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Positioning smallholder farmers in the dairy innovation system in Malawi: a perspective of actors and their roles

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Abstract

The preference of an innovation systems approach to development is based on its inclusiveness and interactions of the actors to co-influence each other to learn and innovate to bring about tangible benefits. As more actors with diverse interests engage, the innovation system becomes more complex and actors with higher influence power are likely to benefit more. Smallholder farmers in developing countries are the core actors of an agricultural innovation system but their ability to influence other actors to maximize their benefits is contentious. This paper applies a historical analysis of the progressive development and complexity of Malawi's diary innovation system through phased emphasis on technological, organizational and institutional development to illustrate the centrality of smallholder dairy farmers in the innovation system. A social network analysis is applied to assess the influence of smallholder farmers on other actors. The existence and growth of the diary innovation system in Malawi is founded on the resilience of smallholder dairy farmers to produce milk. Whereas the smallholder farmers are the most connected in terms of interaction, they have the least influence on other actors in the innovation system. To take advantage of their central position to maximize benefits, smallholder farmers can only rely on their collective power to influence other actors. Organizing farmers in groups and associations is a step in the right direction, but deliberate interventions by innovation brokers as intermediaries needs to focus on empowering these groups.

Keywords**:** institutional transformation through innovation**,** dairy system, actor network, historical perspective

Introduction

The livestock sector in Malawi is dominated by smallholder farmers and contributes about 11% to national GDP (Chagunda et al., 2010). Although dairying constitutes a small proportion of the livestock sector (Tebug, 2012) it is significant to rural livelihoods with regard to food, income and nutritional security (GoM, 2013). Smallholder dairy farming in Malawi is rapidly growing (Thomson, 2013) due to increasing urbanisation and incomes, population growth and market liberalisation (Gerosa & Skoet, 2012; Zhou, 2010). In 2012, smallholder farmers produced 80-85% of milk output in Malawi (Sindani, 2012). Whilst a growing market creates opportunities along the dairy value chain, it also imposes challenges for smallholder farmers to innovate and effectively operate in a dynamic market environment. Innovation is an outcome of conscious effort and processes of experiential social

learning through network building and interactions with multiple and heterogeneous actors (Davis *et al*., 2006; Tefera, Tegegne *et al*., 2008; World Bank, 2006). The innovation systems approach has become a popular development paradigm (Spielman *et al*., 2009a) where new knowledge and learning are at the core of innovation (Kibwika, 2006). Innovation by smallholder farmers is driven by new knowledge, learning new practices or even unlearning old practices, taking up new technologies, and gainfully engaging with a variety of actors. Context-based learning leading to innovations is an interactive process where heterogeneous actors engage not only to apply new knowledge but also to co-create and adapt new knowledge, practices and technologies (Hartwich and Negro, 2010; Klerkx *et al*., 2009a). Such interactions are not neutral as they are characterised by power relations and controls (Hartwich and Negro, 2010). Understanding how smallholder farmers relate with the other actors is therefore important.

For the past two decades, efforts to commercialize livestock production by smallholder farmers in Malawi focused on provision of knowledge and technical know-how, dairy processing infrastructure, and macro policies and institutional arrangements (Tebug, 2012). The development goal was to increase competitiveness and maximise benefits to smallholder farmers (Sindani, 2012) to help them break out of poverty. Previous studies portray smallholder farmer as simply recipients of externally introduced technologies and knowledge (Banda, 2008; Banda *et al*., 2011; Chagunda *et al*., 2010) without focussing on understanding their interactions with other actors in the dairy value chain. This paper addresses the question: What are the outcomes and implications of the interactions between smallholder farmers and other actors in the dairy value chain in Malawi? A comprehensive review of innovations centred on actors, the roles they play and the activities they are involved in (World Bank, 2006) is applied as an analytical framework.

