



Full Length Research Article

INSTITUTIONAL CONSTRAINTS AFFECTING DAIRY DEVELOPMENT IN WESTERN KENYA

^{1,2}Wanjala, Simon P. Omondi and ¹Njehia, Bernard, K.

¹Department of Agribusiness Management and Trade, Kenyatta University, P.O. Box 43844-00100,
Nairobi, Kenya

²Kenya Agricultural Research Institute

ARTICLE INFO

Article History:

Received 24th April, 2014
Received in revised form
30th May, 2014
Accepted 19th June, 2014
Published online 20th Julv. 2014

Key words:

Western Kenya,
Dairy institutions,
Feed technologies,
Dairy meal,
Artificial insemination,
Dairy cooperatives,
Agribusiness orientation.

ABSTRACT

This study examined institutional constraints and agribusiness capacity of key institutions involved in dairy development in Western Kenya. Using checklists and interview guides, data was collected from Kenya Agricultural Research Institute (KARI), farmer groups, credit institutions, agro dealer feed stockists, Inseminators, County livestock department and dairy cooperatives. The results showed that despite developing many feed technologies, KARI lacked agribusiness orientation which limited the scaling up and dissemination of improved technologies to target users. Fear to take loans on the part of farmers, and lack of tailor made loans targeting dairy farmers' priority needs affected availability of credit. The protein content of commercial dairy meal were not labelled on bags by feed companies and analysis showed that the Kenyan dairy farmer was exposed to low quality concentrate due to lack of an inspectorate service. The study also found that the devolved county governments lacked dairy strategic plan, while Artificial Insemination services were constrained by lack of liquid nitrogen, semen bank and testing laboratory. Finally, assessment of dairy cooperatives showed they were still embedded in traditional functions and had not taken off on a business path. It is concluded that key challenges affecting dairy development and farmer groups in particular are mainly institutional rather than technological. Creating an enabling policy, institutional and regulatory framework would be key to the sector's growth. Further studies should be carried out to identify specific agribusiness impact model that would revitalise dairy development in the region.

Copyright © 2014 Wanjala, Simon P. Omondi and Njehia, Bernard, K. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

Dairy development in East Africa in general and Kenya in particular has evolved through three eras. Before independence up to 1960s, dairy was dominated by colonial settlers and was characterised by large scale farms and formal milk marketing based on the industrialized Western model (Staal *et al.*, 2008; Conelly, 1998). The 1960s to 1980s was characterized by state controlled, free or subsidised livestock services to enable smallholder farmers improve productivity while formal milk marketing was done through a giant farmer organization, the Kenya Cooperative creameries (KCC) (Muriuki, 2004, FAO, 2011). From early 1990s most Sub Saharan African countries including Kenya were experiencing economic difficulties and budgetary constraints, leading to failure of state run enterprises to provide subsidised / free services. Pressure from Bretton wood institutions (World Bank and International Monetary Fund) led to structural adjustments leading to economic liberalization of input and output markets in which the private

sector was expected to take over hitherto state controlled functions (de Haan and Bekure, 1990; Karanja, 2003). These reforms included: Cost sharing of veterinary drugs in 1988, price liberalization of animal feeds and transfer of cattle dipping to communities (1989), privatization of A.I services in 1991, de regulation of milk prices and liberalization of the dairy sector in 1992, privatization of veterinary clinical services in 1994 (Kurwijila and Bannett, 2011; Omore *et al.*, 2009). Thus many players, mainly milk traders, input suppliers and private processors emerged in the dairy sector. Though these policy changes were well intentioned, private sector entry did not effectively improve delivery of some services, especially dairy inputs (Tambi *et al.* 2004; Omiti, 2002; FAO, 2011). To date, institutional failure still continue to limit access to inputs and marketing resulting in low productivity and commercial orientation especially of smallholder farmers in rural areas (Omiti, 2002). Kurwijila and Bennett (2011) indeed argue that a major constraint to developing competitive and sustainable milk production in the East African region is the weak institutional framework for farming organizations. Nonetheless growth in demand for milk and milk products, spurred by rapid population growth, urbanization and per

***Corresponding author: Wanjala, Simon P. Omondi**
Department of Agribusiness Management and Trade, Kenyatta University, P.O. Box 43844-00100, Nairobi, Kenya

capita income, has been the major driving force especially in developing countries (Delgado *et al.*, 2002; Stall *et al.*, 2008). To satisfy this anticipated high demand in Eastern African region in general, and Kenya in particular, technological change should go hand in hand with strong institutional linkages (Pérez, 1989, cited in Altenburg *et al.*, 2008; Leeuwis, 2004). Using the case of Western Kenya, a region with high raw milk prices but low productivity, the objective of this study was to assess the capacity and inefficiencies in key institutions involved in dairy development.

