



**NARC**  
Nepal Agriculture Research Council

# Transforming livelihoods in South Asia through sustainable livestock research and development

Report of a Regional Meeting, Kathmandu, Nepal, 13-14  
November 2018

Compiled by Peter Ballantyne and Vijayalakshmy Kennady

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# Summary

On 13 and 14 November 2018, ILRI convened a regional meeting with partners from Bangladesh, India, Nepal and Pakistan. Together with ILRI senior staff and scientists, some 30 people from public and private institutions reviewed country development outcomes, agricultural priorities and constraints and potential contributions of the livestock sector in the region. The formal objectives were to:

1. Identify priority livestock-related development outcomes that would contribute to the Agenda 2030 sustainable goals of the participating countries in four areas: food and nutrition security; livelihoods and economic growth; health and animal welfare; and climate and natural resource use.
2. Identify and prioritize sustainable livestock-related research for development opportunities that would contribute to achieving national transformation priorities through investment in identified priority areas: dairy value chain; goat value chain; feeds and forages; and animal and human health.
3. Agree a plan to turn the conclusions and ideas from the meeting into a set of investment proposals with supporting business cases.

The meeting was opened by Habibar Rahman, ILRI Regional Representative for South Asia. He called on participants develop a roadmap to help transform the livestock sector in the region. ILRI Director General Jimmy Smith reminded participants of the importance of the livestock sector, pointing to adverse forces trying to remove livestock from the planet, and calling for renewed efforts to increase livestock productivity while protecting the environment.

Prakash Mathema, Secretary of the Nepalese Ministry of Agriculture and Livestock Development highlighted the importance of livestock in the economic development of Nepal. He said that livestock is an integral component of Nepalese agriculture, it contributes significantly to the GDP, contributes to food and nutrition security, provides employment opportunities, and supports rural economy. He argued that the productivity of livestock can grow tremendously if research can be linked to the needs of the farmers.

The meeting process had the following main elements:

- Political scene setting with high-level participation by ILRI and the governments of India and Nepal.
- Introductory presentation on ILRI's research for development approach, emphasizing its partnership elements and focus on outcomes.
- Introductory country presentations on sustainable livestock development priorities, challenges and opportunities from Bangladesh, Nepal and Pakistan.
- Participatory identification of country and regional priority outcomes and major bottlenecks and challenges in four areas: dairy development, goat development, feed and forage development, animal health.
- Six short 'inspirational' presentations illustrating specific livestock research for development lessons, insights and outcomes
- Participatory identification of potential interventions to achieve the identified outcomes in four areas: dairy development, goat development, feed and forage development, animal health.
- Informative presentation on regional livestock development challenges, opportunities and priority interventions from a SAARC perspective.
- Small group work to translate the day 1 discussions into initial country/regional project business cases or ideas that could be further developed into full investment projects. The ideas were 'pitched' to the full audience as well as representatives from USAID Bangladesh and World Bank Nepal to solicit feedback and comments to help improve the basic ideas.
- The final sessions focused on actions and next steps to take the ideas forward.

Trilochan Mohapatra, Director General of the Indian Council of Agricultural Research explained the roles of livestock in the Indian economy and its potential to increase incomes and food security. He highlighted the ways that livestock can contribute to the Indian Prime Minister's goal to double farmers' incomes by 2022. He particularly argued for enhanced regional cooperation in research and development to enhance the productivity of local and indigenous livestock breeds, expand One Health approaches, make livestock climate-resilient as well as productive and tackle animal and zoonotic transboundary diseases.

Dil Bahadur Gurung, Member of Nepal's National Planning Commission said that livestock contributes around 26.8 percent to the agricultural GDP in Nepal, giving it a vital role in increasing the incomes of smallholder farmers. He looked forward to stronger cooperation with ILRI and the other countries attending the meeting.

Drawing on the discussions on desired outcomes and challenges faced, participants identified promising livestock research for development (LR4D) interventions and drafted eight initial project ideas in four areas (dairy development, goat development, feed and forage development, animal health), which will be further refined and prioritised in the coming months:

1. South Asia dairy sector development.
2. Sustainable development of goat farmers through enhanced productivity and value.
3. Climate-smart, high yielding and nutritive forages for South Asia.
4. Interactive feed supply demand tools for South Asia.
5. Community based hill and rangeland management for sustainable livestock production in South Asia.
6. Increased availability of affordable off-farm produced feed in South Asia.
7. Utilizing and enriching crop residues and unconventional feed resources in South Asia.
8. Develop a pen-side/point of care test for PPR in sheep and goats.

These ideas are the basis for further collaboration to formulate concrete proposals for research activities in the region. They will be supported by stepped-up regional investor intelligence and engagement supported by ILRI globally and through its South Asia regional office.

Alongside the meeting sessions, discussions among ILRI-NARS leadership and potential investors on other concrete activities were fruitful, including:

- Signature of an MOU between ILRI and the Bangladesh Livestock Research Institute to undertake collaborative livestock research for development to enhance the economic status of smallholders in Bangladesh.
- Agreement in principle for ILRI to open a country office in Nepal, hosted by NARC
- Interest of ICAR to facilitate and support regional collaboration in three areas: controlling transboundary animal and zoonotic diseases, expanding the conservation and sustainable productivity of indigenous livestock breeds, and on One Health approaches to animal, human and environmental health.
- Discussions were held with the National Planning Commission of Nepal where the role of livestock was recognized as important within the upcoming national development strategy formulation.
- Discussions with Nepal Ministry of Agriculture and Livestock indicated potential areas for ILRI to collaborate to strengthen Nepal's livestock sector: feed and fodder, animal health, small ruminant value chain, dairy value chain.

- Discussions with the World Bank Nepal office and National Livestock Sector Innovation Project indicated there is interest to support ILRI inputs to a national livestock masterplan project as well as support for research activities related to value chains, feed and fodder and capacity development.
- Discussions with the Bangladesh team indicate there is interest for trilateral ILRI-India-Bangladesh collaboration on Brucella Vaccine Trials in Bangladesh.

Knowledge and communication materials from the meeting are listed in annex 3.

# Setting the scene

## *Opening remarks by Dil Bahadur Gurung, Member, National Planning Commission, Government of Nepal*

It is my great honour to be a part of this valued regional meeting of International Livestock Research Institute.

Looking at the theme of this meeting, it seems that livestock industry is becoming an important sub-sector in agriculture globally. As we all know that the demand for livestock products in developing countries has been projected to be doubled over the next 20 years. This calls for a robust investment and collective efforts in the livestock sector to have a strong research and evidence-based programming for achieving the projected demand.

This meeting has been organized in such a time, when Nepal is in the process of formulating its vision for 25 years with an overarching goal of Prosperous Nepal and Happy Nepali, a multi-dimensional and multi-sectoral national commitment. Further, this is the final year of our 14th development plan and currently reviewing its achievements and successes. The lessons and best practices learned in the fourteenth plan will be incorporated in the coming 15th five-year plan for the period of 2019-2023. Further, experiences, lessons and best practices of the region shared in this meeting will certainly benefit Nepal for developing a master plan for the livestock sector.

Livestock and crops are the major components of an integrated agriculture system in Nepal. It contributes significantly to end hunger, achieve food security and improve nutrition. SDG 2 targeted to reduce the prevalence of undernourishment and this sector is one of the major contributors to achieve this challenging target. The SDG 2 also aimed at doubling agricultural productivity and income of small-scale food producers by 2030 and maintaining the genetic diversity of farmed and domesticated animals and their wild relatives.

Livestock contributes around 26.8 percent to the agricultural GDP in Nepal, which plays a significant role in the economic development of Nepal. This sector can play a vital role in increasing the income of small holder poor farmers thereby bringing them out of vicious circle of poverty.

The Agriculture Development Strategy, a 20 year-long guiding document for the agriculture development of the country provides an appropriate road map with clearly spelt out indicators for the development of livestock sector. We have success stories of becoming self-sufficient in poultry products. We are striving to become self-sufficient in meat, milk and fish in the near future.

The International Livestock Research Institute is mandated to develop, collaborate and partner a global research program in the livestock sector. Based on this mandate, Nepal can collaborate with ILRI to develop and conduct high quality research program for the transformation of livestock sector in Nepal to make the sector more profitable.



## *Opening remarks by Jimmy Smith, Director General, International Livestock Research Institute*

Livestock production plays a major role in the life of farmers in developing countries. The livestock sector safeguards the livelihoods of around 1.3 billion people, of whom many are poor and vulnerable, creates income and employment in many regions of the world and helps to develop rural areas. Sustainable intensification, by increasing livestock productivity enhances livestock's contribution to people's livelihoods. Poverty, livelihoods and economic growth are intricately linked and, in Low and Middle – Income Countries (LMICs), livestock are key to all three. The livestock sector currently accounts for about one-third of value addition in agriculture in LMICs, a proportion that increases as countries develop economically. It provides food, income, employment and many other contributions to rural development.