Theoretical framework

Innovation is a common terminology in contemporary research and development paradigm. Lundvall (1985) and the World Bank (2006) provide alternative and complementary definitions of innovation but Tefera *et al*. (2008) outlined the key aspects of innovation as, (i) knowledge becomes innovation when it is successfully used for economic and social purposes, (ii) innovation results from the application of new knowledge, accumulated knowledge or creative use of existing knowledge, (iii) innovation can be drastic or incremental continuous changes, (iv) innovation is the outcome of conscious effort and continuous processes of experiential social learning through network building and interactions with multiple and heterogeneous actors, and (v) innovations can lead to improved productivity, commercialization, and income and welfare gain.

Innovation therefore results not only from inventions and their application but also from complex social dynamics and interaction among groups and individuals networking to access new knowledge and to learn to develop and apply technologies in specific context (Asem-bansah, 2012; Hartwich and

Negro, 2010). A substantial amount of theory has hitherto been developed to guide the application of innovations in development context (Edquist, 1997; Freeman, 1997; Johnson, 2001; Lundvall, 1985; Spielman *et al*., 2009b; Tefera *et al*., 2008). The behaviors and actions of the actors influence the final outcomes of an innovation system (World Bank, 2006) and eventually compensating for economic security (Nilsson & Hess, 2016). Literature on performance of innovation system (Howells, 2006; Kilelu *et al*., 2012; Klerkx *et al*., 2009a) presents the key functions of different innovation agents as: demand articulation, network building, capacity building and innovation process management, knowledge brokering and institutional support. This functional framework is adopted and applied to situate the smallholder farmers among other actors in the dairy value chain in Malawi. The mode of interactions and resultant outcomes however depend on the social context and conditions (Hannon *et al*., 2014) that exist in Malawi.

Methodology

A qualitative research design based on a case study approach with interviews was used to explore the status of actors in the dairy value chain. The design was appropriate for gaining an in-depth understanding of the actors, their interactions and resultant outcomes (Yin, 2013). Two case studies, namely, Lilongwe and Blantyre Milksheds were studied between September and November 2014. These represent 80% of the 41 functional dairy farmers' associations supplying milk to the major cities of Malawi. Focus Group Discussions (FGD) were conducted with representatives from three farmer associations in each of the selected milkshed areas. The farmers' associations were purposively selected based on their functionality and productivity. Six focus group interviews were conducted with each comprising 6 to 8 farmers with experience in operations of their respective associations. The interviews focused on innovations, actors and their roles and responsibilities, linkages and interactions. In addition, leaders of the farmers' associations were interviewed as key informants to complement and validate information obtained through the FGD. A total of 24 actors were included in the study. Data on actor roles description, actor organizational structure, and mode of operations were obtained from documents and records of the associations.

Data analysis

The interviews were transcribed and thematic analysis performed using NVIVO software to establish the functions and roles of the actors in the dairy innovation system. Codes were derived based on the principles of grounded theory guided by Howells (2006) broad innovation actors' functions. Sub codes were developed using Klerkx and Leeuwis (2009) innovation typologies to characterize the innovations. A Social Networking Analysis (SNA) was used to illustrate the interaction of actors using Ucinet64 software (v6.53) (Borgatti *et al.*, 2002). In SNA, the nodes represent entities such as people, firms and organizations while links represent relations between nodes (Rights, 2011). The SNA aids

mapping the innovation system, and capturing knowledge flows and other attributes contained within such interactions (Spielman *et al*., 2009a). Table 1 presents the elements of the SNA.

Results and Discussion

Historical development of dairy innovation system in Malawi

A historical view of the dairy innovation system in Malawi depicts a progressive trend and growth with increasing complexity resulting from interactions between an increasing number of actors. Progression of the dairy innovation system manifests in three distinct phases with emphasis on technological innovation, organizational innovations and institutional innovations respectively (Figure 1).

