

EXPLORING INNOVATION CAPACITY IN ETHIOPIAN DAIRY SYSTEMS®

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1. INTRODUCTION

Ethiopia has huge untapped potential for market-oriented smallholder dairy development; with 30 million genetically diverse cattle population, suitable agro-climate for dairying (Ahmed et al, 2004), and potentially large and growing market for dairy products. Commercial smallholder dairy development in the country can be an effective pathway out of rural poverty. However, the potential has not been fully exploited.

Despite decades of research and development efforts, the rate of fodder technology adoption has remained extremely low (Ahmed et al, 2004); crossbred and exotic dairy cattle constitute only 1.8% of the total population of milking cows in the country (Pratt et al, 2008); and input and output marketing systems for smallholder dairying are not yet well established. The country's milk production level increased only by 1.6% and per capita production declined by about 0.8% annually during 1966-2001. Per capita milk consumption has been reduced from 26 liters in the mid 1980s to about 16 liters in 2001 (Staal et al, 2008). Although the country recently recorded an annual growth rate of 3% in national milk production, it was achieved mainly due to increased herd size (60%) than productivity improvements (Ahmed et al, 2004).

Globally, new and dynamic markets for agricultural products and services are emerging at a never-before pace in a dynamic global environment and institutional setting (Puskur et al, 2007). It is increasingly being realized that what is important is not just knowledge

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about technology and production, but institutions (formal and informal) and organizations (including their attitudes, practices, and new ways of working), management, marketing changes among others. Government policies have a critical role to play by providing the enabling environment, to avoid institutional, policy or market failures.

The context for smallholder dairy development in Ethiopia too has been changing rapidly, creating both new opportunities and challenges. The demand for milk and products, butter in particular, and prices have increased over the last five years with increasing urbanization, population growth, improving infrastructure and access to market (Tesfaye and Puskur, 2007). But fodder/feed, land and water scarcity has increased, and the competition for accessing them is fiercer today than ever before. High spatial and social diversity of the production systems (Staal et al, 2008; Sintayehu et al, 2008) also calls for context specificity in interventions and absorptive capacity, i.e., the ability to translate information into functional knowledge (Cohen and Levinthal, 1990 cited in Speilman, 2006). In addition, national policy priority has also changed in favour of pro-poor, gender sensitive and ecologically sustainable commercialization of smallholder production systems; and the policy envisions an increasing role for the emerging private sector. Further, new actors and relationships are emerging in the dairy sub sector; and the existing actors, particularly research and development organizations, are under immense pressure to revisit their roles and 'business-as-usual' in order to adapt and respond to changing number and diversity of actors, demands and situations.

This paper presents the interim results of diagnostic assessment of innovation capacity in the Ethiopian dairy systems. Organizational survey, to be followed by community level study and stakeholders workshop, was carried out to assess factors influencing capacity of organizations to effectively perform their role and to contribute to collective learning and innovation. The research has been informed by the innovation systems perspective, as it provides a holistic framework for understanding the system functioning, going beyond technologies and acknowledging the importance of institutions; habits, practices and incentives and; policy and enabling environment. The study looked into actors and

their roles, pattern of interaction, habits, practices and incentives conditioning interactive relationships, and the policy environment.

The paper has been organized in five sections. The next section briefly highlights the two key concepts in the current analysis namely; ‘innovation’ and ‘innovation capacity’. Section three describes the approach and methods employed for the investigation. The major results are reported in Section four. Finally, conclusion and recommendations are provided.

2. INNOVATION AND INNOVATION CAPACITY

The literature provides alternative, yet complementary, definitions of ‘innovation’ (World Bank, 2006; Spielman, 2005; Leeuwis, 2004; Engle, 1997). The insights that can be derived from the definitions include: i) knowledge becomes innovation when it is successfully used for economic and/or social purposes, ii) innovation results from the application of ‘new’ knowledge, accumulated knowledge or creative use of existing knowledge, iii) innovation can be drastic or incremental continuous changes, iv) innovation is not an event, rather it is a process. It is the outcome of a conscious effort and of continuous processes of experiential social learning through network building and interactions with multiple and heterogeneous actors, v) the existence and nature of interactions among actors is shaped by economic and social institutions; vi) usually successful innovations have technical and socio-organization dimensions, and vii) innovations could lead to improved productivity, commercialization, and income and welfare gain.

Continuous learning and innovation are critical for success in a dynamic environment. Learning and innovation, in turn, require capacity. Organizations need response capabilities, i.e., ability to continuously learn, adapt and respond to changes in markets, politics, technology, physical environment, and changing demands of stakeholders (Horton, et al, 2003). According to Hall (2006), in a multi-stakeholder situation,

innovation capacity refers to *‘a complex combination of various components of the systems encompassing: actors, their roles and pattern of interaction between them; incentives, habits and practices influencing learning, interacting and innovation; co-ordination mechanisms; and policy environment and policymaking processes.’*

3. RESEARCH APPROACH AND METHODS

Some initiatives geared towards stimulating the transformation of smallholder production systems to market-oriented systems have been underway in Ethiopia. One such initiative is the Improving Productivity and Market Success (IPMS) project, of the Ministry of Agricultural and Rural Development (MoARD) of Ethiopia. This study was conducted in eight Pilot Learning *Woredas* (*PLWs*) or districts of IPMS (Map Annex 1), where commercial smallholder dairying has been selected as one of priority commodities targeted for promoting market-oriented development. These *woredas* are Fogera and Bure (Amhara Region), Ada’a and Miesso (Oromia Region), Alaba and Dale (SNNPR) and Alamata and Atsbi Womberta (Tigray Region). This paper presents findings based on organizational surveys in these *woredas*, to assess innovation capacity of the dairy systems, particularly policy and institutional factors influencing capacity of organizations to effectively perform their role and to support collective learning and innovation.