MATERIALS AND METHODS

Study area

The study was carried out in Butula and Butere districts in Busia and Kakamega counties of Western Kenya. The region has an estimated 99000 smallholder dairy farmers keeping about 192300 improved dairy cattle (FAO 2011). Both Butula and Butere lie at an altitude of 1200-1500 Meters above sea level and experience a bimodal rainfall pattern of 1500-2000 mm (Jaetzold *et al.* 2006). Farmers practice mixed livestock-crop farming, in which sugarcane is the main cash crop while maize, beans, sweet potatoes and cassava are the main staples. Dairy farming is a prominent activity in Butula and Butere districts.

Study variables

The study assessed capacity of institutions dealing with various services which were identified as important predictors of milk production in the region in a recent study (Wanjala and Njehia, 2014). These included: thirty agro dealers (dairy meal), Kenya Agricultural Research institute (fodder), Livestock department (source of breeding stock, Artificial insemination services, disease control), County government (Policy), financial institutions (credit), ten cooperatives and dairy farmer groups (group membership).

Data collection and analysis

Data was collected using checklists and interview guides administered to key institutions involved in dairy development in Butula and Butere districts. Analysis of data entailed use of frequency counts, percentages as well as thematic grouping.

RESULTS AND DISCUSSION

Institutions involved in dairy development in Butula and Butere districts

Kenya Agricultural Research Institute

Table 1 shows an analysis of selected parameters specific for dairy improvement in various institutions. The mandate of Kenya Agricultural Research Institute (KARI) is “to contribute to increased productivity, commercialization and competitiveness of the agricultural sector through generation and promotion of technologies that respond to clients demand and opportunities” (KARI Strategic Plan, 2009-2014). A case study of the institute revealed that over the years KARI has developed and validated dairy feed technologies consisting of pastures, legumes, fodder trees and crop residues (Table 1). However, lack of agribusiness orientation and inadequate

funding for livestock programmes has limited the scaling up and dissemination of these technologies to target users. A recent study of 400 dairy farmers in the region showed that 56.2% were not aware of existence of improved research technologies while 35.6% said research technologies were not accessible. The study further indicated that availability of research technologies explained 3.3 % variance in milk production while fodder availability explained 35.7% (Wanjala and Njehia, 2014). Several studies in Kenya have shown that inadequate quantity and quality of feed is the major constraint affecting milk production (FAO, 2011; Omoro *et al.*, 1999), yet, productivity enhancing technologies in research stations remain largely inaccessible. The relevance of an institution depends squarely on its ability to be on the forefront of providing solutions to challenges, especially with regard to facilitating business and initiating reforms that can make the dairy industry competitive (Kurwijila and Bannet, 2011). Given that research is a public good funded by tax payers, there is urgent need to initiate effective partnerships to facilitate awareness, availability and utilization of research findings. Some of the initiatives suggested by various respondents through informal interviews to make improved technologies accessible included partnerships between research and farmer organizations, creation of an agribusiness entity to promote, sell and market demand driven technologies and services.

Farmer groups

In depth focus group interviews with six farmer groups in Butula and Butere identified key challenges to dairy development as: lack of breeding stock, inadequate feeds and feeding, Unreliable AI services, tick borne diseases, inaccessible credit and lack of dairy cattle management skills (Table 1). These findings suggest that dairy development in the region is mainly constrained by institutional rather than technological factors. Following liberalization era of 1990s, institutional support previously undertaken by state agencies was either withdrawn or reduced leading to near collapse of services at farmer level (FAO, 2011; Karanja, 2003, Tambi *et al.*, 2004). Forging stronger farmer organizations as entry points for input supply, modern technology, credit, marketing, knowledge sharing, innovation and policy advocacy could partly fill this gap.

