changed from the traditional lecture-type to adult learning techniques that are more effective. The awareness creation component of the intervention by TDB failed due to a lack of financing, and alternative models would be needed for a successful intervention. Government support (enabling policy environment) for the intervention was lacking. The lack of any official legal requirement for T&C of traders and its enforcement alongside other legal requirements was a huge blow to the intervention success. In the absence of such government support, public demand driven by consumer groups and civil society campaigns might be an option. Branding, which was meant to promote public demand for food safety, was not trusted by consumers and, therefore, not an effective option in this context.

The respondents displayed enthusiasm for food safety improvement in the informal sector, and there were indications that the T&C would still be supported with some improvements to enhance effectiveness. However, some of the suggestions for food safety improvement included the exclusion of small-scale traders, which would threaten the livelihoods and nutrition of the affected traders. While there is good reception of the T&C approach by the government, the mindsets of government agencies are oriented to enforcement of Codex food standards to enhance food safety in the informal sector. This is even though both value chain actors and regulatory agencies lack requisite capacities and incentives. There is, therefore, a need for the persuasion of policymakers through empirical evidence to consider alternative policy approaches that are more aligned with existing capacities and incentives.

CHAPTER 7

7 CONCLUSION

7.1 INTRODUCTION

This chapter will conclude the study by summarising key findings concerning the research objectives and discussing their value and contribution. It will also review the study's limitations and propose opportunities for future research.

7.2 RESEARCH AIMS AND KEY FINDINGS

This thesis sought to investigate the root causes for the poor performance of value chain actors and regulatory agencies in implementing the Codex food safety regulation policy and to determine the effectiveness of an alternative policy approach to addressing food safety and the root causes for its extent of effectiveness. Results indicate that inadequate capacities and incentives among value chain actors and regulatory agencies drive the poor performance in implementing the Codex food safety regulation approach. The T&C intervention was ineffective in addressing food safety regulation due to inadequate capacities and incentives among value chain actors, business development service providers and regulatory agencies to implement the training and certification as designed. Overall, the implementation of the two policy approaches in food safety regulation was ineffective due to capacity and incentive deficiencies among value chain actors and regulatory agencies. The capacity and incentives deficiencies in implementing the two policy options are summarised in the section below.

7.3 CAPACITY DEFICIENCIES

Economic underdevelopment in developing countries translates to a lack of capacities among value chain actors and regulatory agencies necessary to implement Codex food safety systems and the T&C intervention. In this thesis, three types of capacities were explored among regulators and value chain actors: technical capacities, infrastructure capacities, and institutional capacities.

7.3.1 TECHNICAL CAPACITY DEFICIENCIES

In Tanzania, dairy sector food safety regulatory agencies and dairy value chain actors lacked the adequate technical capacity to implement the Codex food safety standards and the T&C intervention.

The regulatory agencies in Tanzania lacked the adequate skilled staff to implement and enforce the two policy approaches to food safety regulation in the dairy sector. Implementing the two risk-based food safety systems requires competent and adequate staff to undertake various tasks effectively. However, the technical staff was inadequate to undertake various implementation and enforcement activities. The lack of technical capacity among the regulatory agencies was driven by the lack of government investment in staff capacity building. This resulted from the lack of prioritization of food safety and the lack of financial resources to commit to food safety investment by the government.

On the other hand, the value chain actors were predominantly small-scale and operating at the individual level with little or no collaboration. As a result, they lacked access to relevant food safety information and appropriate milk handling skills. The challenge was exacerbated by the differentiation of roles in the value chain activities for women, men and youth. Women were involved in production activities but not production decision-making. Men often had better access to information on production technology and practices. Still, women were left to attend to the animals, resulting in a disconnect between acquiring and applying information and technology in dairy production. Women further participated in milk vending, a critical node in milk safety due to the connection to both producers and consumers. However, the hours of operation were limited because the vendors had to attend to other household duties, limiting their ability to engage in capacity-building initiatives to enhance their skills in appropriate milk handling practices. On the other hand, the youth participated in collecting milk from the producers and supplying vendors for retailing. The youth, however, are resource-constrained and unable to acquire recommended milk handling equipment or meet training costs to develop skills in appropriate milk handling.

Capacity-building efforts in good production and milk handling practices among dairy value chain actors in Tanzania were random and uncoordinated. Various regulatory agencies and development partners offered random training sessions. An assessment of the impact of such training offered through the training and certification intervention indicated no change in knowledge and milk handling practices among trained traders. This outcome drove a lack of consistent follow-up training to ensure that knowledge is reinforced. Furthermore, the capacity-building initiatives are often carried out as pilot projects within a donor-funded period. These pilots never scale beyond the pilot period due to a lack of strategy and/or funding to achieve scale. Therefore, the positive outcomes of such capacity building never extend beyond the pilot

participants. The implication was poor food safety practices by dairy value chain actors and all the value chain nodes.

A key driver for the uncoordinated capacity-building efforts in Tanzania's dairy sector was the incongruence between policy and value chain practices. Dairy policy in Tanzania requires value chain actors to implement Codex food safety standards. While it is evident that value chain actors do not comply with the policy requirements, the government has adopted a do-nothing approach to food safety regulation in the informal dairy sector. The do-nothing approach by the government is driven by either of two possibilities or both. The first possibility is that the government cannot intervene in food safety regulations. The second possibility is the lack of prioritization of food safety in government investment. Both factors were evident in Tanzania.

Regulatory agencies engaged in capacity building of the value chain actors lacked adequate financial resources to fund capacity-building activities. Due to limited resources available within the central government, the regulatory agencies were often allocated very limited finances from the central government. Further, there is a lack of credible evidence on the country-specific burden of foodborne illnesses in Tanzania, similar to other developing countries. Evidence of the incidences of food safety hazards, their prevalence, and the extent of risk they pose to food handlers and consumers is critical in prioritizing food safety investments. Such evidence was lacking in Tanzania's dairy sector due to a lack of well-coordinated systems for collecting and disseminating such evidence. The lack of such evidence limits the prioritization of government investment in food safety activities such as capacity-building.

In the absence of capacity to implement the Codex food standards and lack of evidence on the extent and significance of foodborne illnesses, the government has no clear strategy to address food safety concerns in the informal sector. The interventions by various development partners are, therefore, random and unsustainable. The impact is often localized at the implementation location and short-lived.

Instead of maintaining the do-nothing attitude towards the informal sector in Tanzania, the government should acknowledge the inefficiencies of implementing the two food safety systems. A viable alternative would be to establish food safety systems that are not resource-intensive but effectively address food safety concerns in the informal sector. For example, promoting self-regulation among the value chain actors would be one such approach. Self-

regulation addresses the financial burden of food safety regulation from the government and value chain actors while still addressing food safety concerns in the informal markets. The government can then coordinate capacity building necessary for achieving a food safety culture among the value chain actors, which is necessary for achieving self-regulation.

7.3.2 *Infrastructure deficiencies*

In Tanzania's dairy sector, both value chain actors and regulatory agencies lacked the adequate infrastructure to implement the risk-based food safety systems instituted in Tanzania. The value chain actors in the dairy sector lacked physical infrastructures such as a reliable cold chain for milk preservation during storage and transportation. The key drivers for such deficiencies included a lack of financial capacity among value chain actors to acquire cold chain infrastructure. The other reason for the lack of a reliable cold chain in the dairy sector in Tanzania was poor electricity supply coverage, especially in rural areas. The lack of government investment in such requisite infrastructure is often a result of economic underdevelopment and limited financial resources. The other possible explanation for limited government investment in such basic infrastructure is poor governance leading to poor allocation of resources by the government.

Alternative technologies could be used for milk preservation without the conventional cold chain. The alternatives include solar for cooling or using a Codex-approved lactoperoxidase system for milk preservation. However, such technologies were absent in Tanzania, typical of poor uptake of innovative technology in developing countries. One possible explanation for the low uptake of technology is the informal actors' lack of access to financing facilities to facilitate their acquisition of such technologies. Value chain actors' unaffordability of recommended technology limited uptake of stainless steel/aluminium milk storage containers recommended as affordable technology in the T&C intervention.

Therefore, better uptake of innovative technology by value chain actors may be enhanced by facilitating value chain actors to access affordable credit facilities. One of the reasons for the limited access to financial facilities by the value chain actors is their lack of organization to operate collectively to reduce debt risk for the lenders. The lack of organization among small-scale dairy value chain actors was prevalent in Tanzania, which may explain their inability to pool resources to acquire infrastructure. Poor governance and consequent lack of confidence for participation in such organizations by value chain actors are possible explanations for their nonexistence in Tanzania. One possible approach to addressing governance in such institutions

is establishing a binding code of conduct or constitution that protects members' rights. Government support in establishing such associations would also be instrumental in their successful establishment. Trader associations are critical for facilitating the financing of value chain actors to access affordable technologies to achieve appropriate milk handling. Furthermore, organized groups would be a perfect platform for the execution of self-regulation.

Regulatory agencies also lacked the infrastructure to implement and enforce the Codex food safety standards and the T&C approach. Two national laboratories for comprehensive milk testing in Tanzania were grossly inadequate to serve the entire country. Even locally, dairy inspectors lacked simple technology such as lactometers to carry out milk testing. Furthermore, the dairy inspectors lacked access to vehicles for mobility to the grassroots level for milk implementation and enforcement of food safety systems. The lack of requisite infrastructure among the dairy sector regulators directly resulted from the government's inadequate investment in such infrastructure. As explained in the section above, a possible explanation for the lack of government to invest in such infrastructure is twofold. The first explanation is that the national government is resource-constrained and lacks funds to commit to such infrastructure. The second explanation is the poor prioritization in financing food safety by the government. These are severe economic underdevelopment and poor governance issues that would take a long time to be addressed. Meanwhile, food safety remains a concern in the dairy value chain and needs to be addressed. In the short term and maybe long term, self-regulation that is not resource-intensive for the government and supported by the acquisition of affordable technologies may be feasible.

Participatory risk assessment has also been proven to be an affordable and effective approach to food safety hazard identification and prioritization in resource-constrained developing countries. It can be an alternative to the resource-intensive Codex risk assessment in resource-constrained developing countries. In contrast to the quantitative risk assessment, participatory risk assessment relies on qualitative analysis of the uncertainties and complexities of informal food value chains. It further employs participatory learning approaches to engage study respondents and enhance ownership. In participatory risk assessment, novel rapid and robust laboratory tests are also adopted for quality assessment. This approach could be combined with self-regulation among value chain actors to achieve low-cost and objective food safety risks identification, prioritization, and action.

7.3.3 INSTITUTIONAL CAPACITIES

In Tanzania, regulation of the dairy sector under the Codex food safety system is characterized by multiple regulatory requirements implemented by multiple agencies. The implication of the diversity of regulatory requirements results in the burden of interpretation, monetary compliance costs, and time costs for meeting all the requirements. The compliance burden is heaviest for the small-scale value chain actors who are resource-constrained and unable to meet the compliance costs. The large-scale formal processors who have financial capacity often engage professionals to interpret the legal requirements and help them acquire compliance. However, the small-scale processors and informal value chain actors could not afford the services of experts or full payment of the compliance costs. The net effect was a lack of proper comprehension of all the regulatory requirements by the small-scale processors and the informal value chain actors. In other instances, even though the processors and informal value chain actors were aware of regulatory requirements, they simply could not afford them. Therefore, by non-compliance due to lack of knowledge of the requirement or inability to afford compliance, many small-scale processors and informal value chain actors were excluded or exited voluntarily from formal regulation.

The government of Tanzania was cognisant of the impracticability of the multiple food safety regulations for the informal dairy traders. It had deregulated the small-scale raw milk trade. The small-scale raw milk traders were only required to comply with three regulatory requirements, which significantly reduced their compliance burden. This is relative to the compliance burden for formal processors, who must comply with 17 regulatory requirements administered by 18 regulatory bodies. Interestingly, the small-scale raw milk trade deregulation did not increase compliance. On the contrary, the degree of non-compliance among the small-scale raw milk traders was high. Two things may have driven the unexpected negative impact of deregulation on the small-scale raw milk traders. First, the scale of operations for the small-scale traders was too small for the compliance costs to be economically sensible for the traders. Even though there were only three regulatory requirements, they all involved payment of some compliance fees by the traders annually. On top of the annual fee, there were frequent penalties due to periodic inspections by the regulatory agencies. The multiple fees paid by small-scale traders were burdensome for most traders, who often opted to operate informally to avoid the compliance costs.

In another twist, most of the traders were mobile without physical premises and were not accessible for inspection by the regulatory authorities. Due to their existence in large numbers

and scattered geographically, and the limited capacity of regulatory agencies to interact with them, the small-scale traders were not inspected for compliance with regulatory requirements. The traders were aware of the inadequacy of the regulatory agencies and that there were no consequences for their non-compliance and therefore were not motivated to comply with the legal requirements. This amounted to a lack of legitimacy of the regulatory agencies. The regulatory agencies had the authority to enforce the raw milk trade regulation, but they were hindered in actualizing it. Such a lack of legitimacy of the regulatory agencies often results in disregard of the law, characteristic of the small-scale traders' attitude towards food safety regulation.

Some of the available options for addressing the situation of toothless regulatory agencies include their empowerment through the provision of all necessary capacities so that they can exercise their powers. However, this option seems out of reach for the dairy regulators in Tanzania in the short term due to the economic underdevelopment that characterizes the country limiting investment in food safety is a systemic issue that is unlikely to be addressed in the short term. The other seemingly feasible option in the absence of capacity for regulation implementation and enforcement by the regulatory agencies would be a promotion of self-regulation among the traders, as this would take away the responsibility of food safety regulation from the regulatory agencies.

