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Policy incoherence in smallholder dairying in Bihar, India

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Policy incoherence in smallholder dairying in Bihar, India

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Contents

Tables

Figures

Abbreviations

AI	Artificial Insemination
AIS	Agricultural Innovation System
ATMA	Agricultural Technological Management Agency
BAMETI	Bihar Academy of Management on Extension Training Institute
BLDA	Bihar Livestock Development Agency
BVA	Bihar Veterinary Association
CDS	Cattle Development Centres
COMFED	The Bihar State Milk Cooperative Federation Ltd.
DCS	Dairy Cooperative Society
DIPWG	Dairy Innovation Policy Working Group
DoAH	Directorate of Animal Husbandry
DoAHDF	Department of Animal Husbandry Dairying and Fisheries
DoD	Directorate of Dairying
DoH	Department of Health
DoI	Department of Industries
FD	Fodder Development
GoB	Government of Bihar
GoI	Government of India
IAHP	Institute of Animal Health and Production
ICAR	Indian Council of Agricultural Research
ICAR-RCER	ICAR Research Complex for Eastern Region
ILRI	International Livestock Research Institute

KVK	Krishi Vigya Kendra
NDDB	National Dairy Development Board
NGO	Non Government Organization
NPCBB	National Project for Cattle and Buffalo Breeding
NBDDDP	National Program for Bovine Breeding and Dairy Development
RBP	Ration Balancing Program
RKVY	Rashtriya Krishi Vikas Yojana
SGIDT	Sanjay Gandhi Institute of Dairy Technology
SIPB	State Investment Promotion Board
VBMPS	Village Based Milk Procurement System

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Abstract

Smallholder dairying plays an important role in the socioeconomic development of Bihar. While several organizations exist for dairy development in Bihar and there is an increase in investments and interventions in this sector during the last one decade, these are yet to contribute to increasing milk productivity. The paper maps the existing innovation capacity of the smallholder dairy sector through an analysis of patterns of interaction among the various actors and identifies the major institutions and policies that currently constrain development of improved capacity for innovation. The paper argues the need for addressing the policy incoherence in the smallholder dairy sector in Bihar through organization of a multi-stakeholder policy working group which focuses on ways of addressing policy gaps, enhances capacities for policy implementation and facilitates policy learning.

Introduction

This paper explores the dairy innovation system of Bihar mainly to explore the critical bottlenecks in the policy environment that constrain smallholder dairying in the state. Dairy farming is an important occupation here, and the farming supports a large number of resource poor and landless families. Dairy development is important for strengthening of the rural economy and for creation of rural employment (GoB, 2012a). Though the state has several organizations working for dairy promotion, there is not any major increase in livestock productivity. The state has taken several initiatives for breed improvement, improving animal health, enhancing fodder and feed availability. However, smallholder dairy farmers continue to face several challenges (Planning Commission, 2008, Singh et al 2010, GoB, 2012a, Singh, et al 2013, Pandey, 2015).

The paper maps the existing innovation capacity of the smallholder dairy sector through an analysis of patterns of interaction among the various actors. It also identifies the major institutions and policies that currently constrain development of improved capacity for innovation. The paper concludes by suggesting that the main point of intervention to address policy incoherence is to organise a multi-stakeholder policy working group on dairy. The working group can be used as a platform to share and learn mechanisms that could lead to better appreciation of the contributions of each actor and joint action.

The remainder of this paper is organised as follows: The context of smallholder dairying sector is discussed in the next section (Section II). The framework adopted for analysing innovation capacity is discussed in Section III. The findings from the innovation system diagnosis are presented in Section IV. This is followed by a brief discussion on the conclusions and implications for addressing these institutional and policy bottlenecks.

Context: smallholder dairying in Bihar

Animal husbandry and dairy is the main subsidiary income generating activity for the rural poor of Bihar. It is an important source of income and employment for millions of landless poor in the state (Planning Commission, 2008). Smallholder dairying plays an important role in the socioeconomic development of Bihar. About 80% of the total milk produced in Bihar is from landless poor, agricultural labourers and small and marginal farmers (ILRI, 2014). Milk in Bihar mainly comes from cows and buffaloes (Table 1).

Table 1: Share of milk production by cows, buffaloes and goats (2010-11)

No	Type of dairy animal	(000 tonnes)	% Share
1	Cows	3561	54.7
2	Buffaloes	2798	42.9
3	Goats	158	2.4
	Total	6,517	100.0

Source: GoB (2012b) Bihar Animal Husbandry Statistics-2012

In the flood-prone north Bihar villages there is higher marketable surplus for milk with buffaloes contributing significantly to milk production. However, there is a steady increase in the share of cow milk. In the drought-prone south Bihar villages, the available marketable surplus milk is low compared to the flood-prone districts. The share of the cow milk is higher; among cows more than 90% milk is produced from nondescript animals (ILRI, 2014).

During 2012-13, Bihar produced 6845 thousand tonnes of milk and it currently holds the tenth position among the list of milk producing states (DoAHDF, 2014). The aggregate milk production in Bihar increased from 2869 thousand tonnes in 2002-03 to 5783 thousand tonnes in 2007-08 and 6845 thousand tonnes in 2012-13. The target is to take this production level up to 11035 thousand tonnes by 2017 and to 14867 thousand tonnes by 2022 (GoB, 2012a). To reach these targets, the per-animal productivity in Bihar has to go up significantly.

The Government of Bihar (GoB) recognises this challenge and it is implementing several programs related to breed improvement, animal health and milk marketing to strengthen the dairy sector in the state. It also intends to do more on these lines as articulated in the dairy road map which forms part of a comprehensive agriculture policy (Krishi Road Map) drawn up by the state for 2012-17.

Will the state of Bihar be able to increase its milk procurement to 4400,000 litres per day by 2017 (as envisioned in the Krishi Road Map) from 1496,000 litres per day it procured in 2013? Will the significant investments currently being made in this sector in the state contribute to significant increase in animal productivity? The evidence so far indicates that the average per animal productivity has remained almost static over the last few years (Table 2). At the national level, with respect to per animal productivity, Bihar ranks 10th in the case of exotic/cross bred cows; 5th in the case of Indigenous/non-descript cows and 9th in the case of buffaloes.

Table 2: Average yield per animal in milk (kg/day)

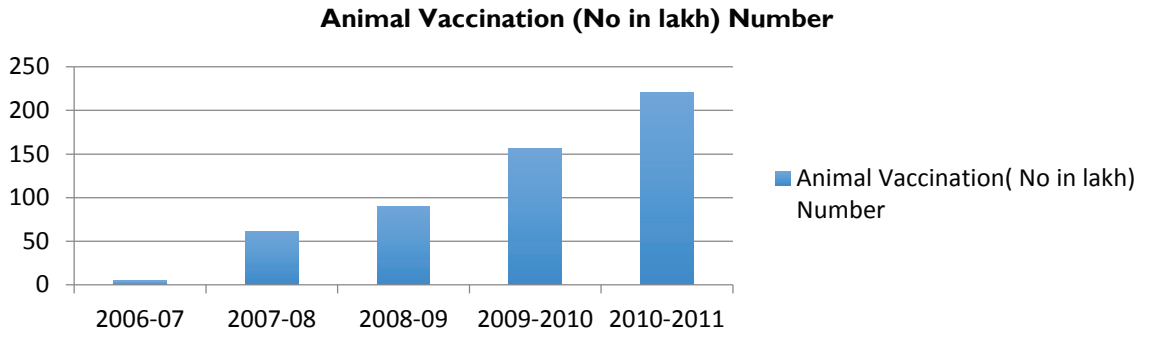
Sl No	Years	Exotic Crossbred Cows	Indigenous/Non-descript Cows	Buffaloes
1	2007-08	6.16	2.92	3.82
2	2008-09	6.26	2.89	3.88
3	2009-10	6.19	2.91	3.92
4	2010-11	6.16	2.85	3.92

Source: GoB (2012b) Bihar Animal Husbandry Statistics-2012

The planned forty fold increase in outlay on Agriculture by GoB from Rs. 204.3 million in 2005-06 to 7978.6 million during 2011-12 seems to have had very little effect on the increase in animal productivity. Though the rates of animal vaccination (Figure 1), artificial insemination (Figure 2) and milk procurement (Figure 3) by the state milk marketing federation (COMFED) have increased significantly during this period, these have contributed only very little by way of increased animal productivity and thereby enhanced income for dairy farmers.

