



## Bihar State (India) smallholder dairy value chains impact pathways narrative

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# Smallholder dairy value chain problem context <sup>1</sup>

Bihar's (India) dairy sector is considerably characterized by low input-low output production systems. A significant percentage of dairy farmers own unproductive and uneconomically small herds of approximately 3 heads of cattle per household. Farmers mostly rely on extensive grazing and minimal use of external inputs. Moreover, over 80% of the labor force, especially for dairy production, is provided by women who also face inadequate access to inputs and services. On the other hand, Bihar produces about 5.5% of India's total milk output. This output, consisting about 80% of Bihar's marketable surplus, is mainly produced by the landless and smallholder producers. The dominance of smallholder in this sector presents several value chains challenges including the need for quality maintenance as the state struggles to improve its export potential and look for alternative dairy market outlets. Smallholders reliance on low input-low output production systems is also associated with the widespread low productivity across the value chains. The major underlying causes of low productivity include: poor genetic potential of dairy animals (cows and buffaloes), inadequate access to quality feeds and fodder, inadequate inputs and service delivery arrangements, deficient knowledge management and delivery systems and low value addition along the dairy value chain.

Inadequate access to quality feeds and innovative feeding practices are among the leading causes of low productivity. Feed cost accounts for as high as over 70% of total dairy production cost. High cost of feed and feeding is primarily due to land scarcity, the lack of locally available feed ingredients and the inadequate access to information and skills by smallholders to produce quality feeds. Land scarcity, compounded with widespread livestock keepers' landlessness, has led to a rapid decrease in grazing grounds as most land is converted into agricultural land. Consequently, there is a stiff competition for food between humans and animals as animal populations continue to rise at an alarming rate; thus increasing the price of cereals, including maize, which have commonly been used as substitute fodders and concentrate ingredients. Moreover, available fodder is of poor nutrition quality since farmers lack appropriate and quality fodder seeds as well as the knowledge and skills to produce quality fodder. In addition, the overall demand for supplemental feeding among smallholders is low due to several factors including: 1) feeding concentrates to low productive dairy animals (local breeds) being uneconomical, 2) farmers mostly rely on traditional feeding practices, and 3) concentrates are relatively expensive for smallholder dairy producers. Inadequate knowledge of feeds and feeding and skills has also contributed led to farmers poorly mixed feeds being inconsistently and improperly fed to dairy animals.

Low productivity has also been associated with the poor genetic composition of dairy animals that most smallholders own. Dairy cows and buffaloes are mostly of local breeds and of low productivity potential. Even among the few smallholders who keep cross-bred

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<sup>1</sup> This problem context is synthesized mainly from the India dairy value chains business case presented in the Livestock and Fish CGIAR research program proposal, the India dairy value chains situational analysis and deliberations at the Bihar (India) dairy value chains stakeholder workshop.

animals, conception rates remain miserably low, estimated at below 40%, due to deficient access to quality germplasm and Artificial Insemination (AI) services. Overall, the production and delivery of genetic materials is highly deficient. To begin with, the sector constitution of numerous multiple players complicates efforts to regulate the sector besides stretching the capacity of institutions implementing dairy development policies, particularly the breeding policy. Poor infrastructure and inadequate technical support have jeopardized smallholders' access to quality germplasm and semen and to recommended dairy management practices.

Absence of viable and appropriate input and service delivery mechanisms has also been associated with the widespread low productivity. Smallholders have poor access to veterinary services besides the services being provided by private actors who are mostly profit motivated. Service provision is fragmented, uncoordinated, non-integrated and not closely tailored to the specific needs of smallholders. As a result, service providers are unable to provide services and inputs at low transactions costs to enable smallholder farmers to breakeven. Moreover, smallholders' inability to access appropriate and locally based knowledge systems limits them from adapting to new innovations and continuously providing feedback to improve the performance of the value chain.

Finally, the low value addition along the value chain and poor marketing of dairy products has significantly affected the development of the dairy value chains. A significant quantity of milk is marketed unprocessed and unpackaged. This has raised several quality concerns regarding dairy products from Bihar. Whereas this has enabled poor households in Bihar to access this milk it has negatively affected the state's export potential and its efforts to open up the sector to new and alternative dairy markets. The second quality concern has been mentioned as the widespread use of chemical preservatives to reduce milk spoilage. The use of chemical is aggravated by the lack of standards and adequate capacity (equipment and personnel) to monitor the chemical usage and disposal, largely due to the absence of pro-poor low cost postproduction handling innovations.