Increasing per capita expenditure on quality food products and growing demand for livestock and poultry products are typical. The demand for food of animal origin, in particular food derived from meat, milk and eggs, is projected to rise significantly in many regions of the world due to the growing population, increasing purchasing power and changes in consumer behavior. At the same time, consumers are increasingly calling for livestock production to be made more sustainable and more respectful of animal welfare.

In many parts of our world diverse livestock systems play a major role in combatting hunger and malnutrition as well as reducing poverty by securing the livelihoods of many people, in particular in rural areas, and constitute an important national economic factor, for instance through promoting investment and trade and providing jobs in rural areas. The differences that exist regarding access to adequate food and nutrition, the diversity of livestock systems and production methods worldwide and the importance of the diversity of animal genetic resources and their conservation, sustainable use and development for breeding, livestock husbandry and food security.

Animal agriculture is an integral part of food-producing systems, with foods of animal origin representing about one-sixth of human food energy and one-third of the human food protein on a global basis.

Animals also consume one-third of the global cereal grain supply. In a world with human population forecast to reach 7.7 billion by the year 2020, a fixed or possibly shrinking quantity of arable land, and an estimated 800 million undernourished people, Council of Agricultural Science and Technology (CAST) deemed it prudent to quantify the net contribution of animal production to quantity and quality of the world food supply.

Consumption of meat, milk, and eggs varies widely among countries, reflecting differences in food production resources, production systems, income, and cultural factors. Per capita consumption is much higher in developed countries but the current rapid increase in many developing countries is projected to continue. Total meat consumption in developing countries is projected to more than double by the year 2020, while, in developed countries, it is projected to increase no more and, in some cases, less than population growth. Because most of the world's population is in developing countries, which are experiencing the most rapid growth rates, global demand for meat is projected to increase more than 60% of current consumption by 2020.

At low levels of intake of meat and milk, an increase in consumption of these foods is known to be nutritionally beneficial, particularly for young children. These benefits result from the higher content and nutritional availability of essential amino acids and several micronutrients including minerals

and vitamins. Thus, if achieved, projected increases in per capita intake of meat and other animal products in developing countries should improve people's nutritional status. In developed countries, on the other hand, intakes of food from animals are higher than justified by nutritional grounds alone. A decrease in intake of these foods to reduce intake of saturated fat and cholesterol has been recommended by some health scientists, but there is continuing debate about the probable benefits to the health of the general population of such a reduction.

The biological value of protein in foods from animals is about 1.4 times that of foods from plants. Thus, diverting grains from animal production to direct human consumption would, in the long term, result in little increase in total food protein and would decrease average dietary quality and diversity.

The demand for foods of both plant and animal origin in 2020, while sustaining the productive capacity of the land, will be challenging but feasible. Animal agriculture will continue to be an important part of food-producing systems. Investment in agricultural production research and development and implementation of policies that encourage production, while protecting the environment, will be essential to achieving the goal of an adequate global food supply.

*Opening remarks by Trilochan Mohapatra, Secretary, Department of Agricultural Research and Education and Director General, Indian Council of Agricultural Research, Government of India*

Livestock plays an important role in Indian economy. About 20.5 million people depend upon livestock for their livelihood. Livestock contributed 16% to the income of small farm households as against an average of 14% for all rural households. Livestock provides livelihood to two-third of rural community. It also provides employment to about 8.8 % of the population in India. India has vast livestock resources. Livestock sector contributes 4.11% GDP and 25.6% of total Agriculture GDP. He also informed India has the highest number of livestock at about 512.05 million, first in the total buffalo population in the world - 105.3 million buffaloes, second in the population of cattle and goats - 140.5 million goats, second largest poultry market in the world - production of 63 billion eggs and 649 million poultry meat and tenth in camel population in the world, world top in the milk production, second largest producer of fish in the World and third largest producer of eggs in the World

The livestock provides food items such as milk, meat and eggs for human consumption. India is number one milk producer in the world. It is producing about 165.4 million tons of milk in a year (2016-17). Similarly, it is producing about 88.14 billion of eggs, 7.40 million tonnes of meat in a year (2016-17). The value of output of livestock sector at current prices was Rs 8,11,847 crores in 2015-16.

The livestock also contributes to the production of wool, hair, hides, and pelts. Leather is the most important product which has a very high export potential. India is producing about 43.5 million Kg of wool per annum.

A large number of people in India being less literate and unskilled depend upon agriculture for their livelihoods. But agriculture being seasonal in nature could provide employment for a maximum of 180 days in a year. The land less and less land people depend upon livestock for utilizing their labour during lean agricultural season. The livestock products such as milk, meat and eggs are an important source of animal protein to the members of the livestock owners. The per capita availability of milk is around 355 g / day; eggs is 69 / annum.

The economic value of the livestock is difficult to evaluate and specific research needs to be done in order to better understand and assess the role of livestock in the wellbeing and in development of rural communities in India and to quantify its economic value. The extent to which the poor potential of livestock can be incremented would depend on how technology, institutions, policies and financial support address the constraints of the sector. The number-driven growth in livestock production may not sustain in the long run due to its increasing stress on the limited natural resources. The future growth has to come from improvements in technology and service delivery systems leading to accelerated productivity, processing and marketing.

India has large number of non-descript indigenous animals/livestock like cattle, buffalo, sheep, goat, poultry, pig, yak, mithun and goats and recognizing those indigenous animals by registering them as breeds to protect them from bio-piracy and preserve in the Indian context. A total of 183 breeds of indigenous animals have been given citizenship certificate by ICAR/Government of India thoroughly characterizing them by molecular and genetic strategies.

Besides, food and nutritional security, livelihood of small holder/marginal/landless farmers is a great concern in India. Honorable Prime Minister of India has given a call for doubling farmer's income by 2022. As agriculture productivity has already been reached threshold, this can be only achieved through livestock particularly small ruminants, backyard poultry and pigs.

India is having international border with six countries. The border is porous and many times animals, poultry and their products are moving without any restrictions. As a result, several diseases (emerging, zoonotic and transboundary diseases) entered the country like Crimean-Congo Hemorrhagic Fever (CCHF). The DG, ICAR stressed that disease surveillance of transboundary animal disease (TAD) should be taken as regional importance.

India specifically working on Onehealth programme especially ICAR and ICMR working together for identifying many zoonotic diseases like brucellosis, tuberculosis, anthrax, rabies and also on anti-microbial resistance (AMR). Many programmes have been launched and implemented in the country to control such diseases.

Changing climate is a concern and the Council is doing all to enable Indian agriculture climate resilient. Under National Innovations on Climate Resilient Agriculture (NICRA), Vulnerability Atlas for the country has been prepared to identify 100 most critically vulnerable districts for appropriate interventions. Several climate resilient crop varieties and animal breeds along with efficient National Resource Management (NRM) technologies have been successfully introduced in 151 villages spread across the country for enabling climate smart agriculture. District level contingency plans have been updated that are being adopted by the state governments.

### *Opening remarks by Prakash Mathema, Secretary, Department of Livestock, Ministry of Agriculture and Livestock Development, Government of Nepal*

Nepal is an agrarian country with more than two-thirds of population engaged in agriculture. Livestock is an integral component of Nepalese agricultural system and it contributes significantly to the national GDP. This sector contributes to food and nutrition security, provides employment opportunities, and supports rural economy. It has been estimated that this sector has a potential to contribute to almost half of Nepal's agricultural GDP.

Nepal has a great geographic variation within a small area. The elevation ranges from less than 100 meters above mean sea level to the highest point on Earth. Accordingly, Nepal has climatic variation ranging from sub-tropical to alpine conditions.

This diversity in climatic condition provides good habitats for multiple species and breeds of livestock. Cattle, buffalo, sheep, goat, pig, and poultry are raised by farmers for livelihood as well as commercial production. The indigenous breeds dominate our overall livestock population. The indigenous breeds are popular due to religious and socio-cultural reasons. Their productivity is very low compared to improved breeds but these breeds can withstand harsh environment and are resistant to various diseases.

In Nepal, various policies and strategies for livestock development are in place, and programs for increasing the productivity of livestock and conserving the indigenous breeds are being implemented. Our efforts at increasing livestock productivity include improving the indigenous livestock breeds through cross breeding, provision of better veterinary services, promoting quality feed and forage, and improving technical services to farmers.