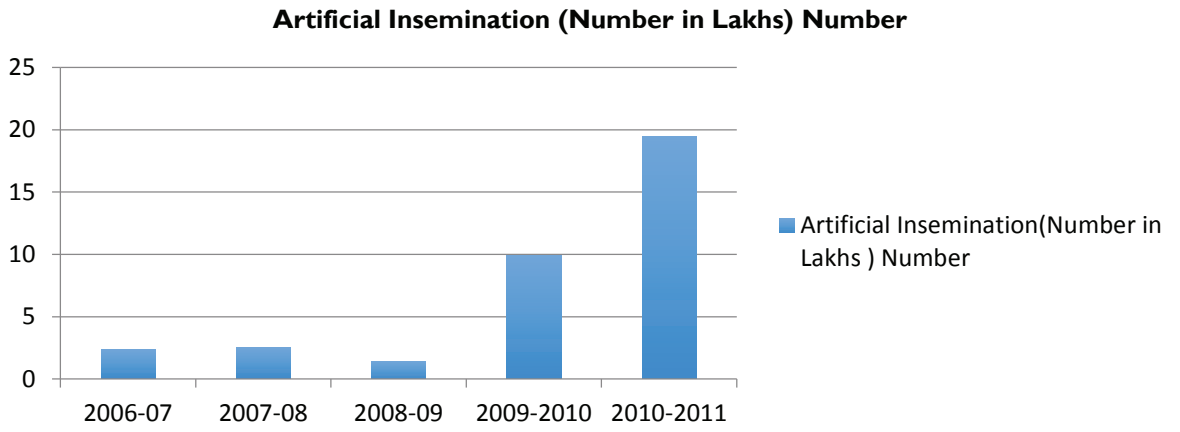
The Department of Animal Husbandry is the single largest agency providing livestock health services to farmers in the state. Over the last few years, the government has organised several vaccination camps to protect animals against infectious disease like FMD, HS and BQ (Figure 1).

Figure 1. Animal vaccination in Bihar.



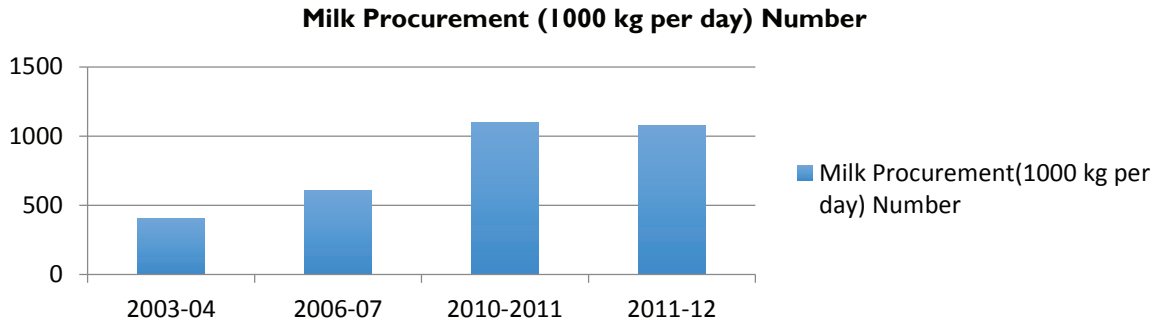
The increase in production is mainly coming from the increase in number of crossbred cattle. AI services are provided by the DoAH, BLDA, COMFED, BAIF, JK Trust and private AI workers and there is a steady increase in AI service delivery over the years (Figure 2).

Figure 2. Artificial insemination in Bihar.



Overall the milk production and consumption are increasing in Bihar. Bihar supplies milk to neighbouring states such as West Bengal and Assam. COMFED is the single largest agency involved in milk procurement and it currently covers 44.5% of all villages in Bihar.

Figure 3. Milk procurement by COMFED (1000 kg per day) trends in Bihar.



"The growth of livestock sector has been found slower in Bihar than at the national level. The share of Bihar in India's livestock sector income has not changed significantly. In terms of total livestock income, Bihar is lagging behind states like Uttar Pradesh, Andhra Pradesh, Rajasthan, Maharashtra, Tamil Nadu, Punjab, West Bengal and Gujarat" (Pandey, 2015).

Bihar has shortage of 9.93 million tonnes of dry fodder, 23.47 million tonnes of green fodder and 5.48 million tonnes of concentrates (GoB, 2012a). Chronic feed deficit is the major constraint to animal production in Bihar. Most of the dairy farmers are smallholders having one or two local-breed milch animals, which are raised on crop residues and natural pastures with under-employed family labour. Feeding grains, oil cakes and green nutritious fodder are generally restricted to some crossbred cattle (Singh et al, 2013). Paddy and wheat straw are the major fodders that account for about 95% of the total marketed fodder in Bihar (Singh et al, 2013).

Common grazing lands are limited and many of them are overgrazed. Only about 2% of the land area in the state is allocated to green fodder crops (Singh RKP, 2013). The proportion of green fodder in total livestock feed is close to 10%. About 55% of green fodders are cultivated (Singh et al, 2013). Though the government provides mini kits of improved and high yielding fodder seeds to farmers, hardly 3 to 4 percent of the state's green fodder requirement is met by the domestic production (Singh et al, 2013).

Are these increasing investments resulting in increasing production and productivity in the state and thereby contributing to the livestock sector productivity and competitiveness of the dairy sector in Bihar? Bihar seems to have several different organizations that are playing some role in the livestock sector. But are these organizations playing relevant and complementary roles that enhance the capacity of producers to apply new, relevant and appropriate knowledge in dairy farming? Are there any critical bottlenecks in the policy environment that constrain realisation of increased investments and efforts into productivity enhancement at the farm level? This study was undertaken to primarily answer these questions.

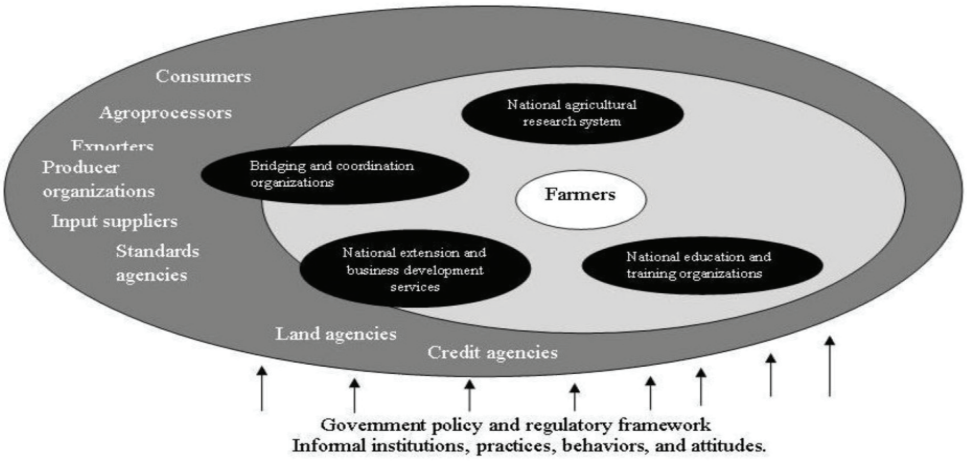
Methodology

Study framework

Agricultural Innovation Systems

There is an increasing realization that farmers need access to a wider range of support and services from different organizations with complementary knowledge and expertise regarding adoption of new knowledge. Research, education and extension are usually not sufficient to bring knowledge, technologies and services to farmers and entrepreneurs and to get them to innovate. In other words, putting new knowledge into use is no longer a post-research, information dissemination task per se. Innovation requires a much more interactive, dynamic and ultimately flexible process and it is no longer useful to consider it a linear process of science developing new knowledge and transferring it on to extension for wider dissemination (World Bank, 2006). Innovation requires interactions among a large number of actors within the Agricultural Innovation System (AIS) who have complementary knowledge and expertise (Figure 4).