## Vision and long term goals

The Livestock and Fish (L&F) CRP's vision statement for Bihar state (India) smallholder dairy value chain is:

“By 2023, Bihar dairy value chain would be an equitable and sustainable dairy value chain in India producing enough milk that benefits poor small-holders, consumers and other poor actors”.

The program intends to achieve the vision through the following goals:

1. Improving access to quality inputs and services in order to efficiently achieve dairy system-wide productivity with the poor value chain actors as the focal targets.
2. Improving access to reliable, well-coordinated and efficient dairy products marketing arrangements with resultant improvement in household income and livelihoods of the poor.
3. Poor consumers have improved access to quality, safe and nutritious dairy products at affordable prices to increase their per capita consumption of dairy products.

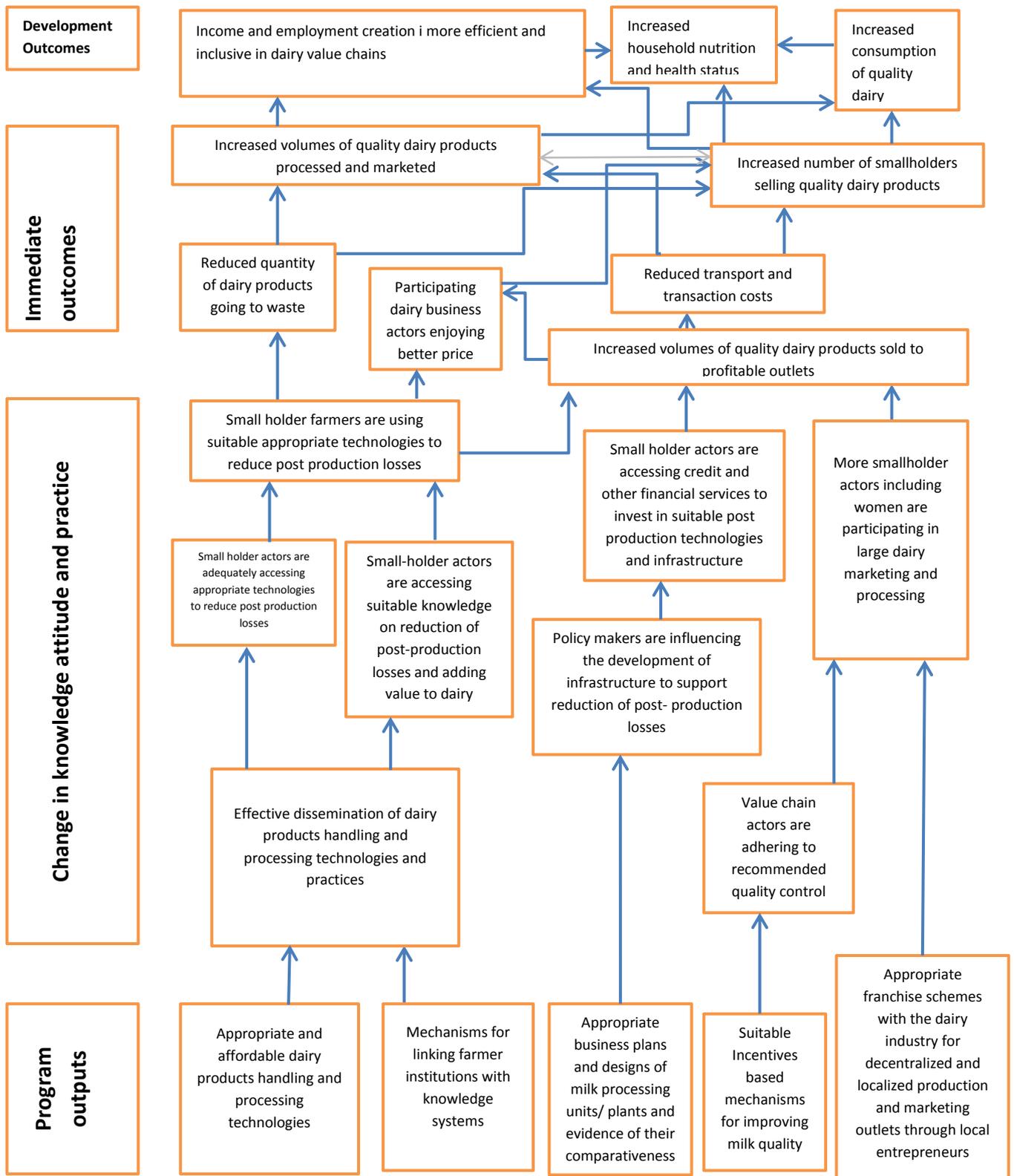
# Value chain impact pathways

Livestock and Fish CGIAR program approach in Bihar state (India) dairy value chain will lead to several long term positive changes in direct benefits of target beneficiaries (development outcomes), particularly the poor smallholder value chain actors. Smallholder poor beneficiaries will: 1) increase milk production per animal, 2) have increased income and employment opportunities along the value chain, 3) have improved household nutrition and health, 4) enjoy an overall improvement in the investment and policy environment, 5) have an overall increase in the supply of dairy products in the value chain and 6) experience a reduced pressure on the environment and the ecosystem. These long term changes will be arrived at via five identified impact pathways:

- 1) Innovative and appropriate strategies and technologies for improving postproduction handling of dairy products.
- 2) Institutional arrangements for farmers' sustainable access to knowledge, inputs and services.
- 3) Dairy animal genetics technologies and strategies for improving the productivity of dairy animals.
- 4) Nodal institutions to enhance linkages among value chain actors and influence policy.
- 5) Innovative technologies and strategies to reduce cost of dairy production.

## **Impact Pathway 1: Innovative and appropriate strategies and technologies for improving postproduction handling of dairy products**

Smallholder dairy farmers across Bihar face the challenge of reducing the high levels of post-production losses resulting from the inadequate access to appropriate and affordable post production innovations. By facilitating the development of appropriate and affordable dairy products handling and processing innovations, developing effective mechanisms to link farmers' institutions with knowledge systems, developing appropriate milk processing plans and innovative milk marketing models and generating evidence of appropriate marketing models, this research program will increase the number of smallholders participating in dairy marketing and the increase in the volume of marketed dairy product will eventually lead to better incomes, more employment and better nutrition and health outcomes for a significant number of poor value chain actors (Figure 1). These changes will also be realized through the promotion of suitable incentive-based mechanisms for improving milk quality and developing locally based franchise schemes that promote decentralized and localized production and marketing arrangements.



**Figure 1: Innovative and appropriate strategies and technologies for improving postproduction handling of dairy products impact pathway.**

The causal logic embedded in this impact pathway follows that combining the development of affordable and locally appropriate dairy processing technologies, information and efficient delivery systems will encourage smallholders to adopt innovations that will directly lead to lower post-post production wastage and increase the profit margins across value chain actors. It also follows that through the development and testing of these innovations and generating credible evidence, policy makers will be encouraged to create conducive environment for increased investment in the Bihar dairy processing industry. An improved investment and policy environment will enable smallholder to access alternative and profitable market outlets to improve their profit margins. Similarly, other actors along the value chain will enjoy better and equitable profit margins resulting from the reduced transaction costs. Again, the promotion of incentive-based mechanisms to improve milk quality combined with the promotion of locally adapted franchise dairy marketing schemes will allow smallholder farmers to enter more profitable dairy markets at lower transaction costs and thereby increase their income and employment opportunities.

The development of appropriate dairy processing and dairy handling technologies require the close engagement of several actors in designing and piloting action research for prioritized innovations, generate evidence and influence policy. Key actors will include: National Dairy Development Board (NDDB) and COMFED, research institutions including ICAR-RCER, ILRI, NDRI, IVRI, Bihar Veterinary College, Sanjay Gandhi Institute of Dairy Technology, and DST. Actors for ensuring that technologies are effectively disseminated include Animal Husbandry Department (AHD), Dairy Development Department (DDD), NRLM, BRLPS, NDDB/ COMFED, private dairies and relevant NGOs. Infrastructure development will require that smallholder tailored processing and marketing innovations are profitable to financial institutions and private entrepreneurs. Lastly, policy support and influence will mostly require the program's close collaboration with appropriate Government departments, financial institutions, civil societies and NABARD.

## **Impact Pathway 2: Institutional arrangements for farmers' sustainable access to knowledge, inputs and services**

A deficient input and service delivery system has been reported as a central bottleneck to improving productivity among smallholder dairy farmers in Bihar. By combining the development of strategies to effectively communicate dairy innovations, developing tools to enhance value chain actor networks including the use of ICT and integrating local knowledge in knowledge systems, the L&F CGIAR program will contribute to improving farmers' access to inputs and services (Figure 2). Furthermore, the program will facilitate the development of robust but novel and locally adapted platforms to more efficiently deliver innovations to smallholder farmers. Similarly, the development and testing of business models to decentralize and localize input supply through creation of partnerships with private input retailers and suppliers in combination with creating mechanisms to enhance the development of inclusive, democratic and legally structured institutions of livestock farmers will improve inputs and service delivery by reducing transaction costs of their acquisition and delivery. It is likely to be through lessening these bottlenecks, especially those linked with input and service delivery, that dairy productivity will be enhanced and farmers and

smallholders will eventually enjoy the ultimate benefits of improved income, employment opportunities, improved household health and nutrition.