Besides the monetary burden of compliance with multiple regulatory standards, the value chain actors dealt with numerous regulatory agencies. The implication of the diversity of regulatory agencies was time consumption for the traders who had to commit time to the various agencies for compliance processes. This took up their business hours which impacted negatively on their overall performance. The roles of the multiple regulatory agencies often overlapped, resulting in duplication of enforcement activities. Regulatory agencies' over-interference in the traders' business activities led to a negative attitude towards them and the tendency to avoid them.

The multiplicity of the regulatory agencies and duplication has been addressed in developed countries that implement risk-based food safety systems by centralizing food safety regulation in a single institution. However, the centralization of food safety regulation in Tanzania may be hindered by the prevailing political and structural dynamics. In Tanzania's context, the lack of clarity in the roles of the multiple regulatory agencies could be addressed through a clear definition of the roles of the various regulatory agencies. However, even with a clear separation of roles among the regulatory agencies, the agencies may still engage in aggressive inspections

to collect revenue from the traders. All the regulatory agencies are financially constrained, and revenue collection through licensing and inspections of traders is one of the most accessible means of revenue generation for them. Therefore, the burden of overregulation would still linger and have the same net effect of limited compliance by the traders. Self-regulation remains the most feasible approach in settings where economic underdevelopment is prevalent. Self-regulation reduces the burden of establishing and sustaining an appropriate regulatory function, a struggle in underdeveloped economies.

Besides being burdensome to comply with, the regulatory requirements were sometimes incongruent with cultural norms and beliefs about food safety. The formal dairy sector regulations require heat treatment of milk, and pasteurization is highly recommended because science regards it as the safest mode of milk treatment. However, many consumers believe pasteurized milk is inferior to raw milk. This group of consumers includes the Maasai, who culturally consume raw milk without any heat treatment because they believe it is pure when raw and should not be interfered with to avoid losing its purity. Another section of consumers who believe raw milk is superior to pasteurized milk is ill-advised about the process of pasteurization. They believe that pasteurized milk contains harmful additives that are particularly harmful to vulnerable population groups, including children under 5 years of age, the elderly, and the sick. Consumers, therefore, prefer to use raw milk for the vulnerable groups, which they perceive as pure and fresh.

Such cultural norms and beliefs among consumers discourage regulatory compliance among the traders because the consumers provide a market for raw milk. Besides the belief that raw milk is superior to pasteurized milk, consumers were also driven by the affordability of raw milk compared to pasteurized milk. Furthermore, the formal sector was inefficient in providing an adequate supply of pasteurized milk to satisfy the demand for liquid milk nationally due to production inefficiencies which resulted in the underutilization of installed processing capacity. The informal sector, therefore, continues to supply consumers with milk in lieu of the failed formal sector. While pasteurization may not be achievable by informal small-scale traders due to a lack of access to pasteurization facilities, milk safety could be enhanced through other heat treatments such as boiling. Although it is challenging to achieve behaviour change, especially with deep-rooted cultural practices and beliefs, it would be beneficial to educate the value chain actors on the dangers of raw milk consumption and the benefits of consumption of heat-treated milk. With such knowledge, there would be a greater self-initiative to engage in

practices that enhance food safety among the value chain actors under any policy approach adopted by the government.

7.4 Incentive deficiencies

One of the key drivers for the failure of food safety regulation in Tanzania's dairy sector under the two policy approaches reviewed is the lack of consumer demand for safe milk. While market demand is the most critical driver of success for policy uptake, demand for food safety is often mainly lacking in developing countries. The Codex standards promote the sale of pasteurized milk. However, pasteurized milk is pricey and unaffordable to many consumers in developing countries. In Tanzania, the price of pasteurized milk was more than double the price of raw milk. Furthermore, raw milk is sold in small affordable units. It is often available on credit instead of pasteurized milk sold in fixed units and is not commonly available on credit. The situation for Tanzania is incredibly delicate because the cost of milk processing is high due to systemic issues resulting in highly-priced pasteurized milk. Milk processing in Tanzania is challenged by an inconsistent supply of raw milk, the importation of skilled labour and pasteurization equipment, and considerable compliance costs for the processors. As a result, milk processors operate below capacity and often struggle to operate profitably. With the systemic milk processing challenges, pasteurized milk remains inaccessible to most consumers in Tanzania.

Raw milk is critical for nutrition and livelihood for numerous dairy value chain actors. It poses potential public health concerns in the absence of food safety regulation. The T&C intervention, an alternative policy approach to milk safety regulation, sought to achieve safety in raw milk traded by small-scale traders. One of the assumptions of the intervention was that consumer demand for safe milk would drive the adoption of appropriate milk handling practices among milk traders resulting in enhanced milk safety. The consumers were meant to identify milk traders who sold safe milk through branding. Traders that demonstrated exceptional performance in observing appropriate milk handling practices would have their premises branded for identification as traders of safe milk by consumers. Unfortunately, the branding component did not take off in Tanzania, and consumers had no way of identifying traders that sold safe milk. The branding component of the intervention was the responsibility of TDB. Still, just like the TDB functions, there was no adequate funding to finance this component.

In addition to the failure of the branding component to take off, consumers did not trust branding approved by government authorities. This is probably driven by the fact that other products available in the market are not always safe, even if they bear the government-issued standardization mark of quality. Such lack of trust in branding is not unique to Tanzania and is reported in Kenya (Mtimet & Karugia, 2020). Such outcomes reflect poor government performance fulfilling its mandates to serve the people diligently. Branding, therefore, may not be a suitable option for identifying safe milk by traders to enhance consumer demand for safe milk. An alternative option may be the adoption of rapid test kits to determine milk quality at the point of purchase by the consumers.

Another critical incentive built into the T&C intervention was the mandatory requirement for training and certification of raw milk traders before registration with the dairy board as legal traders. Training and certification were meant to incentivize traders' uptake of the intervention and benefit the board in gaining greater control in milk safety regulation among the raw milk traders. However, the implementation of the training and certification required before registration of traders by TDB was overtaken by the board's revenue generation agenda. Raw milk traders were registered with TDB indiscriminately, even without acquisition of the training and certification, as long as they could pay the registration fee.

The implications for eliminating this incentive were low intervention uptake because the traders could still operate without the training and certification.

A key reason for the failure of the incentive was the lack of its enforcement by the dairy board as a compulsory requirement for traders. While the assumption was that the board would be keen to control the regulation of the raw milk traders, revenue generation seemed to be a more urgent priority for the board. Rather than seeking to have as many traders trained and certified, the board sought to register as many traders as possible. The training and certification requirement hindered the achievement of the registration of large numbers of traders. This is because the intervention reach was geographically limited and unpopular among traders due to the costs and logistics inconveniences. Enforcing the training and certification requirement would have meant limiting the number of traders registered by TDB and less revenue from the registration. Ultimately, the training and certification requirement for traders before their registration as legal traders were not aligned with government priorities and, therefore, inappropriate in the context of Tanzania.

Revenue generation remains a key agenda among regulatory agencies in developing countries due to their underfunded state. Therefore, any incentive that is likely to interfere with their revenue generation efforts is bound to fail. Instead of relying on enforced incentives, creating a food safety culture among the traders under the self-regulation approach, where the traders drive the food safety plan through an understanding of the importance and need for food safety, is an available option for addressing food safety among the traders. The use of social incentives in the self-regulation approach has also been demonstrated to work well elsewhere (Alonso et al., 2016; Blackmore et al., 2020; Lindahl et al., 2018). Social incentives include consumers' recognition of milk traders for consistent supply of safe, good quality milk and gaining respect and a huge customer base. This way, the need for the regulatory agency to actualize the incentive is removed.

Besides the legal requirement for the training and certification as an incentive for uptake of the intervention, the accumulation of other benefits such as improved milk quality and enhanced profitability among the traders was meant to incentivize the uptake of the intervention by other traders. Trained traders reported the benefits of improved milk quality, a wider customer base, and reduced milk spoilage losses. However, such benefits on their own were not adequate to incentivize the uptake of the intervention by other traders. This emphasizes the need to establish feasible incentives to ensure that they all work as intended and achieve synergy in enhancing policy uptake among the targeted beneficiaries.

7.5   THEORETICAL IMPLICATIONS

The first contribution of this research to the academic community is provision of an explanation of the extent and drivers of challenges faced by value chain actors and regulators in achieving food safety under risk-based food safety management systems in developing countries. This research goes beyond explaining the nature of challenges faced by value chain actors and regulators in current literature to explain how the challenges unfold and their root causes.

The second contribution is to the root causes of poor performance of alternative policy approaches to food safety regulation and formalization of the dairy sector, which currently does not exist.

Third, this thesis supports that the various theories of informality are complementary rather than competing in explaining the occurrence of informality due to either or both exit (incentives/ disincentives driven) and exclusion (capacity deficiency driven). The extent of informality by exit or exclusion depends on context-specific socioeconomic factors.

7.6 Policy Implications

This research has asked how policy has failed to address food safety in the informal dairy sector, what could be done differently in Tanzania, and whether there are relevant policy lessons for other developing countries. Some policy lessons emerged in the text, and this conclusion section offers some insights.

Acknowledge the impracticability of Codex food safety standards: Most governments in developing countries insist on adopting Codex food safety standards in domestic food markets. However, government agencies and value chain actors lack the requisite capacities and incentives to actualize them. Governments that do not have the resources to improve the capacities and incentives should consider looking for effective alternative approaches to addressing food safety in domestic markets, especially informal ones. This may entail the existence of two parallel food safety systems, one based on Codex standards for the large processors who can afford it and a second for the lower tier of traders with limited resources.

The regulatory agencies in Tanzania's dairy sector and regional trade bodies such as Southern Africa Development Community (SADC), acknowledge the capacity deficiencies among value chain actors and regulatory agencies in implementing Codex food safety regulation. However, the Government of Tanzania and SADC both maintain the vision of commercializing the dairy value chain (Dairy Industry Act, 2004; SADC, 2011). Dairy sector regulation by both institutions dictates the Codex food safety regulation implementation by value chain actors. Development practitioners also support the commercialization approach. For example, the East Africa Dairy Development (EADD) project was implemented by multiple development agencies in Kenya, Rwanda and Uganda between 2008-2018. The project established dairy development hubs under cooperatives where producers were trained in good production and milk handling practices and facilitated to access good quality inputs and extension services. The producers also had access to cold storage, milk testing, and a consistent market provided by processors (EADD, n.d). While effective at enhancing milk safety, the intervention does not address milk safety in the informal sector. The practical implications discussed below address this gap by proposing elements that may enhance the effectiveness of an intervention such as the T&C, that addresses milk safety in the informal sector.

Promote a food safety culture among value chain actors: Without the capacity for government-enforced food safety regulation, establishing a food safety culture among value chain actors may be more effective at driving food safety among value chain actors. The regulatory agencies are incapacitated by the lack of requisite capacities for implementing and

enforcing food safety systems. Therefore, the responsibility for food safety needs to shift from the government agencies to the value chain actors. This could be achieved through the official adoption of self-regulation by the value chain actors. However, this would need to be supported by capacity building in the foundations of self-regulation, which includes a high commitment to food safety culture among the value chain actors. Nevertheless, the self-regulation approach is limiting in terms of government control because they are ultimately responsible for the safety of consumers. Enforced self-regulation may be a more acceptable approach where the government plays a facilitatory role. At the same time, the value chain actors drive food safety regulations.

Embrace social incentives rather than enforced incentives: Enforced incentives for food safety among value chain actors are bound to fail due to competing interests among regulatory agencies and lack of capacity to implement and enforce them. Social incentives have been demonstrated to achieve the same level of motivation in behaviour change as financial incentives, although the former is less prevalent. Social incentives have been demonstrated to be equally effective in motivating behaviour change and even more effective than financial incentives in some instances. In other instances, social incentives have yielded less positive impact than financial incentives. Literature, therefore, reports mixed results on the effectiveness of social incentives. More research is needed to determine more accurately how social incentives influence behaviour change and its sustainability. However, social incentives are more sustainable than financial incentives because they are based on societal values, which are unlikely to change over time as opposed to the tangible financial incentives that fade after the intervention period. This reasoning is supported by the argument that human beings are social creatures and can be motivated by social life aspects which entail gaining approval from others to make everyday decisions about life.

Devise better methods to drive food safety demand: While market demand is the most effective driver for food safety, it was lacking in Tanzania's dairy sector. A key driver for the limited market demand was the lack of a reliable means of determining milk safety for unpackaged raw milk. Given the inability to implement the proposed branding component of the T&C intervention and the lack of trust in government-approved branding by consumers, there is a need for alternative means of objectively determining milk safety for consumers. The development of rapid test kits for determining milk safety at the point of purchase is one such approach. The rapid test kits would need to be affordable, portable, and easy to use for the value chain actors. The rapid tests could be reinforced by periodic comprehensive testing of

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raw milk samples by the government and providing information on the milk safety status to the public.

Address cultural incongruence between policy and cultural beliefs: Consumers profoundly believe that raw milk is safer than pasteurized milk. While these beliefs are scientifically disproven due to the potential of raw milk containing disease-causing pathogens, they are deeply rooted. Pasteurization may be hard to achieve in the short term, but there is a need to subject milk to heat treatment to destroy potentially present disease-causing pathogens. While heat treatment such as boiling does not guarantee milk safety, it eliminates most pathogens. Therefore boiled milk is safer than raw milk that is not boiled. There is a need for awareness creation on the potential public health risks posed by raw milk consumption to address the gap between the cultural practices and beliefs and the risk-based food safety requirements.

Financial inclusion of small-scale value chain actors: Facilitation of value chain actors to acquire low-cost technology for milk testing and proper milk handling is necessary regardless of the policy approach to food safety regulation adopted. The small-scale traders who are resource-constrained lack the financial resources to acquire recommended low-cost technology for milk testing and preservation. Small-scale traders are often cut off from credit facilities because they are regarded as high risk when acting individually. This limits their ability to acquire capital assets such as milk storage containers and lactometers for milk testing. However, access to financing could be addressed by encouraging collective action among value chain actors who come together in groups, and the government can negotiate agreements with lenders to finance them.