Figure 4. An Agricultural Innovation System.



Source: The World bank (2012) Agricultural Innovation Systems An Investment Source Book (Modified from Rivera et. al.n.d.)

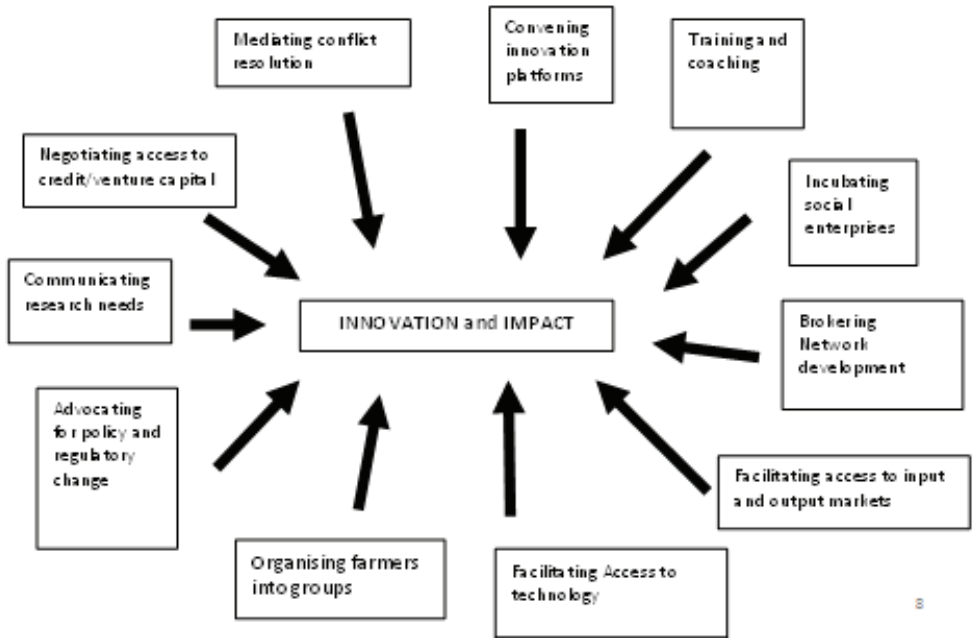
An innovation system is defined as a *network of organizations, enterprises and individuals focused on bringing new products, new processes and new forms of organizations into social and economic use, together with the institutions and policies that affect their innovative behaviour and performance* (World Bank, 2006). The attraction of this concept is that it recognizes that innovation is not a research-driven process simply relying on technology transfer. Rather, innovation is seen as a process of generating and accessing knowledge and putting it into use. The AIS concept is increasingly recognised as useful to identify interventions, design investments and organise complementary interventions that appear most likely to promote agricultural innovation and equitable growth (World Bank, 2012).

While interaction among the actors within the AIS is critical for innovation, several institutional and policy barriers generally constrain effective collaboration and knowledge flows among these different actors. Institutions (the attitudes, habits, rules, laws, norms, practices and way of working) shape how individuals and organizations interact. Similarly policies and the nature of the policy environment also affect innovation (Hall et al 2004). Advocating for change in institutions and policies is therefore critical for innovation. The process of interaction quite often needs to be facilitated as actors often need an initial push or opportunity to break barriers against joint discussion, action, sharing, and learning. Innovation platforms are increasingly used to bring different actors together to discuss and negotiate collective or coordinated action (Klerkx and Leeuwis, 2009).

Innovation Management

Innovation involves a wide range of functions, activities and tools (performed by several agencies that work through platforms, alliances or partnerships) that are collectively referred to as Innovation Management (Figure 5). While facilitating access to technology is important for putting research outputs into use, it has value only when it is bundled together with other innovation management tasks such as the development of networks, organising producers, communicating research needs, mediating conflicts, facilitating access to credit, inputs and outputs services, convening innovation platforms, advocacy for policy change and other negotiated changes in practices and action (Sulaiman et al, 2010).

Figure 5. Innovation management tasks (Sulaiman et al, 2010).



This perspective argues that it is not the focus and quality of research efforts that are important per se in determining whether research leads to technical change and innovation. Rather it is the capacity of the innovation system as a whole to create, mobilise, adapt, combine and use knowledge in response to the changing set of opportunities that society faces.

Exploring Innovation Capacity

Based on this concept of an innovation system, innovation capacity entails more than the ability to invent new technologies, or the expertise and information within research organizations that are required to produce them, important though they are. The capacity for innovation also includes the process through which research-based

knowledge and context-specific knowledge are combined for the development of solutions that actually work in a specific context. Second, innovation capacity includes a system or network of multiple nodes of expertise. Users of new products and services, such as farmers and consumers, are prominent nodes in their own right. These systems are often informal, adaptive and transient, and are characterised by the context in which they emerge. The emergence and operation of the networks of interaction that give rise to innovation are usually unplanned and spontaneous. However, if these processes could be strengthened, better linked to formal research and directed toward developmental goals, innovation and impact could be greatly enhanced (Hall et al, 2009).

Here, we used the four element tool for diagnosing innovation capacity adapted from the World Bank (2006) study "Enhancing Agricultural Innovation: How to Move Beyond Strengthening Research" as a guiding tool for this study.

The four guiding questions are as follows:

a. What actors are relevant for agricultural innovation? In the case of agricultural innovation, it ranges from researchers, farmers, and development organizations, but also cooperatives and other enterprises related to agricultural input and output markets. What role do these organizations play? Are they sources of technical knowledge on livestock production, disease management or milk marketing and/or organizations engaged in social mobilization, institutional development, pro-poor development and addressing gender issues? Are they engaged in provision of inputs, value addition or output marketing? Do they act as intermediary organizations that link together different groups within the wider system? Do they have a policy or a policy advocacy function? Are they champions for a particular cause, playing a catalytic role in change? Are they associations, clubs or coordinating bodies that help knit together networks of different players and help foster systems coherence?

b. What patterns of interaction exist between different players? Are certain groups better connected together? Are key organizations isolated or well integrated in to the wider set of activities and organization in the system? How are these organizations linked? What function do existing patterns of interaction and linkage facilitate -- exchange of information on technology or developmental interventions?

c. How can the current pattern of roles and interactions be explained? What are the habits and practices that cause organization to behave the way they do with respect to how well they link with other? Are there traditions or routines that cause organizations to work in certain ways because they have always worked like that? Do patterns of social, economic and political power influence the way organizations work, how does this impact on patterns of interaction? Are there specific policies of either organizations or in the form of legislation that cause actors to work in certain ways that may effect interaction, transmission and use of knowledge and innovation?

d. What are the key technical/policy/market/environmental challenges and opportunities being faced? How well have organizations reconfigured their patterns of interaction to meet these challenges? What has prevented this or enabled this?

Study Approach

The study approach combined desk review with interviews and interactions with various dairy/livestock actors in Bihar. The field visit provided the opportunity for direct interaction with several state level actors and for observation of field settings.