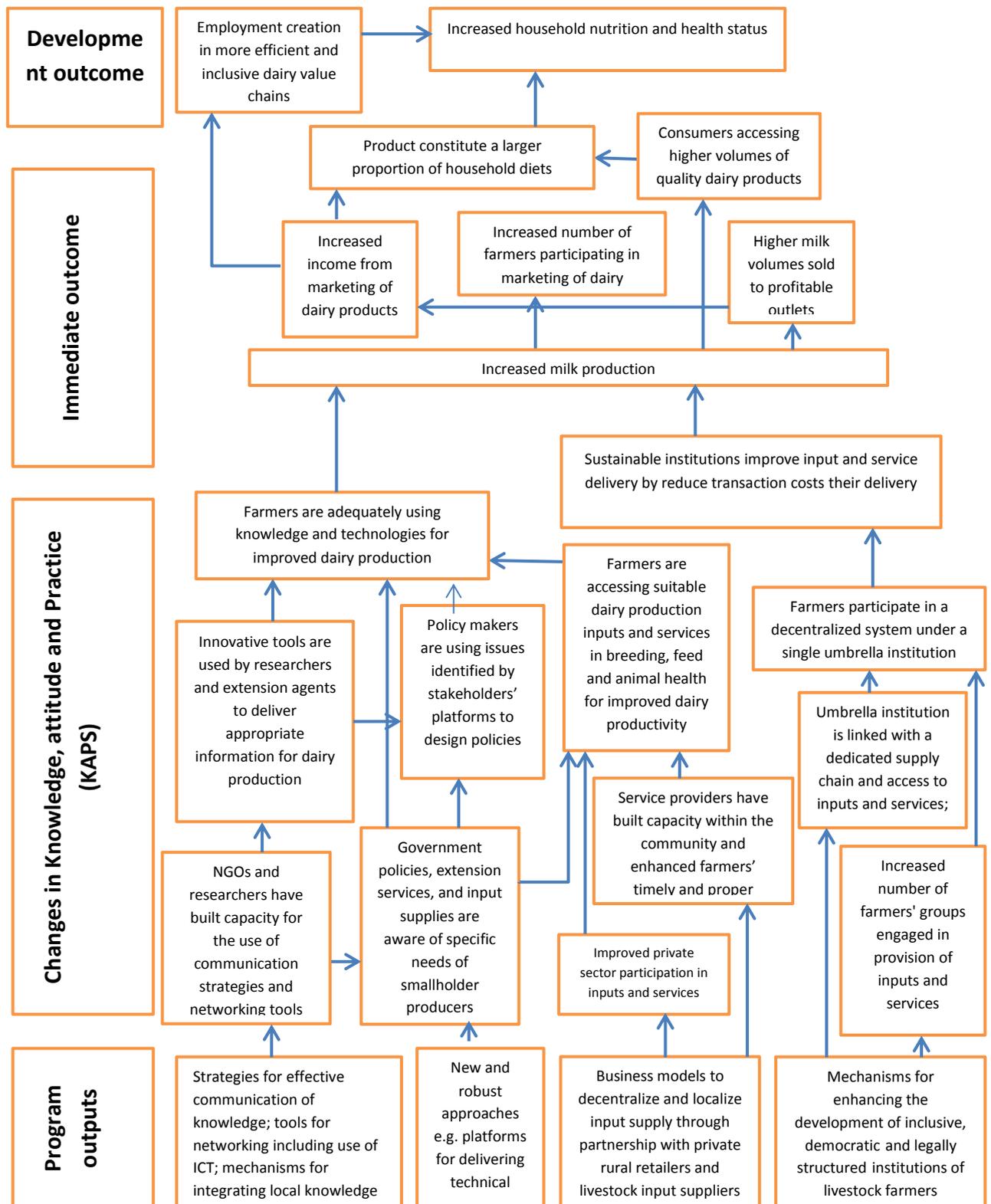


Figure 2: Institutional arrangements for farmers' sustainable access to knowledge, inputs and services.