Embrace inclusivity in the development of the value chain actors: Given the differentiated roles assumed by men, women, and youth in the dairy value chain and the different nature of challenges they face in achieving food safety due to their position in society, development practitioners need to consider addressing the unique socio- cultural challenges faced by the three groups of value chain actors. Women, for example, participate in the production node but have limited access to information and technology which hinders uptake of key technology and best practices. Targeting women in information provision on technology advancements and appropriate production practices would enhance food safety at the production node. Furthermore, women are involved in milk vending but because they are constrained in participating in food safety capacity building initiatives because they need to undertake household chores as well. Tailoring the capacity-building initiatives to accommodate women's

schedules would greatly facilitate the uptake of appropriate food safety practices among female vendors who are likely to advance the knowledge forward and backward among producers, intermediaries and consumers they engage with directly and therefore expand the scope of influence. The youth who dominate the intermediary's node of the value chain due to their ability to operate in the wee hours for milk collection and are physically able to lift bulk milk could be facilitated to access financial facilities to enable them to acquire appropriate milk handling equipment and training in proper milk handling practices which they currently lack access to due to lack of financial resources.

Encourage the establishment of sustainable traders' associations: While TAMPRODA represented dairy producers and processors represented by TAMPA, the small-scale raw milk traders were not represented in any organized group. The lack of organization of raw milk traders made their capacity-building access difficult. Without proper organization, the traders are also limited in accessing financing or having a voice in matters of interest to them. For example, their lack of organization limited their representation in the dairy boards' annual council and, therefore, their participation in decision-making in matters related to dairy policy. TAMPRODA and TAMPA were instituted by TDB in fulfilment of their mandate to promote dairy sector development. The lack of institution of a trader's association reflects the government's position in pursuing commercialization of the dairy sector, which may have informed non support for the latter.. However, given the prevalence of the informal raw milk trade and the potential food safety risks it poses to consumers, it is only feasible that the government offers necessary support to the informal traders to enhance food safety outcomes. The government of Tanzania should provide incentives for trader organizations, such as negotiated financing through microfinance. The existence of such trader organizations would provide multiple benefits. They would be the basic units for food safety self-regulation in the dairy sector and contact points between the government and the numerous small-scale raw milk traders.

7.7 RESEARCH LIMITATIONS

1. This was a single case study which limits the generalizability of results to other contexts.
2. It was impossible to determine of T&C intervention effectiveness faded over time, or if the intervention was totally ineffective. This is because an effectiveness assessment of the intervention was not conducted in the short term in Tanzania.

3. The sample size used in this study was small and non-probabilistic, which limited the generalizability of the effectiveness of the T&C intervention.

7.8 RECOMMENDATIONS FOR FUTURE RESEARCH

It would be useful to carry out a study where a representative sample is used in evaluation of alternative food safety regulation policy approaches to enhance the generalizability of findings in other contexts. Application of a comparative case study for countries with different contexts would also be an interesting dimension to future research, enhancing the generalizability of the findings in other contexts.

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APPENDICES

Appendix 1: *Coding Summary by Code*

239

Aggregate	Classification	Coverage	Number Of Coding References	Reference Number	Coded By Initials	Modified On

Node

Nodes\\Attitude towards the informal sector

Document

Files\\R10

No		0.0471	1			
				1	C.K	2021-10-11 02:35

We would want to see milk processed but the processing capacity is too low and farmers need to sell their milk. Since the sale of milk in the informal sector is inevitable, they suggest establishment of measures to ensure milk safety i.e., use of proper equipment (stainless steel or Aluminium cans) and facilitation of milk testing. The new dairy sector bill is proposing collaboration of informal sector traders who will then receive sponsorship from government, NGOs or processors for milk testing.

Files\\R11

No		0.0375	1			
				1	C.K	2021-10-11 02:38

Milk quality is poor; poor quality milk rejected by processors is sold in the informal sector. The informal milk sector is an obstacle to processors, they handle significant quantities of milk which is usually adulterated and unfit for processing. We would like to see them registered with TDB and better regulated. The milk they handle should be tested at the milk collection centres and handled in appropriate containers that will preserve the quality and safety.

Files\\R13

No		0.0747	6			
				1	C.K	2021-09-02 10:24

Sale of raw milk is legal as long as the milk passes platform tests and the traders are registered with TDB and licenced to trade by the local government

				2	C.K	2021-09-02 10:24

Trade in raw milk not a welcome approach by TDB but accepted because it contributes to income generation and nutrition of the consumers. Trade in raw milk shunned because the traders use inappropriate milk handling equipment which is usually not clean. Traders generally lack knowledge in hygiene and appropriate milk handling practices. They should ideally be trained n hygiene and appropriate milk handling practices by TDB but TDB lacks financial capacity and technical staff for capacity building activities.

				3	C.K	2021-09-02 10:25

Have had dairy inspectors recruited at the local government in various regions who then train the traders on milk hygiene and appropriate handling practices although the continuity is challenges by the limited term of 5 years

Aggregate	Classification	Coverage	Number Of Coding References	Reference Number	Coded By Initials	Modified On
				4	C.K	2021-09-02 10:26

The accessible traders are trained in milk hygiene and appropriate milk handling practices and they are also required to register with the board at a fee to be recognized as milk traders

| | | | | 5 | C.K | 2021-10-11 03:41 |

Research conducted by TDB in collaboration with Sokoine University of Agriculture on milk safety and quality

| | | | | 6 | C.K | 2021-09-02 10:27 |

Yes, the government has generally not invested in the dairy value chain compared to other value chains such as the meat value chain which is better regulated and controlled.

The local government s such is not very keen on regulating milk trade; there are no designated areas for sale of milk in the market compared to other food products which have been allocated specific areas of operation in the markets. Longido is however an exception and has a designated area for milk sale

Files\\R14

No		0.0673	7			
				1	C.K	2021-09-02 10:27

Sale of raw milk is illegal but sale happens and no action is taken. The reasons for existence of raw milk trade include inefficient milk processors, operate below capacity and cannot fulfil the market demand, processors offer low price to farmers who otherwise fetch better prices for their milk from the informal sector

| | | | | 2 | C.K | 2021-09-02 10:33 |

No action taken currently for sale of raw milk without licences

| | | | | 3 | C.K | 2021-09-02 10:33 |

Illegal, on grounds of milk being unsafe

| | | | | 4 | C.K | 2021-09-02 10:33 |

Yes, they only work with processors of pasteurized milk which is perceived to be safe

| | | | | 5 | C.K | 2021-09-02 10:34 |

Research, they test both raw and pasteurized milk for various quality parameters

| | | | | 6 | C.K | 2021-09-02 10:34 |

I agree and this is driven by the lack of adequate supply of pasteurized milk and the fact that it is too expensive for the ordinary consumer

| | | | | 7 | C.K | 2021-10-11 02:42 |

It contributes to the nutrition of consumers but health and safety impact may be compromised.
It also contributes to income generation of the farmer and vendor.

Files\\R15

241

| No | | 0.0526 | 8 | | | |

| | | | | 1 | C.K | 2021-09-02 10:35 |

Sale of raw milk is legal

Aggregate	Classification	Coverage	Number Of Coding References	Reference Number	Coded By Initials	Modified On
				2	C.K	2021-09-02 10:36

Okay with the sale of raw milk but trying to encourage investors to process raw milk because the raw is readily available

| | | | | 3 | C.K | 2021-09-02 10:36 |

Yes, we license both the processors and the informal traders

| | | | | 4 | C.K | 2021-10-11 03:44 |

Reports from others

| | | | | 5 | C.K | 2021-09-02 10:37 |

No

| | | | | 6 | C.K | 2021-09-02 10:37 |

True that raw milk is the most preferred. However, they view processed milk as safer i.e., treated

| | | | | 7 | C.K | 2021-09-02 10:37 |

Important for the income generation of the traders and contribution to nutrition of the households consuming
Challenges producers may not observe such as the withdrawal period after treating animals

| | | | | 8 | C.K | 2021-10-11 03:42 |

They lack equipment to test milk safety
They lack equipment to preserve milk for prolonged shelf life

Files\\R3

| No | | 0.1374 | 3 | | | |

| | | | | 1 | C.K | 2021-09-02 10:17 |

Selling to consumers --- it is legal (that is why it is sold in all rural areas); but some countries have set up some regulations to control its sale in urban areas.
purchasing for processing
the Uganda/ Kenya case-- previously, Kenya used to put restrictions to prevent Brookside from importing milk yet the processor needed raw milk during dry season.
the processor may be taking advantage of the EAC`s common markets protocol to import raw milk, Brookside also recently acquired a major processing plant in Uganda

| | | | | 2 | C.K | 2021-09-02 10:17 |

242

extremely important--it supports the largest number of value chain actors, is an investment opportunity, good for nutrition

many positive aspects -- access to markets, employment for many operators (small-scale traders, transporters, retailers, etc.).

helps poor income earners to access milk at lower prices

problems

poor practices of the actors (e.g., adulteration)

not well organized

compliance with regulations is poor (they see regulations as a way of eliminating them and will resist)

Traders put a lot of advocacies to fight government regulations (e.g., UNDATA (for milk traders in Uganda), they may even go to court; they may not be equally organized in all the countries. The association may not be able to oversee activities of the members in the entire country;

it is difficult to monitor quality of products marketed (many actors who are not organized, not regulated, and can sell products of any quality).

no access to finance to improve their businesses

Regulations should not be aimed at eliminating them. The law should be able to help them improve the handling and quality of milk i.e., support them to improve quality through aspects such as certification.

Aggregate	Classification	Coverage	Number Of Coding References	Reference Number	Coded By Initials	Modified On
				3	C.K	2021-09-02 10:17

Based on practice, has worked at all levels in the dairy value chain (animal health, dairy management, research, development etc.).
EAC -- not yet done any research on informal sector

Files\\R4

No		0.0549	2			
				1	C.K	2021-10-11 11:15

Poor disease control due to lack of proper vaccination programs and poor quality of drugs

				2	C.K	2021-10-11 02:34

They view them as important in the milk supply and want them to be regulated and milk tested before sale. The government is also pushing for farmer organizations to be able to access markets and the processors to improve the price for raw milk. Government has offered tax relief to processors and imposed taxes for imported milk products
Government agencies have similar views and do not differ in opinion

Files\\R5

No		0.0683	3			
				1	C.K	2021-09-02 10:19

The sale of raw milk is legal; there is no specific law that prohibits its sale. Milk traders operating in fixed premises or milk collection centres are required to have the general local government trade license but there is no specific license issued by the local government for milk trade.

				2	C.K	2021-10-11 02:44

Raw milk consumption is not a safe option and there is need to educate the society on the hazards and risks of raw milk consumption
The raw milk is however important for consumer nutrition and income generation for vendors and producers who are then able to engage in development projects and educate their children
Trade in raw milk is challenged by the risk of mil being contaminated before it reaches the consumer or processor for conversion to other dairy products

243

| | | 3 | C.K | 2021-09-02 10:21 |

Attitude based on reports from institutions of higher learning and TDB test results

Files\\R6

No		0.0171	1		
			1	C.K	2021-10-11 03:08

Raw milk is not safe for consumption; it has high microbial load because it is not handled properly during storage and distribution posing potential health risks.

2021-10-14 10:05

Aggregate	Classification	Coverage	Number Of Coding References	Reference Number	Coded By Initials	Modified On

Files\\R7

No		0.0231	1		
			1	C.K	2021-10-11 03:09

The sale of raw milk is not appropriate, the milk is largely adulterated and therefore unsafe. The milk is further unsafe if consumed raw when it came from treated animals whose withdrawal period was not observed.

Files\\R8

No		0.0058	1		
			1	C.K	2021-10-11 03:09

is okay if it is properly boiled before consumption

Files\\R9

No		0.0484	3		
			1	C.K	2021-09-02 10:22

Yes, the traders are considered legal as long as they are registered with TDB and have TFDA and TBS licences and Local government business permit

| | | | 2 | C.K | 2021-10-11 02:40 |

Positive. Since milk is boiled before consumption, it is not as risky. Furthermore, the sector is important for revenue generation of the seller and nutrition of the consumer. The public health office intends to continually educate the traders to improve delivery of safe milk

| | | | 3 | C.K | 2021-10-11 03:41 |

Attitude based on personal insights.
Office doesn't conduct individual research regarding the informal sector

Nodes\\Attitude towards the informal sector\Raw milk preference

Document

Files\\R10

No		0.0549	1		
			1	C.K	2021-10-11 02:46

Yes, raw milk is the preferred option although it may be hazardous for lack of pasteurization. The reasons for its preference over raw milk include its affordability (1000-1500/L) compared to pasteurized milk which retails at 4500/L or powder milk whose price has skyrocketed due to the additional taxes recently imposed. However current supply of processed milk is inadequate for the existing demand; stock in supermarkets depleted by 11am/ 12pm. The taste of raw milk is also preferred especially in tea and it offers convenience where the consumers often get door to door delivery.

2021-10-14 10:05

Aggregate	Classification	Coverage	Number Of Coding References	Reference Number	Coded By Initials	Modified On
Files\\R11						
No		0.0263	1			
				1	C.K	2021-10-11 02:58

True, raw milk is often preferred; processed milk is often perceived as having unpleasant additives both by the illiterate and literate.
It is possible that the quality and safety does not differ due to common source which is initially contaminated; Microbial load in raw milk is used by processors is not of acceptable quality.

