Access to and supply of finance for enhancing dairy productivity

Working Paper No. 232

CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)

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RESEARCH PROGRAM ON
Climate Change, Agriculture and Food Security

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Correct citation:
Wilkes A, Odhong' C, Ndonga S, Sing'ora B, Kenyanito L. 2018. Access to and supply of finance for enhancing dairy productivity. CCAFS Working Paper no. 232. Wageningen, the Netherlands: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Available online at: www.ccafs.cgiar.org

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The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) is a strategic partnership of CGIAR and Future Earth, led by the International Center for Tropical Agriculture (CIAT). The Program is carried out with funding by CGIAR Fund Donors, Australia (ACIAR), Ireland (Irish Aid), Netherlands (Ministry of Foreign Affairs), New Zealand Ministry of Foreign Affairs & Trade; Switzerland (SDC); Thailand; The UK Government (UK Aid); USA (USAID); The European Union (EU); and with technical support from The International Fund for Agricultural Development (IFAD).

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Abstract

The dairy sector is the largest single sub-sector within Kenya‘s agricultural sector, contributing about 14% of agricultural GDP and 3.5% of total GDP. With population growth, urbanization and rising incomes, consumption demand for milk is projected to increase significantly. If this is met from domestic production, greenhouse gas emissions from the dairy sector will increase. A proposal is being developed for submission to the emerging sources of climate finance for a dairy Nationally Appropriate Mitigation Action (NA-MA) in Kenya that aims to promote low-emission development of Kenya’s dairy sector. One of the main proposed approaches to reducing GHG emissions from the dairy sector is to increase the productivity of dairy cows and lower the intensity of GHG emissions (kg CO2e per kg milk). Increasing productivity on smallholder farms will require improved access to technical extension and advisory services, improved market linkages through dairy cooperatives, and finance for investments by farmers and dairy cooperatives. This report assesses access to credit finance by smallholder farmers and cooperatives, and the supply of finance from financial institutions and other sources, and identifies potential modalities for increasing access to finance to enable investments by smallholder dairy farmers and dairy cooperatives.

Although participation in informal financial institutions is prevalent, the vast majority of dairy farmers have never had a loan from a formal financial institution. Constraints include lack of a perceived need for a loan, fear of loss of assets, inability to repay, lack of collateral and/or lack of financial records/credit history. The limited visibility of farmers‘ financial track record, and awareness of production and market risks and hence higher transaction costs are key barriers for financial institutions in financing dairy producers. Among households that have had a loan from a formal financial institution, SACCOs are the most common source. Dairy cooperatives also use their own funds, and funds from SACCOs and commercial banks to finance capital investments and operating expenses, and some have established relationships with financial institutions to facilitate payments for milk intake as well as other inputs and services.

Loans to the dairy sector by formal financial institutions constitute a very small proportion of total loans for most financial institutions, except for SACCOs with a strong farmer base. Compared to commercial banks, SACCOs are better placed to serve dairy farmers, and their loan products have lower interest rates and more flexible terms. However, SACCOs are constrained in their ability to utilize international sources of finance, such as climate finance, and commercial banks, which typically focus on small and medium enterprises, are better placed to meet the

financial needs of dairy cooperatives. Concessional loans, credit guarantees and technical assistance are all relevant mechanisms for supporting financial services to the dairy sector. Financial institutions highlighted in particular the need for technical assistance with developing financial products suited to the dairy sector's needs and with application of information and communication technologies to provide supply chain financing solutions.

The dairy and financial sectors in Kenya are both areas of dynamic innovation. Further research should focus on identifying and evaluating existing financial innovations in the sector, and assessing the potentials for up-scaling. Although many innovations make use of the relatively better supply of data and in-formation for decision-making and structured supply chain relationships in the formal sector, the majority of dairy farmers supply informal milk value chains and have limited links with formal financial institutions. The financial relationships and potential for innovations to promote financial inclusion outside the formal dairy and financial sectors should be a focus for future research.

Keywords

Dairy, Agriculture, Kenya, Finance

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Acknowledgements

This work was implemented as part of the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), which is carried out with support from CGIAR Fund Donors and through bilateral funding agreements.

For details please visit https://ccafs.cgiar.org/donors. The views expressed in this document cannot be taken to reflect the official opinions of these organizations.

Contents

Acronyms

ASCA	accumulating savings and credit association
CCAFS	CGIAR Research Program on Climate Change, Agriculture and Food Security
CO_2e	carbon dioxide equivalent
FAO	Food and Agriculture Organization of the United Nations
FI	financial institution
GDP	gross domestic product
GHG	greenhouse gas
IFAD	International Fund for Agricultural Development
KSh	Kenyan Shilling (2015 US$1=98.18 KSh)
LIBOR	London interbank offered rate
MIS	management information system
NAMA	Nationally Appropriate Mitigation Action
ROSCO	rotating savings and credit association
SACCO	Savings and Credit Cooperative
UHT	Ultra-high temperature

1 Introduction

1.1 Background to the study

The dairy sector is the largest single sub-sector within Kenya‘s agricultural sector. It contributes about 14% of agricultural GDP and 3.5% of total GDP (Nassiuma and Nyoike 2014). With population growth, urbanization and rising incomes, consumption demand for milk is projected to increase 3.4 fold to 11.5 billion liters per year by 2030 (Republic of Kenya 2010). Official estimates put total annual milk production at about 5 billion liters, of which 3.8 billion liters is from dairy cattle, with an annual average growth rate of about 3% over the last decade (Kibogy 2016, FAOSTAT data)1. Agriculture is the source of about 42% of Kenya’s net green-house gas emissions (Republic of Kenya 2015). In 2010, Kenya’s livestock emit-ted about 16.6 million tonnes of carbon dioxide equivalent (CO2e), of which about 20% was from dairy cattle. As the country’s dairy sector continues to grow, greenhouse gas (GHG) emissions will continue to rise.

A proposal is being developed for submission to the emerging sources of climate finance for a dairy Nationally Appropriate Mitigation Action (NAMA) in Kenya that aims to promote low-emission development of Kenya’s dairy sector. The proposal is being developed through a partnership between the State Department of Livestock of the Ministry of Agriculture, Live-stock and Fisheries and Kenya Dairy Board, with technical support from UNIQUE forestry and land use, UN FAO, CCAFS and ILRI. One of the main proposed approaches to reducing GHG emissions from the dairy sector is to increase the productivity of dairy cows. As productivity (milk yield per cow) increases, the intensity of GHG emissions (kg CO2e per kg milk) de-creases (Gerber et al. 2011). Thus, with higher productivity, the increase in GHG emissions would be lower than if consumers’ demand for milk is met through supply from animals with lower productivity. Increasing productivity on smallholder farms will require improved access to technical extension and advisory services, improved market linkages through dairy cooperatives, and finance for investments on-farm.