Credit institutions

Institutions offering financial services in the region included commercial banks, micro finance and, savings and credit societies which charged 17.5%, 12.5 and 12% interest per annum. Key obstacles to financing of dairy enterprises were identified as the apparent fear to take loans on the part of farmers, and a lack of tailor made loans targeting dairy farmers' priority needs. Inaccessible credit and imperfect credit markets has been reported to limit agricultural productivity among farmers, particularly smallholder farmers (Lerman, 2004). Credit is expected to link farmers with modern technology through the purchase of inputs thus leading to increased productivity, market orientation and participation (Omiti, 2002; Lerman, 2004; Martey *et al.*, 2012). Thus there is need for financial institutions to secure loans through tying credit to delivery of milk or share capitalization rather than collateral requirements in order to allay farmers' fear for loss of land due to perceived inability to repay.

Table 1. Research, farmer groups and financial institutions

Institution	Parameter	Inefficiencies	Opportunities	Potential upgrading strategy
Kenya Agricultural Research Institute	Pastures:	No commercial plots available.	Growing number of dairy farmers in the region.	Establishment of autonomous agribusiness division charged with sales and marketing of research technologies and services. Partnerships with commercial agents / farmer cooperatives.
	• Napier grass	Lack of agribusiness orientation and effective dissemination strategy.	High milk prices.	
	• Boma Rhodes	Inadequate funding for livestock programmes.	Devolved county government functions.	
	• Giant setaria			
	• Guatemala			
	• Mulato			
	Legumes			
	• Desmodium			
	• Sweet potato vines			
	• Microtyloma			
• Lucerne				
Fodder trees				
• Calliandra				
• Leucaena				
Fortification of Crop residues				
• Sugar cane tops				
• Bean hulls				
• Maize stover				
• Rice straw				
Dairy farmer groups	Breeding stock	Lack local source of breeding stock.	Support from NGOs.	Establish breeding multiplication centres
	Feeds	98% reliance on Napier grass. Low use of concentrates.	Availability of energy and protein feed technologies in research institutions.	Capacity building on fortified feed formulation and utilization. Adoption of pulverizer technology for feed processing.
	Credit	Fear to take loans. Lack of dairy agribusiness skills.	Availability of Many financial schemes/ agents.	Group borrowing.
	Management skills	Inadequate skills on how to feed a dairy cow.	Availability of expertise in livestock department.	Group training on dairy cow management, heat detection and agribusiness skills.
	Disease control	Tick borne diseases.	Disease control strategies available.	Group training.
Financial providers	Usage of AI services	Low AI use (39.8%)	Growing population of dairy cattle.	Establish local supply AI
	Credit facilities	High interest rates. Lack of special products for livestock .	Purchase of dairy cows, feed improvement are priority credit needs for farmers	Tailor loan products targeting farmers' needs.

Source: Compiled from field data

Quality of commercial concentrate

As shown in table 2, the findings of this study show that the main issue with commercial concentrate (dairy meal) is the low quality. A survey of 16 companies supplying dairy meal to agrodealer stockists in the region established that there were three types of dairy meal available in the market: ordinary, standard and High yield. However, the level of protein content or ingredients were not labelled on bags and therefore unknown to both agro dealers and farmers. A recent analysis of feeds bought from the market in Kenya by large scale farms (Egerton university, personal communication) and a study of small holder farms by Katiku *et al* (2014) showed that feeds from most companies had very low protein content (Table 2). The Kenya Bureau of standards (KEBS), the body charged with setting and enforcing standards, specifies the quality of Dairy meal at 14-16 % Crude protein (www.nafis.go.ke/livestock/dairy-cattle). For along time in Kenya, concerns on the low quality of commercial concentrate have been raised in various studies, reports and stakeholder workshops, but the problem still persist due to weak enforcement (Karanja , 2003; FAO, 2011; Kilimo Trust 2012).

There are more than 150 commercial feed manufacturers in Kenya with the level of technology utilised in the industry varying from very rudimentary, labour intensive production (e.g. backyard mixing with spades) to fully automated and computerized mills. The lack of policy on GMP/HACCP Quality system coupled with weak inspectorate and lack of penalty for non compliance implies that the Kenya feed industry will continue to be a free-for-all market with livestock farmers paying the ultimate price for sub standard feeds.