Files\\R13

No		0.0159	1		
			1	C.K	2021-10-11 02:29

Agreed, raw milk preferred but which is okay because the milk is usually boiled before consumption in Chai or porridge which are the common forms of milk consumption. There are however concerns in the quality of raw milk which is often adulterated and limited distribution of the raw milk in areas that are geographically distant from the production areas

245

Files\\R14

No	0.0108	1			
			1	C.K	2021-10-11 02:48

I agree and this is driven by the lack of adequate supply of pasteurized milk and the fact that it is too expensive for the ordinary consumer

Files\\R15

No	0.0083	1			
			1	C.K	2021-10-11 02:49

True that raw milk is the most preferred. However, they view processed milk as safer i.e., treated

Files\\R4

No	0.0280	1			
			1	C.K	2021-10-11 02:46

Raw milk is only preferred because it is readily available and cheap. However, consumers are aware of the health and safety risks of raw milk consumption and would prefer to consume quality processed milk if it could be accessible and reasonably priced.

2021-10-14 10:05

	Aggregate	Classification	Coverage	Number Of Coding References	Reference Number	Coded By Initials	Modified On

Nodes\\Future focus

Document

Files\\R3

No	0.1344	2			
			1	C.K	2021-08-17 12:31

246

the focus has been on control of trans-boundary animal diseases, but in the future, want to work on supporting animal health in pastoralists communities (water, feeding etc.), a proposal has been prepared and now looking for resource partners.

EAC is also developing a revised strategy for control of transboundary disease (i.e., FMD, rift valley fever, and PPR)

for milk production/ processing/ marketing, there are no plans by EAC to intervene in this area in the near future

however, with AUIBAR, EAC wants to support interventions in the dairy value chain, under an EU funded project "live2Africa". Regional economic communities were asked to suggest value chains they would like to work on, EAC identified dairy.

| | | | | 2 | C.K | 2021-08-17 12:59 |

Opportunities

the secret to facilitating the intra-regional trade is the "common market protocol" which allows for free movement of goods from one country to another without any tariff.

this includes milk products manufactured within a country. It also allows for free movement of services, labour etc. also mutual recognition agreement to veterinary professionals.

the freedom provides a lot of freedom -- goods, services, businesses, investments etc.

perhaps the reason why Brookside has established a factory in Uganda

farmers can increase their production as the market is wider; also, more is processed as processors can access a bigger market.

At the regional level --- we are slowly reducing on international imports

Sharing of experiences

no activities at the EAC but at the national level where heads of regulatory agencies meet, trade fairs are organized and attended by different partner states

is important but no resources to organize activities

a platform of regulatory agencies was established by EAC but is not active (only discussed the issue of harmonization of standards but not for regulations

Nodes\\Future focus\Authority structuring

Document

Files\\R13

| No | | 0.0635 | 4 | | | |

| | | | | 1 | C.K | 2021-08-17 10:37 |

The annual council which currently comprises of 10 members is targeted to reduce the members by half

There are plans to introduce cess fee to milk processors

Intention to develop policy that guides the appointment of dairy inspectors at the local; government

| | | | | 2 | C.K | 2021-08-17 10:40 |

What future changes to policy in the dairy sector (that are relatively imminent) are expected? What are key points/shifts contained within this policy?

Representation of the board to have less private sector stakeholders

Delegation of power to enforce dairy sector regulation to any competent authority including the local government

2021-10-14 10:05

Aggregate	Classification	Coverage	Number Of Coding References	Reference Number	Coded By Initials	Modified On
				3	C.K	2021-08-17 10:40

247

Appointment of dairy inspectors at local government
Introduction of cess on raw milk for processors

| | | | | 4 | C.K | 2021-08-17 10:42 |

There is strategy to attract investors in dairy production and processing by improving the business environment through protectionist policy measures. Processors will be assisted by the government to access milk producers who will be organized in associations and producers helped to access AI services easily. These changes are targeted to reduce the trade in raw milk which is perceived to limit revenue collection and pose health hazards to the consumers. The increase in milk production and processing is expected to enhance milk consumption especially among those in regions that have no or limited milk production because of the enhanced shelf life which will facilitate distribution to wider geographical areas.

Files\\R14

No		0.0012	1			
				1	C.K	2021-08-17 11:46

Not aware of any

Nodes\\Future focus\Recommendations to improve informal dairy sector

Document

Files\\R1

No		0.0095	1			
				1	C.K	2021-09-21 09:22

Establishment of farmers/ vendors associations which could seek commercial financing to expand their business activities

Files\\R10

No		0.0936	3			
				1	C.K	2021-10-11 11:15

The vendors operate at very small scale and as such lack willing financiers
They are no keen to formalize because they do not want to remit the fees required by the multiple regulatory agencies which amounts to huge sums of money. The time taken to obtain licenses is also disincentivizing for them.

| | | | | 2 | C.K | 2021-09-21 09:26 |

The government should work with the traders to understand their challenges and perspectives and together charter a way forward towards formalization

Aggregate	Classification	Coverage	Number Of Coding References	Reference Number	Coded By Initials	Modified On
				3	C.K	2021-10-11 11:14

traders are not keen on getting formalized due to the many bureaucratic processes involved, heavy taxes and license fees associated with formal milk processing. Formalization should only target vendors who are looking for growth and expansion in the formal industry; otherwise, such initiatives should avoid involving vendors who are in the business short term. Additionally, necessary information should be provided to the vendors on the benefits of formalization to get their commitment. The successful ones would be role models to their peers.

Files\\R11

No		0.0206	1			
				1	C.K	2021-09-21 09:28

Improvement of infrastructure to ensure raw milk collected is of good quality. Milk should be collected through milk collection centres with cooling and testing facilities. Producers should also be educated on how to handle milk properly to preserve quality

Files\\R12

No		0.0108	1			
				1	C.K	2021-09-21 09:27

Merging with TAMPA to gain representation at local levels
Enhancing training among producers with little knowledge / lack knowledge

Files\\R13

No		0.0076	1			
				1	C.K	2021-08-17 10:46

Establishment of code of conduct for the various value chain actors and sustained appointment of dairy inspectors at the local government to enforce the code of conduct

Files\\R14

No		0.0344	2			
				1	C.K	2021-08-17 11:48

Poor market coordination where producers are not willing to sell to the processors due to poor prices and the processors use powder milk for reconstitution instead.

				2	C.K	2021-08-17 11:48

Dairy farmers should establish farmers associations where quality will be assured collectively and the processors will be willing to buy at higher price.
TDB and MOALF to educate farmers on how to produce high quality milk and safe milk which will facilitate the farmers to work together

249

Aggregate	Classification	Coverage	Number Of Coding References	Reference Number	Coded By Initials	Modified On

Files\\R15

No		0.0469	2			
				1	C.K	2021-08-17 12:06

There is need to enable the informal traders to collectively start small scale processing and milk packaging e.g., the Mronga women group in Kilimanjaro they have managed to evolve from informal traders to processing and packaging

				2	C.K	2021-10-11 11:12

Livestock office to provide special milk containers for milk vendors which will preserve milk quality and safety
There should be establishment of policy that requires establishment of milk collection / processing centres that are well equipped and isolated for milk only as opposed to sale of milk in general merchandise shops.

Files\\R3

No		0.0589	1			
				1	C.K	2021-08-17 12:34

help the traders to develop the necessary infrastructure to deliver quality milk (collection, bulking, vending). cold chain is essential -- in Uganda, cold chain handling was made mandatory in Uganda (no transport of warm milk). Boiling of milk was found to spoil the quality of the product (because of adulteration)
hawkers -- are an efficient way of reaching the consumers; need to licence them, and licence the tools they use
empower the regulatory agencies to monitor operations e.g., do spot checks. They also need resources for capacity building of their staff.
self-regulation through trader associations, but there is a tendency to exploit the members e.g., over charge them, which forcing them to comply.
sensitization of the actors (e.g., milk handling, also consumers on how to identify bad milk).

Files\\R5

No		0.0412	1			
				1	C.K	2021-08-17 10:19

Training of dairy value chain actors on the importance of raw milk hygiene, safety, quality, nutrition and hazards of raw milk consumption
Provision of equipment to test milk quality/ safety by the dairy inspectors and also provide the appropriate milk handling vessels
Dairy producers to be trained on the appropriate feeding regimes and animal management
The vendors to be educated on the importance of having the necessary licences and follow up inspections for compliance to be conducted regularly

250

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Files\\R9

Aggregate	Classification	Coverage	Number Of Coding References	Reference Number	Coded By Initials	Modified On
No		0.0069	1			
				1	C.K	2021-08-17 10:33

Increased frequency of inspection and education on milk safety and hygiene

2021-10-14 10:05

Aggregate	Classification	Coverage	Number Of Coding References	Reference Number	Coded By Initials	Modified On

Nodes\\Mandate

Document

Files\\R13

Aggregate	Classification	Coverage	Number Of Coding References	Reference Number	Coded By Initials	Modified On
No		0.0540	3			
				1	C.K	2021-09-14 12:29

TDB is mandated to develop, regulate and promote the dairy industry. Functions of the board include to organize, regulate, develop and promote the efficient production marketing, distribution and supply of dairy produce; to improve the quality of dairy produce; to secure reasonable prices; to conduct market research; to promote private sector development.

				2	C.K	2021-09-14 12:32

TDB registration certificate @ Tshs 5000 valid for five years but an annual fee amounting to 10% of the registration fee required for subsequent years after registration up to the 5th year.
Takes a maximum of 2 days to acquire the certificate after application if all standards are met.
Standards to be met include possession of suitable milk handling equipment, equipment to conduct platform tests and achievement of hygiene (not explained)
Purpose of license is to ensure that the traders' capacity to achieve milk safety has been assessed and is satisfactory and develop a database of existing milk traders for traceability.

				3	C.K	2021-08-17 10:45

Promotion of milk consumption through training of health benefits from milk consumption among consumers including promotion and implementation of school feeding programs in collaboration with development agencies

Files\\R14

Aggregate	Classification	Coverage	Number Of Coding References	Reference Number	Coded By Initials	Modified On
No		0.0979	2			
				1	C.K	2021-09-14 10:20

251

Establishment of quality/ safety parameters through a technical committee; Issuance of the mark of quality which is compulsory for milk processors; General regulation of processed milk and milk products; implements public health and nutrition Acts

Yes, formulates policy; the "quality policy" is currently under development and touches on all food products and seeks to clarity on roles of various agencies to avoid conflict

It is difficult to quantify time/ budget allocated to dairy sector; depends largely on market demand

| | | | 2 | C.K | 2021-09-14 10:33 |

Inspections are carried for pasteurized milk out among dairy processors; none for raw milk although they have developed raw milk standards and code of conduct for raw milk value chain. Raw milk standards are implemented by TDB and inspections too.

Initially they inspected for quality while TFDA inspected for safety but with the disbandment of TFDA, TBS does inspections for both quality and safety.

For safety non-compliance, production is normally stopped and processor advised on how to improve; they are allowed to continue operations after compliance. For persistent non-compliance the processor is fined.

There are targeted number of inspections and certifications expected from the officers. These are stratified based on the revenue levels that they earn.

Files\\R15

No		0.0486	3		
			1	C.K	2021-08-17 11:59

Issue business license to dairy sector traders at a fee

Aggregate	Classification	Coverage	Number Of Coding References	Reference Number	Coded By Initials	Modified On
				2	C.K	2021-08-17 12:02

Engagement with the dairy sector only involves issuance of trade licenses to traders in the dairy sector and inspection for its validity.

| | | | | 3 | C.K | 2021-09-14 11:16 |

They trade license fee is seen as a disincentive to the traders in obtaining the license. The vendors with fixed premises are required to pay Tshs 50,000 per year. Mobile vendors were required to pay a daily rate of Tshs 500 but in 2019 this changed and they are now required to obtain an annual business ID at Tshs 20000 as long as their annual revenue does not exceed Tshs 4000000.

Files\\R3

No		0.0431	1		
			1	C.K	2021-08-17 12:21

Mainly focuses on establishing an enabling environment for livestock production and trade in livestock products. All sectors (ordinarily those that the national governments would deal with); the agriculture and food security department focus on agriculture (crops, livestock, fisheries, apiculture)

inform a harmonized policies, legal framework, regulations, strategies and guidelines

Also facilitate intra-regional trade and address any trade related issues (policies, infrastructure, non-tariff barriers

But also, at the international level --address issues at production and trade levels

Files\\R5

No		0.0863	3			
				1	C.K	2021-08-17 10:02

The local government partners with the central government ministries to deliver key services including education, health care, local road networks, provision of extension services.

				2	C.K	2021-09-14 12:20

Carries out work related to enhancement in dairy production and milk hygiene which is carried out by livestock officers in collaboration with Dairy technicians and TDB. The officers visit dairy producers and educate them on appropriate dairy production techniques and hygiene. The Ministry has also been involved in installation of milk cooling tanks at milk collection centres in the milk producing areas although this has been greatly challenged by lack of adequate financing.

				3	C.K	2021-09-14 12:21

At the milk collection centres, the livestock officers are required to inspect the milk for platform tests compliance. However, the livestock officers lack necessary equipment to carry out the tests. Ideally, if milk is found to be non-compliant, it should be discarded; no fines are implicated. There are no targets set for number of inspections that a livestock officer should achieve annually.

Files\\R9

No		0.1320	4			
				1	C.K	2021-08-17 10:25

Assess food business premises for hygiene and advise business owners on how to achieve food safety
Inspect food business premises for proper layout to ensure that the flow of food in processing is right to achieve food safety
Conduct random food testing for compliance with legal standards in collaboration with TFDA and TBS
Public health education among food handlers.
Ensure that all food handlers are certified to be medically fit and issued wit public health certificate

2021-10-14 10:05

Aggregate	Classification	Coverage	Number Of Coding References	Reference Number	Coded By Initials	Modified On
				2	C.K	2021-08-17 10:27

The dairy sector operators that we engage with are few. However, we issue public health certificates to those we engage with and periodically inspect them for compliance

				3	C.K	2021-09-14 11:29

Public health officers inspect layout of premises for appropriate flow of milk, hygiene of premises and public health certificates for milk handlers for those with processing plants / hotels or milk bars
If the business is non-compliant the owner is educated on how to achieve compliance and given time to comply. If they do not comply within the stipulated time frame, they are forced to close the business until they comply.