Phase 1: 1950 – 1970 The search for technological innovations: Up to 1950, dairy farming in Malawi was basically traditional and farmers relied on indigenous knowledge and breeds for milk production. There were no known government interventions targeting the dairy industry. However, between 1950 and 1960 some emerging commercial farmers imported exotic dairy breeds from South Africa. The challenge at the time was to increase production and productivity of milk to meet the growing market demand and hence the focus was on breed improvement. As the milk supply and consumption steadily increased, the government began to support the technology and knowledge generation system for the growing dairy sub-sector. In 1961, the Government of Malawi supported installation of milk pasteurizers to add value to locally produced milk and increase its distribution as a strategy to reduce milk imports and save foreign exchange. In 1962 Bunda College of Agriculture (established as part of the University of Malawi) was responsible for generating knowledge and technological innovations as well as developing expertise to support the dairy sub-sector.

Phase 2: 1971 – 1990 Market and organizational innovations: Whereas support for technological innovations continued, this phase witnessed a government shift in emphasis to value addition and organizing smallholder farmers to supply emerging milk processing industries. The Malawi Bureau of Standards was established in 1972 with responsibility to monitor and regulate the quality of milk and milk products. There was expansion of the milk processing industries in high potential areas such as Lilongwe and Mzuzu. The comprehensive Dairy Development Programme in 1979 supported by the government and CIDA established improved dairy breed stock farms in Southern and Central regions for farmers to access high yielding dairy breeds to increase milk production. The smallholder farmers started to organize themselves into associations for bulk supply of milk to the processing industries and to enhance their collective bargaining power with other actors. This marked the beginning of contractual relationships between producer associations and processors common in the late 1980s. The government played an important role in establishment and operations of the processing industries.

Phase 3: 1991 – 2014 Creating an enabling environment through institutional innovation: The growth of the dairy sector was interrupted by political unrest between 1991-1994 as the country switched from

a one-party to multi-party political system. Political unrest led to a temporary reduction of dairy breeding stocks. With the momentum of commercialization, the dairy industry quickly restored stability soon after 1994. This phase was characterized by institutional reforms such as the liberalization and privatization policies led by the World Bank across the sub-Saharan region. The government withdrew from direct involvement in business to focus on policy and regulatory functions that encouraged private sector investment. Consequently, the government owned dairy processing industries were privatized in 1997. The liberalization and privatization policies attracted more non-state actors in the dairy innovation system to provide a variety of services. The established producer associations increasingly took over the management and coordination responsibilities while the NGOs and private actors took over the service delivery roles.

In 1999, the government developed a Dairy Production Guiding Framework, the livestock policy of 2005 (reviewed 2011) and introduced taxes on imported milk in 2009. Some NGOs, often referred to as innovation brokers (Klerkx and Leeuwis, 2009), namely Small Scale Livestock Promotion Program (SSLPP) and Land 'O' Lakes (LOL) were the pioneer intermediaries brokering the access and use of improved dairy breeds, artificial insemination, extension services and input supply. By 2012, several agencies including Heifer International (HI), Voluntary Services Organization (VSO), World Vision International (WVI), Civil Society Agriculture Network (CISANET), Farmers Union of Malawi (FUM), commercial banks, Farm Radio and Trustees of Agricultural Promotion Programme (TAAP) were actively engaged in different aspects of the diary value chain, with smallholder farmers being their main service target. Figure 1 illustrates emergence of a complex dairy innovation system transiting through phases of technological, market/organizational and institutional innovations. The most important factor in this development was the resilience of the smallholder dairy farmers. As producers of the raw material, they were most critical element of the dairy industry. For this reason, they were also the main target clients for most non-state actors. With an increasing number of actors in the dairy innovation system, smallholder farmers should be able to productively engage with many more and diverse actors than previously.