Artificial Insemination Services

Table 3 presents the capacity, span of control and major issues affecting AI services in the study area. There were only two AI inseminators in Butula while Butere had four who covered an average distance of 40 km to reach farmers. The ratio of inseminators to dairy animals in Butula and Butere was 1 to 1700 and 1 to 650 respectively, showing an acute shortage of providers. Problems associated with AI services as perceived by farmers were high frequency of bull calves, repeated service and poor quality of calves. Interviews with the inseminators revealed that lack of semen (39%), unavailability

Table 2. Analysis of commercial concentrate (dairy meal) and agrodealers in Kenya

Source	DM g/kg (%)	CP g/kg (%)
Chemusian farm* (LS)	88.10	2.51
Tatton farm*(LS)	90.61	15.71
Laikipia university* (LS)	87.50	4.03
Small holder farms Embu (n=12)**	89.40	12.0
Parameter	Description	Status
Dairy clientele	No. of dairy farmers served by agro dealer per month.	Range from 150 in rural to 1500 in large town stockists
Dairy meal sales	No. of bags (70 kg) sold per month.	10-100 bgs (rural/urban respectively)
Types of Dairy meal	Ordinary, Standard, high yield.	<ul style="list-style-type: none"> • Price ranges from shs 1800- shs 2400. • Farmers prefer low price ordinary Dairy meal. • Level of protein content of dairy meal or ingredients are not indicated on bags by suppliers (16 companies)
Quality problems	Inputs with frequent quality problems.	Dairy meal and drugs - dewormers
Constraints	Main constraint faced by agro dealers	Multiple licences totalling shs 22000 per year----38% High cost of inputs--- 29% Lack of own transport---18% inaccessible credit---10% Low quality inputs Dairy meal /drugs--5%

N= 30

LS = Large scale farm

Source: Compiled from field data and *Egerton university; **Katiku *et al.*, 2014.**Table 3. Artificial Insemination Providers**

Parameter	Description	Status
Capacity	No of inseminators	Butere (4), Butula (2)
Distance	Average distance covered by inseminator	40 km
Size of clients*	No of farmers per month	30-100
Span of control	Ratio of inseminators to dairy cattle population	Butula 1: 1700, Butere 1: 650
Type of semen	Semen used in AI service	<ul style="list-style-type: none"> • Local : CAIS @ KES 1500 • Imported : @ KES 2500-3500 • Sexed: @ KES 5000
Complaints on AI service	Farmer perceptions about quality of AI	Bull calf-----50% Repeats-----35% Poor quality calf-----15%
Constraints	Main constraint faced by AI providers	Unavailability of semen-----39% Lack of liquid nitrogen-----24% Repeated service-----22% low /defaulted payment by farmers----15%

*Only 39.8% of dairy farmers use A.I services in the region while the rest use bull service (Wanjala and Njehia, 2014)

CAIS: Central Artificial Insemination Services

Source: Compiled from field data

of liquid nitrogen (24%), repeat inseminations (22%) and low payment by farmers (15%) were the key challenges affecting delivery of AI services in the area. The findings of this study reveal that the inefficiency of AI service is an institutional problem not only in Western Kenya but in the whole country, whose origin is traceable from the liberalization policies of 1990s which were hurriedly implemented and have hitherto continued to affect availability and delivery of services to farmers (Musalia *et al* 2010; Gamba, 2006; Karanja 2003). Nevertheless, an opportunity to revamp AI service now exist through devolved county government units, whose functions include among others, prioritization and implementation of livestock programmes in their areas of jurisdiction (GoK, 2010). From our informal interviews with livestock officers and farmer groups, it was suggested that AI services in the region could be improved through establishment of an A.I centre in the region equipped with liquid nitrogen plant, semen bank, semen testing laboratory for easy acquisition of semen; and training of more inseminators.

Livestock Department

The mandate of livestock department in Kenya is dissemination of technologies, information and capacity

building of farmers (GoK, 2010). There were eight livestock workers in Butula compared to twelve in Butere (Table 4). The major challenges affecting delivery of services by the department were: Lack of dairy strategic plan (30%), low funding by national/county government (25%), inadequate facilitation (24%) and weak linkages with research institutions in technology dissemination and feed back (21%). However, linkages with NGOs appear to be strong since they are actively involved in implementing dairy development projects in the region.