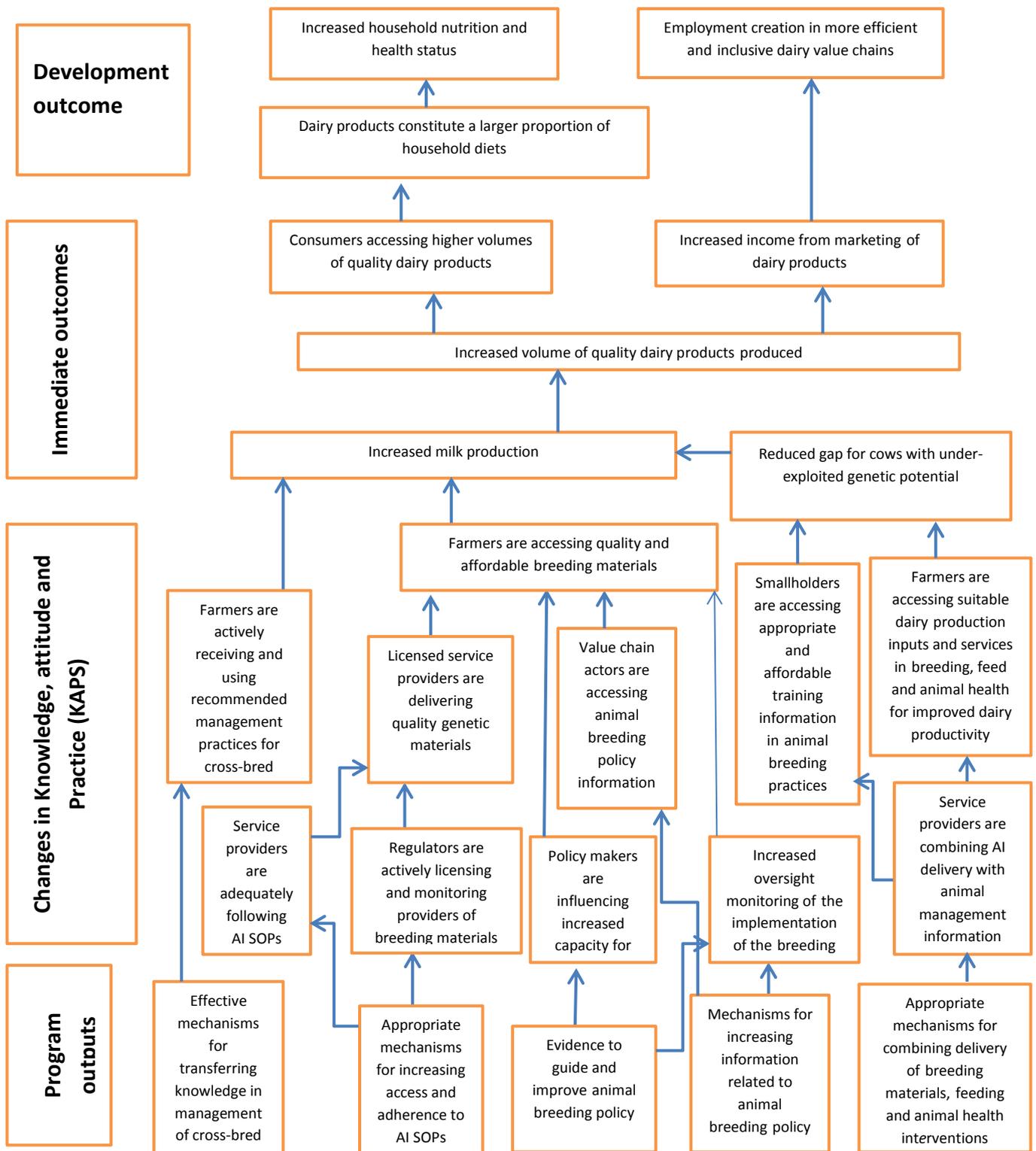
Overall improvement in productivity is likely to result from farmers actively and properly using dairy production knowledge and innovations and farmers' institutions sustainably improving inputs and services delivery and reducing transaction costs of inputs and service delivery. Farmers' active and proper use of knowledge and innovations will demand that the program engages researchers and "next users" in developing and using highly innovative strategies and mechanisms to effectively communicate and deliver information associated with these innovations. This will include the use of novel ICT applications and development of new methods of building actor networks and ensuring that local knowledge is used to enhance the performance of these innovations. Secondly, innovative stakeholder platforms will become the principle channels through which policy makers will be informed of the specific needs of smallholders to enhance the development of pro-smallholder dairy producer policies.

Besides the efficient delivery of knowledge and information, the program will also need to work closely with the private sector in developing and testing novel business models that decentralize and localize input supply through locally based input retailers and suppliers. Successful reduction of transaction costs for input and service delivery will require the program to facilitate development and piloting of inclusive, democratic and legally structured institutions of livestock farmers including those of share livestock herders. These models will then lead to increased number of livestock farmer groups acting under umbrella institutions and getting linked with dedicated inputs and service providers. The program will need to collaborate closely with actors including livestock farmers, research institutions, regulators, financial institutions and communities of practitioners.