Actor interaction in the Malawi dairy innovation system

A typology of innovation actors developed by Klerkx *et al*. (2010) and adapted by Kilelu *et al*. (2012) describes six categories of actors in an innovation system. Based on this typology, the actors in the Malawi dairy innovation system, can be placed in only three overlapping categories namely; innovation consultants, brokerage organizations and systemic instruments. The overlap of categories (Figure 2) is an indication that actors are not specialized and have multiple functions. For example, it is not possible to differentiate innovation consultants aimed at individual with those aimed at collective farmers and agri-food SMEs. There were no distinct actors for internet base portals and databases for knowledge and information to farmers, and boundary organizations acting at the policy/ education/research interface. The roles of actors in these typologies are critical to understanding the

functionality of the innovation system (Howells, 2006; Klerkx & Leeuwis, 2009). The actors interact to co-influence each other and co-create knowledge and technologies as springboards for innovation. Klerkx et al (2009b) describe six categories of innovation functions: demand articulation, innovation process management, capacity building, network brokerage, knowledge brokering and Institutional support. These however, appear rather discrete and presume intentions of mutual benefit from all parties and yet some actors may have competing interests. Some may advance individual interests with little regard for other actors – a power based relationship. How the actors co-influence each other and develop their own institutional dominating conditions (Soy-Massoni *et al.*, 2016) is an indication of power relations between them. A social network analysis was performed to understand these interactions and how the various actors co-influenced each other (Table 2).

The three most widely used centrality measures namely the in and out degree, closeness and betweeness (Borgatti & Everett, 2000) were used to identify the 'important' actors within the network as reflected by the extent to which a network revolves around a single node (Amlaku et al., 2012). The density – thus the nodes actually tied as a proportion of all possible ties in a network was 0.45, meaning that only 45% of the possible direct linkages were present. This implies that the interaction of actors is less than half of what is expected indicating a low level of innovative capacity in Malawi's dairy innovation system. The collaboration among the actors measured by the degree of centrality identifies eight organizations with higher out degree measures of centrality: CISANET, DAHLD, MMPA, SHIMPA, CREMPA, VSO, LOL and smallholder farmers. The smallholder farmers had the least influence despite being the most connected actor in the network. This can be attributed to the weak organizational capacity and empowerment of the smallholder farmers, which consequently limits their ability to influence other actors in the system. CISANET had the highest degree of centrality, out degree (influence), in degree (prominence) and betweeness (favored position) because of its role in organizing multi-stakeholder fora and thus influencing a wider range of actors. DAHLD, a public agency under the Ministry of Agriculture and Food Security, had the second highest degree of centrality and collaboration due to its link with several non-government actors especially NGOs, which use government employed extension workers to deliver services. It is common practice that government extension workers are facilitated to deliver NGO services. Though the arrangement is non-formal, it increases the organizational connectivity for DAHLD, which is in charge of extension. Furthermore, DAHLD has the mandate to authenticate activities of all other non-state actors in the dairy sector. The department yields a betweeness value of 75 with other actors, indicating a stronger potential for control over others. In a way, the relationship between DAHLD and non-state actors depicts the potential of private-public partnerships to enhance innovation capacity if formalized and well managed. The Farmer groups and associations namely MMPA, SHIMPA and CREMPA had relatively high degrees of collaboration, influence and prominence. As an umbrella farmer association known as MMPA had a higher influence and prominence among these three organisations. The farmer

associations serve as intermediaries and link farmers with other actors at the upper end of the value chain such as milk processors, as well as service providers such as input suppliers, credit providers and AI/veterinary service providers. NGOs also deliver some services through farmer associations.

Among the processors Lilongwe Dairy Industry (LDI) had highest degree of centrality, in degree, out degree, closeness and betweeness due to its scope of operations covering two regions, CREMPA and SHMPA and hence interacting with more actors than other processors. Apart from purchasing raw milk, the processors also provide other services including; supplying milk quality testing reagents to bulking groups, maintenance of milk coolers, and providing interest-free loans to individual farmers through their bulking groups. Ironically, whereas training and research institutions are expected to provide the essential knowledge and expertise to influence innovations in the dairy sector, they are rather peripheral actors in the dairy innovation system having among the lowest influence similar to banks, consultants and Farm Radio. This is not to indicate that they are less relevant but their relationships with other actors have not been influential to-date.