Review of policy and research documents and analysis of focuses and strategies of previous projects, provided important insights, particularly with respect to historical perspectives on dairy development in the country. The research design, implementation and analysis were informed by the ‘Guideline for Diagnostic Assessment of Innovation Capacity’ (World Bank, 2006), drawing on tools from the methodology for Rapid Appraisal of Agricultural Knowledge Systems (RAAKS) (Engel, 1997). Eliciting views of different actors on alternative courses of action to enhance systems performance was an integral part of the investigation. Analysis of knowledge flows, resource linkages and partnerships, and factors constraining inter-organizational interaction, knowledge sharing and innovation with the participation of relevant actors formed the core of data collection and analysis.

The primary method employed for collecting data was a series of semi-structured interviews with key actors/organizations in the dairy and forage innovation system using pre-tested checklists. Most of the key actors had been identified prior to the appraisal on the basis of information available from various sources and literature. Additional actors were identified through ‘snowballing’ during the fieldwork. The actors interviewed both at regional and woreda levels and included: management, members and experts from research and development organizations (state and non-state); dairy cooperative members and leaders; individual service providers such as the owners of veterinary clinics, veterinary pharmacies, industries producing livestock feeds; and relatively bulk consumers of milk and milk products like restaurants and cafes. The fieldwork was conducted during Oct-Nov, 2007. The qualitative information has been systematically categorized, tabulated and summarized.

4. MAJOR FINDINGS

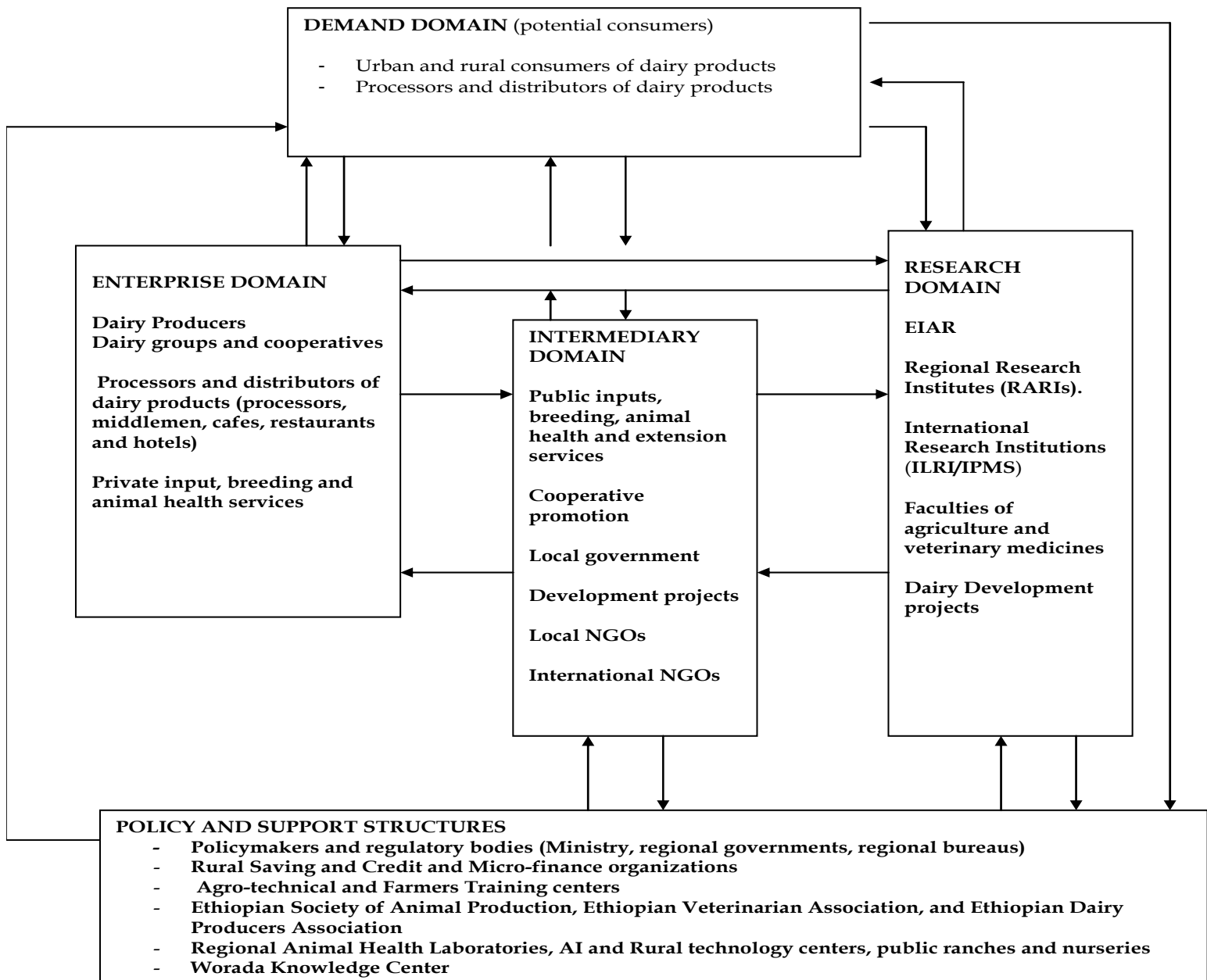
This Section reports on major findings of the research with respect to actors in dairy innovation systems, their roles and competencies; and policy and institutional factors influencing responsive capacity of the organizations and inter-organizational interactive relationship for collective learning and innovation.