This report assesses demand for credit finance by smallholder farmers and cooperatives, and the supply of finance from financial institutions and other sources, and identifies potential modalities for increasing access to finance to enable investments by smallholder dairy farmers and dairy cooperatives. The report draws on information from several sources. Published literature on dairy farmers’ access to credit was reviewed. Data from the 2016 FinAccess survey was analyzed, with special attention to rural households selling livestock products in that sample (FSD Kenya 2016)[2]. In addition, three surveys were conducted for this study. A survey of seven dairy cooperatives was undertaken in 2015, focusing on their financial relationships as well as cooperative managers’ and bank staff perceptions of their related capacity needs (Odhong’ 2015). A second survey of financial institutions, SACCOs and cooperatives was undertaken in June-July 2016 (BlueInventure Ltd. 2016). The survey covered six co-operatives, three processors, five SACCOs, two commercial banks, two microfinance banks and one

[1] FAO. FAOSTAT. http://faostat3.fao.org/download/Q/QL/E

[2] The FinAccess survey is representative at regional level, but the sample includes both urban and rural households. 87% of the 504 rural households reported owning cattle with the primary purpose of selling livestock products rather than live animals. We assume that these households are engaged in milk production and sales.

cred-it only microfinance institution. The survey of financial institutions and SACCOs' focused on understanding their current supply of credit to the dairy sector and their support needs if they are to increase financial services to the dairy sector. The survey of cooperatives focused on understanding their existing financial relationships and needs. A third survey conducted was an ex post assessment of a sample of investments supported by the IFAD-funded Small-holder Dairy Commercialization Programme[3], which estimated financial rates of return and feasible credit conditions for alternative investment projects at cooperative or farmer group and individual household level (Vorlaufer and Odhong', 2016). The study analyzed data from five cooperatives and farmer groups and 41 dairy farming households in Nakuru county.
This report summarizes the findings of these studies with regards to:

- Identifying the main investment needs of dairy co-operatives and individual farmers and their current access to finance;
- Understanding how finance for on-farm investments and investments by co-operatives are currently delivered;
- Understanding the current status of the supply of credit finance and other financial services to dairy farmers and cooperatives;
- Identifying constraints to increased supply of financial services faced by financial institutions; and
- Exploring options for how innovations in financial products and financing relationships could enhance financial access in the dairy sector.

1.2 Dairy sector context

About 1.8 million farming households – or 35% of rural households in Kenya – produce milk. About 80 per cent of Kenya's cow milk is produced by small holder famers, with the remainder produced by medium and large-scale farmers. Of the milk produced, about 42% is consumed on-farm by calves and house-hold members. An estimated 58% of milk produced is marketed. About 70% of marketed milk is sold through the informal market, either directly to consumers or through traders. The remainder (ca. 600 million liters in 2015) is channeled to dairy processing companies, often via dairy cooperatives. Informal sector milk sales to consumers or traders are mostly paid in cash on a daily or weekly basis. The cooperatives and processors pay farmers on a monthly basis.
Dairy cooperatives and farmer groups play a vital role in the dairy sector. They handle around 355 million liters per year, which is about 18% of the total marketed milk volume, or 60% of the milk volume processed by the formal sector[4]. There are 412 registered dairy cooperatives in Kenya, with membership commonly ranging between 30-2000 households, 90% of which have daily intakes of between 70 and 8000 liters of milk (Figure 1). Of the 412 cooperatives, 72% currently have milk coolers. Farmers benefit from group or cooperative membership due to a reliable market outlet, economies of scale in milk marketing, provision of inputs and input credit, linkages to financial institutions for credit and savings, and other services provided by cooperatives (Table 1).

3 http://www.sdcp.or.ke/

4 Kenya Dairy Board data

Figure 1 Distribution of dairy cooperatives by scale of daily milk intake (litres)

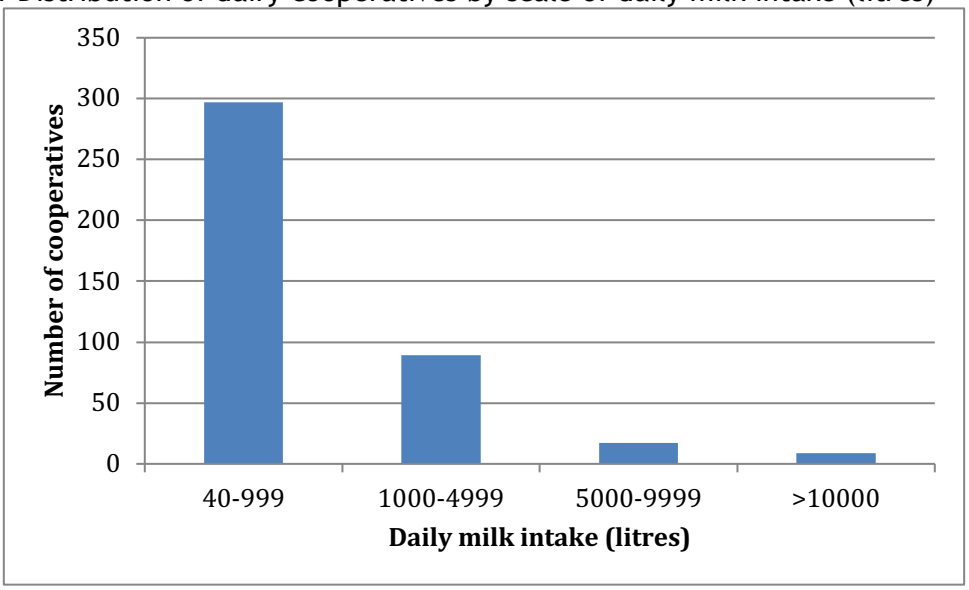

Table 1 Overview of membership and services provided by selected dairy cooperatives

	Coop 1	Coop 2	Coop 3	Coop 4	Coop 5	Coop 6
Number and type of members						
Subsistence farmers		2,711	2,521	7,500	-	-
Semi-commercial farmers		-	-	-	2,399	1,440
Commercial farmers		-	-	-	-	216
Medium-sized farmers		-	-	-	-	144
Large scale farmers		-	-	-	-	-
Total members	9,500	2,711	2,521	7,500	2,399	1,800
Number of Employees	450	24	10	120	36	26
Services provided to Farmers						
Purchase & marketing of milk	✓	✓	✓	✓	✓	✓
Milk transport services	✓		✓	✓	✓	✓
Training, extension, advisory services	✓	✓	✓	✓	✓	✓
Animal feed supply		✓		✓	✓	✓
Animal health services				✓	✓	✓
Artificial Insemination	✓			✓	✓	✓
Credit services to farmers			✓		✓	✓
Linking Farmers with Strategic Partners	✓			✓		

Source: BlueInventure Ltd (2016)

2 Demand for and access to finance by dairy farmers and cooperatives

2.1 Finance and investment needs

Average dairy cow productivity in Kenya is low, at about 1800 liters per cow per year, but the wide variation in yields among farms identified in field surveys points to the strong potential to increase dairy productivity. Even where smallholders raise cows of improved breed (e.g. Friesians, Aryshires and Jerseys), the genetic potential of these animals is often much higher than is reflected in current milk yields. Potential reasons include poor management of the cow's lactation cycle, poor feeding (in terms of quality of forages and quantity) and poor cow welfare (Biwott et al. 1989; Gillah et al. 2014; Richards et al. 2015). As dairy farmers seek to increase yields, adoption of a range of improved practices implies needs for investment and operating capital. Purchasing heifers of an improved breed can increase the genetic potential of cows raised on farm. Improving the nutritional status of dairy cows is crucial for improving milk production and reproductive performance. On-farm production of fodder grasses and legumes requires expenditures on seed, fertilizer, tillage services, and labour and machine hire costs during harvesting. In some areas, maize and grass silage production, which enables storage of forage into the dry season, is a key strategy for overcoming seasonality in fodder supply. Many farmers also purchase feed concentrate, which requires operating capital. Purchases of chaff cutters and other farm machines also support improved feeding practices. About three quarters of Kenya's dairy cows are raised in extensive grazing and semi-intensive systems, in which cows obtain fodder through a combination of grazing and stall feeding. Zero-grazing systems are increasingly popular particularly in areas with high population density and small land holdings per farm. Investment in improved housing can improve the infrastructure for feeding and manure management and increase cow comfort. Changes in production practices are generally made gradually, with related investments spread out over a period of some years.