Concluding comments

From a historical perspective, the resilience of the smallholder dairy farmers has been the most important factor for the progressive growth of the dairy innovation system in Malawi. Whereas the Malawi dairy innovation system has yet to reach the ideal status (Howells, 2006; Klerkx et al., 2009a), it has progressively advanced through phases that depict focus on technological innovations through market/organisational to institutional innovation. There has been increasing number of actors through the innovation development phases; most interacting with the shallholder farmers in some way either as individuals or through groups and associations. The number of actors also represents diversity of interests and therefore power relations in the interactions. Whereas individually and in associations the smallholder farmers interact with the majority of the actors in the innovation system, they have the least influence. The smallholder farmers are more recipients of technologies and services rather than determinants. Their current position makes them more vulnerable for exploitation by more powerful and aggressive business entrepreneurs who seek to maximize profits. They will need to further empower themselves to maximize benefits and sustain the dairy innovation system as it becomes more complex.

Having smallholder farmers organized in groups and associations is right but it is only a starting point towards building their strength for empowerment. Rather than focusing on organizing farmers for ease of access to pre-determined services of various providers, some intermediaries need to focus on building capacity of the farmer associations to articulate their needs now and in the future to which the service providers align themselves. An ideal dairy innovation system is possible when the smallholder dairy farmers in Malawi gain their rightful position of being in the “driving seat” to influence the technologies, services, and institutional arrangement they require to operate gainfully and sustainably.

Based on the findings from this study, the following policy implications are derived. Creating an environment for free engagement of non-state actors through such policies as liberalization and privatization is pathway to building functional and productive agricultural innovation systems. However, it should be realized that unequal power relations characterize interaction of actors. Deliberate interventions are needed to empower and protect the important but weak actors in the system such as the smallholder farmers. Provision of public good type services such as research and extension services is crucial for the development of innovation systems. Formalized public-private partnerships arrangements can leverage meager government resources to effectively provide research and extension services to various actors in the innovation system.

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Table 1 Elements of the social networking analysis.

Element	Definition
Node	Any individual, organization, or other entity of interest
Tie	Interconnection between actors
Network size	Total number of nodes in a network
Network Density	Nodes that are actually tied as a proportion of all possible ties in a network
Centrality	Measure of the number of ties that a node has relative to the total number of ties existing in the network as a whole; centrality measures include degree, closeness, and betweenness
Degree	Number of ties a node has to other nodes
In- Degree	Number of ties initiated by the node. A node is central, when it has higher number of ties with other nodes
Out degree	Number of ties initiated by the node. Out degree is usually a measure of how influential the actors may be
Closeness	Measure of reciprocal of the geodesic distance (the shortest path connecting two nodes) of node to all other nodes in the network
Betweeness**	Number of times a node occurs along a geodesic path. It is a node that can play the part of a liaison or broker or gate keeper with a potential for control over others
Periphery*	Nodes that are only loosely connected to the core and have minimal or no ties among themselves

Source: Scott (2000).

357 **Table 2** Interaction among actors in the Malawi dairy innovation system.