### **Impact Pathway 3: Dairy animal genetics technologies and strategies for improving dairy animal productivity**

Low dairy animal productivity largely resulting from inadequate access to genetic materials and animal breeding information has consistently constrained the developing the Bihar (India) dairy value chain. As a pathway to improving productivity and eventually generate more smallholder income, employment opportunities and health and nutrition outcomes, the program will focus on increasing farmers' access to quality breeding materials and information (Figure 3). This will also involve transferring appropriate knowledge for better management of improved dairy animals, novel strategies to increase smallholders' access to information on AI Standard Operating Procedures (SOPs) and the overall breeding policy, producing and packaging quality information to improve the breeding policy and developing and testing appropriate mechanisms for coupling genetic material delivery and other dairy management inputs and services.

Improved productivity will mainly happen through 3 channels: 1) farmers actively receiving and using recommended management practices for improved animals, 2) farmers actively receiving affordable and quality breeding materials and 3) actors exploiting the genetic potential of indigenous animals.



**Figure 3: Dairy animal genetics platforms and strategies for improving dairy animal productivity impact pathway**

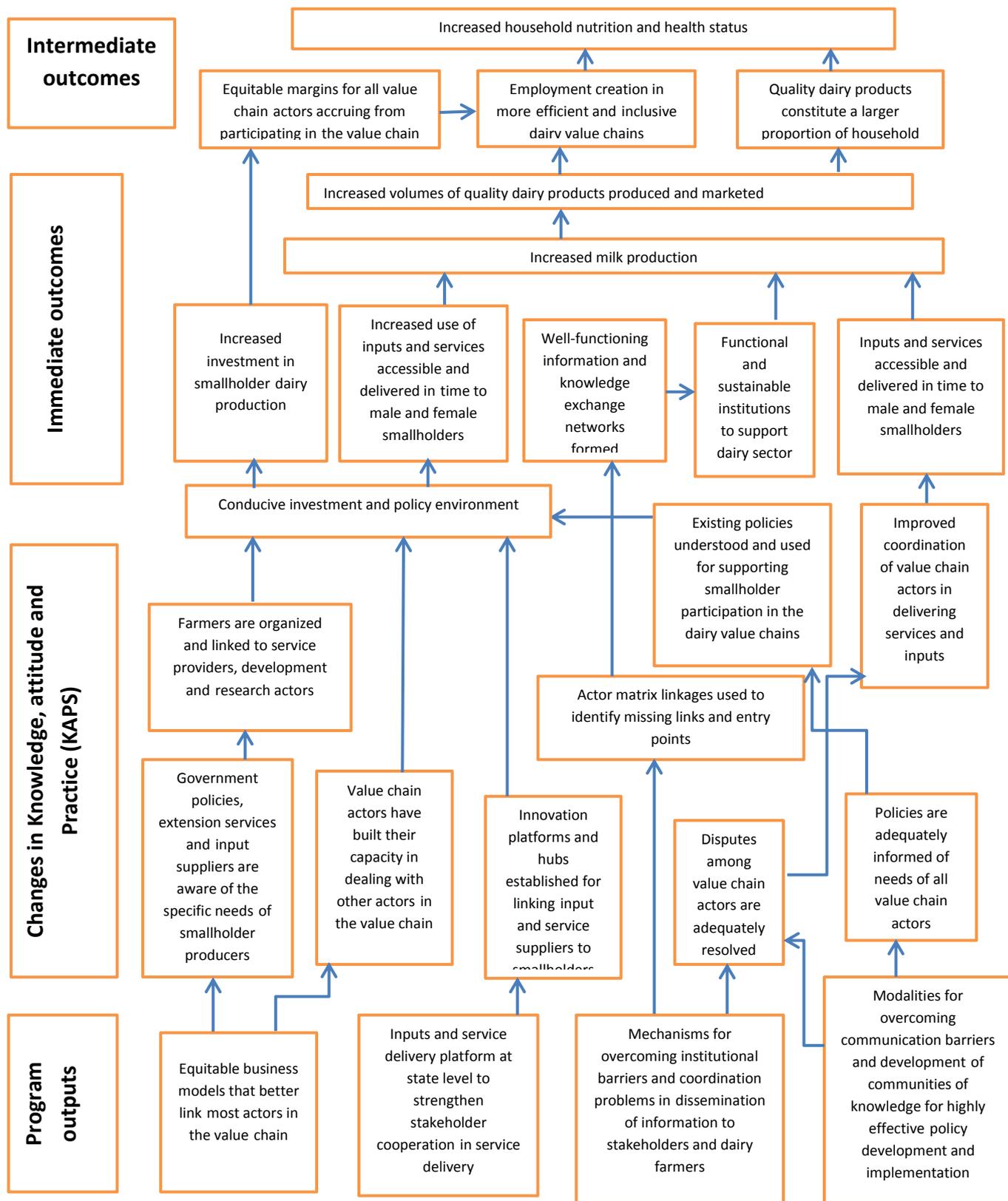
First, it is assumed that by service providers actively following provided AI SOPs, regulators efficiently monitoring and managing the delivery of breeding materials, value chain actors receiving adequate information about the breeding policy and that there is increased oversight of the implementation of the breeding policy, smallholders access quality and