Table 2 Adoption rates and investment costs of selected practices that support dairy productivity increases

Practice	Range of reported adoption rates	Initial investment costs per household (US$)	Sources
Cultivation of Napier grass	88-90%	$250	Mutoko et al ., 2014; Kiptot et al., 2015; Nangole et al., 2013
Hay production (Rhodes grass)	7-95%	$468	Mutoko et al ., 2014; Kiptot et al., 2015; Njarui et al., 2011; Mwamuye et al., 2013; Nangole et al., 2013
Purchase chaff cutter	24%	$300	Kimenchu et al. 2014
Purchase improved breed heifer	3-79%	$2500	FSD Kenya 2016; Murage & Ilatsia (2011)
Construct zero-grazing unit	41-84%	$1457	Nalunkuuma et al. 2013; Vorlaufer and Odhong' 2016

Farmer groups and cooperatives also require investments and operating capital for collective activities and to provide services to members. Typical collective activities of farmer groups may include fodder or hay production or feed processing. Investment needs of cooperatives vary considerably, depending on their business model (e.g.

whether they bulk and market milk only or also do value addition) and on the range of services they supply to their members (e.g. whether they also provide fodder mechanization and storage services). Most co-operatives have a milk cooler, and some have pasteurizing equipment. Most cooperatives use service providers for milk transport, but some invest in their own vehicle. Cooperatives that are able to provide financial visibility for their members also require an automated documentation system. Estimated costs for an automation system are about US$ 150,000, while a 5000 L cooler costs about $180,000 and a pasteurization unit may cost about US$ 40,000 (BlueInventure Ltd. 2016). Co-operatives also need financial services from financial institutions to run their day to day activities such as milk collection, payment for milk deliveries, other operation costs.

An ex post assessment of investments made by individual dairy households, farmer groups and cooperatives with financial support from the IFAD Smallholder Dairy Commercialization Project in Nakuru County suggests that most investments at household and group levels achieved a reasonable rate of return (Table 3). However, characteristics of the resulting cash-flows point to constraints on using formal credit to finance these investments. Several in-vestments only breakeven after five or more years, and feasible repayment periods are even longer if the household dairy enterprise is the only source of funds for repayment. Feasible interest rates are also lower than the interest rates on many available credit products provided by formal financial institutions.

Table 3 Analysis of feasible credit terms for selected group/cooperative and farmer investments

Investment project	**Initial investment (US$)**	**IRR 10 years**	**IRR 20 years**	**Years to break-even (years)**	**Feasible interest rate**	**Feasible grace period (years)**	**Feasible repayment period (years)**
Farmer group investments							
Dairy meal processing	3,800	20%	24%	2	10%	2	8
Hay production	3,500 in year 1 plus 1800 in years 5 and 10	16%	23%	6	8%	2	6
Milk cooler	174,000	1%	10%	6	10%	4	10
Milk pasteurizing	80,000 (additional to the 174,000 for cooler)	16%	23%	7	10%	6	10
On-farm investments							
Zero-grazing unit	1,457	25%	29%	5	12%	2	8
Zero-grazing unit + biogas	2,125	31%	34%	5	12%	2	6
Zero-grazing unit + biogas + fodder production	2,875	28%	31%	5	12%	2	6

Source: Vorlaufer and Odhong' (2016)

Note: Data presented are based on in-depth surveys with 41 households and 5 dairy cooperative associations in Nakuru, so results are not representative for all Kenya, and do not indicate variability in returns across households.

In addition to producers and dairy cooperatives, milk transporters, veterinarians, animal breeding technicians, and agro-input dealers provide critical inputs to the dairy supply chain. One study suggested that milk transporters, and veterinarians and animal breeding service providers who cross-sell both services are sufficiently profitable to support financial services (Pelrine et al. 2009). Feed dealers reportedly earn low margins, and consequently dairy cooperatives often develop feed sales as a supporting service to ensure access to feed concentrate by cooperative members. The remainder of this reported does not consider the financing needs of these supporting value chain actors.

2.2 Access to credit

According to a 2015 survey of financial access in Kenya, rural households make use of a variety of financial services from a range of formal and information financial institutions[5]. Although only about a quarter of rural households have a bank account, about 70% have a working mobile phone, and mobile money (e.g. M-PESA) is the most commonly used financial service among rural households. The most important uses of mobile money are receiving and sending money with friends/family, and savings. More than half of rural households belong to some kind of informal institution to which they make monthly or weekly payments. The most important reported benefits of those institutions include making lumpy investments, keeping money and for help in emergencies. In terms of savings, common methods include keeping cash and saving with a rotating savings and credit association (ROSCO) (Table 4). Rural households selling milk are also more likely to save with a savings and credit cooperative (SACCO) or accumulating savings and credit association (ASCA) than rural households in general. In terms of loan products, 77% of rural households selling milk have never had a loan product from a formal institution (i.e. bank, Mshwari, SAC-CO, micro-finance or government fund), similar to the 79% of all rural households. Loans from family, friends, neighbours and credit local shops or suppliers are more common than other sources, followed by loans from ASCAs and chamas. However, average loan volumes from these informal sources are likely to be much smaller than those potentially available from formal institutions. Among formal financial institutions, SACCOs are the most commonly used source of loans. Very few rural households report having applied for a formal loan. Lack of a perceived need for a loan, fear of loss of assets, inability to repay and lack of records are the main reasons given by rural households selling milk for not applying for a loan, while lack of a guarantor or collateral are also common reasons given by rural households[6]. Thus, most dairy farmers appear not to even attempt to secure loans from formal institutions. When explaining the main source of finance for their farm, 90% of rural households selling milk cite their own savings, about 5% state that they borrow from neighbours or friends, and about 2% cite the buyer as the main source of finance. Only about 2% cite formal banking institutions.

Table 4 Use of savings products by rural households and rural households selling milk (2015)

[5] This paragraph draws on data provided by FSD Kenya (2016)

[6] While about 85% of rural households own their farm, only about 55% have a title deed (FINACCESS SURVEY 2016)

	Milk selling rural households (n=438)			Rural households (n=3076)		
	never	**current**	**used to**	**Never**	**current**	**used to**
Savings with a ROSCA/merry-go-round	50%	43%	8%	56%	34%	9%
Savings you keep in a secret hiding place	53%	42%	6%	54%	39%	7%
Savings account at SACCO	79%	17%	4%	82%	14%	4%
Savings with an ASCA	79%	17%	4%	81%	14%	5%
Saving through Mshwari, KCB Mpesa	87%	11%	3%	86%	11%	3%
Savings with a group of friends	87%	8%	5%	86%	8%	6%
Shares, stocks, mutual funds	91%	8%	1%	93%	5%	1%
Savings given to a family or friend to keep	88%	6%	6%	87%	6%	6%
Group *chama* investments	92%	6%	2%	94%	4%	1%
Savings at microfinance	92%	4%	3%	94%	3%	3%

Source: FSD Kenya (2016)

Table 5 Use of loan products by rural households and rural households selling milk (2015)