4.1 Actors and their Roles

The relevant actors can be categorized based on their respective roles into enterprise, research, intermediary, demand, policy domains and supporting structures (Arnold and Bell, 2001 cited in Hall et al, 2006). Figure 3 provides a stylized dairy innovation system at the woreda level. There are many and diverse public and non public actors in the dairy innovation systems, with a huge variation in number and composition of actors across regions and PLWs. Public actors are dominant and play a key role in providing a wide range of production inputs, extension, livestock health and regulatory services; and this will likely remain so for the foreseeable future. Public dairy research has generated appropriate and useful knowledge/technology, it’s effectiveness has been limited though

due to the neglect in addressing non-technical impediments related to policy, institutions, market, etc, for improving productivity and market success of small dairy producers.

Figure 1: A stylized Dairy innovation system at the woreda level



The private actors have rather limited roles, relatively visible in vet drug retailing across PLWs. Private (Ada'a and Bure) and cooperative (Ada'a) provision of AI and natural bull mating (Ada'a, Alamata and Fogera) services, and animal health services through para professionals (Miesso) and Community Animal Health Workers (CAHW) in Alaba, rural veterinary drug shops (Misso), private nursery and urea molasses block production and supply (Alaba and Miesso) are being promoted in many PLWs, but at experimental levels. Ada'a, with relatively developed and commercialized dairy system, is the only PLW where relatively established formal fodder and feed market exists.

Dairy development projects are important intermediaries; playing a special role in building capacities of public, private, dairy producers and producer groups, and in facilitating the development of dairy value chain and creation of multi-stakeholder platforms to stimulate functional dairy innovation systems.

Well established local NGOs (Organization for the Rehabilitation and Development of Amhara (ORDA) and Relief Society of Tigray (REST) in Tigray) and rural financial organizations (Amhara Credit and Saving Institutions (ACSI) and Dedit Credit and Saving Institution (DCSI) in Tigray) are present in PLWs located in Amhara and Tigray regions. However, these players usually target small ruminant and fattening, rather than smallholder dairying which has relatively long gestation period.

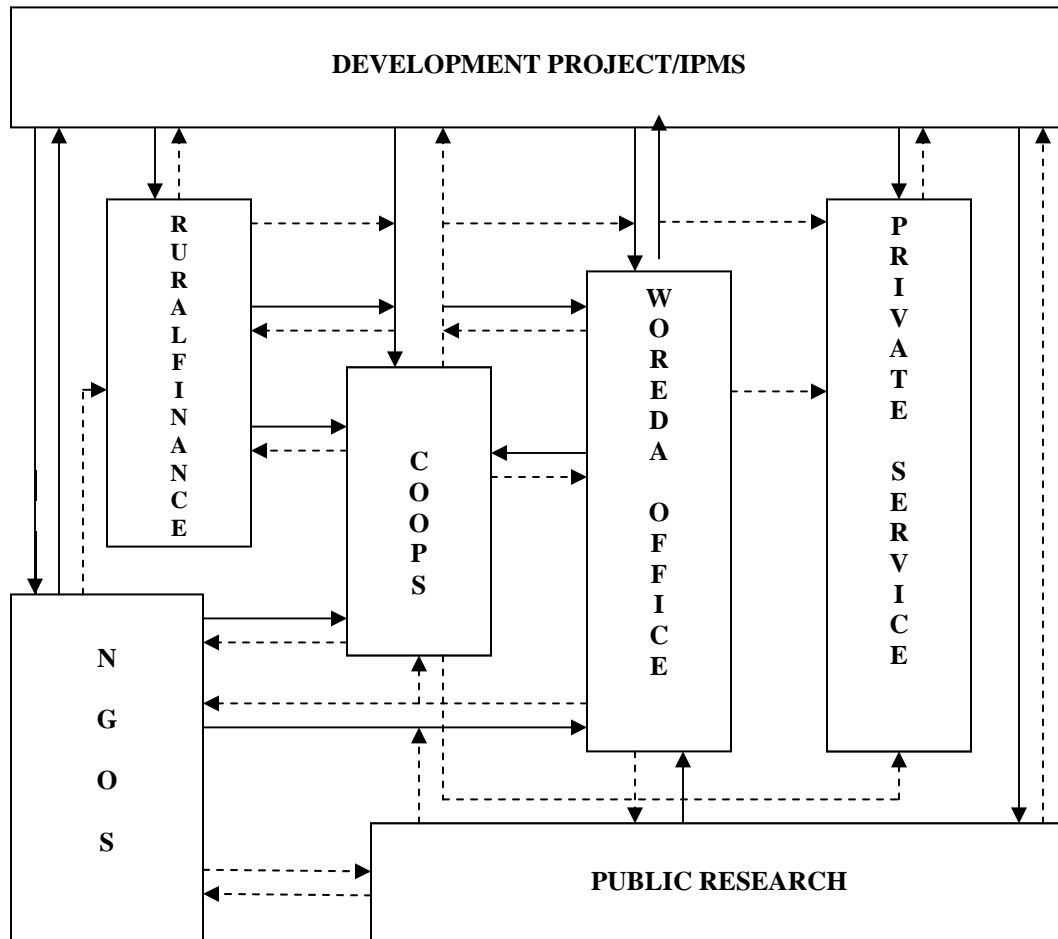
4.2 Pattern of Interactions

Participatory actor linkage and knowledge flow analysis was used to understand pattern of interactions between the key actors and; habits, practices and incentives influencing the nature and extent of interactive relationships. Summary of the major observations are presented here.

Except for Ada'a Dairy Cooperative, no meaningful linkages for knowledge sharing have been observed or reported with research in the remaining PLWs, including Alamata PLW which houses an agricultural research center. Ada'a Dairy cooperative is again the only cooperative with formal market contract with a private processor (Shola) and,

formal contract with private service providers for vaccination. Rural finance organizations, public extension, dairy development projects and NGOs have good interactions with dairy cooperatives.