We developed a generic checklist of questions to be posed to our interviewees/key informants in each of the two districts. The actors were first divided according to their institutional character and functions—and the purpose was to capture the views of diverse actors. Initial meetings with some of the key actors provided an opportunity for snowballing to further actors, who were then selected as key informants/interviewees.

Findings

Actors and their roles

Several organizations are involved in dairy-livestock development in Bihar. To be able to compare profiles of different types of actors and to examine whether there are gaps, these organizations have been clustered under – 1) value chain actors and 2) enabling environment actors. The value chain actors are those organizations/ agencies that are directly involved in handling of milk and its products. The enabling environment actors include those agencies that play a support role for the value chain actors in discharging their roles. The enabling environment actors have been further divided into research actors and development actors. The main roles of these different agencies are given in Table 3.

Table 3: Actors in the smallholder dairy innovation system and their roles

Sl No.	Actors	Roles relevant for smallholder dairying
I.	Value chain actors	
1	Milk Vendors	Procure milk directly from farmers in the morning and make payment on a monthly basis. They supply the milk either to sweet makers or the private dairies.
2	Cottage Processors	Procure milk directly from producers and they produce milk products such as paneer, channa & khoa from milk
3	Sweet makers	Procure milk from vendors daily based on the daily demand and they make the payment to vendors based on the yield of khoa they get from milk
4	Cattle owners	Maintain cattle and produce milk from cattle. They supply milk to various agencies including vendors, coop dairy collection centres, sweet makers, cottage processors, etc.
5	Input dealers	These local-level entrepreneurs sell different inputs required for cattle production such as fodder, feed, medicine, etc.
6	Private AI workers/ para vets	About 4500 private AI (Artifical Insemination) workers in the state provide breeding and different livestock health services. They collect frozen semen and other inputs from different agencies and provide services at the doorstep of farmers.
7	The Bihar State Milk Cooperative Federation Ltd (COMFED)	Biggest organized player of the dairy sector in the state. About 16% of surplus milk produced in the villages is procured through 9 Unions spread over 38 districts. Sell processed liquid milk, milk powder and other dairy products and set milk price. Provide AI services and vaccination services through their staff and trained self-employed personnel; supply adult cattle feed and bypass protein feed produced in its cattle feed plants, and organise regular training of milk producers and office bearers of management committees of DCS.
8	Anuj Dairy	An important private sector diary, involved in collecting milk from farmers. Leading manufacturer and supplier of dairy products in the private sector marketing its range of dairy products under "RajFresh" brand name.
9	Ganga Dairy	An important private sector dairy, involved in collecting processing and selling milk and milk products under the brand name "Amrit"
II	Enabling environment actors	

Sl No.	Actors	Roles relevant for smallholder dairying
A	Research actors	
1.	ICAR Research Complex for Eastern Region (ICAR-RCER). Patna	Conducts adaptive research focussing on farming system improvement. Has undertaken research on farmer friendly low-cost feed formulations.
2.	Bihar Veterinary College	Produce Veterinary graduates & Post-graduates, organise trainings for veterinarians and carry out research in different areas related to animal husbandry. Undertakes limited diagnostic, health care, training and extension activities.
3.	Sanjay Gandhi Institute of Dairy Technology (SGIDT), Patna	Conduct under graduate and post graduate program in dairy technology, organise short term training to dairy farmers and carry out research on dairy science and technology issues.
B	Development actors	
1	Directorate of Animal Husbandry (DoAH)	Mainly focussed on animal health (disease reporting, diagnostics, control and prevention/treatment) and animal breeding programs; has a network of 39 hospitals, 783 veterinary dispensaries and 1595 first aid centres. Undertakes limited extension and publicity activities
2	Directorate of Dairying (DoD)	DoD plan, monitor, supervise and implement different dairy development programs mainly through COMFED. It also organises demonstrations on green fodder, support establishment of dairy cooperative societies and AI centres.
4	Institute of Animal Health & Production	Vaccine production cum Referral Diagnostic Institute under DoAH. Responsible for production, research and quality control of vaccines in the state
5	BAIF	Provision of paid AI services through their network of cattle development centres (CDS) and implement specific livestock development projects
6	J K Trust	Provision of AI services through their staff
7	Jeevika (Bihar Rural Livelihoods program)	The state component of the National Rural Livelihood Mission (NRLM) implemented with a focus on social and economic empowerment of the rural poor, especially women. Has established SHGs of women which are federated at village and cluster levels. In some locations they promoted collectives of women for pooling milk to supply to COMFED.
8	NABARD	Nodal agency for proving loans for implementation of Dairy Development Entrepreneurship program a central sector scheme implemented by the Department of Animal Husbandry, Dairying & Fisheries (DAHDF)
9	Commissioner, Food Safety, Department of Health (DoH), Government of Bihar	Food safety officers under the Commissioner, Food Safety at the state level collect fresh milk samples from vendors, cooperative milk collection centres and processed milk from COMFED and test the same for its adherence to food safety standards.
10	State Drug Control Authority Department of Health (DoH), Government of Bihar	State Drug Control Authority under the DoH is responsible for regulating the manufacture, sale and distribution of drugs including veterinary drugs and vaccines
11	Udyog Mitra, Department of Industries (DoI), Goverment of Bihar	Udyog Mitra under the DoI support potential entrepreneurs who plan to set up all types of industries including food processing industries by providing technical guidance in the form of relevant project profiles and policy information.
12	State Investment Promotion Board (SIPB), Department of Industries, Government of Bihar	State Investment Promotion Board (SIPB) under the DoI is responsible for assessing and approving investment proposals (including food processing) in the state.
13	Bihar Academy of Management on Extension Training Institute (BAMETI)	State level training agency engaged in training officials of various agencies involved in agricultural development including staff of DoAH
14	Bihar Livestock Development Agency (BLDA)	Manages one frozen semen bull station; On behalf of the State Government, procures frozen semen and liquid nitrogen from agencies outside the state for distribution to government- run AI centres
15	Bihar Veterinary Association (BVA)	BVA is an association of veterinarians across Bihar and represents the concerns of veterinarians regarding livestock development at different platforms

Sl No.	Actors	Roles relevant for smallholder dairying
16	National Dairy Development Board (NDDB)	National Dairy Development Board has sanctioned, 14 sub-projects with a total outlay of Rs 258 million for Bihar, comprising of Rs 252 million as grant assistance and Rs 6.6 million as share of End Implementing Agencies (EIAs). These 14 sub-projects are implemented for the following activities: Fodder Development (FD), Ration Balancing program (RBP) and Village Based Milk Procurement System (VBMPS).
17	Department of Civil Supplies	Responsible for quality control of feeds using BIS standards for animal feed

At the state level, the two Directorates, the Directorate of Animal Husbandry and the Directorate of Dairy Development under the Department of Animal Husbandry and Fisheries are responsible for dairy-livestock development. These two organizations, along with the State Milk Marketing Federation (COMFED) implement the projects under the Centrally Sponsored National program for Bovine Breeding and Dairy Development (NBDDDP) and the Central Sector Scheme National Dairy Plan (Phase I). The Central Sector scheme "Dairy Development Entrepreneurship Scheme" is implemented by NABARD.

The state adopts a three-pronged strategy for livestock development in Bihar which includes controlled breeding, expanding health cover and infrastructural development for breeding, health and milk marketing. Bihar has also been implementing the "National Project for Cattle and Buffalo Breeding (NPCBB)" since 2000 with focus on genetic upgrading of cattle and streamlining AI services and support systems. The Bihar Livestock Development Agency (BLDA) was established as part of the NPCBB project. BLDA is the nodal agency for implementing the breeding policy. It procures semen from the Animal Breeding Centre of NDDB at Salon, Rai Bareilly and also produces some semen from its bull farm in Patna. This is distributed to the Government AI centres across the state. It also distributes liquid nitrogen to store semen. It has established 9 cryo-stations established with RKVY (Rashtriya Krish Vikas Yojana) support.