With limited resources, some research on various aspects of livestock development is also being conducted. Productivity of livestock can grow tremendously, if we can link research to the needs of the farmers. In this context, ILRI's research activities targeted at improving food and nutrition security through enhanced livestock value chains and improving human health could be useful to us.

Nepal can collaborate in various ongoing research and development activities of ILRI for better and more sustainable use of livestock including managing forage gene-bank; surveillance and early warning system for climate sensitive diseases; nutrition improvement in harsh conditions; improving productivity in smallholder dairy system; thermo-stable PPR vaccine production technology; and trans-boundary animal diseases and zoonoses control. These activities will contribute to the development of Nepal's livestock sector in achieving the relevant sustainable development goals.

ILRI's research on quantifying the environmental footprint of livestock production by measuring greenhouse gas emissions with a specific focus on methane emissions from ruminants needs to include South Asia as well as we have sizeable livestock population in this part of the world.

I would like to thank ILRI for organizing this important regional meeting in Nepal. I hope that the participants will have a good opportunity to share experience and best practices of livestock development. I am confident that the participants will also be able to build productive and lasting networks, and continue to provide feedbacks to one another's research works.

I hope that the outcomes of the meeting will provide valuable ideas for future research and identify priorities for investment in the livestock sector in the region.

I would like to congratulate ILRI for its success in delivering innovative high impact solutions in the field of livestock sector. Your efforts have contributed to the transformation of livelihoods across the world. I believe this regional meeting in Kathmandu will be another success story for ILRI.

On behalf of my Ministry, I would like to reiterate our commitment to work with all local, national, regional and global stakeholders in the areas of livestock research and development.

# Region and country priorities

Before moving into specific potential livestock research for development (LR4D) interventions, participants were informed on wider agriculture and development priorities, in four areas: food and nutrition security; livelihoods and economic growth; health and animal welfare; climate and natural resource use. Presenters were also asked to identify opportunities, expertise, and other needs to transform and extend the contributions of these areas to national development: Dairy value chain; Goat value chain; Feeds and forages; Animal and human health.

## *South Asia<sup>1</sup>*

Nure Alam Siddiky from BLRI gave an overview presentation on livestock in the region where he gave details on the livestock and poultry population, dairy animal population and productivity, milk production and demand, the contributions of livestock in National and Agricultural GDP, farm animal genetic resources, and challenges of livestock in the SAARC region.

### **Challenges of Livestock in SAARC Region**

- Low productivity of the farm animals
- (Cow- 627.86, Buffalo-1257.96, Goat- 83.45Kg/Animal/Year
- Low genetic potential of the Indigenous Farm Animals
- Smallholder-dominated livestock farming
- Shortage of feeds and fodder
- Highly pathogenic emerging and reemerging of diseases
- Impact of trans-boundary animal diseases (TADs)
- Low input services for the livestock keepers
- Indiscriminate livestock breeding policy
- Weak value chains exist in livestock industry
- Low investment from both public and private sector
- Climate change and its Impact
- Antimicrobial resistance (AMR) in livestock production systems

### **Opportunities for regional cooperation and synergies**

- Regional collaboration to combat trans-boundary animal diseases
- Combat antimicrobial resistance in livestock production system
- Exchange of promising livestock genetic materials/ fodder germplasm for mutual benefits
- Establishment of regional livestock gene bank to conserve trans-boundary livestock breeds
- Establishment of regional livestock and poultry vaccine bank
- Harmonization of livestock rules and regulations to foster livestock trade
- Sharing of technology
- Exchange visit and exposure visit
- SAARC Epidemiological Network
- SAARC Laboratory Network

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See the presentation: <https://www.slideshare.net/ILRI/southasia-ppt-saarc>

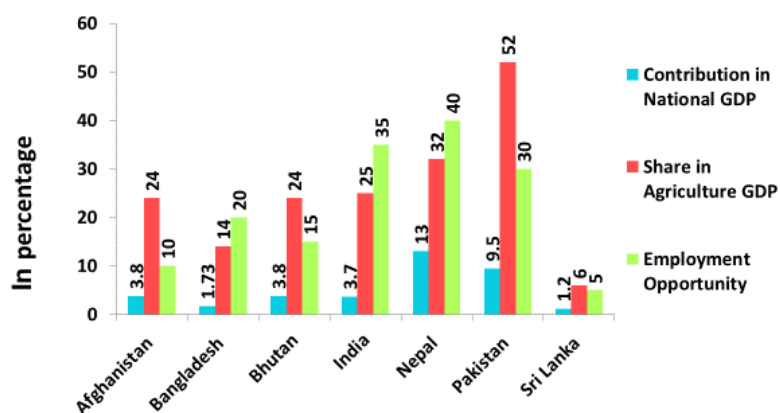
## Dairy Animal Population in the SAARC Region

Population in Million

Country	Cattle	Buffalo	Sheep	Goat	Camel	Total
Afghanistan	4.8	0.0	12.3	5.8	0.2	23.1
Bangladesh	23.70	1.47	3.33	25.76	0.0	58.26
Bhutan	0.38	0.001	0.017	0.039	0.0	0.437
India	191	108	65.07	135.20	0.4	499.67
Nepal	7.3	5.2	0.8	9.5	0.0	22.8
Pakistan	37	33	28.5	64.9	0.8	163.3
Sri Lanka	1.3	0.4	0.1	0.3	0.0	2.1
Total	265.6	148.01	110	240.5	1.4	765.5
% of Global	25%		15%		7%	21%

Source: SAARC, 2015 & Member States Information

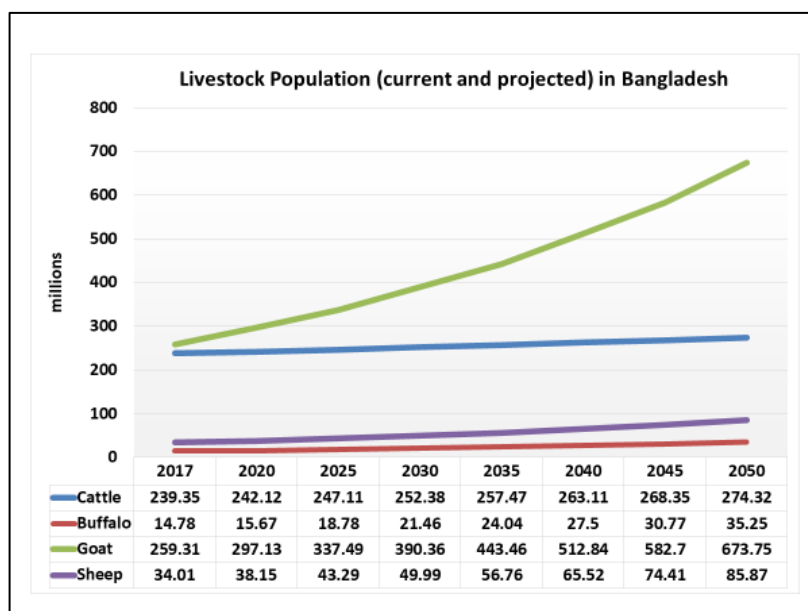
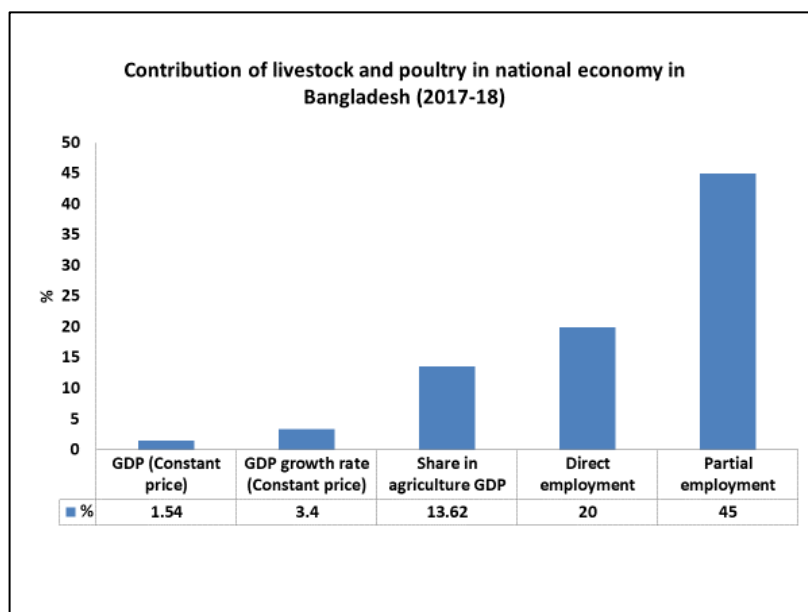
## Contribution of Livestock in National and Agricultural GDP with Employment Opportunity



Source: SAARC, 2014 & Member States Information

## Bangladesh<sup>2</sup>

Nathu Ram Sarker, Director General, Bangladesh Livestock Research Institute (BLRI) presented the perspectives of livestock sector in Bangladesh, under which he emphasised the contribution of livestock and poultry in national economy in Bangladesh, livestock census in Bangladesh and production of livestock products in Bangladesh over the years, contribution or share of livestock in national GDP, dairy production and marketing systems in Bangladesh, small ruminant value chain, napier grass value chain, as well as challenges and way forward associated with livestock development in Bangladesh.