	Milk selling rural households			Rural households		
	never	**current**	**used to**	**never**	**current**	**used to**
Local shop/supplier providing goods/ services on credit	69%	13%	17%	73%	10%	17%
Loan from family/friends/neighbour	75%	8%	16%	75%	7%	18%
Loan from a SACCO	89%	8%	3%	91%	5%	4%
Loan given by government / government-related institution to buy a house	89%	8%	3%	91%	5%	4%
Loan from an ASCA	88%	7%	5%	91%	5%	4%
Loan from a *chama*	90%	5%	5%	92%	3%	5%
Personal loan/business loan from a bank	93%	4%	3%	93%	3%	3%
Personal loan/business loan from Mshwari, KCB Mpesa	92%	4%	4%	93%	3%	4%
Hire purchase	93%	4%	3%	93%	3%	3%
Loan to buy/build a house, or to buy land from a bank, building society	92%	4%	4%	93%	3%	4%
Loan from a microfinance	95%	3%	3%	96%	2%	3%
Loan from shopkeeper	91%	3%	6%	88%	3%	9%
Loan from a government institution	98%	1%	1%	98%	1%	1%
Loan/credits from buyer of your agricultural products	97%	1%	1%	98%	0%	1%
Loan from an employer	98%	0%	2%	97%	1%	3%
Loan from an informal moneylender	98%	0%	2%	99%	0%	1%
Loans that you get through the phone that you download through apps eg Zidisha	100%	0%	0%	99%	0%	1%

Source: FSD Kenya (2016)

These findings are generally in line with the findings of other published studies, but there is also significant variation across years, regions and population groups. Dairy farmers participating in the formal value chain may have higher rates of financial inclusion than other dairy farmers. Studies report borrowing rates ranging between 8%

and 33%, with between 15% and 40% of loans being used for investment in the household livestock enterprise (Mburu et al. 2012; Zander et al. 2013; Njehia and Wanjala 2014). Farming, education and general expenses are often more common reasons given for taking a loan. Studies of formal credit applications suggest that refusal rates are between 40% and 60%, with a higher chance of success for male compared to female applicants, for households with a higher annual income, and for households owning land (Rambo 2012). While some studies report that the majority of dairy farmers are financially solvent, lack of a financial track record is among the main reasons for refusal of loan applications.

Few studies have been undertaken of access to finance by dairy cooperatives. A series of case studies conducted in 2015 highlights significant diversity among cooperatives in their relationships with financial institutions and their capital investment decisions (Odhong‘ 2015). Among the seven cooperatives investigated, cooperatives in Meru County (Cooperatives 1-4 in Table 6) were relatively well integrated with financial institutions, which facilitate farmer payments for milk deliveries, and offer credit to cooperative members on the basis of their milk delivery records supplied by the cooperative. Operation capital for the cooperatives themselves were supplied by SACCOs, banks or advance payments from the processor. Cooperatives in Machakos (Cooperatives 5-7 in Table 6) had not established such relationships. Where cooperatives had made capital investments, these funds mainly came from banks or SACCOs. In some cases, cooperatives used SACCOs for operation capital and banks for capital investments. While processors sometimes provided a loan guarantee, lack of collateral or guarantees, interest rates and the inability of cooperatives‘ financial records to meet banks‘ loan application assessment requirements were among the main barriers to credit access perceived by cooperative managers.

Table 6 Financial relationships and investments by selected cooperatives (2015)

	Coop 1	**Coop 2**	**Coop 3**	**Coop 4**	**Coop 5**	**Coop 6**	**Coop 7**
Has bank account	Y	Y	Y	Y	Y	Y	Y
Farmer payments facilitated by FI	Y	Y		Y			
Credit from FI available to members with milk delivery records		Y	Y	Y			
Source of operation capital							
FI	Y		Y	Y			
Processor		Y	Y				
Own funds					Y	Y	Y
Capital investments in last 5 years	N	Y	N	Y	Y	N	N
Investment project							
Milk transport		Y		Y			
Cooler					*Y*		
Processing equipment					*Y*		
Source of loan		Bank		Bank	Bank		
					SACCO		
Planned investments	Y			Y	Y		
Investment project							
Milk transport	*Y*						

Digital procurement & payment system		*Y*		*Y*			
Processing equipment					*Y*		
Milk dispensers					*Y*		
Perceived constraints to credit access							
collateral or guarantee	Y			Y	Y		
financial management records	Y	Y					
interest rate		Y	Y	Y	Y		
no investment need						Y	Y

Source: Odhong' (2015)

3 Supply of finance to dairy farmers and cooperatives

3.1 Supply of credit finance

The main formal sector financial institutions include (in order of total assets): commercial banks, micro-finance institutions, SACCOs, and government funds[7]. Formal finance sector lending to agriculture is a very limited proportion (<5%) of total lending by financial institutions (FIs) in Kenya (Tyson 2016). This holds also for the dairy sector. Interviews with five banks and micro-credit institutions and five SACCOs showed that for most non-SACCO FIs, the dairy sector accounts for 0.2% - 5.12% of the total loan book as compared 10%-100% for SACCOs (Table 7). The SACCOs interviewed were mainly set up by farmer based organizations and their members are mainly farmers or individuals involved in agricultural production. On the other hand, the average size of dairy loans is higher for banks than for SACCOs. This is because SACCOs mainly serve smallholder farmers who typically borrow in small amounts, while banks mainly target medium to large scale farmers, small and medium enterprises and cooperatives. SACCOs and some microfinance institutions are thus better placed to serve smallholder farmers. Banks, on the other hand, are a key source of on-lending funds for SACCOs, with a few banks featuring prominently as providers of capital to SACCOs. It is also more attractive for banks to lend to cooperatives than to individual farmers, because of the higher cost of servicing smallholder farmers and banks' relatively limited staff and branch outreach.

Most banks and dairy related SACCOs have one or more products targeting dairy farmers (Table 8). These products are mostly for investment in financing heifers, inputs such as feeds, farm equipment and infra-structure, working capital and invoice financing. Typical credit amounts offered to farmers by the financial institutions range from KSh 10,000 – KSh 5 million per loan (i.e., US $100-$50,925) with tenors of between 6 – 60 months depending on the nature of financing, with working capital loans having shorter tenors. Banks however offer higher limits and longer tenors compared to SACCOs, because banks are able to access long-tenor lines of credit for on-lending, unlike SACCOs who borrow from the banks.

However, SACCOs provide not only more affordable loans to farmers, but also have more flexibility in terms of eligibility criteria and lending terms. SACCO loan interest

[7] E.g. Agriculture Finance Corporation is a government-owned fund that provides credit at below-market rates. Other funds also exist targeting youth and other disadvantaged groups.

rates range between 10% - 16%[8] while those of non-SACCO financial institutions have interest rates of up to 24%, despite non-SACCO FIs having access to lines of credit for agriculture (including dairy) financing and more branches with which to mobilize deposits that are a cheaper source of funds. SACCOs are also less demanding when it comes to the level of contribution by clients per project, requiring 0% - 30% client contribution depending on the nature of project financed, whereas banks and other FIs require contribution rates of 15% and upwards.

[8] All interest rates on reducing balance basis have been converted to rate (dividing by a factor of 1.8) for ease of comparison. Flat rates also enable quick calculation of regular repayments e.g. monthly.

The reason for the higher interest rate of commercial and microfinance bank products is that these institutions face challenges in mobilizing long term funds for on-lending, since most depositors are short term in nature and banks cannot fully rely on deposits to fund loans to the agriculture sector where demand for medium to long terms loans is higher. These institutions therefore seek long-term finance from the money market or international funders, but the cost of the funds forces the banks to on-lend at high rates. Concessional loans are therefore relevant to enable banks and SACCOs to support farmers who would otherwise be priced out of the market for credit.