				4	C.K	2021-09-14 11:30

Public health certificate whose cost ranges Tshs 5,000 to Tshs 200,000 depending on size of business
Requirements before issuance of certificate are TRA clearance, clean premises, public health certificates for food handlers, District council office clearance and TFDA clearance
Issuance of the public health certificate takes 2 days if all requirements are met.

Nodes\\Mandate\Accountability

Document

Files\\R13

No	0.0057	1			
			1	C.K	2021-08-17 10:35

Annual performance reported to the MOALF and overall performance of the institution further assessed by the treasury registrar

Files\\R14

No	0.0432	3			
			1	C.K	2021-08-17 11:33

Ministry of Industry and investment

			2	C.K	2021-08-17 11:42

Annual targets are set by the ministry and passed over to the employees which are then assessed at the end of the year
Monthly reports also done to the immediate supervisors
Annual targets set by employees and their supervisors and assessed every six months
Progress reports are communicated to the ministry and used to evaluate individual performance which informs promotions

			3	C.K	2021-09-14 10:33

There are targeted number of inspections and certifications expected from the officers. These are stratified based on the revenue levels that they earn.

2021-10-14 10:05

Aggregate	Classification	Coverage	Number Of Coding References	Reference Number	Coded By Initials	Modified On
Files\\R15						
No		0.0427	2			
				1	C.K	2021-08-17 12:00

The trade office in Arusha DC which is a local government office reports to the Regional Administrative Secretary in Arusha who then passes on the reports to the national level local government office.

				2	C.K	2021-08-17 12:01

254

The head of trade section gives targets to the trade officers against which their performance is assessed. The District Executive Director also assesses overall trade department performance. External auditors assess district performance in Revenue collection, service provision and trade licence issuance.

Files\\R3

No		0.0257	1			
				1	C.K	2021-08-17 12:26

EAC does not set the sector performance, it only coordinates, implementation is done at the national level.
for EAC, targets / indicators are linked to specific project interventions where outputs/ outcome/ and milestones have to be achieved and reported. It is important for ensuring funding, for EAC to be able to secure the next round of support.

Files\\R5

No		0.0088	1			
				1	C.K	2021-08-17 10:04

Both annual and quarterly targets usually set and performance assessed at the end of each reporting period.

Files\\R9

No		0.0091	1			
				1	C.K	2021-08-17 10:26

Annual targets are normally set for all levels and assessed at the end of the year by supervisors.

2021-10-14 10:05

Aggregate	Classification	Coverage	Number Of Coding References	Reference Number	Coded By Initials	Modified On

Nodes\\Mandate\Policy enforced in the dairy sector

255

Document

Files\\R13

No		0.0048	2			
				1	C.K	2021-08-17 10:39

2004 Dairy Industry Act

				2	C.K	2021-08-17 10:41

The Dairy Industry Regulations of 2007
Milk import and export regulation of 2012

Files\\R14

No		0.0033	1			
				1	C.K	2021-09-14 10:31

implements public health and nutrition Acts

Files\\R3

No		0.0647	2			
				1	C.K	2021-08-17 12:29

there is no EAC regulation on trade or consumption of raw milk in the region; these exist at the individual partner state level
there are harmonized standards for raw milk, powder milk, and pasteurized one

				2	C.K	2021-08-17 12:30

EAC does not have any regulations on the domestic marketing of agricultural products. It is only concerned with cross border trade.
Milk is covered under general rules / policies (so EAC does not have a policy / regulation that is specific to milk).
Any product that is produced by the member country is free of any tariff; the rules of origin have to apply (so it is clear the product is produced in that particular country).
The only regional initiative on milk / milk products is harmonization of standards.
There is a livestock policy at the regional level (need to confirm if dairy is included). Dairy is also included control of animal diseases at the regional level.

Files\\R5

No		0.0209	1			
				1	C.K	2021-08-17 10:12

Regarding livestock, the local government uses the 2006 livestock policy which emphasizes on improved modern breeds and use of AI. They also refer to the 2003 Animal Health / Disease Control Policy. The Good Animal Nutrition Policy is also a key reference.

256

Aggregate	Classification	Coverage	Number Of Coding References	Reference Number	Coded By Initials	Modified On
Files\\R9						
No		0.0082	1			
				1	C.K	2021-08-17 10:31

Public Health Act 2009
Local Government by laws 2010
Environment Management Act 2014

Nodes\\Mandate\Policy making

Document

Files\\R14

No		0.0356	3			
				1	C.K	2021-09-14 10:32

Yes, formulates policy; the "quality policy" is currently under development and touches on all food products and seeks to clarity on roles of various agencies to avoid conflict

				2	C.K	2021-08-17 11:47

Yes, Cow raw milk standard which is utilised by processors at the point of purchase of raw milk

				3	C.K	2021-08-17 11:48

Initially challenged by small scale processors unwillingness to contribute to standards development and payment for purchase of standards but the industry has grown now and these challenges are less

Files\\R15

No		0.0138	1			
				1	C.K	2021-08-17 12:02

In policy formulation we give input in trade policy matters to the Ministry of Industry and trade who then tables bill to parliament for the process of legislation.

Files\\R5

No		0.0122	1			
				1	C.K	2021-08-17 10:07

We collaborate with the MOALF in formulation of dairy sector policy e.g. the Dairy Policy of 2006 which guides livestock production and milk handling

Aggregate	Classification	Coverage	Number Of Coding References	Reference Number	Coded By Initials	Modified On

Files\\R9

No		0.0178	1			
				1	C.K	2021-08-17 10:27

Yes, local government by laws relating to public health.
The local government officers formulate the bylaws, then the local government minister approves for use at the local government level.

Nodes\\Mandate\Regulation effectiveness

Document

Files\\R15

No		0.0380	1			
				1	C.K	2021-09-14 11:18

Milk traders constitute less than 1 percent of all trade licensed. Majority of milk traders do not take up trade licenses. Instead, they use other general store retailers as the point of sale for their milk. Traders in the dairy sector that have trade licenses are the ones that operate small industries where they pack milk. Other milk traders that apply for the trade license are those that are interested in accessing financing for their business.

Nodes\\Operating challenges faced

Document

Files\\R13

No		0.0304	1			
				1	C.K	2021-08-17 10:36

258

Challenge: Limited number of technical personnel currently have five permanent staff who are technical. Have recruited dairy inspectors at the local government level to enhance reach but these are appointed for five years which expired in July 2018. Reappointment has been challenged by lack of financial resources to pay them and bureaucratic process

Change needed: The appointment of dairy inspectors at the local government should be more effective and the bureaucracies eliminated.
Challenge: Lack of adequate financial resources to fund the institution operations
Needed change: Introduction of cess fees to dairy processors to increase the revenue generation base.

Aggregate	Classification	Coverage	Number Of Coding References	Reference Number	Coded By Initials	Modified On
Files\\R14						
No		0.0157	2			
				1	C.K	2021-08-17 11:45

Manpower is inadequate to cover the wide geographical region of Tanzania.
There is no strategy in place currently to change the situation

| | | | | 2 | C.K | 2021-08-17 11:45 |

Increasing the number of staff to cover the wide geographical area

Files\\R15						
No		0.0422	2			
				1	C.K	2021-08-17 12:03

Business operators are not willing and ready to voluntarily pa for trade licenses. They feel the amount paid is a lot but they fail to understand that the license gives them access to financial resources
Low manpower and lack of infrastructure i.e., vehicle to do inspections
Lack of financial resources to facilitate training of traders in trade matters

| | | | | 2 | C.K | 2021-08-17 12:03 |

Central government should increase funding of budget to facilitate financing of capacity building activities and approve recruitment of more manpower

Files\\R3						
No		0.0683	2			
				1	C.K	2021-08-17 12:27

259

Resource constraints --

Limited human resource (because of the limited funding can only afford to hire 1-2 staff in each department, and a lot of work needs to be done)

Some partner states lag behind in domesticating agreed policies / protocols; they take time to abide to what has been agreed on (policies, guidelines etc.).

There are efforts to address the policy challenges but this implemented step by step. Usually, the council will remind the member state to implement what has been agreed on.

Non-tariff barriers -- some member states put barriers to trade which is against the customs union of protocols (which they signed)

Delay to remit contributions by member states

		2	C.K	2021-08-17 13:00

Non-tariff barriers that are imposed by the countries, on the road and at the border. Transporters and importers face numerous non-tariff barriers

They also face some regulation challenges that impact on their businesses.

Own challenges -- e.g., capital

Aggregate	Classification	Coverage	Number Of Coding References	Reference Number	Coded By Initials	Modified On
Files\\R5						
No		0.0479	1			
				1	C.K	2021-08-17 10:06

Lack of adequate financing to run the office day to day operations

Lack of manpower due to lack of finances to pay their salaries

Lack of equipment for extension officers and means of transport for them to reach their clients

Political interference, they are limited in exercise of powers because some of the stakeholders have strong political affiliation

Lack of access to credible data due to lack of proper management.

The challenges are likely to be around for long; they are mainly related to lack of financial capacity and there is no clear strategy to resolve it currently.

Files\\R9						
No		0.0267	1			
				1	C.K	2021-08-17 10:26

Lack of adequate funds to finance our activities

Lack of enough ward health officers

Financing could be improved through increased budget allocation from the local government

Recruitment of more ward health officers by the district council to ease the burden occasioned by limited staff

Nodes\\Operating challenges faced\Collaboration with other policy makers

Document

Files\\R13

No		0.0207	1			
				1	C.K	2021-08-17 10:45

NEMC, TBS, local government, weights and measures, OSHA, Fire Dept and DVS
Collaborates with TBS in standards development and licencing; TDB has to register traders before they can be licensed by TBS.
Collaborates with DVS in control of import of milk and milk products and offering training on zoonotic diseases.
Recruits milk inspectors who work under the local government for capacity building among milk value chain actors and inspection for compliance

Files\\R14

No		0.0176	2			
				1	C.K	2021-08-17 11:46

TBS works with TDB to help them establish standards and codes of conduct whose mandate lies with TBS

Aggregate	Classification	Coverage	Number Of Coding References	Reference Number	Coded By Initials	Modified On
				2	C.K	2021-08-17 11:46

Collaborates with MOALF, NEMC, TDB and atomic energy agency to do integrated market inspections periodically among milk processors

Files\\R15

No		0.0476	2			
				1	C.K	2021-08-17 12:04

BRELA through the trade officers at the local government works with TDB to help them recruit traders to participate in milk consumption campaigns e.g., the "milk day in Tanzania" where people are educated on the importance of milk consumption

				2	C.K	2021-08-17 12:04

MOALF who engage with livestock producers in production matters who the use the shopkeepers to sell their milk at a commission
Public health office who issues public health clearance to traders who process and pack their milk so that they are then issues with trade license upon compliance with the trade office requirements

Files\\R5

No		0.0373	1			
				1	C.K	2021-08-17 10:08

The local government collaborates with TDB in appointment of inspectors at the local level who then carry out the functions of inspection, capacity building and registration on behalf of TDB.

Collaborates with MOALF in capacity building, provision of equipment, revenue generation, development projects, providing trainings and seminars, milk campaigns, data collection at local government offices and conflict resolution among livestock and crop farmers

Files\\R9

No		0.0188	1			
				1	C.K	2021-08-17 10:31

TDB collaborates with the livestock officers and medical practitioners to address zoonotic diseases
TDB also works with livestock officers in case of livestock disease outbreaks to trace and address them

2021-10-14 10:05

Aggregate	Classification	Coverage	Number Of Coding References	Reference Number	Coded By Initials	Modified On

Nodes\\Operating challenges faced\Decision making

Document

Files\\R13

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No		0.0414	2			
				1	C.K	2021-09-14 12:31

The board was meant to be semi-autonomous but according to one sector expert, the government didn't feel comfortable to have the board so far removed from itself.

In terms of structure: TDB is governed and reports to the Ministry Livestock and Fisheries through the Chairman of the board.

The annual council which is comprised of various dairy sector stakeholders sits under the minister and is responsible for promoting a sustainable dairy sector and scrutinizing the performance of the board. The board reports to the council and is the executive arm of the council meaning it implements the council decisions.

				2	C.K	2021-08-17 10:35

Still not autonomous with some decision making controlled by the MOALF

Decision making is otherwise through discussion of agendas proposed by the board members and voting by majority. Currently the private sector are the majority members of the dairy board and therefore carry the decisions most of the times

Files\\R14

No		0.0218	1			
				1	C.K	2021-08-17 11:34

Decisions are made from the top and communicated down the structure for implementation except for standards development which is led by the standards officers. The institution is semi-autonomous and only gets government funding for salaries but other institution operations are self-funded

Files\\R15

No		0.0284	1			
				1	C.K	2021-08-17 12:01

Executive director at the district local government office is the final decision maker and below him is the head of trade department section to whom the trade officers report. The trade officers have the power to issue or deny trade licences to the business operators and inspect for presence of the trade license among existing businesses

Files\\R3

No		0.0147	1			
				1	C.K	2021-08-17 12:26

when a decision is made by EAC, national governments (partner states) are required to implement. When a law / policy etc. is made, if it is a regional law, it takes precedence, and has to be followed.