<sup>2</sup> See the presentation: <https://www.slideshare.net/ILRI/southasia-ppt-bangladesh>

## **Opportunities**

- Large number of animal population
- Integrated agricultural farming
- Fertile land
- Transformation from subsistence to commercial farming
- Due to awareness and education, animal protein consumption increasing

## **Challenges**

- High prevalence of economically important livestock and poultry diseases
- Low productivity of farm animals
- Severe scarcity of livestock and poultry vaccines
- Unnecessary uses of Antibiotics and hormones
- Maintain of Sanitary and Phytosanitary standards (SPS)
- Decreasing of grazing land
- Scarcity of feeds and fodder
- Competition between human and animal feeds
- Disorganized marketing system of livestock and products
- Climatic change and environmental pollution
- Lack of quality slaughter facilities
- Lack of Quality livestock breeds
- Unskilled human resources
- Lack of financial support and insurance
- Indiscriminate breeding
- Lack of biosecurity and biosafety
- Transboundary diseases

## **Ways forward**

- Animal breeding and genetics
- Animal production, Feed and Fodder research
- Animal Health, Food safety and Zoonotic Diseases
- Climate resilient livestock production
- Livestock value chain development
- Food safety
- Women integration in livestock sector
- Strong Networking for cooperation, surveillance
- Capacity Development



## *India*<sup>3</sup>

Livestock plays an important role in Indian economy. About 20.5 million people depend upon livestock for their livelihood. Livestock contributed 16% to the income of small farm households as against an average of 14% for all rural households. Livestock provides livelihood to two-third of rural community. It also provides employment to about 8.8 % of the population in India. India has vast livestock resources. Livestock sector contributes 4.11% GDP and 25.6% of total Agriculture GDP.

Livestock provides food items such as Milk, Meat and Eggs for human consumption. India is number one milk producer in the world. It is producing about 165.4 million tons of milk in a year (2016-17). Similarly, it is producing about 88.14 billion of eggs, 7.40 million tonnes of meat in a year (2016-17). The value of output of livestock sector at current prices was Rs 8,11,847 crores in 2015-16.

The livestock also contributes to the production of wool, hair, hides, and pelts. Leather is the most important product which has a very high export potential. India is producing about 43.5 million Kg of wool per annum.

Livestock are also considered as “moving banks” because of their potentiality to dispose of during emergencies. They serve as capital and in cases of landless agricultural labourers many times it is the only capital resource they possess. Livestock serve as an asset and in case of emergencies they serve as guarantee for availing loans from the local sources such as money lenders in the villages. Livestock is a source of subsidiary income for many families in India especially the resource poor who maintain few heads of animals. Cows and buffaloes if in milk will provide regular income to the livestock farmers through sale of milk. The animals also serve as moving banks and assets which provide economic security to the owners.

A large number of people in India being less literate and unskilled depend upon agriculture for their livelihoods. But agriculture being seasonal in nature could provide employment for a maximum of 180 days in a year. The land less and less land people depend upon livestock for utilizing their labour during lean agricultural season. The livestock products such as milk, meat and eggs are an important source of animal protein to the members of the livestock owners. The per capita availability of milk is around 355 g / day; eggs is 69 / annum.

The economic value of the livestock is difficult to evaluate, and specific research needs to be done to better understand and assess the role of livestock in the wellbeing and in development of rural communities in India and to quantify its economic value. The extent to which the poor potential of livestock can be incremented would depend on how technology, institutions, policies and financial support address the constraints of the sector. The number-driven growth in livestock production may not sustain in the long run due to its increasing stress on the limited natural resources. The future growth has to come from improvements in technology and service delivery systems leading to accelerated productivity, processing and marketing.

14 new breeds had been registered by (National Bureau of Animal Genetic Resources – NBAGR) in India. Cattle-2; Buffalo- 2; Goat-6; Sheep-1; Pig-1; Donkey- 1; Chicken-1. After this registration of this new breeds, there are about 183 breeds which consists of Cattle-43; Buffalo- 15; Goat-34; Sheep-43; Horses and Ponies- 7; Camel- 9; Pig- 8; Donkey-2; Yak-1; Chicken-19; Duck-1; Geese-1.

In India, there is an increase in the production of foodgrains by 5.4 times; horticultural crops by 10.1 times; fish by 5.2 times; milk by 9.7 times and eggs by 48.1 times, since 1951 to 2017.

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<sup>3</sup> Taken from notes used by ICAR DG in his keynote address

## **Doubling Farmers income by 2020**

The Indian Prime Minister shared the vision of doubling farmers' income with the nation at his Bareilly address. Further, recognizing the urgent need for a quick and time-bound transformation of the vision into reality, a time frame of six years (2016-17 to 2022-23) was delineated as the period for implementation of a new strategy. At the basic level, agriculture when defined as an enterprise comprises two segments – production and post-production. The success of production as of now amounts to half success and is therefore not sustainable.

The strategy platform is built by the following four concerns:

- Sustainability of production
- Monetization of farmers' produce
- Re-strengthening of extension services
- Recognizing agriculture as an enterprise and enabling it to operate as such, by addressing various structural weaknesses.

Notwithstanding the many faces of challenges, India's agriculture has demonstrated remarkable progress. It has been principally a contribution of the biological scientists, supplemented by an incentivizing policy framework. This will free the resources, as also time for the biological scientists to focus on new science and technology, that will shift production onto a higher trajectory - one that is defined by benchmark productivities & sustainability. However, henceforth both production & marketing shall march together hand in hand, unlike in the past when their role was thought to be sequential.

## **ICAR One Health approach**

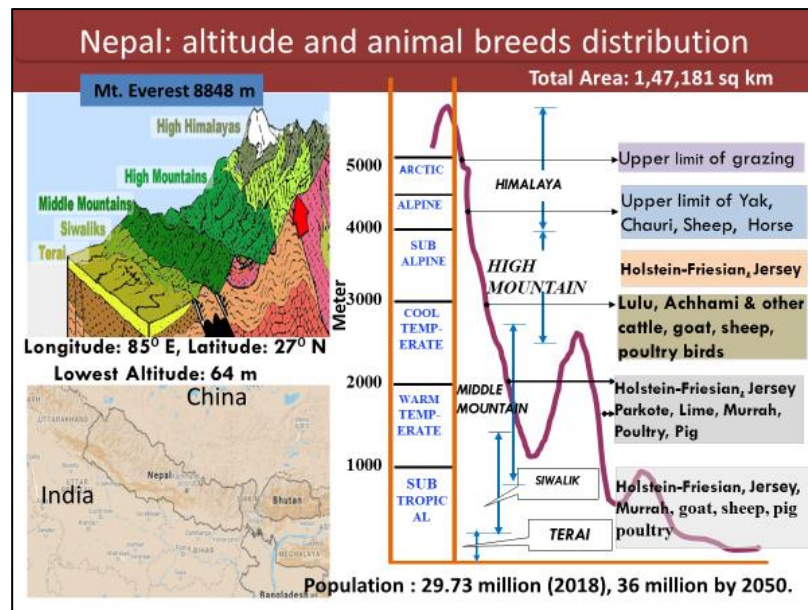
The One Health approach becomes all the more pertinent in the context of developing countries such as India with burgeoning issues surrounding several aspects –regulations around use of antibiotics in humans and the entire food chain, poor control of zoonotic diseases, food safety etc. There is a high need for a multi-stakeholder approach to discuss these critical issues and employ the One Health Approach. The summit will converge thought leaders across academic institutions, international organizations, policymaker, regulators and industry to discuss the Indian context and lay the foundation for this integrated intervention approach to be adopted in priority areas.