Actors	Degree	In Degree	Out Degree	Closeness	Betweeness
Small Scale Livestock Promotion Programme (SSLPP)	0.4925	0.5650	0.4200	0.0697	2.2670
Heifer International (HI)	0.4925	0.5650	0.4200	0.0697	2.2670
Civil Society Agriculture Network (CISANET)	0.8365	0.7830	0.8900	0.821	25.0730
LSPCA	0.5165	0.5330	0.5000	0.821	5.7640
Malawi Milk Producers Association (MMPA)	0.6880	0.6960	0.6800	0.676	13.3250
Malawi Bureau of Standards	0.2670	0.3040	0.2300	0.767	0.7740
Central Region Milk Producers Association (CREMPA)	0.5010	0.5520	0.4500	0.59	4.7900
Shire Highlands Milk Producers Association (SHIMPA)	0.5475	0.5650	0.5300	0.676	8.4930
World Vision International(WVI)	0.3650	0.1300	0.6000	0.676	0.0000
Voluntary Service Organization (VSO)	0.5370	0.1740	0.9000	0.535	0.0000
Malawi Dairy Industries (MDI)	0.4540	0.4780	0.4300	0.548	5.2450
Lilongwe Dairy Industries (LDI)	0.4790	0.5220	0.4360	0.657	6.0420
Suncrest Creameries	0.4040	0.3480	0.4600	0.657	2.8420
Proto Feeds	0.2520	0.1740	0.3300	0.605	0.1600
G&S Consultants	0.0985	0.0870	0.1100	0.548	0.0000
Land O Lakes (LOL)	0.5260	0.6520	0.4000	0.523	9.3610
Opportunity International Bank of Malawi (OIBM)	0.4155	0.2610	0.5700	0.742	0.8030
New Building Society (NBS)	0.2305	0.2610	0.2000	0.575	0.8030
Training Institutions	0.2955	0.3910	0.2000	0.622	0.1780
TAPP	0.2135	0.2170	0.2100	0.561	0.0000
Farm Radio	0.1520	0.1740	0.1300	0.548	0.0000
Farmers Union of Malawi (FUM)	0.2940	0.4780	0.1100	0.657	3.2710
Department of Animal Health and Livestock Development (DAHLD)	0.7000	1.0000	0.4000	1	75.0730
Farmers	0.5735	1.0000	0.1470	1	75.0730

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Figure 1 Historical view of innovations and actors in the Malawi diary industry.