Table 7 Overview of dairy sector lending by selected financial institutions

	MFB 1	**Bank 1**	**MFB 2**	**MFB 3**	**Bank 2**	**SACCO 1**	**SACCO 2**	**SACCO 3**	**SACCO 4**	**SACCO 5**
Legal Status										
Commercial Bank		Y			Y					
Microfinance Bank	Y		Y							
Credit Only Microfinance				Y						
SACCO						Y	Y	Y	Y	Y
Asset and Liabilities (31 Dec. 2015, KSh million)										
Total Assets	25,320	145,000	4,500	853	558,090	254	945	7	2,400	2,087
Total Liabilities	21,020	131,000	4,400	818	476,840	196	749	3	1,600	1,861
Shareholder Funds	4,300	14,000	100	35	81,250	59	196	4	800	226
Total Loan Book (KSh million)	16,580	92,000	3,710	616	345,960	183	773	2	1,500	1,532
Total Agribusiness Loan Book (KSh million)	320	1,850	260	616	13,840	95	696	2	1,000	426
Agribusiness/Total Loan Book (%)	1.9%	2.0%	7.0%	100.0%	4.0%	52.0%	90.0%	100.0%	66.7%	27.8%
Total Number of Agribusiness Borrowers	212	500	650	no data	no data	6200	11514	62	25000	10004
Average Agri Loan Size Per Borrower (KSh million)	1.51	3.70	0.40	no data	no data	0.02	0.06	0.03	0.04	0.04
Total Dairy Finance Loan Book (KSh million)	7	182	190	no data	no data	26	626	2	150	234
Dairy Finance/Agribusiness Loan Book (%)	2.19%	9.84%	73.08%	no data	no data	27%	90%	100%	15%	55%

Dairy Finance/Total Loan Book (%)	0.04%	0.20%	5.12%	no data	no data	14%	81%	100%	10%	15%

Source: BlueInventure 2016

Table 8 Overview of financial products targeting the dairy sector offered by selected financial institutions

	MFB 1	**Bank 1**	**MFB 2**	**MFB 3**	**Bank 2**	**SACCO 1**	**SACCO 2**	**SACCO 3**	**SACCO 4**	**SACCO 5**
Dairy loan structure and terms										
Shortest loan tenor (months)	12	3	2	18	18	1	1	1	1	1
Longest loan tenor (months)	18	48	36	24	36	36	60	12	24	24
Lowest loan processing fee		1.0%	0.0%			no data	1.0%	1.0%	1.0%	1.0%
Highest loan processing fee	3.0%	3.0%	3.3%	3.0%	2.5%		2.0%		5.0%	
Lowest priced dairy loan		10%	11%			10%	13%	10%	10%	10%
Highest priced dairy loan	24%	13%	24%	20%	12%	14%	15%	16%	12%	
Portfolio at Risk										
Agriculture Sector Portfolio	14.0%	7.0%	7.5%	3.0%	no data	10.0%	3.8%	6.0%	20.0%	18.0%
Dairy Sub-sector Portfolio	10.0%	1.0%	7.2%	1.5%	no data	12.0%	no data	6.0%	2.0%	3.0%

Source: BlueInventure 2016

Table 9 Indicators of the capacity of selected financial institutions to serve the dairy sector

	MFB 1	**Bank 1**	**MFB 2**	**MFB 3**	**Bank 2**	**SACCO 1**	**SACCO 2**	**SACCO 3**	**SACCO 4**	**SACCO 5**
Staffing										
Total employees	1,280	1,600	450	150	7,500	21	45	6	150	230
Total agribusiness staff	20	20	7	90	200	4	8	3	20	30
Agri staff/total employees (%)	2%	1%	2%	60%	3%	19%	18%	50%	13%	13%

Agri staff with agriculture background	10	10	3	45	140	0	0	0	0	30
% of agri staff with agriculture background	50%	50%	43%	50%	70%	0	0	0	0	1
Productivity of agri staff (KSh million/staff)										
Average agri loan book per agri staff	16	93	37	7	69	24	87	1	50	14
Average dairy loan book per agri staff	0	9	27	no data	no data	7	78	1	8	8
Training of loan officers in agriculture		Yes	Yes		Yes			Yes		Yes
Management Information System										
Loan portfolio disaggregation to agriculture sector	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes
Loan portfolio disaggregation to dairy sector	Yes	Yes		Yes	Yes	Yes	Yes		Yes	Yes
Branch network										
Total number of branches	44	62	19	20	200	1	5	1	17	14
No. of rural branches	22	17	8	19	no data	1	5	1	15	14
% of rural branches	50%	27%	42%	95%	no data	100%	100%	100%	88%	100%

Source: BlueInventure 2016

3.2 Non-bank suppliers of financial services

In addition to financial institutions, some cooperatives provide in-kind lending solutions, such as provision of animal feeds, artificial insemination and other inputs on the milk delivery check-off system. However, many co-operatives are limited in their ability to provide these services, because this ties up working capital in advances to members, while working capital is required for milk procurement, which is the cooperatives‘ core business. Some cooperatives have linked up with financial institutions to enable payments for such in-kind lending.
Processors also facilitate provision of these financial services by linking farmers with financial institutions such as SACCOs to enable them access credit for investment, by guaranteeing farmers loans with financial institutions; supporting co-operatives to purchase critical goods for their members in bulk such as milk cans; and facilitating linkages between cooperatives and input suppliers.

3.3 Constraints to supply of financing to dairy farmers and cooperatives

Financial institutions face a number of constraints that reduce or limit their willingness or ability to lend to dairy farmers and cooperatives.

3.3.1 Capacity needs of financial institutions

Non-SACCO FIs tend to have relatively few rural branches as a percentage of their total branch network (Table 9). Although they all have agriculture loan officers working with farmers, the level of engagement with farmers is limited, as indicated by the ratio of agriculture loans to the total loan portfolio (i.e. 2%-14%), compared to SACCOs for which the ratio is 27% - 90%. This is also partly because SACCOs have worked with farmers for many years, whereas engagement with agriculture for other FIs is more recent. SACCOs also have more staff per branch focused on agriculture lending than commercial and micro-finance banks. SACCOs are thus better placed to serve more farmers. Although some banks and SACCOs do invest in training their agriculture loan officers in agriculture credit skills, both SACCOs and other FIs indicated a need for staff training in agriculture credit management and product development. As indicated by the feasible credit terms shown in Table 3 above, investments in the dairy sector tend to have relatively long repayment periods. There is thus a need to support financial institutions to design and deploy financial products that are farmer-centred and that address the credit needs of the beneficiaries. Both SACCOs and banks expressed interest in capacity development and support to in product development as well as exploring the potential of technology to enhance delivery of solutions to farmers.
Another common and major capacity need for the both banks and SACCOs interviewed is improvement in the management information systems (MIS). The majority of financial institutions interviewed have an MIS for the agriculture portfolio in general, and most mark dairy loans within their agriculture portfolio. However, they also indicated that the process of capturing and storing data may not be fully reliable, and indicated a need for support to develop better solutions for data capture, storage, retrieval, analysis and reporting. Financial institutions would benefit from being able to clearly disaggregate their agriculture portfolio because this visibility would enhance their risk management and enable them proactively man-age problem loans or anticipate the impact of events in the dairy sector that have a direct impact on the loan book. For

instance, if a region with dairy clients of a bank is affected by drought, the bank would be able to easily identify which clients might be affected and to what extent this may affect the loan portfolio, thus enabling them to be more proactive in portfolio risk management.