The objectives of One Health approach should be:

- Sensitize and converge stakeholders on a common platform to network and discuss the development of One-Health Science
- Develop the idea of an integrated approach to human, animal and environmental health as the best solution to unmet needs in health
- Draw attention to growing problem of antimicrobial resistance, challenges across the food chain and practices around use of antibiotics in human and animal health
- Importance of superior food safety norms and practices; and development of better and safer medicines for zoonotic and emerging infectious diseases
- Engage policymaker and industry in a multi-stakeholder discussion and trigger engagement in developing and adopting One-Health solutions
- Bridge the gap between evidence-based research and health policies
- Showcase new innovations and technologies by the industry, research organizations, community groups, individuals etc.,
- Fostering partnership among the key players nationally and globally-to achieve the best health for humans, animals and our environment

## Nepal<sup>4</sup>

Tek Bahadur Gurung, Director (Livestock and Fisheries), NARC spoke on priority areas of livestock sector for strengthening food and nutrition security in Nepal. He linked altitudes and animal breeds distribution in Nepal, and commented on the livestock sector in Nepal, status of malnutrition in Nepal, challenges and priorities of livestock sector, livestock research, native breeds, various technologies developed by the Government related to livestock and fodder development, and climate resilient technologies.



### Livestock sector in Nepal

- Per capita income 1000US\$
- Livestock contributing ~11% to NGDP (MoLD 2017).
- Population growth rate 1.13% (2016)
- Population in Agriculture 65.6%
- Without livestock small farmers cannot sustain
- 10-20% of livestock farmers may be commercial
- Highest ratio of livestock to humans in Asia (5.8 heads of livestock and poultry/ household).
- Cattle - as sacred animal
- Goat, poultry & pig- sacrificed in ceremonies.

### Challenges

- Import substitution is the great challenge.
- Despite of high number of animals, poor genetics, nutrition, value chain, health and small holdings etc. causing low productivity.
- Climate change impacting feed availability, animal health and reproduction.

<sup>4</sup> See the presentation: <https://www.slideshare.net/ILRI/southasia-ppt-nepal>

## Priorities

- 58 directives by Hon. Minister
- Self-sufficiency in egg, meat & milk production
- Genetic improvement by:
- Doubling the improved breeds by 2020.
- Promotion of AI activities
- Prioritizing frozen semen production of improved breed
- Value chain promotion
- Emphasis on pasture-based livestock development
- 4 mission programs, forage, goat, pig & pork
- DCIP, BGIP Collaboration (DLS & NARC)

## *Pakistan*<sup>5</sup>

Muhammed Farooq Tareen, Principal Veterinary Officer from Government Poultry Farm, Pakistan spoke about the livestock sector and its contribution to Pakistan economy, the livestock population in Pakistan, livestock production systems, traditional rural poultry, livestock development constraints, livestock development policy, different breeds of livestock in Pakistan.

## Livestock sector importance and contribution

- Livestock in Pak GDP: 11.4 %
- Share in agri. GDP: 53.2 %
- Livestock in export: 8.5 %
- Dependent families > 8.5 m
- Employs 35 million people and produces almost \$500 million of products
- Provides raw material for industry
- Social security for rural poor
- Security against crop failure in Barani areas

## Roles in livestock development

- Federal
  - National policies, planning & economic coordination
  - Import/export of animals and animal products and animal quarantine
  - Research and international coordination
  - Catalyst for livestock development
- Provincial
  - Livestock Development
  - Veterinary Vaccine Production
  - Disease surveillance and reporting
  - Livestock research
  - Livestock production and health education
  - Milk and meat quality
- District
  - Veterinary Health service (Preventive & Curative)
  - Breeding services (Artificial insemination)

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<sup>5</sup> See the presentation: <https://www.slideshare.net/ILRI/southasia-ppt-pakistan>

- Animal slaughtering
- Livestock Markets

### **Livestock development constraints**

- Inadequate feed resources (short by 30%)
- Widespread breeding of genetically inferior livestock
- Epidemics of infectious diseases
- Poor marketing infrastructure
- Inadequate institutional infrastructure
- Outdated regulatory framework
- Limited credit availability to the livestock farmers (1/10 of agricultural credit)
- Low investment by government

### **Livestock development policy and strategy**

Vision: Promoting livestock to provide safe and quality products at competitive prices, covering entire value chain with focus on market and poverty reduction

Policy: Private sector led development with public sector providing enabling environment

Strategy: Private sector led; Increase in productivity; moving from subsistence farming to market-oriented and commercial farming; covering entire value chain.

# Priority livestock research intervention areas

Following the country and region overviews, participants worked in groups to identify: priority LR4D outcomes, major bottlenecks and challenges, and promising interventions in each of the priority areas: Dairy; Goats; Feeds; Animal Health.

## Innovative livestock for development approaches

Following the discussions on livestock development challenges, several short presentations illustrated livestock research for development lessons, insights and outcomes that could help inspire discussions on potential interventions.

Michael Blummel showcased several spin-off technologies from 2<sup>nd</sup> generation biofuel development that can transform crop residues into high-quality concentrates. Download:

<https://hdl.handle.net/10568/98270>

Sita Ram Ghimire introduced ILRI work on forages in Africa with potential for South Asia. Download:

<https://hdl.handle.net/10568/98269>

V. Padmakumar shared 4 key lessons to deliver successful goat development programs in South Asia. Download: <https://hdl.handle.net/10568/98268>

Dieter Schillinger introduced ILRI's work on animal and human health, highlighting research on food safety, anti-microbial resistance, and the nutritional value of animal-source foods in the first 1000 days. Download: <https://hdl.handle.net/10568/98267>

Raj Kumar Gera from Hester Biosciences Ltd introduced a large-scale project to deliver Newcastle Disease vaccines to smallholders in India. Download: [www.slideshare.net/ILRI/southasia-ppt-hester](http://www.slideshare.net/ILRI/southasia-ppt-hester)

Jenny Hutchison from Ausvet explained how changing the focus of animal disease surveillance to focus on the information needs of those who generate data promotes system sustainability while applying advanced ICTs results in the timely submission of accurate, high quality data that can be summarised, analysed and monitored. Download: [www.slideshare.net/ILRI/southasia-ppt-ausvet](http://www.slideshare.net/ILRI/southasia-ppt-ausvet)

## *Dairy development*

### **Desired outcomes (Nepal and Bangladesh):**

- Milk self-sufficiency (trade deficit) - [milk is a basic need]
- Livelihoods of small farmers - Requires good services and inputs
- More productive animals = production and productivity = increased availability of milk and animal-source foods (ASF)
- Needs market-led production
- Improved breed quality
- Product diversification (goat, yak)
- Improve buffalo for dairy (Bangladesh)
- One-stop services
- Improve milk and product quality and safety at all levels
- Commercialize small farmers into enterprises
- Increased automation and mechanization of operations
- Equitable availability of milk and milk products

### **Challenges**

- Lack of inputs and services
- Low adoption of improved tech and practices
- Low productivity
- Deficit in feed and fodder – high cost
- Limited market linkages (roads, chilling plants, collection centres) / poor VCs
- Institutional capacities, farmer organizations
- Quality assurance and regulation
- Many non-productive cows
- buffalo pop decrease in Nepal
- Poor animal health services/high disease burden
- High lost production
- Lack systematic breed program
- Prevention of reproductive disease, infertility, poor heat detection
- Low private sector
- Inefficient VCs
- Lack of biosecurity
- Out-migration of youth and lack of interest
- Difficult terrain = market access
- Appropriate mechanisation
- Knowledge gaps – VC studies
- Barriers to regional trade in genetics

## Potential interventions

1. VC and market/product diversification
  - a. Value chain assessment
  - b. New market thru diversification
  - c. Low cost milk product delivery
  - d. Upgrading informal markets
  - e. Quality control
  - f. Goat, yak products
  - g. policy

Policy, credit and insurance / investment

  - a. Non-collateral loans
  - b. Policy and advocacy for intra-gov coordination
  - c. Private sector investors
  - d. Public policy and investment
  - e. Institutional structures and capacities
2. Youth incubators
  - a. Dairy related enterprises
  - b. Women
  - c. ICT
  - d. Other ages
3. Design and implement systematic breeding and genetic delivery system
  - a. Id appropriate genetics
  - b. Selection and development (cross or upgrade)
  - c. Distribution
  - d. Buffalo and cattle

Integrated approach to feeds and forages

  - Appropriate cultivars
  - Crop residue improvement
  - Fodder trees
4. One-stop services
  - a. Health
  - b. Genetics
  - c. Feed
  - d. Education
  - e. PPP