Figure 2: Interaction between key actors in dairy innovation systems



Private services have limited interaction with research, for acquiring inputs (improved forage planting material, heifers etc). But generally the research system does not have

adequate capacity to provide the quantities of improved inputs required. The private services are rarely seen as important clients by rural financial service providers. Private services initiated by regional bureaus or woreda offices in collaboration with project or NGO actors (para vets) have strong knowledge linkage with extension or seen as part of the public service, but no meaningful knowledge linkage exists with public research. Autonomously emerging private services (private vet drug retailers and fodder/feed suppliers) have no linkages with research and the linkage with regional bureaus or woreda offices is for administrative (licensing) and regulatory (policing) purposes. However, reasonable knowledge and resource linkages exist between project actors and private services; and recognizing the gap, IPMS has been providing credit support and also conducting research on ways of strengthening the private sector role in services provision.

There has been very limited and ad hoc (e.g. researchers as resource persons for training, participation in workshops, requests for improved inputs) knowledge linkage between NGOs and the public research. While NGOs are pro-active and often interact with public extension, the intensity and quality of interaction varies across PLWs, and more often is not trust-based. The interaction of NGOs with private service is usually absent. One exception is the partnership between an Italian NGO (LVIA), IPMS and Alaba woreda offices for promoting CAHW in Alaba PLW; and similarly ORDA is working in partnership with Amahara Region bureau for agriculture and rural development to promote private forage seeds and AI service provision.

The development projects usually play the key roles of financing and facilitation of linkages among key actors. These projects are being implemented mainly through the existing public organizations and, to a certain extent, in collaboration with NGOs. Whilst these various development projects interact occasionally, their engagement in systematic and continuous experiential social learning and scaling up/out successful experiences is debatable. The effectiveness of similar attempt by EIAR and RARIs to stimulate multi-stakeholders platforms has been constrained by institutional, structural and policy related factors (Teklu, 2007); and often cereal-biased with less attention to livestock.

More often than not, various actors have different and even conflicting motives that drive the interactions. Whilst one partner initiates an interactive relationship for facilitating joint experiential learning and innovation, the other views the interaction as a means of accessing additional resources for routine organizational activities. This difference in motives coupled with lack of shared vision and limited communication has in many instances weakened interaction, and gradually leads to erosion of trust-based relationships, the prerequisite for taking risk to innovate.

Understanding comparative advantages of respective actors, with respect to competencies they currently possess to perform their respective roles and to contribute to collective learning and innovation is useful. The actors could play complementary roles, and could benefit from each other's knowledge and resources-base and social capital.

- Bureaus/WoARD have strong technical capacity, grassroots presence and political capital.
- Public research has organizational structure capable of serving various agro-ecologies, is well connected to crucial knowledge sources and is relatively more willing and flexible to take risks.
- NGOs have strong poverty and gender focus, large experience in facilitating participatory development, relatively better poised to mobilize technical and resource support through networking and linkages and, have structural and financial flexibilities for experimenting with service delivery innovations.
- Rural financial organizations have strong poverty and gender focus, active engagement with local administrative structures, flexibility for experimenting with alternative structural and institutional arrangements to expand their coverage and reach disfranchised groups.
- Dairy cooperatives play a crucial role in facilitating access to external technical and material support and, reduction of transaction costs for small dairy producers' participation in input and output markets.
- Private service providers have direct incentive to be more responsive and timely.

- Development projects have higher access to both domestic and external knowledge bases, have structural and financial flexibility for learning and innovation and play a unique role in bringing together multiple stakeholders and facilitating platforms.

4.2.2. Habits, Practices and Incentives Influencing Interactive Relationships

Established habits, practices and reward systems could make taking on new roles, and responding to needs of new clients as well as changing needs of traditional clients by public and non-public actors a daunting task. This section highlights few examples that have been captured by the current study with regard to the roles of organizational habits, practices and incentives in influencing pattern of interactions.

Tradition and incentive influencing the responsiveness of research to societal needs

Some university faculties of agriculture with Livestock Sciences streams, have retained the tradition of undertaking scientific research to '*generate knowledge to be communicated to scientific communities through publishing articles in peer-reviewed journals*'; with the presumption that 'someone else' has to take the responsibility for proper communication of the knowledge generated. Knowledge generated by faculties and research are often not communicated in useful and accessible manner to livestock keepers (Azage et al, 2006). This tradition is also being reinforced by existing incentive system; the number of publications has remained a single important criterion for achieving higher academic ranks in universities. The traditional focus of public dairy research has been on the generation of technical knowledge/technology for use by smallholder dairy producers and has remained intact. As a result, dairy research has little to offer the public and non-public actors who often grapple with non-technical impediments to achieving market-oriented dairy development such as alternative models for organizing, financing and coordinating pluralistic dairy service delivery, facilitation of pro-poor dairy value chain development etc. The fact that technical/technological innovation more often than not requires concomitant socio- organizational innovations received little or no attention by dairy research.

However, all is not bleak! There are encouraging developments in the form of moving away from the conventional disciplinary and supply-driven research and technology demonstration approach to commodity-based (ARARI and TARI), interdisciplinary project-based (SARI) and field-based Farmer Research Group (ORARI) approaches.

Less responsive attitudes and practices lead to weak interaction of public research with other public/non-public development actors

Smallholder dairy producers are just one, among many key clients for commercial dairy development. Small processors and distributors of dairy products need to acquire the needed technological, entrepreneurial and institutional capacities to succeed in a competitive market. Other non-state actors such as private service providers, rural finance and other business development services need knowledge to provide efficient support services for commercialization of the dairy sub-sector. Yet, research may not seriously consider these actors as its key clients. Even where it does, it usually has neither the required organizational structure nor the necessary skills and experience mix to cater for diverse knowledge needs of the non-traditional clients.