Unlike in other states, several agencies are involved in AI service provision in Bihar. Apart from the Government AI centres managed by BLDA (897 centres), COMFED has about 2800 AI centres. BAIF has 245 AI centres and the JK Trust has 300 AI centres. Apart from these about 4500 private AI service providers provide AI services at the doorstep of farmers which the Government agencies are not able to provide.

DoAH has 39 veterinary hospitals, 783 veterinary dispensaries and 1595 first aid centres. This infrastructure has more or less remained static during the past decade and is highly inadequate to meet the support and service needs of the increases bovine population during the same period. Apart from this the DoAH faces severe shortage of staff at all levels. Limited doorstep delivery of services and unavailability of medicines at these institutions discourage farmers from availing government services. Private service providers fill this gap by offering services including medicine at farmers' doorstep. But there is no system for controlling quality of services provided by many of these poorly trained livestock service providers.

"On an average, 72 per cent of the farmers market their milk through the traditional milk supply chains and 60 per cent of the marketed milk is purchased by these milk market agents" (Kumar, 2010). Only about 16 percent of the milk production is processed by COMFED and another 2-3 percent in the private sector. The Bihar State Milk Cooperative Federation Ltd. (COMFED) was established in 1983 as the implementing agency of operational Flood program of dairy development on "Anand" pattern in Bihar. The main technical inputs given to milk producers include breeding facility, animal health cover, feed & fodder and extension/training services.

The NDDB has sanctioned 14 sub-projects with a total outlay of about Rs 258 million for Bihar. These 14 sub-projects would be implemented for activities like Fodder Development (FD), Ration Balancing Program (RBP) and Village Based Milk Procurement System (VBMPS). These are being implemented through the state DoD and COMFED. This assistance is however not available to other value chain actors who are outside the milk producer cooperatives.

Although there are several agencies in the small-holder dairy innovation system, there seems to be a gap in role with regards to bringing together different agencies for sharing knowledge, resources and concerted action. All these agencies are focused on implementing their respective mandates that account for only a part of the innovation management functions. Some of the agencies listed above, such as the National Dairy Development Board (NDDB) or Bihar Veterinary Association (BVA), seem to have the potential to play a much broader intermediation role in the innovation system. The following section further highlights the need for this while describing the current patterns of interactions among different agencies.

Patterns of Interaction

Though several organizations are working for dairy/livestock development in the state, there is very little collaboration among these different organizations (Table 4) due to limited human resources, vertical accountability and lack of perspectives and policy emphasis on collaborative functioning.

Table 4: Current patterns of interaction among various actors

Sl No	Actors	Patterns of Interaction	Consequences
1	Directorate of Animal Husbandry (DoAH)	DoAH staff works closely with DoD, BLDA, COMFED and other service providers in the dairy sector including AI service providers. However lack of sufficient human resources, for instance, out of 1850 veterinarian positions, only 1030 are filled (630 permanent staff and 400 contract staff), has an impact on its efficiency.	Limited number of staff at various levels (veterinarians and livestock assistants) constrain the DoAH in effectively serving the dairy producers and also monitoring the functioning of AI centres and disease reporting.
2	Directorate of Dairying (DoD)	Works closely with DoAH, BLDA, COMFED but have very poor links with the private organised dairy players and the vast network of unorganised/ informal dairy value chain actors	The dairy value chain actors involved with more than 80% of surplus milk are left out of the services and support that are required for strengthening these value chains
3	The Bihar State Milk Cooperative Federation Ltd (COMFED)	Works closely with the DoAH, DoD and have reasonably good relations with most of the government agencies in the dairy sector including those providing AI services and consumers of its dairy products in the state. Competitive relationship with the organised private dairy and unorganised milk value chain actors	The private organised dairy players perceive that there is no level playing field in the dairy sector in the state, as only COMFED has access to government finances and other services.
4	Institute of Animal Health and Production (IAHP)	Comes under the DoAH. Weak links with the rest of the actors due to severe erosion in its R&D and vaccine production capacity over the years.	Erosion in capacity for public funded vaccine production and quality control. Faces a number of challenges, including the right competencies and the most modern R&D infrastructure.
5	Bihar Veterinary College	Work closely with the DoAH. Lack of major interactions with any other value chain actors. Only a third of the students who join the veterinary degree complete their course as they move to other courses/jobs	Lack of recruitments in the state DoAH (the main employer for veterinary graduates) for the past several years have led to poor demand for veterinarians in the state and the students shifting to other courses during the course.
6	Bihar Livestock Development Agency (BLDA)	Work closely with the DoAH as most of the people are on deputation from DoAH. Lack dedicated staff to implement the Breeding Policy for which it is responsible.	Breeding policy remains on paper as the BLDA has virtually no capacity to monitor the implementation of AI performed by a wide range of actors
6	BAIF	Linked to cattle owners in locations where they operate. Works closely with the DoAH. It has good relations with COMFED but has competing relations with other AI service providers such as JK Trust. It operates 115 cattle breeding centres in the state with focus on providing paid AI services in the state	Trained AI operator provide AI services at the doorstep of farmers but the coverage is limited

Sl No	Actors	Patterns of Interaction	Consequences
7	J K Trust	Linked to cattle owners in the locations where they operate. Operates integrated livestock development centres mainly to promote AI services. No major interactions with any other actors of the dairy innovation system.	Trained AI operator provide AI services at the doorstep of farmers but the coverage is limited
8	Private AI workers	Many are trained and supported initially by COMFED and DoAH. Not linked to other actors and they collect semen from a number of sources and provide AI services at the doorstep of farmers without following the breed specificity suggested in the breeding policy	With virtually no control on semen usage and distribution, the AI is resulting in in-breeding and repeat breeding, which eventually is resulting in increased infertility in dairy cattle. Serious damage to the breeding policy.
9	Jeevika	Work with COMFED in establishing and strengthening women dairy cooperatives. Jeevika has organized SHG households into Dairy Cooperative Societies (DCS). Through these societies and the partnership with COMFED, households are provided with access to both input and market linkages. However there are huge differences between the two organizations regarding procurement and service provision which are yet to be resolved.	Could be potentially a win-win situation for both as Jeevika is interested in profitable employment opportunities for its SHG households and COMFED is looking for increasing the reach of its network. These DCS serve as centres where milk is collected, tested (for the fat content) and sold to COMFED. But a lot more needs to be done to build trust and more productive relationships between the two.
10	Private Dairy Units (Anuj Dairy/Ganga Dairy)	Linked to producers and collection agents for milk procurement and retail consumers and food industry for sale of milk and milk products. As it is outside the cooperative framework it is unable to receive any support from the Government. Though the role of private dairy industry is recognised by the Department of Industry and the SIPB, their role and contribution is not sufficiently recognised by DoD and COMFED.	Private dairy units are struggling to compete with COMFED and they are finding it difficult to expand
11	NABARD	Well connected with the DoAH, COMFED and farmers. Provide subsidy component of dairy development programs.	Farmers lack access to credit for buying cattle, unless it is subsidy linked. But it has not been able to influence banks to enhance allocation for credit for buying milch animals
12	ICAR Research Institute for Eastern Region (ICAR-RCER). Patna	Some linkages with the Veterinary College. Not linked to most of the dairy innovation system actors.	Researchable issues are not identified and acted upon by this key research institute of the region.
13	Commissioner, Food Safety, Department of Health (DoH), Government of Bihar	Lack of adequate staff and not sufficiently linked to other actors such as DoAH and COMFED which can potentially increase awareness on clean milk production and production and marketing of milk products.	Very little monitoring on quality of milk and milk products (especially that are sold without labels/brands)
14	State Drug Control Authority Department of Health (DoH), Government of Bihar	Not sufficiently linked to other actors Lack of sufficient staff and the existing staff burdened with several other responsibilities	Virtually no monitoring on the quality of veterinary drugs and vaccines
15	Udyog Mitra Department of Industries (DoI), Goverment of Bihar & State Investment Promotion Board (SIPB), Department of Industries, Government of Bihar	Poorly linked to the DoAH, DoD and COMFED	Lack of clarity on promotion of private dairy enterprises