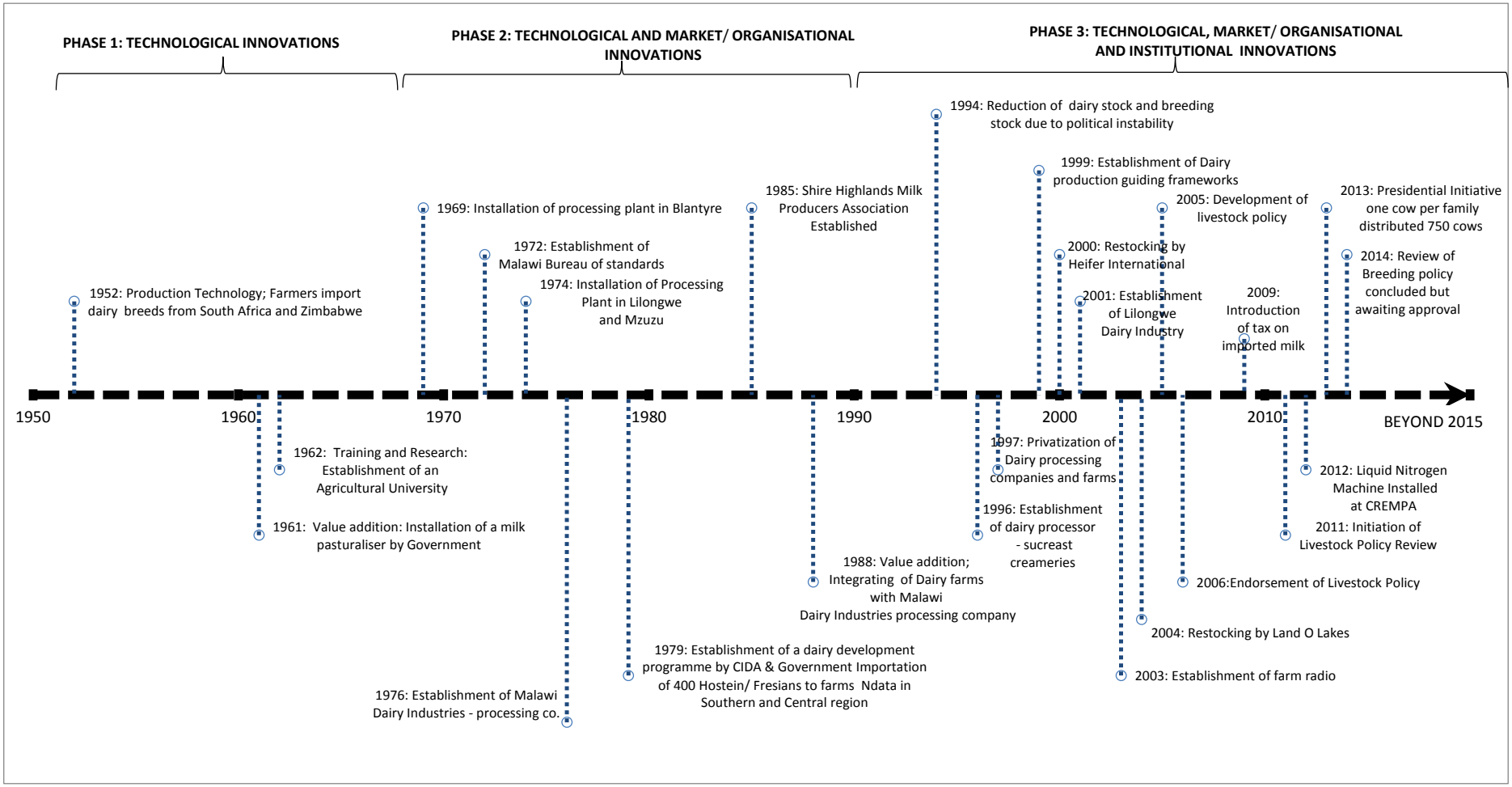
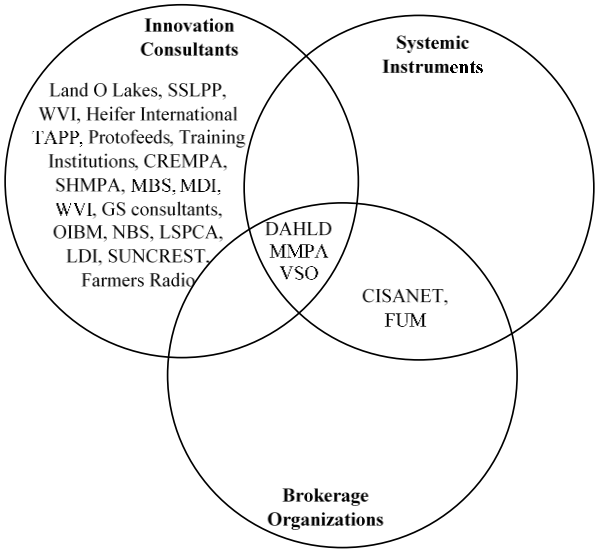


Figure 2 Typology of the actors in Malawi dairy innovation system.



KEY

SSLPP - Small Scale Livestock Promotion Programme
HI - Heifer International
CISANET - Civil Society Agriculture Network
LSPCA - Lilongwe Society for the Protection and Care of Animals
MMPA - Malawi Milk Producers Association
MBS - Malawi Bureau of Standards
CREMPA - Central Region Milk Producers Association
SHIMPA - Shire Highlands Milk Producers Association
WVI- World Vision International
VSO - Voluntary Service Organization
MDI - Malawi Dairy Industries
LDI - Lilongwe Dairy Industries (LDI)
LOL - Land O Lakes
OIBM - Opportunity International Bank of Malawi
NBS - New Building Society (NBS)
TAPP - Trust Agricultural Promotion Program
FUM - Farmers Union of Malawi
DAHLD - Department of Animal Health and Livestock Development