Failure to reconfigure attitudes, habits and incentive to changing context makes public extension less relevant to other actors

Public extension has a long tradition of working with subsistence dairy producers; and it has been aggressively promoting productivity-enhancing dairy technology in a top-down fashion; with no or little attention to marketing (Berhanu et al, 2006), institutional and policy constraints. The policy priority has shifted in favor of commercialization; and the policy has envisioned increasing role for the private sector and affirms support. Yet, public extension system has not yet reconfigured itself in line with this policy shift, the emergence of new actors and increasing needs for innovations of different nature, both by its conventional and new clients. The private actors also fail to appreciate the significance of being part of knowledge networks to be able to respond and succeed in the fast changing context.

Preference to work independently leads to weak interaction and duplication of functions.

The preference by some NGOs to work independently, has constrained NGO – Public partnership.

Habits and incentive system discourage actors to take new roles

An Input Agency has been established recently in a region to take over the responsibility from Livestock Development Department for multiplying/purchasing, distributing and monitoring the use of inputs like crossbred heifer, bull, semen and liquid nitrogen. The arrangement was intended to free the latter from input provision so that it would focus on linkage facilitation and knowledge brokerage activities. Yet, the Livestock Development Department had been reluctant to give up its traditional role of supplying inputs, leading to unnecessary competition between the two. Further examination indicated that the prevailing incentive and reward system which is output rather than impact oriented might have been the reason behind such a behavior. Linkage facilitation and knowledge brokerage activities apparently have no tangible or easily measurable outputs that might be rewarded.

4.3. Policy Environment and Policymaking Processes

The wider policy environment has profound influence on the stimulation and innovative performance of dairy innovation systems. National policy reforms such as decentralization, privatization, commercialization, and gender and poverty focus, and increased public investment in transport, information and communication technology (ICT) and knowledge infrastructure are gradually creating an environment that would enable innovations.

Increasingly efforts are being geared towards non-technical innovations by various research and non-research actors. However, no functional mechanisms are in place for facilitating collective experiential learning and for scaling out/up successful experiences to achieve wider impact. For instance, the efforts to stimulate private delivery of animal production and health services are not being systematically analyzed. The factors

identified by the key actors for the absence of effective functional mechanisms for collective learning and innovation included: unfavorable organizational culture and structure; lack of incentives for inter-organization collaboration; lack of dairy producer groups with enough clout to demand services and command accountability; lack of effective structural coordination mechanisms and other structural and procedural issues relating to making mutual adjustments through systematic collective experiential learning; and lack of innovative methods for ensuring regular and multidirectional communicative interactions and knowledge flows among the key actors.

Little attention has been given to context specificity in development interventions and policy support although the smallholder dairy production systems in the country are characterized by huge spatial and social diversity. There is also a widespread feeling among the stakeholders that adaptive and participatory policymaking, informed by process and impact monitoring, is exception, than the rule in Ethiopia.

The translation of policy intentions into operational strategies by public actors has been the weakest link. Despite the policy vision to increase role for the private sector, autonomous private service providers are not often seen as important stakeholders; and constrained by the lack of access to knowledge and resources, bureaucratic hurdles and a non-level playing field. For example, the emerging private services could be 'priced out of the market' due to free or highly subsidized provision of animal production and health services by both GOs and NGOs. Ineffective illegal vet drug control is being discouraging legal importers and retailers of vet drug.

Beyond political will, the presence of well informed and organized stakeholders/interest groups is a prerequisite for pragmatic participatory and adaptive policymaking. Unfortunately, dairy cooperatives do not have enough clout to influence policy or other actors to respond to their felt needs and command accountability; and the private actors are unorganized. However, there are recent initiatives by project actors to address the latter

5. CONCLUSION AND RECOMMENDATION

There are many and diverse actors in the dairy systems; with the public actors playing the dominant role and autonomous private services' scope and role being constrained by lack of knowledge, resources, and adequate public support. Public actors have weak knowledge linkages with NGOs and policymakers; and their response capacity is limited by role ambiguity, rigid mandate, and ineffective incentives and accountability systems. Available evidence indicates that habits, practices and competencies of the public actors are not sufficiently reconfigured in response to changing context. Further, although increasing efforts geared toward innovation are visible, no functional mechanisms are in place for facilitating collective learning and for scaling out and up successful experiences to achieve wider impact. These factors and the lack of actionable strategy (roadmap) to translate policy intentions into actions have contributed to limited impacts of policy and development interventions.

On the other hand, expected increase in demand for dairy products; the policy focus on sustainable commercialization of smallholder dairying; administrative and management decentralization; on-going business processes re-engineering in public organizations; increased public investment in transportation, ICT and knowledge infrastructure; and innovative pilot level initiatives are increasingly creating the necessary condition for learning and innovation. Yet enhancing innovation capacities in the Ethiopian dairy systems require long-term, multi-pronged, multi-level, context specific and process-driven approaches.

What is required urgently is an actionable strategy for sustainable commercialization of smallholder dairying in the country; with definitions of roles and responsibilities for public, private-for-profit and private-for-not profit, and coordination mechanisms. Creating policy awareness, building competencies of public and non-public actors for effective implementation of policy and strategy, and for collective learning, sharing and innovation, and institutionalizing adaptive and participatory policymaking approach should be integral parts of strategic vision. While development partners could assist in

this regard, the concerned federal and regional policymakers have to take the lead with commitment. A good starting point both for appropriate strategy formulation and enhancing collective capacity for innovation is learning from decades of experience in the country - what worked and didn't work, and also from successful experiences of neighboring African and Asian countries.

The 'milkshed approach' is an emerging dairy development strategy being tried across the four regions. This approach enables focusing interventions in areas with comparative advantage for commercial dairying. Areas designated for this purpose would receive priority in input supply and support services provision. Some of the milksheds can be used for pilot testing options for stimulating functional innovation process with systematic process monitoring for drawing lessons to inform policy.