Sl No	Actors	Patterns of Interaction	Consequences
16	BAMETI (Bihar Academy of Management on Extension Training Institute)	Closely linked to the DoAH and BVC	More trainings on dairying and animal husbandry organised currently
17	Bihar Livestock Development Agency (BLDA)	Though it should have been an autonomous body, it continues to operate as an agency under the DoAH, with no independent staff on its own.	No capacity to implement breeding policy and no oversight on animal breeding/AI implementation
18	Bihar Veterinary Association (BVA)	Members come from different agencies but lack direct linkages with any agency.	Has been making efforts in raising awareness and action on several issues that affect the performance of the livestock sector
19	National Dairy Development Board (NDDB)	Connected to the Department of Dairying and COMFED as it funds the National Dairy Plan initiatives in the state, but linked only to the milk cooperative value chain.	Other milk market value chains are not getting any support for up-grading
20	Milk Vendors	Closely linked to producers and processors but lack links to technical support agencies (safe milk collection and transport)	High rate of milk spoilage
21	Cottage Processors	Closely linked to milk vendors and producers at the local level but lack links to sources of R&D (better machinery and production of value added products)	High rate of milk spoilage and low profitability
22	Sweet makers	Closely linked to milk vendors and producers at the local level but lack links to sources of R&D (better machinery and production of value added products)	High rate of milk spoilage and low profitability

There is an overall need for synchronisation of efforts of the large number of actors in the dairy innovation system in Bihar. Very few organizations can claim to have productive working relationships with the rest and obviously there is no capacity for co-ordinating the actions of these different agencies. DoAH which could have ideally played a coordinating role lacks adequate staff. Out of the 1850 veterinarian positions with the DAH, only 630 are filled with regular staff. Apart from this, about 400 contract staff are employed and each veterinarian is in charge of 2-3 blocks. Therefore, the effective reach of veterinarians is limited. Though the DoAH is responsible for monitoring the AI services, especially those provided trained rural youth, they are not able to do this effectively.

The same is the case with BLDA which has no dedicated staff on its own, other than the few which have come through deputation from other departments including the DoAH. Though BLDA is in charge of implementation of breeding policy, it has effectively no capacity to do so. Lack of non-adherence to the breeding policy due to inappropriate semen allocation and use in AI services has already resulted in increased blood levels beyond 50% among crossbred animals and high incidence of infertility and repeat breeding. BLDA also lack sufficient resources. One of the most important points to note here is that BLDA also lacks autonomy which similar livestock development agencies in other states have and it is headed by staff on deputation from DoAH.

Bihar has several different milk value chains but only COMFED receives government support. Private milk processing and marketing organizations are not getting institutional support in Bihar (Singh et al, 2010) but without recognising and enhancing their investments and contribution, the dairy sector in Bihar won't realise its full potential. For instance, a large number of small-scale processors producing different cottage products need support to enhance the quality of their products and efficiency of their enterprise. Similarly, there is a lot of scope for setting up private dairy enterprises in the state to process and add value to the increasing milk supply. But there is no shared understanding on the role of private sector in dairying in the state.

Institutions

Some of the institutions (habits and practices) that are constraining joint exploration and action among these different actors are as follows:

Limited capacity for program implementation:

One of the reasons for poor implementation of programs is the limited number of staff in the DoAH and also BLDA. As discussed earlier, BLDA lacks human resources and it has virtually no capacity to implement the state livestock breeding policy. Only very recently (December 2014), 140 veterinary graduates were appointed. The state government intends to appoint 514 more veterinary graduates in the coming years and hope this will address to some extent the shortfall in staff.

The veterinarians do need training at regular intervals (continuing education programs) to upgrade their expertise but there is no proper training infrastructure to meet these demands. Though a proposal for establishing a state veterinary training centre was developed and put forward about a year back, it is yet to get the needed approvals. BAMETI organizes a few train the trainer programs, but the number of programs is limited. Apart from veterinarians, the veterinary compounders and livestock assistants also need training. Currently they also lack training opportunities. However a few of these staff are getting training under the skill development program (Kaushal Vikas karyekram) funded by the Central Government.

The Institute for Animal Health and Production (IAHP) which is responsible for vaccine production and research hasn't been producing vaccines since 1996 due to lack of appropriate infrastructure. Over the years, the technical competence of the institute is compromised due to placement of non/low qualified staff in areas where staff with high competence is a must. Though the Krishi Road Map has emphasised the need for strengthening IAHP for disease diagnostics and research on vaccines, the progress on this front is slow.

Low morale of veterinarians:

The veterinary and animal science services are a highly specialized area and need qualified technical manpower In Bihar, the bureaucrats from the Indian Administrative Services (IAS) always had an upper hand in decision making in technical departments including Animal Husbandry. Over the past few years, the relationship between the two (bureaucrats and technocrats) have deteriorated considerably and this is quite noticeable in the Animal Husbandry sector where the Director Animal Husbandry; Managing Director, COMFED; and Project Director, BLDA are all held by officers from the IAS. Veterinarians and other key technical professionals feel that their expertise or experience is not valued by these IAS officers who often occupy these positions for a very short duration as they often get shifted to other government departments and positions in 6 months to 2 years intervals. Over the last few years, several technocrats were suspended on corruption charges and these have also demoralised the technical staff in many of these dairy/livestock agencies.

Due to lack of sufficient knowledge about procurement formalities and chances of allegations of corruption, different functionaries of DoAH and DoD are reluctant to procure inputs and equipment. Realizing this situation, the top leadership of DoAH/ DoD have been organizing trainings to relevant staff on procurement procedures in the past few months. Apart from this some changes have been made so that most procurement happen at the headquarters level and staff at lower levels of hierarchy collect materials (inputs/ equipment) from their headquarters at pre-decided prices. These are very recent developments that could have positive impacts in future.

Top down approach to planning and implementation:

Most of the programs implemented in the dairy sector are designed centrally with very little consultation with staff or communities at the grass root level. Many informants pointed out how uniform guidelines (implementation guidelines and budgets for each activities designed centrally) adversely affect the quality of program implementation. For instance, under the National Animal Disease Reporting System, desktop computers were provided to record and transmit data, but due to lack of electricity in the offices where they were provided, these are not being utilised properly. 534 computer assistants were recruited to report animal diseases and they lack technical knowledge. Both these factors have led to poor and wrong reporting and also delayed reporting. The best way to address this problem is by providing hand-held devices to veterinarians who could carry these with them and do online reporting. But there is no space to do this, even when everyone recognises the importance of quick and proper recording of animal diseases.

Varied perception on the role of private sector:

In Bihar, all efforts at dairy development are focussed on COMFED, the state cooperative milk marketing federation which only covers 44.5% of all the villages in the state. In other words more than half of the state is outside the reach of COMFED. Moreover, COMFED is only procuring around 16% of the marketable surplus. The organised private sector procures about 2-3% of the marketable surplus. This clearly shows the wide range of milk marketing arrangements in place and the need to enhance the capacities of the organised private sector and unorganised and traditional milk value chain in the state. COMFED believes that the private sector is exploitative and there is no need for promoting dairy enterprises in the private sector. This is contradictory to the policy thrust of the Department of Industries (DoI) that sees a lot of potential for value addition of milk and milk products through providing incentives to the private sector to establish dairy procurement and processing units. The private sector believes that they don't have a level playing field as they are deprived of all the benefits (loans, grants and other facilities such as provision of public space for milk marketing) which COMFED receives and as the biggest player the procurement and market prices for milk are fixed by COMFED. Smallholder dairy development in Bihar is possible only through varied support to different types of value chains. Mere focus on the milk cooperatives is not in the interest of the producers.