3.3.2 Capacity needs of farmers from financial institutions' perspective

Financial institutions report a number of challenges at the farmer level that limit their ability to lend to farmers. The most common reason given for declining loan applications is the lack of a demonstrated financial track record by borrowers. This is partly linked to the fact that farmers often do not keep proper records of their dairy enterprises. Although some data on milk sales and input credit is held by cooperatives, this data is not visible to financial institutions. The issue of poor records was mostly reported by non-SACCO financial institutions, implying that SACCOs may be better able to access the financial profiles of farmers due to their affiliation to co-operatives. Supporting cooperatives to digitize their records, and availing these records to partner financial institutions (subject to data protection laws) could enable farmers to demonstrate a financial profile over time and thus access formal credit.
Low productivity on smallholder farms as well as lack of structured off-take arrangements (e.g. long-term milk supply contracts) were also listed by financial institutions as limitations to lending to dairy farmers. Low productivity implies low capacity of farmers to meet loan obligations when they fall due, as they may not generate sufficient cash flows from the dairy enterprise. The majority of institutions indicated that there was need for technical assistance to farmers to enable them increase productivity, reduce fluctuations in milk yield and incomes, and hence increase their capacity to repay loans. Off-take agreements are an assurance of the capacity of the farmer to repay the loans and to avoid diversion of funds.
Poor credit history was also mentioned, but was not identified as a prominent gap. These findings are generally corroborated by data from the 2016 Financial Access Survey in Kenya (FSD Kenya 2016). Only 2.5% of dairy households covered in that survey reported having been denied an application for a formal loan. Inability to repay and lack of records were the main reasons given by dairy farmers. (Lack of guarantor or collateral were also common reasons given by rural households in general.)

Table 10 Risks and constraints to dairy sector lending as perceived by financial institutions

Production risks	Weather, animal disease, poor management leading to low yields/fluctuations in yields impacting on repayment ability
Market risks	Market and price fluctuations impacting on repayment ability
Information risks	Poor record keeping, limited visibility of farmers' financial records
Constraints to expanding credit supply	Limited credit lines; multiple borrowing leading to default; high transaction costs of outreach to farmers; high cost of funding leading to high interest rates on loans; competition among FIs; inadequate funds for on-lending
Constraints to farmer access to credit	Insufficient collateral; income fluctuations impact on ability to repay; farmers' low literacy levels

Source: BlueInventure 2016

3.3.3 Financing needs of financial institutions

Many non-SACCO FI in Kenya have received international support for credit lines for agriculture on-lending, some have received credit guarantees, and many have benefited

from some form of technical assistance. These funds are usually provided for the entire agriculture portfolio, but in particular instances they have been extended to designated sectors or value chains in order to meet particular intervention outcomes.
Most SACCOs mentioned inadequate funding to finance on-lending to members as a major constraint, while this was mentioned only by one non-SACCO FI. Only one SACCO had directly received international support, despite their much closer engagement with farmers. The main reasons for low SACCO engagement with international finance is their limited ability to attract such funds, restrictions due to funders' requirements, and their limited ability to absorb debt with external borrowing, since external borrowing by SACCOs is capped at 25% of total assets by the SACCO Societies' Act (2008)[9]. This highlights the need to develop appropriate mechanisms to enable SACCOs to access funding for on-lending to dairy farmers, capacity building at both institutional and client levels, and risk sharing instruments to incentivize expanded engagement with farmers, while also limiting SACCOs' exposure risk.

4 Structuring finance for lending to farmers and cooperatives

4.1 Financing relationships

Banks, microcredit institutions and SACCOs have distinct but complementary roles in the dairy sector. Currently, SACCOs have the strongest linkages with farmers in the formal dairy value chain and thus are best placed for increasing financial inclusion of dairy farmers. However, SACCOs are limited in their ability to take on large volumes of international finance and to manage complex financial relationships, while commercial banks and microfinance institutions have a track record of partnership with international finance sources. Therefore, support to cooperatives and medium- or large-scale farmers should be de-livered through commercial banks. The advantages of channeling funds targeting farmers through banks and via on-lending to SACCOs are that the administration of funds is decentralized to the banks, thus minimizing project transaction costs, and the funding to banks can be used to leverage additional capital from the banks for on-lending to SACCOs, thus increasing the project impact. However, experience sug-gests that with this method of financing, monitoring of the credit line should be strong to ensure that banks do not divert the funding to other sectors.
Non-SACCO FIs tend to focus more on medium to large scale farmers and SMEs (including cooperatives). Therefore, credit lines to commercial banks or microfinance banks should be used to serve the needs of medium to large-scale farmers, dairy co-operatives and other SMEs in the value chain. Figure 1 summarizes the proposed flow of resources for credit finance to the dairy sector.

[9] See http://kenyalaw.org/kl/fileadmin/pdfdownloads/Acts/SaccoSocietiesAct_No14of2008.pdf. External borrowing includes funds received through special arrangements between the Kenya government and other foreign governments or donor agencies for onward lending or distribution.

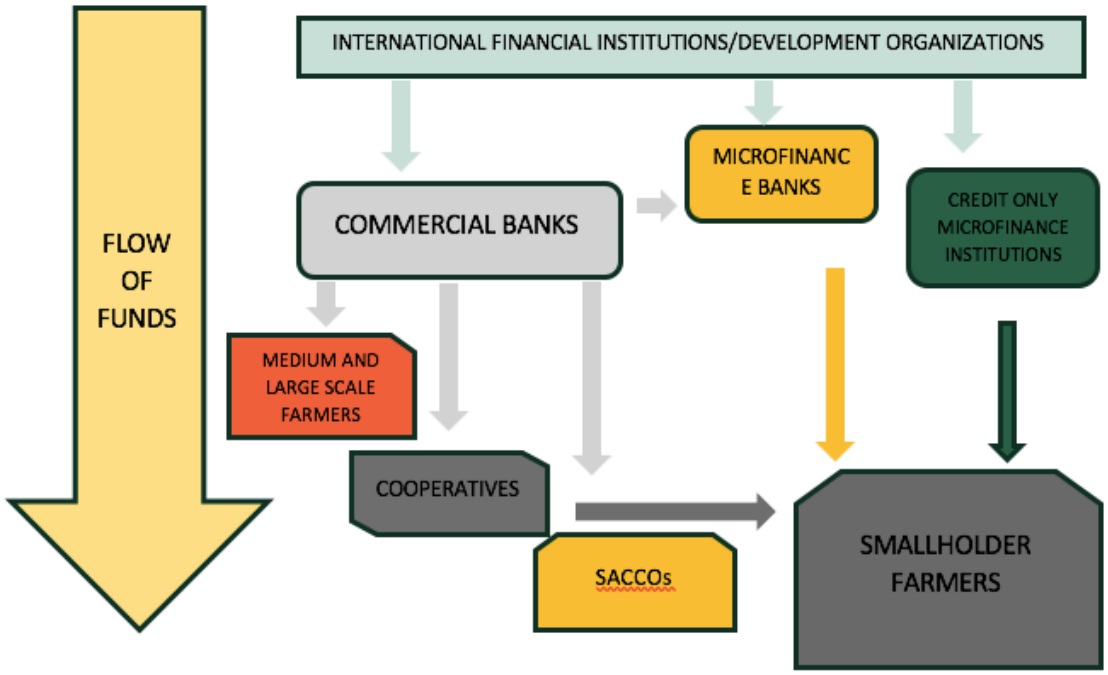

Figure 2 Proposed flow of resources for credit finance to the dairy sector

In terms of finance mechanisms, concessional loans, risk sharing mechanisms and technical assistance grants all have a role to play:

- Concessional loans are critical because they can achieve the twin goals of enabling financial institutions to access capital for on-lending to the dairy sector while also enabling them deliver credit at affordable rates. These credit lines will focus on reaching larger numbers of subsistence and semi-commercial farmers who otherwise do not have access to finance for on-farm investments.
- Risk sharing mechanisms are relevant in the dairy sector, where climate variability, deficiencies in on-farm management and lack of collateral for some farmers increase the risks to FIs of engaging in the dairy sector. Risk sharing mechanisms can build the confidence of and increase lending by FIs to the sector.
- Both SACCOs and non-SACCO financial institutions express demand for capacity building in a number of areas. Technical assistance is thus relevant to ensure the effective deployment of concessional loans and risk sharing funds. SACCOs have a greater need for technical assistance to support finance and credit risk management, institutional governance, product development and information technology applications in their management and lending operations.