Table 4. Service providers in the livestock department

Parameter	Butula	Butere
Livestock officers	1	1
Veterinary surgeons	1	1
Animal health assistants	3	3
Frontline extension staff	1	3
A.I providers	2 (private)	4 (private)
Total	8	12
Dairy strategic Plan	Absent	Absent
Funding (%)	20	25
Facilitation: Transport, ICT	Absent	Absent
Linkages with Research institutions	Very weak	Weak
Linkages with NGOs	Strong	Very strong

Source: Compiled from field data

Table 5. Past and ongoing dairy development projects

On going projects			
Type of project	Lead organization	Main objective	Duration/achievements
Send a cow	Heifer Project	Supply dairy cows	10 years from 2007
Western Kenya community demand driven and flood mitigation project	Special programmes	Supply dairy cows for Poverty reduction	10 years from 2012
Past projects			
Livestock development project	Finland/GoK	Dairy development	10 years.
National dairy development project	Netherlands/GoK	Dairy development	15 years
National Agriculture and livestock expansion programme	World Bank/GoK	Capacity building of extension officers	5 years
Millenium development goals	Ministry of Planning	Poverty reduction	2 years
Njaa marufuku	Ministry of Planning	Poverty reduction	5 years

Source: Compiled from field data

Table 6. Selected parameters on management, traditional and modern roles among cooperatives

Management	Description	Frequency (n= 10)
Level of education of officials	School certificate	70%
	A level	30%
Age	< 50 yrs	15%
	>50 yrs	85%
Competency	Training in financial /agribusiness skills	0%
Disputes	History of leadership wrangles	70%
Interference	External interference by politicians	30%
Indebtedness	Indebted to farmers, creditors	75%
Vision	Availability of strategic/ business plan	30%
Traditional roles		
Bulking / chilling	Availability of cooler	100%
Milk testing	Availability of milk testing equipment: alcohol test, lactometer	95%
Other services	Provision of extension services/ input supply	10%
Member commitment	Active members	7.9 %
	Free riders	92.1%
Modern roles		
Logistics	Own transport	0%
Quality assurance (QA)	Availability of quality / traceability system	0%
Processing and value addition	Product differentiation	10%
	Packaging / Certification by Kebs	0%
Contract with buyers	Forward integration with consumers (supermarkets etc)	0%
Service Diversification	Backward integration: Input supply, extension, information exchange	0%
Professional managers	Technical and financial managers	0%

Source: Compiled from field data

Due to lack of strategic plan at the district level to give direction means that activities by these NGOs may be driven by own agenda (Table 5). The results indicate non of the NGOs is addressing the low milk production problem in the area. Moreover, little information exist on contribution of previous projects on increasing milk production. The findings of this study reflect a general declining trend in funding for livestock services in Kenya. Financing of the sector in 1960s, 1980s, 1990s and 2000s was at 10%, 7.5%, 35% and 1% of total national budget respectively (GoK, 2010). Whereas the sector contributes 10% Gross Domestic Product (GDP), its annual budgetary allocation is only 0.25% GDP. Delivery of extension advice is key to improving productivity. Given that agriculture is the back borne of many African economies, increasing funding to 10% as recommended by NEPAD (2002) would be key to revitalizing the sector (Ochieng, 2007).

Dairy Cooperatives

Unlike in the past when they dominated milk marketing, dairy cooperatives are today the least popular marketing channel for milk in Kenya due to history of mismanagement, corruption and delayed payments (Omoro *et al*, 1999, Karanja, 2003; FAO, 2011). A recent study in Western Kenya identified cooperatives as the better option if restructuring was done (Wanjala, Njehia and Ngichabe, 2014). Results for evaluation

of parameters of management, traditional and modern roles are shown in table 6. The majority of officials had school certificate (70%), above 50 years of age (85%), and without training in financial management. 70% of the cooperatives had a history of leadership wrangles, 75% were indebted and only 30% had a strategic plan. These findings are consistent with those of Wanyama (2007; 2009) in a study on cooperative movement in Africa. Regarding the extent of performing traditional roles, the study found that all the cooperatives surveyed had milk coolers and basic milk testing facilities. However, only 10% provided extension and input supply services. A high proportion of members (92.1%) were not delivering milk to the cooperative and hence free riders. The results reflected major weakness in the ability of cooperatives to attract and forge strong horizontal linkages. The free rider syndrome (Olson, 2009) stem from deficiencies in the cooperative Societies legislation which gives exclusive ownership and management, including voting rights to members (Cooperative Act, 2005). Assessment of whether cooperatives have embraced modern functions (Bijman *et al* 2007), reveal a non starter position. These findings have showed that dairy cooperatives in western Kenya have not taken off on a business path. Dairy cooperatives could play an important role in providing a base for service delivery to farmers, stable agricultural knowledge systems for uptake of improved technology and enhanced management skills among

farmers. However further studies should be carried out to identify specific areas that need to be addressed to transform dairy cooperatives in the region into viable business entities.