Underestimation of the role of knowledge in enhancing productivity and income:

Most of the interventions in the dairy sector focus on providing hard inputs and services (vaccinations, AI services, fodder seeds, cattle feed, milk collection centres etc) and there is very little emphasis on knowledge provision through extension and advisory services. Livestock extension services are almost absent not only in Bihar, but across the country. Considering the high value of livestock, farmers are seeking training in the field of animal health management, feeding and breeding (ILRI, 2014). Farmers lack knowledge on preparation of balanced ration and low cost feed formulations, use of mineral mixtures, preventive health care of animals etc. Though COMFED and the DoAH offer few training programs, their reach is very limited. The state needs an exclusive cadre of livestock extension workers and strengthening of Krishi Vigyan Kendras (KVK) and Agricultural Technological Management Agency (ATMA) with experts from the Animal Husbandry sector but there is no explicit recognition on this aspect yet.

Enabling environment

Bihar has a mixed environment for dairy development. It is very positive for the expansion and strengthening of milk cooperatives through COMFED. However, it has nothing much to offer for the other players in the dairy value chain. A lot of scope exists to enhance the capacities and contributions of the informal sector and attract more private investments in the dairy sector in Bihar. Other than the livestock breeding policy 2009, there is no specific policy on dairy or livestock in the state. Another document that articulates broad policy directions for the livestock-dairy sector is the Bihar Agricultural Road Map (GoB, 2012 a), which devotes a chapter on Animal Husbandry. Though the

National Livestock Policy (Government of India, 2013) provides broad policy guidelines for adaptation at the state level, Bihar is yet to develop a livestock policy along these lines.

The wider policy environment for dairy promotion in Bihar could be discussed under the following three headings:

Huge policy inertia

Two aspects that are going to critically affect the competitiveness of smallholder dairying in the state, namely increasing demand for fodder and the need for qualified and well trained human resources to support livestock development, are yet to receive the needed policy attention in the state.

Bihar faces severe shortage of fodder. Availability and access to quality fodder (dry and green) resources is a major constraint in livestock production in the state. Considering the extremely small size of landholding of the majority of livestock farmers, they may not be able to grow green fodder to feed their cattle. However there is a lot of scope for developing fodder entrepreneurs who grow fodder for the market and develop a local market for green fodder. State government intervention in fodder production and marketing is non-existent in Bihar. Fodder marketing in Bihar has no formal organized structure or formal institutional support. However, the government arranges to supply dry fodder and provides transportation support during floods. Fodder production and marketing does not feature in the 'Road Map for Agriculture and Allied Sectors' by GoB, nor does fodder marketing feature in any dairy development programs in the state. (Singh, 2013 Fodder).

There hasn't been any expansion of veterinary support infrastructure over the last two decades in the state, while the number of livestock units has almost doubled during the same period. The Report of the Advisory Committee on Animal Husbandry and Dairying (Planning Commission, 2009) pointed out the need for additional 101 veterinary hospitals and 1630 veterinary dispensaries in the state. As the state lacks any veterinary polyclinic, the report has suggested establishment of one veterinary polyclinic in each district. These recommendations are yet to get the needed policy attention at the state. The state also lacks adequate staff at all levels (including veterinarians) to even fill the existing positions which has compromised the quality of all other investments in the livestock-dairy sector in the state. The only veterinary college in the state produces about 20 graduates in a year (though the intake is 60). There is no policy or program on Human Resource Planning and Management in the livestock dairy sector in the state. With dairy farming becoming more knowledge intensive, the sector needs more and better qualified staff (veterinarians, livestock assistant, veterinary compounders, dairy extension personnel, AI workers, etc) that also benefit from continuing education. It remains to be seen when and how the state is going to recognise the need for responding to this situation.

Another gap in policy is the issue related to quality of feed, drugs and vaccines and also milk and milk products. The responsibility for monitoring quality and enforcing standards all lie outside the dairy-livestock actors, namely, Department of Civil Supplies, State Drug Control Authority (Department of Health), Commissioner Food Safety (Department of Health), respectively. The regulatory mechanisms in place are currently weak and many of these products sold do not conform with the specified standards. Addressing quality is not merely about enforcing standards, but is also about educating the producer, manufacturer and consumer. Without an operational policy framework that covers both enforcement and education, issues around quality are not going to be addressed effectively. However, there are no efforts in this direction.

Lack of policy Implementation Capacity

This is clearly evident in the case of implementation of the state animal breeding policy the state brought out in 2009. It is not yet clear whether there is lack of willingness or capacity or both in promoting or enforcing this policy. As per the breeding policy the entire state is divided into nine zones and for each zone specific breed is identified. On the basis of breeding policy, AI protocol has to be implemented. The responsibility for implementing this policy rests with the BLDA. But the BLDA has no capacity to implement this policy due to lack of manpower and resources.

The Special Task Force on Bihar constituted by the Planning Commission (2008) noted that "the Government must recognise that semen production and genetic improvement program are highly specialised activities and therefore must ensure that these activities are managed by professionals having specialised skills and knowledge". In Bihar, there is no professional leadership or oversight on AI services. AI services are performed by a large number of agencies including DoAH, BLDA, COMFED, NGOs such as BAIF and JK Trust and the large number of private providers. Everyone is free to bring frozen semen from different sources and there is no monitoring of the movement and use of frozen semen and recording of their use. It is virtually free-for-all as far as AI is concerned in Bihar and increasing incidence of in-breeding/ repeat breeding and infertility is an outcome of this indiscriminate use of semen for AI.

Ineffective policy learning

There is no effective mechanism for drawing lessons from the past and ongoing interventions or to share these lessons for better design and implementation. Lack of trust and respect between the technocrats and the bureaucrats and the resultant low morale of technocrats has also contributed to this lack of policy learning. For instance the deficiencies in the current reporting of animal disease are well known within the DoAH. But there is no willingness to try alternative means of addressing this deficiency through provision of hand-held devices to the veterinarians. Similarly there are instances of disease outbreaks even after vaccination (eg; FMD). But there is no urge to fix this problem by understanding the source of the problem which could be lack of adherence to vaccination protocols or deficiencies in the cold chain management (refrigeration) or even the quality of vaccine itself.

There is no interest to learn from interesting approaches that have been tried in dairy service delivery, such as the one piloted by Indian Grameen Services (IGS) and ITC in Munger, Bihar where farmers receive integrated support covering AI, vaccination, training on improved animal husbandry practices and services of a veterinary specialist (IGS, 2013). Similarly, there is little interest in learning from the good work practices by some of the Livestock Development Agencies in other states and making the needed changes within BLDA.

There has also not been a shared position on the role of the private sector and on ways of creating synergies between the cooperative and private sector. A huge untapped market for milk, ghee, butter, lassi, curd, paneer, Ice Cream, Gulabjamun, Rasogulla, Kalakand etc. exists in the state on a perennial basis and the demand is growing. The DoI clearly recognises this and dairy processing is an area recognised by it for providing support. ITC, one of India's major food industries, is currently setting up a new milk processing plant at Munger which would process 1.5 lakh litres of milk daily to produce skimmed milk powder and butter. There is a need to learn about the contribution of the organised private sector and also the traditional milk marketing channels which still controls about 85% of the milk supply chain in Bihar and develop measures to enhance their capacities and contributions. However, the Krishi Road Map (GoB, 2012a) is totally silent on its support to the private sector and all the assistance is earmarked for supporting milk cooperatives.

Discussion: where do we go from here?