The on-going efforts by development projects to organize private actors in the dairy sub sector, link them with source of finance, and to stimulate policy dialogue by BOAM¹; supporting emerging private services through credit and capacity building, and facilitation of multi-stakeholder dairy platform by IPMS; and recent initiative to develop master plan for livestock development by ESDDP²; and Research, Extension and Farmers Advisory Council (REFAC) being promoted by the national research systems should be capitalized on to learn what worked.

The number of primary dairy cooperatives is also increasing across the regions. Ada'a Dairy Cooperative is one with good organizational performance and extensive knowledge network with diverse actors in the country and beyond which can be used as a successful case to learn from. Further, supporting the emergence of autonomous, representative and accountable smallholder dairy producer cooperatives federated at higher levels, building their capacity to serve as a mouthpiece by ensuring their representation in platform and dialogue; and giving the organizations a political space to influence policy, demand

¹ Support to Business Organization and their Access to Market Project

² Ethiopian Smallholder Dairy Development Project

services and command accountability; and providing knowledge networking support are more critical for stimulating sustainable innovation capacity.

Finally, policy has critical roles to play in addressing institutional and market failures; enhancing skills, developing appropriate incentives and effective accountability process to reinforce behaviors which are compatible with innovation and inter-organizational collaboration. Among others, the current input/ output-oriented reward systems need to be changed to focus on innovation and social and economic outcomes in public extension and research rather than technology generation and transfer. This might also mean making procedures and targets flexible and 'innovation friendly'.

REFERENCES

Ahmed M., Ehui, S. and Yemesrach A., 2004. Dairy development in Ethiopia. *EPTD Discussion Paper No.123*, (International Food Policy Research Institute), Washington DC.

Azage Tegegne, Berhanu Gebremedhin and Hoekstra, D. 2006. Input supply system and services for market-oriented livestock production in Ethiopia. pp 1-19. *Proceeding of the 14th annual conference of the Ethiopian Society for Animal Production (ESAP)* held in Addis Ababa Ethiopia, September 5-7, 2006. Part I: Plenary Session.

Berhanu Gebremedhin, Hoekstra, D. and Azage Tegegne. 2006. Commercialization of Ethiopian agriculture: extension service: from input supplier to knowledge broker and facilitator. *IPMS (Improved Productivity and Market Success) of Ethiopian Farmers Project Working Paper 1*. (International Livestock Research Institute), Nairobi, Kenya. 36 pp.

Engel, P.G.H, 1997 (reprinted, 2002). *The social organization of innovation: a focus on stakeholder interaction*. Technical Centre for Agricultural and Rural Cooperation; Amsterdam: Royal Tropical Institute.

Hall, A., Mytelka, L. and Oyeyinka, B., 2006. Concepts and guidelines for diagnostic assessments of agricultural innovation capacity. *United Nations University- Maastricht Economic and Social Research and Training Centre on Innovation and Technology Working Paper Series no. 2006-017 (April 2006)*.

Horton, D. et al. 2003. Evaluating capacity development: experiences from research and development organizations around the world. International Service for National Agricultural Research (ISNAR); Canada: International Development Research Centre (IDRC); The Netherlands: ACP – EU Technical Centre for Agricultural and Rural Cooperation (CTA).

Leeuwis, C., 2004. *Communication for rural innovation: rethinking agricultural extension*. Blackwell Science Ltd. 3rd edn. UK.

Puskur, R., Tesfaye Lemma Tefera, Berhanu Gebremedhin, Hoekstra, D. 2007. Innovation Systems Perspective (ISP) for sustainable commercialization of smallholder agriculture: preliminary evidence from Ethiopia. Improving Productivity and Market Success (IPMS) of Ethiopian Farmers Project, (International Livestock Research Institute), Addis Ababa, Ethiopia. *Paper prepared for presentation at the IFPRI-EIAR-IPMS Symposium on Commercialisation of Smallholder Farming in Ethiopia EIAR, Addis Ababa 24 September 2007*

Sintayehu Yigrem, Fekadu Beyene, Azage Tegegne and Berhanu Gebremedhin. 2008. Dairy production, processing and marketing systems of Shashemene – Dilla area, Southern Ethiopia. *IPMS (Improved Productivity and Market Success) of Ethiopian Farmers Project Working Paper 9*. (International Livestock Research Institute), Nairobi, Kenya. 62 pp.

Spielman D.J., 2006. Innovation systems perspectives on developing-country agriculture: a critical review. *ISNAR (International Service for National Agricultural Research) Discussion paper 2*. (International Food Policy Research Institute), Washington DC.