Aggregate	Classification	Coverage	Number Of Coding References	Reference Number	Coded By Initials	Modified On

263

Files\\R5

No		0.0185	1			
				1	C.K	2021-08-17 10:03

Decision making is by the central government through the ministry of Local Government Authority. The decisions are passed by the Minister through the Assistant Minister then the permanent secretary to the various departments.

Files\\R9

No		0.0204	1			
				1	C.K	2021-08-17 10:26

Ward heath officer reports to district health officer who reports to district medical officer who reports to district executive director. Directives come from the district executive director and passed down the command chain.

Nodes\\Operating challenges faced\Decision making\Dairy stakeholders' representation in decision making
Document

Files\\R13

No		0.0355	1			
				1	C.K	2021-08-17 10:39

Not well organised; only in Mwanza the informal dairy traders have representation in the annual council; no representation in the board itself
Consumers and input suppliers are also not represented in the board
No plan to improve representation of the various stakeholders. Infect the intention is to reduce the board size from the current 13 members to 9 with representation from dairy value chain actors limited to 2. The change is likely to diminish the autonomy of the board even further; majority representation will be of public officers.
Traders' interests are therefore not well represented due to lack of representation and traders are also not keen to interact with the board because they often regard themselves illegal for lack of compliance with the regulatory requirements

Aggregate	Classification	Coverage	Number Of Coding References	Reference Number	Coded By Initials	Modified On

Nodes\\Operating challenges faced\Funding

Document

Files\\R13

No		0.0306	1			
				1	C.K	2021-08-17 10:35

Central government approximately 10%
Own revenue generation from registration fees of dairy actors, inspection fees and permits to carriers and importers of milk. This contributes 90% of the board's financial resources
The amount is not adequate to cater for the Boards annual budget and covers up to 40% of the annual budget.
Efforts to cover the deficit include registration of dairy stakeholders who are charged registration fees and levies, collaboration with partners who are like minded and therefore fund the board activities, gifts and donations although it is now difficult to get donor funding for government institutions; large projects funded through the central basket

Files\\R14

No		0.0176	1			
				1	C.K	2021-08-17 11:43

Salaries are funded by the central government
Other operation costs are funded by the institution's own revenue generation
In case TBS generates revenue that exceeds their annual expenditure, the excess is remitted to the Ministry

Files\\R15

No		0.0178	1			
				1	C.K	2021-08-17 12:01

Central government allocates about 20% of overall budget; 80% raised through own revenue generating activities including issuance of licenses.
Expenditure of own generated revenue authorised by the local government

Files\\R3

No		0.0730	1			
				1	C.K	2021-08-17 12:27

265

EAC is funded in 2-3 ways

mandatory partner state contribution - each gives same amount each year

donor grants --e.g., USAID, EU, China etc. The donor determines the priority sector to fund. Health, trade and customs (want to see if EAC integration is taking place), agriculture is among the preferred funding sectors; health receives more funding than agriculture.

loans-- procured by partner states for regional projects especially infrastructure, energy and transport. The African Development Bank (the main one) assesses the applications and determines which projects to fund.

EAC can also write proposals independently or with partners in the region.

Donations -- e.g., from China to implement specific activities

The livestock sector benefited from a project funded by development partners to address the problem of Avian influenza and issues of veterinary policy and governance.

None of the projects is specific on dairy (but vet policy / governance may include some aspects e.g., disease

Aggregate	Classification	Coverage	Number Of Coding References	Reference Number	Coded By Initials	Modified On

Files\\R5

| No | | 0.0229 | 1 | | | |
| | | | | 1 | C.K | 2021-08-17 10:05 |

Central Local Government office overhead costs are funded by the central government. Other operational costs at all levels of the Local Government Office are funded through revenues generated through service provision. Development partners fund activities that they are involved in.

Files\\R9

| No | | 0.0269 | 1 | | | |
| | | | | 1 | C.K | 2021-08-17 10:26 |

The central government funds certain initiatives such as mass vaccinations
Other source of funding is revenue generated from levy collection activities
The funds are usually insufficient but the available funds are directed to development activities as much as possible to benefit the citizens

Nodes\\Operating challenges faced\No. of employees in agency

Document

Files\\R14

| No | | 0.0153 | 1 | | | |
| | | | | 1 | C.K | 2021-08-17 11:35 |

266

The bureau has 500 employees
Structure: permanent secretary   B.O.D   Director General   Directors   Managers (H.O.D)   Head of section   Officers

Files\\R15

No		0.0077	1			
				1	C.K	2021-08-17 12:01

The trade office at Arusha DC has 7 trade officers with an annual budget of 25 million Tshs.

Appendix 2: Survey questionnaires

Survey questionnaire for milk producers

Introductions (names)

1. Participant identifier: [ward: interviewer initials: respondent type: number]

2. Age [closed. Options: 15-24; 25-34; 35-44; 45-54; 55-64; 64 and above]

3. Gender: [Closed. Options: male; female; unspecified].

4. Farm size: number of dairy cows and litres of milk produced each year.

5. Location of operation [Options: list all districts in Arusha]

Understanding your business

1. How long have you been operating for? [Closed options; less than a year; 1-3 years; 4-6 years; 7-9 years; more than 10 years]

2. How important is your business to your livelihood/supporting the household, as a % of livelihood income? (Closed. Options: 100-76% of household income; 76-50% of household income. 49-25% of household income; 24-1% of household income).

3. Who do you sell your milk to? [closed. Options: neighbour/direct to consumer, cooperative, processor, middleman, retailer/vendor (what type?); approximate %s of each, other…please specify]

4. What % of milk do you sell into the raw milk market (as opposed to pasteurised/formal market)? [Closed. Options 0; 1-10; 11-20; 21-30; 31-40; 41-50; 51-60; 61-70; 71-80; 81-90; 91-100. Don't know/not sure].

5. Have you sold more or less milk in recent years? [Closed. Options: more; less; stayed the same]

6. Why have you sold more or less raw milk in recent years? [Open-ended. Possible prompts: changes in consumer demand; changes in regulation; changes in my business which has forced this decision; improved profitability of one over the other etc].

7. Do you carry out any other business activities related to milk, for example transporting milk, or retailing it? [closed. no; yes. If yes, which roles? Options: producing; transporting/distributing].

8. How many litres do you produce each day? (Choose a number)

9. How much do you sell your milk for (TSH per litre)? (Choose a number, in TSH).

Understanding the business environment in which you operate

1. Would you say it is harder or easier to operate as a producer now than it has been in the past? (Comparing the last 1-2 years with the time before that).

2. What changes have happened and why? (Political, economic etc). *[Probe for more information on the nature of these changes – who, how, why, when].*

3. What are the most difficult things/biggest challenges you face in running your farm? [open. Production challenges, competition from other farms, maintaining quality, access to technology, access to capital etc etc].

4. Have these changed at all in recent years? If so, which ones and how? *[increased, decreased]*

5. How might the challenges you face in running your farm best be overcome?

6. Which stakeholders do you require more support from and in what capacity?

Buyer relationships and their demands

7. What is your preferred type of buyer? [closed. Options: neighbour/direct to consumer, cooperative, processor, middleman, retailer/vendor (what type?); approximate %s of each]

8. What are the advantages of selling to this type of buyer? [open. Possible prompts: higher prices, convenience – they come to the farm, timely payments, stability/reliability, cash payments, flexible demands, lower standards etc]

9. What kind of agreements do you have in place with your buyers? [close-ended. Options: verbal; written; none at all].

10. How regularly do you change buyer? [closed. Options: very regularly; sometimes; not often, never].

11. What do you and your suppliers agree on before a sale? [Closed. Options: tick all those that apply: price; volumes; timing; quality; payment terms etc?]

12. What prices do your buyers on average pay you for a litre of raw milk? How does this vary by season?

13. What has the general trend been regarding prices paid for your milk in recent years? [upward/downward/remaining stable]?

14. What are buyers looking for when they buy milk from you? [open: possible prompts: quality, safety, packaging etc?]

15. Why do your buyers shop from you and not others? [open. Possible prompts: taste of the milk/quality of the milk; affordable price; convenient location; other services etc]

16. Is it difficult for you to get what your buyers want? [closed. Options: yes/no].

17. If yes, what difficulties do you face? [possible prompts: there is not enough milk, it is expensive, the price is too high].

18. What would make it easier for you to get what buyers want? [open response, for later coding].

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19. Who could help you solve these problems [open ended: prompts include: government, private sector etc]?

Health and safety

20. What does safe milk mean to you? [open, possible prompts: freshness (taste). Freshness (smell) Normal colour. Good thickness/consistency (by sight); Good thickness/consistency (other testing)].

21. What does high quality milk mean to you? [open, possible prompts: freshness (taste). Freshness (smell) Normal colour. Good thickness/consistency (by sight); Good thickness/consistency (other testing)].

22. What do you do to ensure the milk you sell is of high quality and is safe and nutritious? [Open ended. Prompts include: treating cattle effectively/ensuring there are healthy; washing hands; keeping milking areas clean; cleaning containers regularly; using special containers; not mixing morning and evening milk; keeping milk cold etc].

23. How do you conserve quality before it is sold? [open. Possible prompts: (try and list in order of regulatory of use): electrical refrigeration; other methods of cooling (e.g., in water); boiling; quick sale, other…please note].

24. Do you measure safety and quality of milk before selling to others, if so, how?

25. Do your buyers measure safety and quality of milk before buying from you, if so, how?

26. What are the difficulties in maintaining safety and quality of milk before sale to buyers? [open response, for later coding].

27. What % of your milk is spoiled each week? [closed. Options: 0%. 1-10%; 11-20% 21-30%; 31-40%; 41-50%; 51-60%; 61-70%; 71-80%; 81-90% 91-100%].

28. How would you best be able to improve safety and quality? [open, with as much detail as possible. Possible prompts: training; more finances for investment in equipment (e.g., testing, containers etc…list equipment); more finances for investment in premises; other…please note.]

29. Who could help you improve on health and safety of milk? [open ended: prompts include: government, private sector etc]?

30. What challenges do middlemen/vendors face in maintain quality and safety of milk?

31. What could be done to improve on health and safety of milk further down the supply chain?

Training and certification

32. Have you ever sold milk to middlemen or vendors who have participated in a training and certification scheme that involved training on the safe handling of milk, maintaining milk quality and other business skills?

33. If yes, what was your experience of selling to this middlemen/vendor? Did they make any special requests from you as a buyer? Did they have any different demands from other buyers?

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34. What were the advantages and disadvantages of selling to this buyer?

Would you be able to put us in touch with any other milk producers in your area who might be available for an interview? If so, please take contact details.

Survey questionnaire for middlemen

Introductions (names)

1. Participant identifier: [ward: interviewer initials: respondent type: number]

2. Age [closed. Options: 15-24; 25-34; 35-44; 45-54; 55-64; 64 and above]

3. Gender: [Closed. Options: male; female; unspecified].

4. Middlemen size: very small-scale (motorbike), medium-sized (larger vehicles, more employees); large-scale (larger or more vehicles e.g., lorries, more employees), (other please explain)

5. What volumes of milk do they trade in on average each year [or month, if easier?]. [litres]

6. Location of operation [Options: list all districts in Arusha, select multiple – choose]

Understanding your businesses

7. How long have you been operating for? [Closed options; less than a year; 1-3 years; 4-6 years; 7-9 years; more than 10 years]

8. How important is your business to your livelihood/supporting the household, as a % of livelihood income? (Closed. Options: 100-76% of household income; 76-50% of household income. 49-25% of household income; 24-1% of household income).

9. What % of the milk you sell to vendors is raw? [Closed. Options 0; 1-10; 11-20; 21-30; 31-40; 41-50; 51-60; 61-70; 71-80; 81-90; 91-100. Don't know/not sure].

10. Have you sold more or less raw milk in recent years? [Closed. Options: more; less; stayed the same]

11. Why have you sold more or less raw milk in recent years? [Open-ended. Possible prompts: changes in consumer demand; changes in regulation; changes in my business which has forced this decision; improved profitability of one over the other etc].

12. Do you carry out any other business activities related to milk, for example retailing or producing milk? [closed. no; yes. If yes, which roles? Options: producing; retailing?].

Understanding the business environment in which you operate

13. Would you say it is harder or easier to operate as a milk middleman now than it has been in the past? (Comparing the last 1-2 years with the time before that).

14. What changes have happened and why? (Political, economic etc). *[open. Probe for more information on the nature of these changes – who, how, why, when].*

15. What are the most difficult things/biggest challenges you face in running your business? [open. Possible prompts: 1) Cost of licenses (if so, which are the most expensive) 2) Meeting consumer demands. If so, which ones? 3) Time and complexity involved in licensing (if so, which are particularly complex/time-consuming); 4) Time taken out from business for inspections; 5) Indirect cost of inspections (e.g., bribes); 6) Understanding what is required of me as a vendor in relation to health and safety standards/meeting health and safety standards; 7) Competition from other vendors; 8) Competition from formal sector. 9) other…please specify.

16. Have these changed at all in recent years? If so, which ones and how? *[increased, decreased]*

17. What is the government's attitude towards informal milk middlemen, such as yourselves? Is the attitude different depending on the government agency? (e.g., TBS versus TDB versus Mohr). How would you describe the relationship between yourselves and government?

18. How does this attitude show itself? For example, are you harassed by government agencies/representatives, and if so, who, and what form does this harassment take? When and how often? What is the impact on your business? Are you forced to pay bribes? What happens if you do not pay a bribe?

19. Are there any other impacts (positive or negative) of these relationships with government agencies on your business? *E.g., how much you can sell, where you can sell, when you can sell?* How does this in turn affect your livelihood and your household? Does it affect consumers in anyway?

20. What would need to change for this relationship to improve/the negative impacts to be reduced and the positive impacts to be enhanced?