affordable breeding materials. Similarly, by addressing existing productivity gaps of indigenous dairy animals, including the improper feeding and management practices, smallholders will produce more milk production from local indigenous animals. Some of the key actors to collaborate with along this pathway will include: regulators, government livestock related institutions, farmers, policy makers, private AI suppliers and NGOs.

#### **Impact Pathway 4: Nodal institutions to enhance linkages among value chain actors and influence policy**

Across Bihar (India) state, provision of services to smallholders is fragmented, uncoordinated, non-integrated and not tailored to specific needs of smallholders. As a result, service providers are unable to provide services and inputs at low transaction costs to enable smallholder to breakeven (Figure 4). This has mostly been associated with the absence of strong linkages among value chain actors. Through the development of business models that can better link actors in the value chain, creation of state level actor platforms, development of modalities/strategies to overcome institutional and coordination barriers for transferring knowledge and developing novel strategies to overcome communication barriers to influence policy, this program will create a conducive environment to increase investment in the value chain and improve animal productivity to ultimately improve smallholder income, increase employment opportunities, and improving household nutrition and health.

It is assumed that once government agents and service providers are aware of the specific needs of smallholders, they will create the conditions favorable for smallholders to get organized and linked with input and service providers. Similarly, once state-wide innovation platforms and dairy marketing hubs are created and are linked with numerous input and service providers, and value chain actors have also built their capacity to deal with other actors, it is anticipated a favorable environment conducive for generating appropriate smallholder tailored policies and for increased investment in the value chain will be created. In the same regard likely that the resultant conducive environment will evolve from generated policies being based on adequate understanding of the needs of all value chain actors. The resultant improved environment will act as the engine for catalyzing overall value chain performance improvements leading to delivery of improved benefits to smallholder actors. It is also assumed that improvement in the policy and investment environment will translate into better value chain productivity as farmers gain unimpeded access to inputs and services. Moreover, once actor matrices are well-defined, articulated and used to identify missing actor linkages, entry points and institutions are used to actively resolve disputes among actors, well-functioning knowledge and information exchange networks will emerge and lead to increased productivity among smallholder. Overall, it is the increased coordination among value chain actors that will facilitate smooth delivery of inputs and services to farmers resulting in higher productivity and the delivery of the final benefits to value chain actors.



**Figure 4: Nodal institutions to enhance linkages among value chain actors and influence policy impact pathway**

## **Impact Pathway 5: Innovative technologies and strategies for reducing production costs**

Finally, inadequate access to innovative dairy production technologies, especially in animal feed and feeding, is rated highly among factors that have rendered dairy production in Bihar to be costly. Besides a good number of available technologies and practices are less locally adaptable to smallholders' contexts. The program's strategy is that by working closely with target communities, through action research, and developing appropriate and cost effective innovations in animal feed and feeding and health, generating evidence of the competitiveness of these innovations and designing efficient mechanisms for their delivery, smallholders will eventually realize increased household income and better nutrition status (Figure 5). Furthermore, the environment will be less damaged as smallholder adopt and use efficient and environment friendly innovations. Examples of novel and appropriate innovations that might become the focus of this program include developing high quality fodder varieties, improving food-feed crops through crop improvements, use of bi-products from bio-energy production for feed production, novel dairy feeding practices, low cost and easy to use disease detection kits, low cost disease prevention and treatment strategies including developing thermal stable vaccines.