Table 11 summarizes representative characteristics of financial cooperation mechanisms that a sample of commercial banks and microfinance banks report from their recent engagement with international finance. Although few SACCOs have received international financial support, it would be reasonable to assume that their terms would be similar to the terms of microfinance banks, but with a greater need for technical assistance.

Table 11 Representative characteristics of financial cooperation mechanisms

	Minimum ticket size per bank ($)	**Minimum expected leverage per FI**	**Interest rates & fees**	**Lending timeframes**

Banks				
Credit Lines	10 million	30 million	6 Months Libor + 3-4% on US$	7+ years
Credit Guarantee	5 million	5 million	Both origination and utilization fee: <0.5%	7+years
Technical Assistance Grants	0.2 million	0.05 million		3+years
Microfinance banks				
Credit Lines	5 million	10 million	6 Months Libor + 3-6% on US$	5years
Credit Guarantee[10]	2.5 million	2.5 million	Both origination and utilization fee: <0.5%	5years
Technical Assistance Grants	0.1 million	0.025 million		3years

Source: BlueInventure Ltd (2016). Note: LIBOR: London interbank offered rate

4.2 Financial products and services

The evidence reviewed in Section 2 of this report points to a need for innovations in financial products and services to increase dairy farmers‘ access to finance for investment in the dairy sector. Commonly reported reasons for lack of access to finance include perceived inability to repay, lack of a financial track record and a lack of collateral or guarantee. Furthermore data presented in Table 3 suggest that credit products for the dairy sector need to be designed with the financial returns and cash flow characteristics of on-farm investments in mind. Beyond lower interest rates and longer repayment terms, several other innovations appear to be relevant in the dairy sector.

Low productivity and production risks are common in the dairy sector, and contribute to both farmers‘ fear of being unable to repay loans and FIs‘ reluctance to lend to farmers. Linking technical extension and dairy service provision to credit can supporting improvements in the productivity of dairy production and the stability of yields and incomes. Some credit providers have begun tying their credit loans to provision of technical support to dairy farmers in order to ensure farmers‘ ability to repay. However, it is likely that most financial institutions see the organization of these supporting value chain services as beyond their remit, and incurring high transaction costs. Some cooperatives provide technical extension services and other services such as input supply, artificial insemination and veterinary services. Several of Kenya’s leading dairy

[10] Can also leverage existing Credit Guarantee Mechanisms such as USAID DCA among others

processors have also begun to invest in dairy advisory services provision for their suppliers (Odhong‘ et al. 2016). One option would be for data on provision of these extension services and uptake of good management practices to be made visible to FIs, in order to indicate which farmers potentially have lower exposure to production risks. Many farmers do not keep farm records, and their financial track record is not visible to credit officers in financial institutions for risk assessment. However, cooperatives and processors do keep data on milk supply by their members and suppliers. Automation of milk procurement systems can not only improve the accuracy of procurement records. It can also link with receipt and payments systems, including records of payments for in-kind services, such as feed inputs, or artificial insemination services received by cooperative members (Onyiego 2016). Making farmers‘ milk payment records visible to FIs can increase farmers‘ ability to demonstrate a financial track record. One consortium of dairy, communications and financial sector partners has gone further, linking milk supply records with provision of a number of other services. Initially, the Agrilife Platform used data on farmers‘ financial status to enable provision of credit by a micro-finance bank, with milk receipts serving as collateral for the loans (Pambo 2015). Subsequently, insurance companies, and service providers in animal health, breeding, feed, biogas and ex-tension have joined the platform, enabling credit providers to credit provision to a variety supporting services and thus reduce farmers‘ and banks‘ risks.

Lack of collateral is a constraint on access to credit for many farmers. Group lending models have begun to be adopted in Kenya, so that group members can guarantee each other’s loans without the need for physical assets. Loan default rates are lower for loans to group members than to individuals, and some FIs also perceive that the group lending model fits with their strategies to expand the rural customer base (Kodongo and Kendi 2013). In some areas, dairy farmer groups have been established on the basis of informal savings groups, which may provide an institutional basis for linking farmers with formal financial institutions. Digitizing savings groups records can also help farmers document their credit record in a way that is visible to formal financial institutions, enabling a graduation from small-scale, informal loans to larger formal loans (FSD Kenya 2015).

In order to engage in these and other types of financial innovation, both SACCOs and non-SACCO FIs express a need for technical assistance in areas such as product development and the application of information technologies to providing supply chain financing solutions (BlueInventure Ltd. 2016).

5 Discussion

The focus of much of this report has been on financing in formal dairy supply chains. Farmers, dairy co-operatives, processors, dairy service providers and financial institutions all play key but distinct roles in financing the investment and operation costs of the value chain. Dairy cooperatives not only provide payment for milk, but also serve as business hubs through which farmers can access other inputs and services. Financial institutions play key roles in financing cooperatives‘ core business operations as well as facilitating payments for other inputs and services. Digitization of milk payment records and records of other services used by farmers can help unlock access to credit from formal institutions. The relative predictability of the dairy sector, the potential availability of data to support decision making, and the existence of structured supply

chain relationships makes the formal sector attractive to financial institutions. SACCOs and non-SACCO FIs have different potential roles in financing the sector. SACCOs are well-placed to provide credit directly to farmers, as their loan conditions are often more flexible and better suited to dairy farmers‘ needs. Commercial banks, on the other hand, are often better placed to take on large volumes of international finance, such as climate finance, and are more focused on providing credit to larger scale entities, such as dairy cooperatives. Many SACCOs express a strong need for technical assistance with credit risk management and governance, as well as product development and technological innovations to enable them to better link with value chain processes, which are also of interest to non-SACCO FIs. Concessional finance, credit guarantee mechanisms and technical assistance have all been found to be effective in expanding financial access in Kenya, and should be considered as the main financial mechanisms for a dairy NAMA. While dairy cooperatives handle about 60% of the milk volume processed by the formal sector, this is less than 20% of the total volume of marketed milk. And despite the important role of SACCOs in some areas, only a portion of dairy cooperatives are related to specific SACCOs and SACCO membership is only a small proportion of the total number of dairy farmers. For the majority of dairy farmers, own savings, informal savings and credit institutions and mobile financial services are the main sources of finance for investment and working capital for dairy development. Much less is known about the financial relation-ships and potential for innovations to promote financial inclusion among the majority of dairy farmers who primarily serve the informal market and who rarely access formal credit.