## Project idea – South Asia (Bangladesh and Nepal) dairy sector development

<b>Region, country or countries covered by the project.</b>	Nepal, Bangladesh
<b>Which high level priority/ outcome(s) does the project support?</b>	Increased national milk self sufficiency Improved livelihoods of smallholders and their communities Increased availability of milk/ASF
<b>Project name.</b>	South Asia (Bangladesh and Nepal) Dairy Sector Development
<b>Quantify intended benefits (e.g. number of households benefiting, total annual monetary benefit, emission reduction, etc.).</b>	Approximately 10,000 dairy producing households in each of 2 countries, including women-headed, would increase productivity by 25% and incomes from dairy by 30%. 50-100 dairy hubs/coops in each country would be strengthened, and their performance improved. Capacity for policy analysis and implementation would be strengthened at multiple levels in national agencies.
<b>Project summary, incl. timeline (max. 300 words).</b>	<p><i>The project is comprised of modular components which complement each other but can also be implemented separately.</i></p> <p><u>Strategic</u></p> <ol style="list-style-type: none"> <li>1. Policy analysis and advocacy to guide public and private investment, improved financing mechanisms, institutional reform, capacity needs assessment, market and trade support and regulation.</li> <li>2. Systematic breeding and delivery system for improved genetics (buffalo and cattle), including identifying and developing appropriate genetics, and innovative recording and delivery systems. Will support regional coordination and sharing of genetics.</li> <li>3. Integrated feed and forage development (with Feeds group), including both appropriate forage cultivars and also crop residue improvement and processing.</li> </ol> <p><u>Developmental</u></p> <ol style="list-style-type: none"> <li>4. One stop dairy services (hub). Milk chilling/collection center core, accompanied by input and service providers (private and public), credit, extension. Linked to collective/coop or farmer business group, formal processors and informal traders. Accompanied by ICT information platform.</li> <li>5. Dairy value chain assessment and development. Identify new markets and new products (e.g. goat, yak), including low cost packaging, milk delivery. Upgrade informal market through training and certification of traders in improved milk handling and quality control.</li> <li>6. Capacity development of entrepreneurs, including youth and women. Adopt an “incubator” approach, linked to the components above – feed processing, supply of services, ICT platform.</li> </ol> <p><u>Other contextual issues:</u></p> <p>In the developmental activities above, gender mainstreaming and inclusive interventions will be proposed. Use of ICT and increased</p>

	<p>mechanization will attract the youth and will make it easier for women to participate.</p> <p>Milk quality remains a concern in both countries. Engaging the informal milk traders and training them in hygiene and standards, as well as educating farmers in clean milk production will address this. In the formal market, including quality-based milk pricing would be an avenue for improving milk quality related issues</p>
<b>Project partners.</b>	<p>Nepal: Central/Provincial min of Ag, dairy producers coops, NARC, Ag and Forestry Univ., Nat Livestock Breeding Center</p> <p>Bangladesh: BLRI, MilkVita, Dept of livestock services, Bangladesh Ag Univ.</p> <p>Private sector: Inclusive and rigorous VC and policy gaps/constraint analyses and the hub approach will encourage private sector actors to participate, based on informed basis.</p>
<b>What activities will be undertaken during the research phase, including timelines and partners?</b>	<p>Policy analysis, capacity needs assessment and investment plan</p> <p>Value chain and market assessment</p> <p>Matching dairy genotype and production zone (participatory research)</p> <p>Assess delivery and information systems for delivery of dairy genetics</p> <p>Assess seed production and delivery systems, seed markets and regulation, quality</p> <p>Develop and test information platform among producers, farmer groups</p> <p>Identify entrepreneurship opportunities for youth, women and capacity needs</p>
<b>What activities will be undertaken during the implementation/ commercialization phase, including timelines (if applicable)?</b>	<p>Support to coops/groups to establish one stop milk collection and services, links to vendors and information platform</p> <p>Engage with informal market actors, develop training and certification approach with market and government regulators</p> <p>Support to private/coop processors to identify and develop new products and markets</p> <p>Set up entrepreneurship incubators, linked to private/public providers</p>
<b>Explain what is innovative about the project approach</b>	<p>Building on pioneering work in E Africa, there is new and innovative application of ICT for:</p> <ol style="list-style-type: none"> <li>Herd recording to support long-term genetic/recording improvement and farmer feedback/education programs is innovative</li> <li>Using ICT to integrate and connect the actors on near -real time basis is innovative</li> <li>Plans to use genomic technology together with ICT, to increase rate of genetic progress is innovative</li> </ol>

	<p>Also building on work in E Africa and more recently in Assam the project brings an innovative and unique approach to upgrading the informal milk market, instead of trying to suppress it, which is never successful. Components include:</p> <ul style="list-style-type: none"> <li>- Develop training for informal milk market actors to meet their needs for improved hygiene, handling and business skills</li> <li>- Develop capacity of local business service providers to supply this training</li> <li>- Engage local and national policy makers and regulators to agree this approach and to provide official certification for those trained</li> </ul> <p>The enterprise incubator and accelerator approach, engaging in particular youth and women, is also a new and growing type of initiative.</p>
<b>Explain how the project speaks to donor strategies. Indicate relevant donor(s).</b>	<p>Improving incomes and livelihoods among rural households is an important donor objective, and this is the focus of the project. The work brings both strategic efforts that will have long term sustained impacts, as well as short term efforts for immediate impact. Women and youth are key beneficiaries of all the activities.</p> <p>By increasing productivity, the greenhouse gas emissions/unit kg of milk will be reduced (fewer but more productive animals) and will address donor concerns regarding climate change. Promoting climate smart forages will also address CC, including increased ability for adaptation.</p> <p>Tentative list of donors may include IFAD, World Bank, USAID and/or ACIAR, but this requires further discussion and exploration of interests</p>
<b>Budget</b>	Approximately \$5M over 4 years

<b>Dairy development project idea - next steps</b>	
	<p>Contact persons:</p> <p>Nepal:  Neena Gorkhali (neenagorkhali@hotmail.com)  Kiran Pandey (kiranpandey5@gmail.com)  (<a href="mailto:premey_np@yahoo.com">premey_np@yahoo.com</a>)</p> <p>Bangladesh: DLS DDG  Dr Mohammad Ainul Haque  <a href="mailto:ahaquedls@yahoo.com">ahaquedls@yahoo.com</a>  <a href="mailto:directorlri@gmail.com">directorlri@gmail.com</a></p> <p>ILRI: Steve Staal (<a href="mailto:s.staal@cgiar.org">s.staal@cgiar.org</a>)  and Okeyo Mwai (<a href="mailto:o.mwai@cgiar.org">o.mwai@cgiar.org</a>)</p> <p>Timeline:  Send draft notes by end Nov  Receive comments  Identify other stakeholders who need to review  Engage with and identify prospective donors  Concept note to national officials for consideration and approval for further development  Aim towards an eventual writeshop</p>

## Goat development

### Desired outcomes

1. Improve livelihoods and nutrition of smallholders (men, women, youth) by improving productivity of goats
2. Be self-sufficient in meat goat production
3. Position goat meat (BB), goat milk, pashmina as commodities for export

### Challenges

1. Genetics
2. Health
3. Feed and fodder (shrinking grazing land; lack of land)
4. Markets, market intelligence, fair prices
5. Protocol for conservation of pure indigenous breeds
6. Enabling policies
7. Lack of resources

### Potential interventions

1. Genetics: selective breeding indigenous breeds for meat traits
2. Health: package for prevention and control of major diseases
3. Feed: entrepreneurship around feed/fodder production
4. Markets/Nepal: establish live goat market under ppp model

### Project idea - Sustainable development of goat farmers through enhanced productivity and value chain development in South Asia

Region, country coverage.	Bangladesh, India, Nepal and Pakistan
High level priority outcome(s) the intervention supports	Improve livelihood of goat farmers and contribution to food and nutrition security of the people in the region
Intervention/ project name.	Sustainable development of goat farmers through enhanced productivity and value chain development in South Asia
Quantify intended benefits	200,000 goat rearers increase their income by 25% at the end of the project (3-5 years)
Intervention/ project summary, incl. timeline (max. 300 words).	<ol style="list-style-type: none"><li>1. Minimizing yield gap by 50% (total output) through selective breeding in community /private/ govt breeding resource centre, entrepreneurial skill development for feed/fodder business, streamlining veterinary services and inputs supply</li><li>2. Value chain improvement to enhance the income of VC actors by setting up live goat market centres &amp; systems (PPPP), establishment/ strengthening slaughter facility for hygienic and wholesome meat production and value addition</li><li>3. Capacity building (farmers, VC actors)</li><li>4. Policy facilitation:<ol style="list-style-type: none"><li>(i) Regional (germ plasm, vaccine, trans-Boundary diseases, goat trade, regional forum)</li><li>(ii) National (development and enforcement of policies and Acts, national coordination committee)</li></ol></li></ol>