Milk supply

21. Who do you buy milk from? (Closed: options smallholder farmer, smallholder cooperative, other…please specify).

22. Why do you buy from them? [closed. Ranking exercise. please choose your top three in order of importance: convenience/location; cost; quality; volumes; personal relationships; other…please specify…].

23. What kind of agreements do you have in place with your suppliers? [close-ended. Options: verbal; written; none at all].

24. How regularly do you change supplier? [closed. Options: very regularly; sometimes; not often, never].

25. What do you and your suppliers agree on before a sale? [Closed. Options: tick all those that apply: price; volumes; timing; quality; payment terms etc?]

26. Are you always able to get as much milk as you need and/or of the right quality? [Closed. Options tick all that apply: Yes, to obtaining enough milk. Yes, to obtaining milk at the right quality. No to obtaining enough milk, no to obtaining milk at the right quality. Other? Please note. can you give more information?]

Milk demand/consumer preferences

27. What are vendors looking for when they buy milk? [open: possible prompts: quality, safety, packaging etc?]

28. Why do your vendors shop from you and not others? [open. Possible prompts: taste of the milk/quality of the milk; affordable price; convenient location; other services etc]

29. Is it difficult for you to get what vendors want? [closed. Options: yes/no].

30. If yes, what difficulties do you face? [possible prompts: there is not enough milk, it is expensive, the price is too high].

31. What would make it easier for you to get what vendors want? [open response, for later coding].

32. Who could help you solve these problems [open ended: prompts include: government, private sector etc]?

Health and safety

33. What does safe milk mean to you? [open, possible prompts: freshness (taste). Freshness (smell) Normal colour. Good thickness/consistency (by sight); Good thickness/consistency (other testing)].

34. What does high quality milk mean to you? [open, possible prompts: freshness (taste). Freshness (smell) Normal colour. Good thickness/consistency (by sight); Good thickness/consistency (other testing)].

35. How do you measure safety and quality when purchasing from others? [Closed. Options. in order of regularity of use: sight/smell; lactometer; other…please note]

36. What do you do to ensure the milk you sell is of high quality and is safe? [Open ended. Prompts include: washing hands; keeping premises clean; cleaning containers regularly; using special containers etc].

37. How do you conserve quality before it is sold? [open. Possible prompts: (try and list in order of regulatory of use): electrical refrigeration; other methods of cooling (e.g., in water); boiling; quick sale, other…please note].

38. What are the difficulties in maintaining safety and quality? [open response, for later coding].

39. What % of your milk is spoiled each week? [closed. Options: 0%. 1-10%; 11-20% 21-30%; 31-40%; 41-50%; 51-60%; 61-70%; 71-80%; 81-90% 91-100%].

40. How would you best be able to improve safety and quality? [open, with as much detail as possible. Possible prompts: training; more finances for investment in equipment (e.g., testing, containers etc…list equipment); more finances for investment in premises; other…please note.]

41. Who could help you improve on health and safety of milk? [open ended: prompts include: government, private sector etc]?

Business costs and licences

42. Do you have any licences [closed? Options: yes/no]].

43. If yes, which licences [open, list].

44. For each, in turn:

1.1   How much did you pay for it?

1.2   What standards have to be met to be eligible for a licence? [just a brief summary]

45. Are there any licenses you do not have, but should have? [reassure this information is for us only, will not be attributed to them].

46. Why do you not have them? [Open. Prompts: too costly, too difficult to meet the requirements/standards; do not know how to get the licence; do not know where to get the licence; too far away…list all that are mentioned].

47. What are the consequences of not having them? [open. Possible prompts: having to pay bribes, having to be mobile to escape detection; confiscation of milk?).

Training and certification

48. Have you participated in any training or certification to improve the safety/quality of milk or expand your business? [options: yes; no. if no, skip to next section. If yes, continue]

49. When did you receive this training? [year]

50. Who provided this training? [options: government extension worker. Private provider. Another trader. Other…please note].

51. How much did you pay for this training? [open ended, specify amount in TSH]

52. How much time did it take? [options: open-ended, specify in units of days]

53. What positive impacts did the training have? [options: open – possible prompts – cleaner premises; improved handling of milk; milk quality; less harassment by authorities; customer loyalty; accounting/budgeting; value added skills]]

54. In which areas did you expect it to have an impact but it did not? [options, open – please specify].

55. Was it easy to implement what you learnt from the training? [closed. options: yes/no/somewhat].

56. If you faced difficulties, can you explain what these were and why they came about?

57. Did you face any challenges in attending? [options: open-ended, possible prompts – bad timing, expensive, inconvenient location].

58. What improvements are needed to make the training more effective/less costly, more accessible/suitable etc? [options, open-ended. Possible prompts – different location, cheaper, different time. And attribute values to those if possible].

Other training obtained/needed

59. Do you know anyone who has participated in the training, or have you heard about the training? If so, can you give more information on what you've heard/who participated etc]. [open].

60. Have you received any other training, and if so, in what areas? [options: yes; no]

61. With what impact? [options: open-ended]

62. Do you have the need for more training in regards to health and safety or any other business-related issues? [options: yes; no]

63. If so, can you give more detail on what aspects you require training on? [options: open-ended]

Can you recommend any producers we could interview as part of this research? Do you have any contact details for them?

Survey questionnaire for milk vendors

Introductions (names)

1. Participant identifier: [ward: interviewer initials: respondent type: number]

2. Age [closed. Options: 15-24; 25-34; 35-44; 45-54; 55-64; 64 and above]

3. Gender: [Closed. Options: male; female; unspecified].

4. Location of operation [Options: Districts in Arusha]

Understanding your business

5. How long have you been operating for? [Closed options; less than a year; 1-3 years; 4-6 years; 7-9 years; more than 10 years]

6. How important is your business to your livelihood/supporting the household, as a % of livelihood income? (Closed. Options: 100-76% of household income; 75-50% of household income. 49-25% of household income; 24-1% of household income).

7. What % of the milk you sell in a week is raw? [Closed. Options 0; 1-10; 11-20; 21-30; 31-40; 41-50; 51-60; 61-70; 71-80; 81-90; 91-100. Don't know/not sure].

8. Have you sold more or less raw milk in recent years? [Closed. Options: more; less; stayed the same; NA, being operating less than a year]

9. What do you think are the reasons for the selling of more or less raw milk in recent years? [Open-ended. Possible prompts: changes in consumer demand; changes in regulation;

changes in my business which has forced this decision; improved profitability of one over the other etc].

10. Vendor type: [closed: Options: milk bar, mobile seller, supermarket, other...please specify]

11. Do you sell any value-added dairy products (such as yoghurt, mala etc)? [Closed. Options: yes; no]

12. If so, which products do you sell? [open]

13. Have the quantities of these value-added products sold/demanded by consumers increased or decreased in recent years? [Closed. Options: increased; decreased; stayed the same].

14. Do you carry out any other business activities related to milk, for example transporting milk secured from producers, or producing it? [closed. no; yes. If yes, which roles? Options: producing; transporting/distributing].

Profits and costs

15. What is the largest business cost you face? What is the second largest business cost you face? What is third largest business cost you face? What is the fourth largest business cost you face? [Closed. Options: 1) premises – rent etc, 2) electricity/water etc, 3) obtaining milk, 4) equipment to store milk 5) equipment to clean milk, 6) equipment to handle milk, 7) equipment to test milk 8) labour costs (employing people), 9) transport costs – fuel etc, 10) other...please note].

16. What are your major sources of revenue? [Closed. Options, 1) milk sales, 2) yoghurt sales, 3) mala sales; 4) other dairy products...please note... 4) other...please note which]

17. What are the three biggest challenges you face in running your business? [open. Possible prompts: 1) Cost of licenses (if so, which are the most expensive) 2) Meeting consumer demands. If so, which ones? 3) Time and complexity involved in licensing (if so, which are particularly complex/time-consuming); 4) Time taken out from business for inspections; 5) Indirect cost of inspections (e.g., bribes); 6) Understanding what is required of me as a vendor in relation to health and safety standards/meeting health and safety standards; 7) Competition from other vendors; 8) Competition from formal sector; 9) lack of capital to invest in business; 10) spoiled milk; 10) other...please specify.

    o Can you explain a bit more about the nature of these challenges and your thoughts on why these challenges come about?

Relationship with government

18. Generally, what do you think is the government's attitude towards informal milk vendors, such as yourselves? Is the attitude different for different government agencies? (e.g., TBS versus Mohr).

19. How does this attitude show itself? (For example, are you harassed by government agencies/representatives), and if so, who, and what form does this harassment take? When

and how often? What is the impact on your business? Are you forced to pay bribes? What happens if you do not pay a bribe?

20. Are there any other impacts (positive or negative) of these relationships with government agencies on your business? (*E.g., how much you can sell, where you can sell, when you can sell?)* How does this in turn affect your livelihood and your household? Does it affect consumers in anyway?

21. What would need to change for this relationship to improve/the negative impacts to be reduced and the positive impacts to be enhanced?

Milk supply

22. Who do you typically buy milk from? (Closed: options smallholder farmer, smallholder cooperative, middleman, another vendor, other…please specify).

23. Why do you buy from them (choose up to three)? [closed. Ranking exercise. please choose your top three in order of importance: convenience/location; cost; quality; volumes; personal relationships; other…please specify…].

24. What kind of prior agreements do you have in place with your suppliers? [close-ended. Options: verbal; written; none at all].

25. What do you and your suppliers agree on before a sale? [Closed. Options: tick all those that apply: price; volumes; timing; quality; payment terms; other etc?]

26. How regularly do you change suppliers? [closed. Options: very regularly; sometimes; not often, never].

27. If you change supplier, what are the main reasons for the change? [open].

28. Are you always able to get as much milk as you need? Yes, to obtaining enough milk

No to obtaining enough milk.   How does supply vary across seasons/ months?

29. Are you always able to get milk at the right quality? [Closed. Options tick all that apply: Yes, to obtaining milk at the right quality, no to obtaining milk at the right quality. Other? Please note. can you give more information?]

   o   If mention of quality issues, please give more details/information on what kinds of challenges you face in sourcing high quality milk.

Milk demand/consumer preferences

30. What are the two most important things consumers are looking for when they buy milk? [open: possible prompts: quality, safety, packaging, price etc?]

31. Why do your customers shop from you and not from others? [open. Possible prompts: taste of the milk/quality of the milk; affordable price (which currently is Tshs others_____); convenient location; other services etc]

32. Is it difficult for you to provide your consumers with what they typically want? [closed. Options: yes/no].

33. If yes, what difficulties do you face in trying to satisfy your consumers? [possible prompts: there is not enough milk, it is expensive, the price is too high].

34. What would make it easier for you to get what consumers want? [open response, for later coding].

35. Who could help you solve these problems [open ended: prompts include: government, private sector etc]?

Health and safety

36. What does safe milk mean to you? [open, possible prompts: freshness (taste). Freshness (smell) Normal colour (by sight) Good thickness/consistency (by sight); Good thickness/consistency; from a trusted vendor; milk that has been certified; milk that has been tested; other, please specify]

37. What does high quality milk mean to you? [open, possible prompts: freshness (taste). Freshness (smell) Normal colour (by sight) Good thickness/consistency (by sight); Good thickness/consistency; from a trusted vendor; milk that has been certified; milk that has been tested; other, please specify]

38. How do you typically measure safety and quality when sourcing milk from your suppliers? [Closed. can identify up to three options. Options. sight/smell; lactometer; other…please specify]

39. What do you do to ensure the milk you sell is of high quality and is safe? [Open ended. Prompts include: washing hands; keeping premises clean; cleaning containers regularly; using special containers etc].

40. How do you typically conserve quality before the milk is sold? [closed. Choose up to three options. Possible prompts: (try and list in order of frequency of use): electrical refrigeration; other methods of cooling (e.g., in water); boiling; quick sale, other…please note].

41. What difficulties you face in maintaining safety and quality? [open response, for later coding].

42. What % of your milk is spoiled each week? [closed. Options: 0%. 1-10%; 11-20% 21-30%; 31-40%; 41-50%; 51-60%; 61-70%; 71-80%; 81-90% 91-100%].

43. How would you best be able to improve milk safety and quality? [closed, Possible prompts: training; more finances for investment in equipment (e.g., testing, containers etc…list equipment); more finances for investment in premises; other…please note.]

44. Who could help you improve on health and safety? [close ended: prompts include: government, private sector etc. can identify up to 3. Specify who in another box]?

Business costs and licences

45. Do you have a local government business permit? [yes/no].

46. If yes, how much did you pay for the permit per year?

47. What standards did you have to meet to be issued with the permit, if any?

48. Are you registered with TDB?

49. If yes, how much did you pay for registration per year?

50. What standards did you have to meet for registration?

51. Do you have a valid medical clearance certificate?

52. If yes how much did you pay for the medical clearance certificate?

53. What standards did you have to meet for the certificate?

54. Are there any licenses you do not have, but should have? [reassure this information is for us only, will not be attributed to them]. If so, which licences are there?

55. Why do you not have them? [Open. Prompts: too costly, too difficult to meet the requirements/standards; do not know how to get the licence; do not know where to get the licence; too far away…list all that are mentioned].

56. What are the consequences of not having them? [closed. Possible prompts: having to pay bribes, having to be mobile to escape detection; confiscation of milk?).

Training and certification

57. Have you participated in any training or certification to improve the safety/quality of milk or expand your business? [options: yes; no. if no, skip to next section. If yes, continue]

58. When did you receive this training? [year]

59. Who provided this training? [options: government extension worker. Private provider. Another trader. NGO Other…please note].