The diagnosis of the dairy innovation system in Bihar clearly reveals the diversity of organizations that needs to be roped in to promote smallholder dairying in Bihar. Clearly the sector needs coordination and collaboration among the wide range of actors. This is not easy considering the low level of trust among the different actors, low morale of veterinarians, the tradition of working independently and the weak capacities for coordination. There is policy incoherence or in other words lack of synergies between agricultural/livestock policy objectives (as articulated in the Krishi Road Map) and objectives of organizations outside it (such as Industry, Health, Education, Research, Skill development, etc) and without addressing these policy bottlenecks (which affects the performance of each actor individually and also collectively as a system) the sector is not going to witness real progress.

Addressing this policy incoherence needs actions at different levels:

Firstly, there is a need to create a multi-stakeholder consultation forum/platform to share and discuss the nature of interventions each organization is playing in the dairy-livestock sector. This group could be called as "dairy innovation platform" or as "Dairy Innovation Policy Working Group"(DIPWG) and it should comprise representatives of the public, private, cooperative and NGO (Non Government Organization) sector meet at regular intervals to examine, comment and evaluate different policies and interventions in the dairy-livestock sector. Such a forum doesn't exist now and there is an increasing recognition among the stakeholders on the need for such a platform. This platform should be hosted by an organization identified by the stakeholders and should play an advisory and learning function and its activities (meetings and other interventions it identifies) should be funded.

Secondly, there should be a program to enhance the leadership and coordination role of the DoAH and the BLDA and this would require conducting an organizational and Management (O&M) review of these organizations. This would involve an analysis of factors that are important for improved performance including systems, processes, partnerships and people related issues and acting on these. Both these organizations are important for successfully steering the dairy sector in the state to new heights but both of them have weak capacities to do this currently. The findings from the O&M review can help in reforming these two agencies to take a more aggressive role in enhancing the innovation capacity of the dairy sector.

Thirdly, there is a need for creating an interactive policy research around the DIPWG that support it with analysis of evidence and experiences on what is going on in the state and elsewhere and help it with evaluating different options. This research group should respond to the knowledge demands of the DIPWG and support it with developing the right policy options to address say problems related to fodder, human resources or ways of enhancing the contributions of the private sector.

Conclusions

The smallholder dairy sector in Bihar faces several institutional and policy challenges.

The different actors in the dairy innovation system are unable to bring about synergy as there is no mechanism that brings these different agencies on a common platform.

There is a need to enhance the capacities of the two organizations namely DoAH and BLDA in taking a lead role in dairy-livestock development and sector coordination. Merely increasing investments for

AI, feeding, health and milk collection, although necessary is not sufficient for bringing about sector competitiveness.

Policy reforms are long due and this would require a three-pronged approach that addresses policy gaps, enhances capacities for policy implementation and facilitates policy learning.

References

DoAHDF.2014. Basic Animal Husbandry and Fisheries Statistics, Ministry of Agriculture, Department of Animal Husbandry, Dairying and Fisheries, Krishi Bhavan, New Delhi. (available at http://dahd.nic.in/dahd/WriteReadData/Final%20BAHS%202014%2011.03.2015.pdf)

GoB. 2012a. Agricultural Road Map. Government of Bihar. (available at http://krishi.bih.nic.in/roadmap2012.htm)

GoB. 2012 b. Bihar Basic Animal Husbandry Statistics, Department of Animal and Fisheries Resources, Government of Bihar, Patna, Bihar. (available at http://ahd.bih.nic.in/Docs/BAHS-2012.pdf)

Government of India. 2013. National livestock Policy 2013. Ministry of Agriculture, Department of Animal Husbandry, Dairying & Fisheries, Government of India. (available at http://www.dahd.nic.in/dahd/WriteReadData/NLP 2013 Final11.pdf)

Hall, A.J., Yoganand, B., Sulaiman, R.V., Raina, R., Prasad, S., Naik, G., and Clark, N.G., (eds). 2004. Innovations in Innovation: Reflections on Partnership and Learning, International Crops Research Institute for Semi Arid Tropics (ICRISAT), Hyderabad and National Centre for Agricultural Economics and Policy Research (NCAP), New Delhi

Hall, Andy and Sulaiman R.V., Tesfaye Beshah, Elias Madzudo and Ranjitha Puskur. 2009. Agricultural innovation system capacity development: Tools, principles or policies? Capacity.org, 37: 16-17(available at https://cgspace.cgiar.org/handle/10568/304?show=full)

ILRI. 2014. Smallholder dairy value chain development in India and selected states (Assam and Bihar): Situation analysis and trends Intercooperation Social Development India July 2014. (available at https://cgspace.cgiar.org/bitstream/handle/10568/35469/PR_pr_sturation_analysis_India_web.pdf?sequence=11)

IGS. 2013. Development of dairy services for small and marginal farmers, Munger, Bihar. Annual Progress Report 2012-13. Indian Grameen Services.(available at http://www.biharinnovationforum.in/_submitted_doc/application_no000786.pdf)

Klerkx, L. and Leeuwis, C. 2009. Establishment and embedding of innovation brokers at different innovation system levels; insights from the Dutch Agricultural Sector. Technological Forecasting and Social Change, 76(6) 849-860. (available at http://www.sciencedirect.com/science/article/pii/S0040162508001777)

Kumar Anjani. 2010. Milk Marketing Chains in Bihar: Implications for Dairy Farmers and Traders. Agricultural Economics Research Review. Vol 23, pp: 469-477.(available at http://ageconsearch.umn.edu/bitstream/96922/2/10-Anjani-Kumar.pdf)

Pandey A. 2015. Livestock policies and its impact on India and Bihar state. Journal of Agricultural Economics and Rural Development. Vol 1(1), pp: 002-011(available at http://www.academia.edu/10262886/Livestock_Policies_and_its_Impact_on_India_and_Bihar_State)

Planning commission. 2008. Bihar's agricultural development: Opportunities and Challenges. A Report of the Special Task force on Bihar. Government of India. New Delhi. (available at http://planningcommission.nic.in/aboutus/taskforce/tsk_adoc.pdf)

Planning commission. 2009. Report of Advisory Committee on Animal Husbandry & Dairying Volume II [State Specific Reports]. Planning Commission, Government of India, Yojana Bhavan, New Delhi. (available at http://www.indairyasso.org/Volume-II.pdf)

Singh K.M, Singh R.K.P, Jha A.K & Meena M.S. 2010. Dynamics of Livestock Sector in Bihar: A Temporal Analysis. Agricultural Situation in India. Vol LXVI(13), pp: 687-702.(available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1904425)

Singh R.K.P. 2013. Livestock research and development priorities for Bihar and Odisha. IFPRI.(available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2391607)

Singh, K.M., Singh R.K.P., Jha A.K., Abhay Kumar, Anjani Kumar & M.S . Meena. 2013. Feed and fodder value chains in Bihar: Some empirical evidences. (available at http://mpra.ub.uni-muenchen.de/48651/)

Sulaiman, R.V., Andy Hall, Vamsidhar Reddy, T.S. and Kumuda Dorai. 2010. Studying Rural Innovation Management: A Framework and Early Findings from RIU in South Asia. RIU Discussion Paper Series # 2010-11, December 2010, Research Into Use (RIU):UK.(available at http://www.crispindia.org/docs/5 Studying Rural Innovation Management.pdf)

World Bank. 2006. Enhancing Agricultural Innovation: How to go beyond the strengthening of research systems. Agricultural and Rural Development Department. Washington D.C: The World Bank. (available at http://siteresources.worldbank.org/INTARD/Resources/Enhancing_Ag_Innovation.pdf)

World Bank. 2012. Agricultural Innovation Systems: An Investment Source Book (Modified from Rivera et.al. n. d.)(available at http://siteresources.worldbank.org/INTARD/Resources/335807-1330620492317/9780821386842.pdf)

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