The dairy and financial sectors in Kenya are both areas of dynamic innovation. Information and communication technologies, in particular mobile technology, have opened up potential opportunities for expanding both formal and informal financial relationships, many of which have yet to be fully understood and exploited (Johnson 2016). A wide-ranging inventory of existing financial innovations in the sector, evaluations of impacts on financial inclusion and dairy development, and assessment of potentials for scaling up would increase stakeholders‘ access to a toolbox of tried and tested options for supporting finance to dairy development.

References

Anonymus. 2013. Und da war es nur noch Einer – SWL bleibt als einziger Tischlerplattenhersteller in Deutschland übrig. Holz-Zentralblatt, Nr. 19, S. 463.

Biwott KJ, Kaitho R, Gachuiri CK, Wahome RG, Tanner J. 1998. Effects of levels of concentrate supplementation on milk production and body weights of lactating dairy cows. Available at https://cgspace.cgiar.org/bitstream/handle/10568/1584/Biwott et al 1998-Concentrate supplementation-UON.pdf?sequence=1

BlueInventure Ltd. 2016. Assessment of financing needs and modalities for financial support to enhance on-farm productivity in Kenya. Unpublished report at UNIQUE Forestry and Land Use GmbH, Frei-burg.

FSD Kenya. 2015. 2015 FSD Annual Report. Available at http://fsdkenya.org/wp-content/uploads/2016/07/2015-FSD-Annual-Report_Final_Web.pdf

FSD Kenya. 2016. 2016 FinAccess Household Survey. Available at http://fsdkenya.org/dataset/finaccess-household-2015/

Gerber P, Vellinga T, Opio C, Steinfeld H. 2011. Productivity gains and greenhouse gas emissions in-tensity in dairy systems. *Livestock Science*, 139(1): 100-108.

Gillah KA, Kifaro GC, Madsen J. 2014. Effects of management practices on yield and quality of milk from smallholder dairy units in urban and peri-urban Morogoro, Tanzania. Tropical Animal Health and Production, 46(7), 1177–83.

Johnson, S. 2016. Competing visions of financial inclusion in Kenya: the rift revealed by mobile money transfer. *Canadian Journal of Development Studies/Revue canadienne d'études du développement*, 37(1), 83-100.

Kibogy M. 2016. Kenya Dairy Board: Supporting the development of a dairy NAMA in Kenya. Presentation to dairy NAMA multistakeholder platform meeting, 9 August 2016, Nairobi.

Kimenchu MD, Mwangi M, Kairu WS, Macharia GA. 2014. Characterization and Profitability Assessment of Dairy Farms in Central Kenya. *International Journal of Innovative Research and Development*, ISSN 2278–0211, 3(9).

Kiptot E, Franzel S, Sinja J, Nang'ole E. 2015. Preferences and adoption of livestock feed practices among farmers in dairy management groups in Kenya. Downloaded from http://www.worldagroforestry.org/downloads/Publications/PDFS/WP15675.pdf

Kodongo O, Kendi LG. 2013. Individual lending versus group lending: An evaluation with Kenya's microfinance data. *Review of Development Finance*, 3(2), 99-108.

Mburu S, Njuki J, Kariuki J. 2012. Intra-household access to livestock information and financial services in Kenya. *Livestock Research for Rural Development*, 24(2), 2012.

Mwamuye MK, Kisimbii J, Otieno M. 2013. Factors Influencing Adoption of Dairy Technologies in Coast Province, Kenya. Downloaded from http://www.ijbcnet.com/2-7/IJBC-13-2309.pdf

Murage AW, Ilatsia ED. 2011. Factors that determine use of breeding services by smallholder dairy farmers in Central Kenya. Tropical animal health and production, 43(1), 199-207.

Mutoko MC. 2014. Adoption of Climate-Smart Agricultural Practices: Barriers, Incentives, Benefits and Lessons Learnt from the MICCA Pilot Site in Kenya. Downloaded from http://www.fao.org/3/a-i4396e.pdf

Nalunkuuma J, Affognon H, Kingori SW , Salifu D, Njonge FK. 2013. 'Adoption of zero grazing and impact on livestock keepers' knowledge of cattle reproductive parameters in Western Kenya. *African Crop Science Conference Proceedings*, vol. 11, 599-604.

Nangole E, Lukuyu BA, Franzel S, Kinuthia E, Baltenweck I, Kirui J. 2013. Livestock feed produc-tion and marketing in Central and North Rift Valley Regions of Kenya. Downloaded from https://cgspace.cgiar.org/bitstream/handle/10568/34450/livestockfeedproductionandmarketinginkenya.pdf?sequence=1

Nassiuma D, Nyoike N. 2014. Milk production and marketing in Kenya: a preliminary survey 2013 report. Available at http://kdb.co.ke/press/publications/reports/15-report-survey-on-milk-production-and-marketing-2013/file

Njarui DMG, Gatheru M, Wambua JM, Nguluu SN, Mwangi DM, Keya GA. 2011. Feeding management for dairy cattle in smallholder farming systems of semi-arid tropical Kenya. *Livestock Research for Rural Development*.

Njehia BK, Wanjala SPO. 2014. Value chain predictors of milk production on smallholder dairy farms in Western Kenya: a multiple regression analysis.

Odhong' C. 2015. Financing mechanisms in the dairy value chain. Unpublished report at UNIQUE Forestry and Land Use GmbH, Freiburg.

Odhong' C et al. 2016. Processor-led dairy services provision in Kenya.

Onyiego E. 2016. Dairy farmers thrive using mobile innovation. Available at https://www.usaid.gov/sites/default/files/success/files/Innovation%20Cutting%20Dairy%20Farmers%20Losses.pdf

Pambo, K. 2015. Financial technological Innovation and Access is the Key to Unlocking African Agricul-tural Potential: A Case Study of Dairy in Kenya. In 2015 Conference, August 9-14, 2015, Milan, Italy (No. 212608). International Association of Agricultural Economists.

Pelrine R, Besigye A, Ssebbaale E, Awori N. 2009. Kenya Access to Rural Finance: Kenya dairy value chain finance research and recommendations. USAID, Washington D.C. Available at http://s3-eu-central-1.amazonaws.com/fsd-circle/wp-content/uploads/2015/08/30095816/10-07-27_Value_chain_study.pdf

Rambo CM. 2012. Enhancing Access to Bank Credit for Small-Scale Farmers in Kisumu and Kiambu Districts, Kenya Through Public-Private Partnership Initiative. *Chinese Business Review*, 11(11):946-969.

Republic of Kenya. 2010. Kenya National Dairy Master Plan, Volume 1: situation analysis of the dairy sub-sector. Ministry of Livestock Development, Nairobi.

Republic of Kenya. 2015. Kenya Second National Communication to the United Nations Framework Convention on Climate Change. National Environment and Management Authority, Nairobi.

Richards S, VanLeeuwen J, Shepelo G, Gitau GK, Kamunde C, Uehlinger F, Wichtel J. 2015. Associations of farm management practices with annual milk sales on smallholder dairy farms in Kenya. *Veterinary World*, 8(1):88-96. doi:10.14202/vetworld.2015.88-96

Tyson J. 2016. Sub-Saharan Africa's economic downturn and its impact on financial development. ODI Working Paper 440, Overseas Development Institute, London.

Vorlaufer M, Odhong' C. 2016. Financial assessment of dairy related investments. Unpublished report at UNIQUE forestry and Land Use GmbH, Freiburg.

Zander KK, Mwacharo JM, Drucker AG, Garnett ST. 2013. Constraints to effective adoption of innovative livestock production technologies in the Rift Valley (Kenya). *Journal of Arid Environments*, 96:9-18.

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