60. How much did you pay for this training? [open ended, specify amount in TSH]

61. How much time did it take overall? [options: open-ended, specify in units of days]

62. What positive impacts did the training have for you/ your business? [options: closed options cleaner premises; improved handling of milk; milk quality; less harassment by authorities; customer loyalty; accounting/budgeting; value added skills, other…]]

63. In which areas did you expect it to have an impact but it did not? [options, open – please specify].

64. Was it easy to implement what you learnt from the training? [closed. options: yes/no/somewhat].

65. If you faced difficulties, can you explain what these were and why they came about?

66. Did you face any challenges in attending? Yes/no.

67. If yes, what are these challenges? [options: closed: bad timing, expensive, inconvenient location].

68. In your own view, what improvements are needed to make the training more effective/less costly, more accessible/suitable etc? [options, closed, Possible prompts – different location, cheaper, different time, other, no changes required].

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Other training obtained/needed

69. Do you know anyone else who has participated in training on safe milk handling, or have you heard about the training? If so, can you give more information on what you've heard/who participated etc]. [open].

70. Have you received any other training? [options: yes; no] If so, in what areas?

71. With what impact? [options: open-ended]

72. Do you have the need for more training in regard to health and safety or any other business-related issues? [options: yes; no]

73. If so, can you give more detail on what aspects you require training on? [options: open-ended]

Can you recommend any consumers, middlemen or producers we could interview as part of this research? Do you have any contact details for them?

Survey questionnaire for milk consumers

Introductions

1. Participant identifier: [ward: enumerator initials: respondent type: number]

2. Do you buy and consume raw milk, either for yourself or other people in your household? [closed. Yes/no, if no, end interview. If yes, proceed].

3. Do you buy milk from milk vendors, rather than direct from the farm? [if no, end interview]

4. Age [closed. Options: 15-24; 25-34; 35-44; 45-54; 55-64; 64 and above]

5. Gender: [Closed. Options: male; female; unspecified].

6. Home location: [Options: list all Districts in Arusha]

Names and understanding your habits

7. How many litres of pasteurised/packaged milk do you buy a week? [select number]

8. How many litres of raw milk do you buy a week? [select number].

9. If raw, is it boiled when you buy it? [closed. Options: yes; no].

10. If it is raw, do you boil the milk before consumption? [closed. Options: yes; no].

11. Do you prefer to buy raw or pasteurised? [closed. Options: raw; pasteurised]

12. Why do you prefer this type of milk? [do not prompt at first] [Choose four possible options out of the following: in order of priority: freshness; taste; fat content; nutrition value; price; packaging; safety; availability; convenience (of buying); nature of retail outlet/cleanliness, other…please specify etc].

13. Which factors are most important to you when choosing which milk to buy? Choose three possible options out of the following, in order of priority: freshness; taste; fat content; nutrition value; price; packaging; safety; availability; convenience (of buying); nature of retail outlet/cleanliness, other…please specify etc].

14. Which retail outlets do you typically buy milk from? [allow choice of two. Closed. Options: mobile seller; shops; small supermarkets; large supermarkets; other…please note].

15. Do you tend to shop from a small number of vendors (i.e., 1-3); or do you shop around? [closed: small number of vendors; shop around].

16. If you shop from a small number of vendors, why [do not prompt at first]? open. Possible prompts: from a small number: trust, few or no incidence of health problem; accessibility; convenience; gives credit, other…please specify.;

17. If you shop around, why? [do not prompt at first]? [for shop around: to find a better price, to make sure I can get enough milk, to get the best quality etc].

18. When choosing where to buy milk from, what is the thing you think about most? [open].

19. Are there any other things you think about when deciding where to buy milk from? [closed. Choose three possible options out of the following: in order of priority: cleanliness; price; health and safety certificates/licences; friendliness of staff; trust in the safety of the vendor's milk/absence of problems associated with that vendor's milk; provision of other services e.g., credit; convenience (distance); ability to buy multiple products; relationship with vendor; other…please specify].

20. Is it ever difficult to get the milk you want? [closed. Options: yes; no].

    o If yes, what kind of difficulties do you face? [closed. Options (tick all that apply): no milk available; milk expensive; milk of poor quality. Others…please note].

21. How much do you currently pay for a litre of raw milk? [open. Please specify, TSH, or NA].

22. How much do you currently pay for a litre of pasteurised milk? [open. Please specify, TSH or NA].

Attitude of government players towards sale and consumption of raw milk

23. How would you describe the government's attitude to the sale and consumption of raw milk?

24. How does this attitude impact you as a consumer, if at all?

25. *What would need to change for this relationship to be improved or for the impacts on you as a customer to be made positive?*

Importance of milk to household consumption

26. Approximately how much milk does your household consume per week? [open: litres]

27. Approximately how much money do you spend on milk a week? [open's].

28. Which members of the household drink milk, in order of quantity? [closed. Options: parents/HH head; 18-12-year-old children; 11-6-year-olds; under 5s; other relatives].

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29. How do you generally drink milk in the household? [Open. Possible prompts: in tea/chai; in cooking/food; raw/cold; other…etc].

Health and safety

30. What does safe milk mean to you? [open, possible prompts: freshness (taste). Freshness (smell) Normal colour (by sight) Good thickness/consistency (by sight); Good thickness/consistency; from a trusted vendor; milk that has been certified; milk that has been tested; nothing added, other, please specify].

31. What does high quality milk mean to you? [open, possible prompts: freshness (taste). Freshness (smell) Normal colour (by sight) Good thickness/consistency (by sight); Good thickness/consistency; from a trusted vendor; milk that has been certified; milk that has been tested; nothing added, other, please specify]

32. How important is the safety of milk to you when choosing a vendor/retailer? [closed. Options: very important; quite important; neither important nor unimportant; quite unimportant; very unimportant].

    o Why do you say this? (open).

33. How do you decide to if a vendor is selling safe milk or not? [open-ended. prompts if needed: I look for clean premises, I look for a clean person selling the stall, correct licences, certificates, white coat, prior experience/trust – have bought from vendor for long while without problems, they are selling branded milk I recognise] etc. Explore each of these in more detail – e.g., what would a clean premise look like? if found to be important or if unclear what they mean]

34. What challenges do you face in deciding whether a retailer/vendor sells safe milk or not? [do not prompt at first] [open…please specify].

35. Once you are at the vendor, what do you do to make sure the milk you buy is of high quality and is safe? [do not prompt at first. open. Possible prompts: I look at it; I smell it, I taste it; other… please specify]

36. Have you or members of your family ever been ill after drinking milk? [closed. option: yes; no]. if yes:

    o What kind of illness did you or your family member suffer from? [open. Possible prompts: diarrhoea, vomiting, headache…other (please specify)].

    o Were you able to link this milk to a particular vendor/retailer? [closed. Options: yes; no].

    o Did you change vendor as a result? [closed. Options yes/no. I went there less frequently but didn't change completely].

    o Did you change your practices as a result [e.g., boiling]?

Possible demand for training and certification via marketing

37. Have you ever noticed any milk retailers/vendors displaying certificates or licences on their premises? [yes/no].

38. If so, do you know what this certificate or licence was about/what is showed? [open]

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39. Did it increase your trust in the retailer? [yes/no]

   o   If so, why? [open]

   o   Did it make you more likely to return to that particular retailer? [closed. Yes/no].

   o   Did it affect your willingness to pay extra for the milk? [closed. Yes/no].

40. Do you think you would pay more for milk from a vendor who had a certificate saying they know how to safely store and handle milk? Yes/no. If yes, what and why?

41. Would you shop at a vendor more often if they had a certificate saying they know how to safely store and handle milk?? [yes/no/, if yes, why?]

42. Are there any labels, brands or certificates shown on a product that you seek out when buying milk or other dairy products? [closed. Options: yes; no].

43. If yes, which ones, and why? [open. Please specify].

44. Are labels/brands/packaging important to you in making decisions about the safety of food products more generally? [closed. Options: very important; quite important; neither important nor unimportant; quite unimportant; very unimportant].

Appendix 3: key Informant Interview Questions

Key Informant Interviews Questions

1.   What is the legal position on trade of raw milk?

2.   What is the level of compliance of milk traders to regulatory requirements?

3.   Has there been progress in organizing the informal dairy traders into a scheme?

4.   What is the government perception of the informal dairy sector?

5.   What are the long-term development plans for the informal dairy sector?

6.   How much milk is traded in the informal sector?

7.   How would you define the informal sector? What is the legal status for trade in raw milk?

8.   What is the governments perception on the existence of trade in raw milk? What informs the perception?

9.   Which regulatory bodies are you required to register with to trade in milk? What requirements are you supposed to fulfil to acquire registration? How easy is it to fulfil these requirements? Are you currently registered with all the appropriate authorities?

10. What is your role in governance of the dairy sector?

11. What is the level of representation of the informal dairy sector players in the annual council?

12. Who is represented in TAMPRODA; large or small producers?

13. What has TAMPRODA achieved with regard to representation of dairy producers since inception?

14. What is TAMPA's perception of the informal sector? What informs this decision?

15. What does TAMPA feel about merging with TAPMRODA for representation of producers as proposed in the Dairy Development Forums?

16. What is your role in the implementation of the T&C?

17. How many traders in the informal sector have you trained and certified for engagement in milk trade?

18. What has influenced the number of traders you have trained?

19. What challenges have you encountered in implementation of the T&C?

20. Are there other requirements for informal milk traders to adhere to besides the training and certification? What are the other requirements if any?

21. How do you deal with informal sector traders who are not trained and certified?

22. Where does funding for implementation of the T&C come from? Is the financial support likely to continue in the long-term?

Appendix 4: Consent forms

Informed Consent – dairy value chain actors

You are hereby invited for to participate in a research study by Charity Kinyua, a PhD student in Development Studies in the Department of Anthropology and Archaeology at the University of Pretoria. The study seeks to understand your views and opinions on challenges and opportunities related to food safety in the informal dairy sector and why alternative policy interventions to address milk safety have failed to be scaled and sustained.

Title of the study
Assessing the enablers and constraints to scaling innovative policy approaches in the informal dairy sector in Tanzania

What will happen in the study
You will be interviewed on your views and opinion on aspects that the study seeks to understand. The interview will take about an hour of your time and I will be taking notes as a record for the interview session. You can choose to have the interview session either in English or in Swahili.

Risks and discomforts
There will be no danger/harm to you or to your institution from participating in the interview. You are however free to not answer any question that you are not comfortable with or stop participating in the interview at any point of the interview without any negative consequences.

Are there any benefits for joining the study?
There will be no monetary compensation or gifts for participating in the study . The information gathered will be used in writing a thesis and publication of other scientific material which will inform relevant institutions on design and implementation of appropriate policy interventions to enhance milk safety and nutritional outcomes among consumers.

Confidentiality
The researchers are committed to maintain a high level of confidentiality with respect to the information you provide. In general, insights obtained from key informant interviews will be used to improve understanding of the enablers and constraints to formalizing the informal

sector. Insights will typically not be attributed to the individuals being interviewed, but rather to the category of stakeholder (e.g. NGO/research institute/private sector organization/government institute). Your name will not be publicly linked to specific answers without prior authorization from you.

Any questions?
For more information, contact:

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CONSENT DECLARATION
I_____ (write your name) hereby agree to participate

Humanities 100.
——— 1919 - 2019 ———
Department of Anthropology
& Archaeology

Informed Consent – Organisation Stakeholders

You are hereby invited for to participate in a research study by Charity Kinyua, a PhD student in Development Studies in the Department of Anthropology and Archaeology at the University of Pretoria. The study seeks to understand your views and opinions on challenges and opportunities related to food safety in the informal dairy sector and why alternative policy interventions to address milk safety have failed to be scaled and sustained.

Title of the study
Assessing the enablers and constraints to scaling innovative policy approaches in the informal dairy sector in Tanzania

What will happen in the study
You will be interviewed on your views and opinion on aspects that the study seeks to understand. The interview will take about an hour of your time and I will be taking notes as a record for the interview session. You can choose to have the interview session either in English or in Swahili.

Risks and discomforts
There will be no danger/harm to you or to your institution from participating in the interview. You are however free to not answer any question that you are not comfortable with or stop participating in the interview at any point of the interview without any negative consequences.

Are there any benefits for joining the study?

There will be no monetary compensation or gifts for participating in the study . The information gathered will be used in writing a thesis and publication of other scientific material which will inform relevant institutions on design and implementation of appropriate policy interventions to enhance milk safety and nutritional outcomes among consumers.

Confidentiality

The researchers are committed to maintain a high level of confidentiality with respect to the information you provide. In general, insights obtained from key informant interviews will be used to improve understanding of the enablers and constraints to formalizing the informal sector. Insights will typically not be attributed to the individuals being interviewed, but rather to the category of stakeholder (e.g. NGO/research institute/private sector organization/government institute). Your name will not be publicly linked to specific answers without prior authorization from you.

Any questions?
For more information, contact:

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CONSENT DECLARATION

I_____ (write your name) hereby agree to participate in this study.

Appendix 5: Interview pseudonyms catalogue

Interview participant pseudonym	Category
Clara	Consumer
Jaden	Consumer
Kayan	Consumer
Keith	Consumer
Pius	Consumer
Pete	Consumer
Teresa	Consumer
Viola	Consumer
Becky	Consumer
James	Consumer
Margaret	Dairy processor
Elisha	Dairy processor
Taylor	Dairy processor
Tyrese	Dairy processor
Tom	Dairy processors association
Leila	Dairy producers' association
Luke	Development partner
Collins	Development partner
Cyril	Middleman
Tanya	Middleman
Pamela	Producer
Tony	Producer

Mike	Regulatory agency
Rufus	Regulatory agency
Humphrey	Regulatory agency
Maya	Regulatory agency
Jayne	Regulatory agency
Toby	Regulatory agency
Dan	Service provider
Heather	Service provider
Mokaya	Vendor
Matthews	Vendor
Sharon	Vendor
Yvette	Vendor
Jake	Vendor
Donna	Vendor