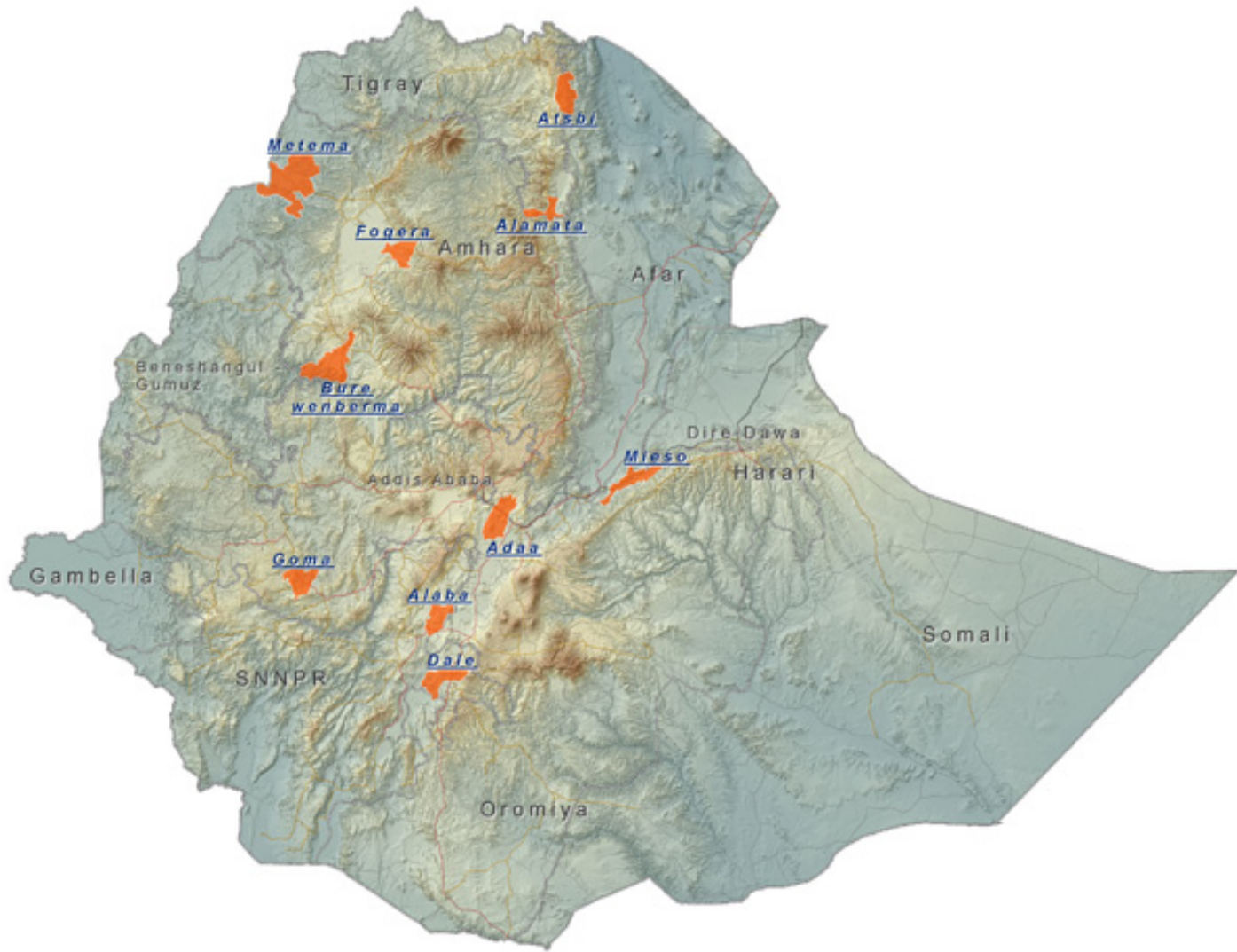
Staal, S.J., Pratt, A.N. and Jabbar, M. 2008. Dairy development for the resource poor part 2: Kenya and Ethiopia case studies. *Pro-poor Livestock Initiative Working Paper No. 44-2*. (International Livestock Research Institute), Nairobi, Kenya.

Teklu Tesfaye (Unpublished paper). 2007. Research-extension-user linkages in Ethiopia: conceptual framework, path dependency, problems and strategies to solve them.

Tesfaye Lemma Tefera and Puskur, R. (2007). Understanding and Analyzing Dairy and Forage Innovation Systems in Ethiopia. Unpublished Research Report. Improving Productivity and Market Success (IPMS) of Ethiopian Farmers Project, (International Livestock Research Institute), Addis Ababa, Ethiopia.

World Bank, 2006. Enhancing agricultural innovation: how to go beyond the strengthening of research system. Washington DC: The World Bank

Annex 1: Map of PLWs



Annex 2: Enterprise domain

<i>Roles</i>	<i>Actors</i>
Private production and health services <ol style="list-style-type: none"> 1. dairy feed <ul style="list-style-type: none"> - forages seed/ planting material - concentrate feed processing/ supply - feed/fodder retailing - fodder export 2. Breeding services <ul style="list-style-type: none"> - AI service - Bull service - Heifer supply 3. Animal health services <ul style="list-style-type: none"> - vet drug supply - Vaccine production - diagnostic and treatment - Routine treatment and vaccination - Routine treatment 	Private nursery Flour factory Private feed processors Ada'a Dairy Cooperative Private feed shops Small fodder traders Private AI technicians Private producer/ groups Vet drug importers National Veterinary Institute Vet drug retailers Private clinics Ada'a Dairy Cooperative Paravets /CAHW
Production, processing and marketing <ol style="list-style-type: none"> 1. Dairy producers 2. Processors and marketing 	Rural small producers Urban small producers Urban private large farms Yichalal dairy farm Private processors Dairy cooperatives/ women milk group Shops and supermarkets Mobile traders Retailers

Annex 3: Research domain

<i>Actors</i>	<i>Roles</i>
ILRI/IPMS	Dairy and forage research, focusing both on technical and non-technical impediments, building national research capacity, financial and technical support to innovative research by public research and higher learning institutions' staff and graduate students.
Faculty of Veterinary Medicine/AAU	Animal Health Research
Ethiopian Biodiversity Institute	Forage seeds conservation
Melkassa ARC	Milk processing equipment
Debre Zeit ARC	Forge dev't, straw treatment, and on farm demonstration of crossbred heifer
Adami Tulu ARC	Breed, forage and milk processing technology demonstration
Warer ARC	On-farm improved forage demonstration
Andassa Livestock RC	Breed improvement, and on-farm demonstration of package of dairy technology, including improved forage
Bahir Dar Agro-mechanization Research Centre	Adaptive research and promotion of milk processing equipment