Conclusion and Recommendations

This study examined constraints and agribusiness capacity of key institutions involved in dairy development in Western Kenya. The results showed that despite developing many feed technologies, KARI lacked agribusiness orientation which limited the scaling up and dissemination of improved technologies to target users. Feed companies did not indicate protein content on bags and analysis showed that the Kenyan dairy farmer is exposed to low quality concentrate due to lack of an inspectorate service. Fear to take loans on the part of farmers, and lack of tailor made loans targeting dairy farmers' priority needs affected availability of credit. The protein content or ingredients of commercial dairy meal were not labelled on bags by feed companies and analysis show the Kenyan dairy farmer is exposed to low quality concentrate due to lack of an inspectorate service. The study also found that the devolved county governments lacked dairy strategic plan while AI services were constrained by lack of liquid nitrogen plant, semen bank and testing laboratory. Finally, Assessment of dairy cooperatives showed they have not taken off on a business path. It is concluded that key challenges affecting dairy development and farmer groups in particular are mainly institutional rather than technological. Creating an enabling institutional and regulatory framework would be key to the sector's growth. Further studies should be carried out to identify specific agribusiness impact model that would revitalise dairy development in the region.

Acknowledgement

The authors are grateful for the support given by the livestock department, dairy farmers and various institutions in Butula and Butere districts in Western Kenya. The study was facilitated by Kenya Agricultural Research Institute and funded by East African Agricultural Productivity Project. This paper is submitted for publication with permission from Kenyatta University.

Potential conflict of interest

The authors declare that they have no conflict of interest.

REFERENCES

- Altenburg, T., Schmitz, H. and Stamm, A. 2007. Breakthrough? China's and India's Transition from Production to Innovation. *World Dev.*, 36 (2): 325-344.
- Bijman, J. 2007. How can cooperatives meet the challenges of agrifood supply chains? In: Ton, G, Bijman J. and Oorthuizen, J. (Eds): *Producer organizations and market chains*. Wageningen: Academic Publishers
- Connelly, W.T. 1998. Colonial Era livestock Development Policy: Introduction of improved dairy cattle in Central highlands of Kenya. *World Dev.*, 26: 1733-1748.
- De Haan, C. and Bekure, C. 1991. Animal health services in Sub-Saharan Africa: initial experiences with new approaches. International Livestock Centre for Africa: Nairobi, Kenya.
- Delgado, C., Rosegrant, M. and Meijer, S. 2002. Livestock to 2020: The Revolution Continues. World Brehman Congress, Rocckhamton.
- Government of Kenya, 2010. Kenya National Dairy Master Plan. Nairobi: Ministry of Livestock Development.
- FAO. 2011. Dairy development in Kenya, by HG Muriuki. Rome: Food and Agriculture Organization of the United Nations.
- Gamba, P. 2006. Beef and dairy cattle improvement services: A policy perspective. Tegemeo Institute Egerton University.
- Jaetzold, R., Schmidt, H., Hornet, Z.B. and Shisanya, C.A. 2006. Farm management handbook of Kenya. Natural conditions and farm information, Vol 11/C, 2nd edn. Nairobi : Ministry of Agriculture/GTZ
- Karanja, A. M. 2003. The Dairy Industry in Kenya: The Post-Liberalization Agenda. Paper presented at Dairy stakeholders workshop held on 27th August 2002, Nairobi Kenya. Tegemeo Institute/Egerton University .
- Katiku P N., Mbuku SM., Gachui CK., Mbugua PN and Kimitei R K (2014). Utilisation of LIFE-SIM as a Management Decision Support Tool for Smallholder Farms in Kenya. *J Anim Sci Adv.*, 4(2): 710-721
- Kenya Agricultural Research Institute. 2009. Strategic Plan 2009-2014. Nairobi, Kenya
- Kilimo Trust. 2012. Strategic and value chain study of the smallholder dairy sector in Central Kenya. Final Report by JKUAT/CAIS/KIPRA.
- Kurwijila, L.R. and Bennet, A. 2011. Dairy development institutions in East Africa: Lessons learned and options. Rome: Food and Agriculture Organizations of the United Nations.
- Lerman, Z. 2004. Policies and institutions for commercialization of subsistence farms in Transition countries. *J Asian Econ* 15:461-479.
- Leeuwis, C. 2004. Communication for rural innovation: Rethinking agricultural extension. UK: Blackwell Science Ltd.
- Martey, E, R. M., Al-Hassan. And Kuwornu, J. K. M. 2012. Commercialization of Smallholder Agriculture in Ghana: A Tobit regression analysis. *Afri. J Agric. Res.*, 7(14): 2131-2141. Available at <http://www.academicjournals.org/AJAR> DOI: 10.5897/AJAR11.1743
- Muriuki, H., Omore, A.O., Hooton, N., Waithaka, M., Staal, S.J. and Odhiambo, P. 2004. The policy environment in the Kenya dairy sub-sector: a review (Research Report). MoA/KARI/ ILRI Smallholder Dairy Project, International Livestock Research Institute: Nairobi, Kenya.
- NEPAD. 2002. New Partnership for Africa's development (NEPAD). Comprehensive African Agriculture Development Programme. Rome: Food and Agriculture Organizations of the United Nations.
- Musalía, L. M., Mukoya, S., Wangia, M., Shivairo, R. S. and Vugutsa, V. 2010. Effects of policy change on the dairy production support services within the smallholder dairy farmers in Butere/Mumias and Kakamega districts of Western Kenya. *Afri. J Agric. Res.*, 5(8) : 661-667.
- Ochieng, C.M.O. 2007. Revitalizing African Agriculture through innovative business models and organizational arrangements: Promising developments in the traditional crops and modern African studies. *J. Mod. Afri. Stud.*, 45 (1) : 1-27.
- Omiti J.M. 2002. Impacts of liberalisation in Kenya's dairy sector. In: Rangnekar D. and Thorpe W. (eds) *Smallholder dairy production and marketing—Opportunities and Constraints: Proceedings of a South–South workshop held*