Project partners.	ILRI (Regional and technical coordination & support), establishment of PMU at country and regional levels Bangladesh: BARC, DLS, BLRI, Heifer, WAVE, pvt sector India: CIRG, DADF, Heifer, Pvt sector Nepal: NARC, DLS, Heifer, Pvt sector Pakistan: NARC, MoNFS&R-Livestock division, Private sector
What activities will be undertaken during the research phase, including timelines and partners?	1. Diagnostic studies, identification of gaps 2. Stakeholder discussions 3. Policy level meetings 4. Sharpening of the proposal (Yr 1)
What activities will be undertaken during the implementation/ commercialisation phase, including timelines (if applicable)?	1. Establish PMU 2. Establish goat breeding resource centre (see identified partners above)-Yr1 3. Training on feed /fodder production & marketing and providing establishment support -Yr 1 4. Identify gaps (veterinary services), training, coordination with line department, cold chain, transportation, storage and administration, mobilization of inputs & service Yr 1 5. Meetings with concerned stakeholders, identification and establishment of market centre, development of marketing mechanism including transport-Yr 2-3 6. Operationalise slaughter house-Yr2-3 7. Training of farmers, traders, processors, technicians -Yr1 8. Coordination committee meetings (quarterly), national and regional policy group formation and meeting (Yr 1-3)
Total project cost in USD.	10 million US\$
Benefit vs cost ratio.	20 million US\$ (2:1)
How it speaks to donor strategies.	Innovation 1: end to end solution Innovation 2: Hight Rol Innovation 3: Inclusive (women, young) Innovation 4: Employment generation, reduction in migration Innovation 2: Multi-disciplinary, multi-stakeholder, multi country

Goat development project idea - next steps		
What	Who	When
Contact persons	Nepal: <ul style="list-style-type: none"> <li>Dr Tej Bahadur Rijal (<a href="mailto:tejrijal07@gmail.com">tejrijal07@gmail.com</a>)</li> </ul> Bangladesh <ul style="list-style-type: none"> <li>Dr Mohammad Rafiqul Islam (<a href="mailto:mrislam210@hotmail.com">mrislam210@hotmail.com</a>)</li> <li>Dr Muhammad Nuruttaman (<a href="mailto:mnuruttaman@usaid.gov">mnuruttaman@usaid.gov</a>)</li> <li>Dr Md Nure Alam Siddiky (<a href="mailto:nasiddiky.saarc@gmail.com">nasiddiky.saarc@gmail.com</a>)</li> </ul> ILRI: V. Padmakumar ( <a href="mailto:v.padmakumar@cgiar.org">v.padmakumar@cgiar.org</a> )	
Incorporate feedback into the CN: gender, climate change and alignment with country priorities	ILRI Team with the support of goat group	December 2018
Circulate the 2nd version among experts including economists	ILRI Team with the support of goat group	Feb 2019
Finalise the CN	ILRI Team with the support of goat group	March 2019
Assess donor priorities and identify potential donors	ILRI (Bolek)	March 2019
Conversion of CN into a full proposal with country specific information	ILRI + Goat group + country partners	June 2019

## *Feed and forage development*

### **Desired outcomes**

Increase productivity and profitability of livestock systems

- Increase production and productivity
- More profitable from fodder production
- Lower cost feeds
- Quality of feeds and fodder
- Year-round availability
- Conservation technology (including storage)
- Reduce imports / substitution for self-sufficiency
- Commercialise fodder production
- Technology and capacity building
- Awareness of forage/feed quality, utility, value
- Use of crop by-products and unconventional feed sources
- Conserve native forage/fodder species
- National feed informatics/information
- Seedbank
- Genetic improvement – climate resilient varieties

### **Challenges**

- Lack of suitable species, seeds
- Low return from forage (perception)
- Limited availability of technology – feeding, processing, production, conservation, mechanisation, utilization, low cost feed, quality control
- Climate change
- Remoteness
- Labour/migration of youth
- Lack of proper feeding technology/methods
- No policy support to fodder production
- Inter-ministry policy support and collaboration
- Mechanization – harvesting, processing
- Declining arable land
- Declining soil fertility

### **Potential interventions**

1. Lack of suitable forage, fodder, pasture, seeds for different production environments
  - a. Assembling germplasm
  - b. Multilocation participatory evaluations
  - c. Validation of selected materials
  - d. Registration/release
2. Development of POP for selected forage species
3. Utilization and enrichment of crop residues and unconventional feed resources
4. Commercialization of feed and forage production
  - a. Contract farming; private sector, farmers, marketing, demand intelligence, value addition
5. Establishment of functional national feed informatics
6. Rangeland/hill areas improvement

## Project idea - Climate-smart, high yielding and nutritive forages for South Asia

Region, country coverage.	Bangladesh, Nepal and Pakistan
High level priority outcome(s) the intervention supports	Improve productivity and profitability of livestock agriculture in Bangladesh, Nepal and Pakistan
Intervention/ project name.	Development of climate-smart, high yielding and nutritive forages for South Asia
Quantify intended benefits	The program benefits a minimum of 30,000 farming households in each participating country.
Intervention/ project summary, incl. timeline (max. 300 words).	Livestock is one of the important agricultural sectors contributing to food, nutrition, employment, income and livelihood of people in Bangladesh, Nepal and Pakistan. Moreover, livestock provides traction and manure for crop production. It contributes up to 30% to national agricultural GDP in these countries. However, the livestock product in the region is several folds lower than those for developed countries. The main factors contributing to a low livestock productivity in the region is limited supply of forages both in terms of quality and quantity. Lesson from South America, Central America, Australia and East Asia have demonstrated that improved forage significantly improve the livestock productivity. All three participating countries in this proposal host diverse indigenous forages genetic resources and several others are accessible through gene banks. Exploration and utilization of these genetic resources, targeted breeding combined with best management practices have potential to improve the forage availability.
Project partners.	NARS, BLRI, PARC and development partners
What activities will be undertaken during the research phase, including timelines and partners?	The following activities are proposed; (i) assembly of forage germplasm base, (ii) targeted breeding, (iii) multilocation evaluations of forage genetic resources for trait of interest (e.g. biomass, nutritive value, resilience etc.) involving farmers and other stakeholders, (iv) development of package for practice (PoP) for different production environments, (v) validation of selected technologies in different environment, (vi) development of forage seed production technologies, (vii) registration/release of forage varieties, (viii) Upscaling of forages involving local government, development agencies, private sectors financial institutes targeting youth and women, (ix) linking with other livestock development initiatives that promote improved breed and veterinary services.
What activities will be undertaken during the implementation/ commercialisation phase, including timelines (if applicable)?	-
Total project cost in USD.	US\$ 5 - 10 million
Benefit vs cost ratio.	1:3
How it speaks to donor strategies.	Low quality and seasonal availability of forage are major contributor to low livestock productivity in Bangladesh, Nepal and Pakistan. There is scope for increasing livestock productivity by 2-3 folds through improved forages. The improved livestock productivity will enhance food and nutrient security, increase income and improved livelihood of people in Bangladesh, Nepal and Pakistan.

## Project idea - Interactive feed supply demand tools for South Asia

Region, country coverage.	Nepal, Bangladesh, Pakistan
High level priority outcome(s) the intervention supports	Rational investments in feed and livestock value chain interventions
Intervention/ project name.	Interactive feed supply demand tools
Quantify intended benefits	
Intervention/ project summary, incl. timeline (max. 300 words).	<p>Use secondary data sets about cropping pattern and land use pattern to assess available feed resources in quantity and quality. Feed quality will be taken from research, feed tables, projects and so on.</p> <p>Livestock census data will be used to assess feed demand. Current livestock productivity data and desired livestock productivity data will be added to livestock maintenance requirement to estimate feed demand. The feed supply-demand tool will be constructed at the smallest administrative unit where cropping and land use data and livestock census land exists.</p> <p>The tool will give information about current feed supply-demand scenarios but will also give the users option to test the impact of changes in feed supply and demand. For example, impact of replacement of one crop /forage by another on feed supply can be tested. Impact on feed demand of interventions can be tested by changing animal breeds, herd structure and productivity levels</p>
Project partners.	NARS, ILRI, Statistical Agencies
What activities will be undertaken during the research phase, including timelines and partners?	<p>Year 1 allocated and match data sets and enter data sets into tool framework (FeedBase)</p> <p>Year 2: Develop scenarios of feed supply-demand and ally plausibility checks, and ground trothing. Clos/correct data gaps.</p> <p>Year 3: Finalize and fine tune tool, disseminate under development actors, policy makers and private sector and delivery training and capacity building</p>
What activities will be undertaken during the implementation/ commercialisation phase, including timelines (if applicable)?	
Total project cost in USD.	300 000 to 400 000 US \$ per country
Benefit vs cost ratio.	
How it speaks to donor strategies.	Provides the basis for all informed decision in livestock value chains. Without informed feed supply-demand information all interventions are guess work and try and error