Increased productivity via this impact pathway will occur through two main routes. The first route will be through smallholders adequately accessing and using these suitable and affordable dairy production innovations once extension agents and researchers have adequately transferred information about the innovations and developed efficient and functional input and service delivery mechanisms. The alternate route will be delivery of high quality and affordable feeds, since feeding costs constitute a significant proportion of production costs. Here, the first entry point will be facilitating the development of appropriate fodder distribution systems and fodder banks. In addition, the program will focus on ensuring that farmers have adequate access to quality and affordable feeds via increased availability and utilization of locally sourced feeds and supplements. The program will also need to ensure the existence of low cost commercial feed quality control systems to prevent poor quality feeds from reaching the market. Increased availability of locally sourced feeds will be supported through the development of low cost and locally based rations and feeding practices. Evidence of the comparative advantage of alternative feed and feeding options will increase the adoption of more efficient feed innovations that are likely to reduced biodiversity loss due to milk production demanding less resources.

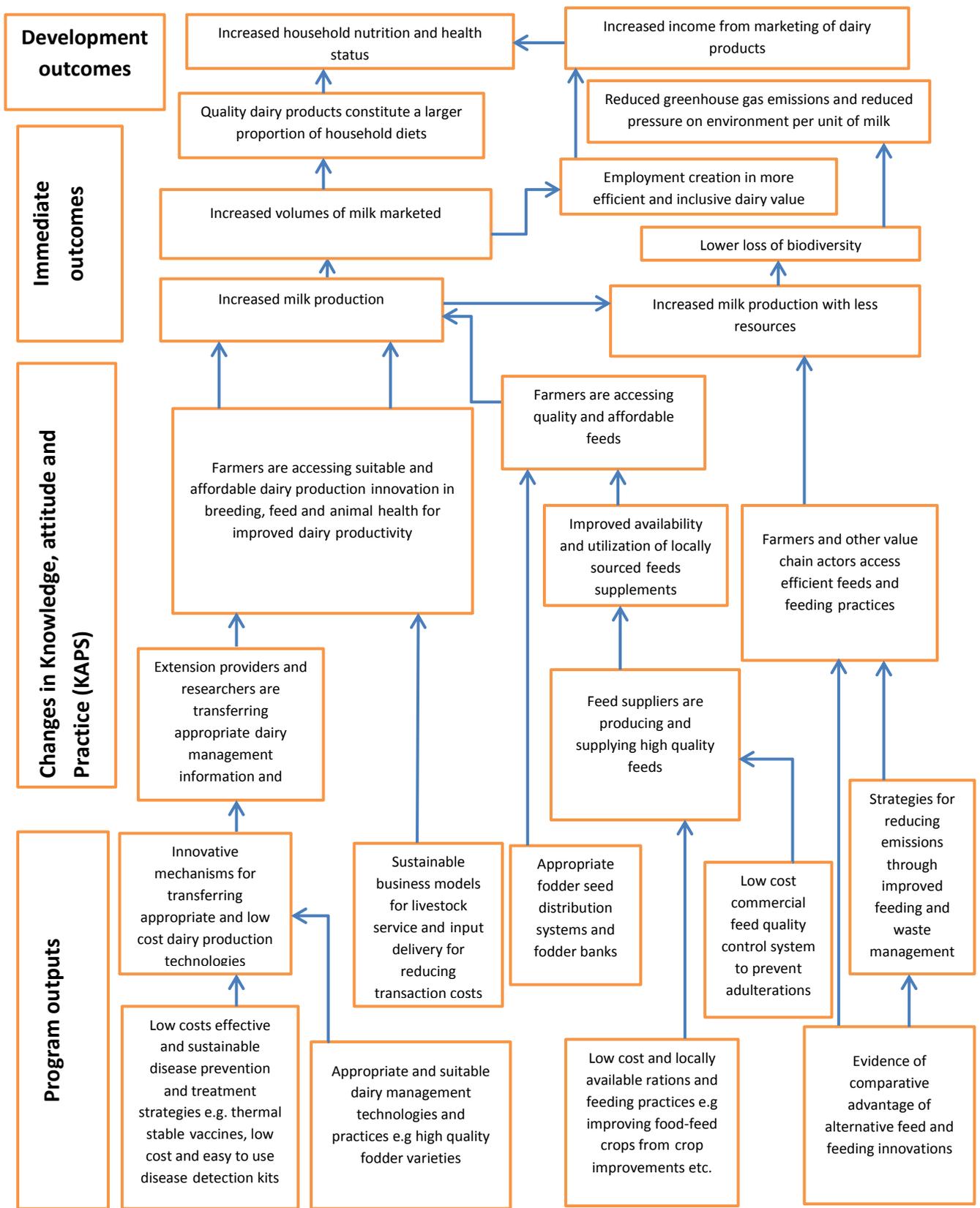


Figure 5: Innovative technologies and strategies for reducing production costs impact pathway