Annex 4: Intermediary domain

<i>Actors</i>	<i>Roles</i>
<p>1. Public</p> <ul style="list-style-type: none"> - Cooperative Agency - Marketing agency - Agricultural Extension - Input Agency - Micro and-Small Enterprise Development Office - Women's Affairs Office - Food Security Office - Urban and rural administration <p>2. Development Projects</p> <ul style="list-style-type: none"> - IPMS - ESDDP - BOAM - NLDP <p>3. NGOs</p> <ul style="list-style-type: none"> - ORDA (local) - REST (local) - World Vision - SG- 2000 - LVIA - International Rescue Committee <p>4. Multilateral supports</p> <ul style="list-style-type: none"> - EU - WFP - FAO - World Bank <p>5. Dairy Cooperative</p>	<p>Dairy cooperative promotion & facilitating their legal organization, Facilitation of credit and market for cooperatives Training, technology demonstration and linkage facilitation Multiplying/purchasing, distributing and monitoring input use Promoting urban dairy group for income generation</p> <p>Organizing and supporting women dairy group Finances dairy and forage technology promotion activities Facilitating access to land, infrastructure and services by dairy coop</p> <p>Improving productivity, value chain development, innovation capacity building and knowledge management Improving productivity and milk quality, and value chain development.</p> <p>Building capacity of the private sector, networking, policy dialogue, and value chain development</p> <p>Strengthening capacity for public AI service provision, supporting forage development and group milk processing and marketing.</p> <p>Improving animal health coverage and AI services, improved forage</p> <p>Improving feeding and husbandry practice, provision of dairy cattle, and promotion of group milk processing & marketing Forage development Crossbred heifer distribution Training and supporting of Community Animal Health Workers (CAHW) Finance improved forage promotion</p> <p>Finance forage development and crossbred heifer supply Budgetary support for irrigation and extension Finance forage multiplication and animal health</p> <p>Collective processing and marketing service, and facilitation of access to external supports by dairy cooperatives</p>

Annex 5: Supporting structures

<i>Actors</i>	<i>Roles</i>
1. Rural Finance <ul style="list-style-type: none"> - ACSI (Amhara Credit and Saving Institution) - DCSI (Dedebit Credit and Saving Institutions) - OCSSC (Oromia Credit and Saving Share Company) - CBO (Cooperative Bank of Oromia) - Rural Fund (Southern Region) - OMF (Omo Micro-finance) - SMF (Sidama Micro-finance) 	Rural financial services for urban and rural dairy producers and producer groups
2. Knowledge infrastructure <ul style="list-style-type: none"> - Worada Knowledge Centre - ATVETs - FTCs - AI Training Centre - ESAP (Ethiopian Society of Animal Production) - EVA (Ethiopian Veterinary Association) - EDPA (Ethiopian Dairy Producers Association) - RALC/WALC/Dairy Platform 	Source of relevant knowledge and potential platform for knowledge sharing Training DAs Farmers training and technology demonstration Training AI technicians Knowledge sharing forum Knowledge sharing forum Knowledge sharing and policy lobbying Innovation Systems coordination
3. Physical infrastructure <ul style="list-style-type: none"> - Regional Animal Health Laboratory (RAHL) - Regional AI Center (RAIC) - Rural Technology Centre (RTC) - Ranches - Public nursery - Rural road and telecommunication service - Rural electrification 	Animal health diagnostic service Producing liquid nitrogen, training technicians Producing processing equipment Maintaining, improving and multiplying breeds Multiplying improved forages and tree seedlings Improving access to market and market information Power supply for storing and processing milk

Annex 6: Competencies of key actors

<i>Actor category</i>	<i>Strengths</i>	<i>Limitations</i>
Bureaus and WoARD	Large number of experienced technical staff; strong structure that extends to grassroots level; improving basic infrastructure for training, technology multiplication, inputs supply and service delivery; political capital; and ability to attracting the attention of non-public actors due to its key roles and position.	Capacity limitations with respect to implementation strategy, appropriate approaches and required abilities to implement pro-market, pro-poor, genders sensitive and participatory development; managing partnership with non-public actors; and limited connectivity to diverse sources of knowledge.
Public Research	Agro-ecological based structure, improving technical capabilities in terms of staff and infrastructure for research; relatively better connectivity with diverse sources of knowledge; and relatively better willingness and structural flexibility to take risk for innovation.	Capacity limitations with respect to operational strategy, appropriate approaches and abilities to address needs of disenfranchised groups, the private sector; less focus on non-technical impediment to dairy development such as market, innovation, organization and financing of service delivery and other institutional issues; and limited means and ineffective methods for communicating research results in organized, useful and easily accessible ways.
NGOs	A strong poverty and gender focus in interventions, and participatory in approach; better capacity to mobilize resources and technical supports through networks and linkages; structural and financial flexibilities for approaches and service delivery innovations.	Limited staff and technical capabilities for effective implementation of integrated development activities; pretty similar development activities and services with those of the public agencies; limited efforts and/or ability for scaling up and- out successful experiences and thereby positively impact public organizations' habits and practices.
Rural Finance	A strong poverty and gender focus in services; actively engaging local structures and community representatives' in decision making; flexible interest rate, and experimenting alternative institutional & structural arrangements in order to increase service coverage and reach disfranchised groups.	Often less suitable credit service for rural smallholder dairy sub-sector, limited connectivity to diverse sources of knowledge, less integration of financial services with extension & development activities.
Dairy coope-ratives	Facilitation of access to external technical and material supports; reduction of transaction costs of participating in input and output market; encouragement of milk selling culture.	Excessive focus on immediate benefits; member-focused in services; high reliance on supply-driven external support; and often poor organizational quality & lack of integration.
Private service providers	Provide producers alternative source of service, relatively more responsive in terms of timeliness and more efficient than public services.	Services limited in scope and space; business-orientation than client-orientation; unorganized to influence policy; and disconnected from relevant sources of knowledge.
Projects	Connected to diverse sources of knowledge; structural and financial flexibility to learn and innovate; relatively free from local politics.	Less understanding of local context; and short duration.