- at NDDDB, Anand, India, 13–16 March 2001. NDDDB (National Dairy Development Board) and ILRI (International Livestock Research Institute), Nairobi, Kenya.
- Omire, A., Kurwijila, L. Grace, D. 2009. Improving livelihoods in East Africa through Livestock research and extension: reflections on changes from the 1950s to the early twenty first century. *Trop Anim Health Prod.*, 41:1051–1059.
- Omire A., Muriuki H., Kenyanjui M., Owango M. and Staal S. 1999. The Kenya Dairy sub sector: A rapid appraisal (Research & Development) Project Report. Ministry of Agriculture/Kenya Agricultural Research Institute/International Livestock Research Institute, Nairobi, Kenya. 51 pp.
- Olson, F. 2009. United Producers Inc. Chapter 11 Restructuring. *J. of Coops*, 23:130-140.
- Staal, S.J., Pratt, A.N. and Jabbar, M. 2008. Dairy Development for the Resource Poor Part 1: A Comparison of Dairy Policies and Development in South Asia and East Africa. PPLPI Working Paper No. 44-1 International Livestock Research Institute.
- Tambi, N.E. and Maina, W.O. 2004. Delivery of Livestock services. Some experiences from Sub Saharan Africa. African Union Inter African Bureau for Animal Resources.
- Wanjala, S.P.O., Njehia, B. and Ngichabe, C. 2014. Assessment of the Structure and Performance of the Milk market in Western Kenya. *IJCR.*, 6(3):5652-5656.
- Wanjala, S.P.O. and Njehia, B. 2014. Value chain predictors of milk production on smallholder dairy farms in Western Kenya: A multiple regression analysis. *IJCR.*, 6(4):6380-6388.
- Wanyama, F.O. 2007. The Impact of Liberalization on the Cooperative Movement in Kenya. First International Social Economic Conference on Strengthening and Building Communities: The Social Economy in a Changing World, October 22- 25, 2007, Victoria, British Columbia, Canada.
- Wanyama, F. O. 2009. Cooperatives for African Development: lessons from experience. School of Development and Strategic Studies, Maseno University, Kenya.