## Project idea - Community based hill and rangeland management for sustainable livestock production in South Asia

Region, country coverage.	Nepal, India, Pakistan, Bangladesh
High level priority outcome(s) the intervention supports	Livestock production and productivity improvement through cooperative based rangeland management
Intervention/ project name.	Community based hill and rangeland management for sustainable livestock production
Quantify intended benefits	
Intervention/ project summary, incl. timeline (max. 300 words).	<p>Recently community-based forestry programs in have been appreciated. In due course the traditional rangelands have been included into the community forestry management. This approach has impacted small holders. As a result, the production and productivity of livestock in terms of milk and meat production has been known to be declined. The community forestry has been encroached by several nuisance invasive weeds. Such degraded rangeland requires to be restored with suitable management practices in the perspective of sustainable rangeland management for generating income. Since the grazing range lands are common resources which are property for use to all but none to care and conserve. Therefore, a group, community or cooperative approach of villagers to revitalize such pasture land for sustainable livestock production should be initiated.</p> <p>The Outputs of project would be:</p> <ul style="list-style-type: none"> <li>• Community based modules of rangeland management for livestock production and productivity innovated.</li> <li>• Community based technologies of restoration of degraded rangelands innovated.</li> <li>• Community based sustainable methods of grazing land management formulated</li> <li>• Production and productivity of pasture-based livestock enhanced.</li> <li>• Scaling up of successful achievements publicized.</li> </ul> <p>Activities</p> <ul style="list-style-type: none"> <li>• Identification and characterization of rangelands</li> <li>• Group/community or cooperative formation of users and conservation of rangelands</li> <li>• Partitioning of pasture land</li> <li>• Applying the principal of quota system approach for sustainable land range management</li> <li>• Introduction new tested fodder and ground grasses</li> </ul>
Project partners.	ILRI, NARC, DLS, BLRI, PARC, India (Hill/mountains areas)
What activities will be undertaken during the research phase, including timelines and partners?	<p>The time line would be 5 years. The main activities would be group/community formation of livestock farmers.</p> <ul style="list-style-type: none"> <li>• Compilation of information on rangelands</li> <li>• Interventional activities to manage the rangelands for sustainable use.</li> <li>• Data collection on types of livestock likely to use the rangeland</li> <li>• Capacity determination of the range land</li> <li>• Community formation</li> <li>• Quota allocation for different user groups</li> <li>• Management practices for rangeland management</li> <li>• Interactions</li> </ul>
What activities will be undertaken during the implementation/ commercialization phase, including timelines (if applicable)?	

Total project cost in USD.	300 000 to 400 000 US \$ per country
Benefit vs cost ratio.	
How it speaks to donor strategies.	<ul style="list-style-type: none"> <li>• It is good to convince the donors on environ sustainability</li> <li>• It highlights on sustainable management of livelihoods on rational use of the rangeland</li> <li>• It concerns community-based livestock management in rural areas</li> </ul>

### **Project idea - Increased availability of affordable off-farm produced feed in South Asia**

Region, country coverage.	Nepal, Bangladesh, Pakistan, India
High level priority outcome(s) the intervention supports	Increased livelihoods through higher benefits from livestock and rural employment opportunities
Intervention/ project name.	Increased availability of affordable off-farm produced feed
Quantify intended benefits	
Intervention/ project summary, incl. timeline (max. 300 words).	<p>Land, water and labour scarcity constrain the extent to which feed resources can be improved on farm. The demand for affordable off farm produced feed is increasing. This is an opportunity for micro, small and medium enterprises (MSMEs) to become engaged in feed production, transaction and processing by the generation ration of feed value chains. The work will be informed by the feed supply – demand tool on where a feed demand gap is strong</p> <p>Explored will be:</p> <ul style="list-style-type: none"> <li>• Forages as cash crop and fodder marketing</li> <li>• Service provision in chopping, hay and silage making</li> <li>• Production of mineral supplements</li> <li>• Production of energy and protein supplements</li> <li>• Production of total mixed rations</li> <li>• Upgrading of crop residues</li> </ul> <p>The project will context specific develop business plans for those MSMEs and develop training and capacity building around it.</p>
Project partners.	NARS, ILRI, private sector
What activities will be undertaken during the research phase, including timelines and partners?	Year 1: Demand and market studies for the different MSME options Year 2 and 3: Implementation of proof-of-concept studies and incorporation of feed backs
What activities will be undertaken during the implementation/ commercialisation phase, including timelines (if applicable)?	Year 4 and 5: Pilot studies and scaling of MSMEs
Total project cost in USD.	5 000 000 US \$ per country
Benefit vs cost ratio.	
How it speaks to donor strategies.	Addresses two key constraints: A) increase availability of affordable feed; and B) generates rural employment and income opportunities through MESMEs

## Project idea - Utilizing and enriching crop residues and unconventional feed resources in South Asia

Region, country coverage.	Bangladesh, Nepal, Pakistan and India
High level priority outcome(s) the intervention supports	Increase the availability the feeds through improvement of crop residues and unconventional feeds and to increase milk & meat production of livestock and also improve the livelihood of the farmers in this region
Intervention/ project name.	Utilizing and enriching crop residues and unconventional feed resources
Quantify intended benefits	About 20,000 households initially undertaken for demonstration, validation of developed technologies on crop residues and unconventional feed resources. The annual monetary benefit by utilization of improved technologies may be increased about 20 % compared existing feeding practices. Feeding has the direct effect of enteric methane emission, better the quality of feeds and fodders, lower the reduction of enteric methane emission of per unit of milk and meat production.
Intervention/ project summary, incl. timeline (max. 300 words).	Livestock is playing a significant role in nutritional and livelihood security in the region, countries like Bangladesh, Nepal, Pakistan and India. Crop residues are playing a great role as feeds for livestock in those countries and crop residues contributing more than 90 % of their total requirements of feeds and fodder. After introduction of improved varieties of rice cultivation in those countries, the production of crop residues is reduced and rice breeders didn't consider the increase the production crop residues instead of crop yield. Further, the literatures reviewed that the availability of crop residues also varies with seasons. It is noted during monsoon period farmers are not able to harvest all the crop residues from the field and due to rain, they can't preserve the harvested crop residues and more 60 % crop residues are wastages especially in Boro rice. In addition to crop residues, there are some other unconventional feed resources haven't yet been fully explored as livestock feeds among the members countries. The above view in mind, there is necessary to take a project to increase the availability of conventional and unconventional resources as livestock feeds through proper management of crop residues, intervention of processing and preservation technologies and entrepreneurship development of commercialization marketing systems for value addition of crop residues and unconventional feeds resources.
Project partners.	BLRI, DLS, NARC, PARC, and ICAR Institutes
What activities will be undertaken during the research phase, including timelines and partners?	The following activities will be conducted during the research phase: <ul style="list-style-type: none"> <li>(i) Development of country wise data base on existing crop residues and unconventional feed resources.</li> <li>(ii) Identify the potential crop and unconventional feed resources available to farmers</li> <li>(iii) Identify the existing utilization practices followed by the farmers among the members countries.</li> <li>(iv) Identify the suitable processing, preservation and utilization technologies available for the farmers</li> <li>(v) Intervention and validate the selected technologies among the countries.</li> <li>(vi) Commercialization of processing and preservation technologies for crop residues and unconventional feed resources</li> </ul>
What activities will be undertaken during the implementation/	

commercialisation phase, including timelines (if applicable)?	
Total project cost in USD.	USD 20 million
Benefit vs cost ratio.	1.34
How it speaks to donor strategies.	

### **Feed and forage development project idea – next steps**

1. Refine all five research for development topics incorporating comments from USAID and World Bank representatives by 15<sup>th</sup> December and share among the group members.
2. Align proposals with national priority
3. Harmonization of methods – for multi-country projects
4. Formulate community of practice on feed and forage resource consisting members from Nepal, Bangladesh, Pakistan and ILRI. Participant(s) from the respective countries/institution will nominate more members in this community.
5. Approach donors operating in the region in consultation with Rahman and Bolek.
6. ILRI coordinates the process and sets timelines (in next communication) for other steps for resource mobilization.
7. Core team:

Tek Bahadur Gurung, Director Livestock and Fisheries, Nepal Agricultural Research Council, Kathmandu, Nepal. Email: [tek\\_fisheries@hotmail.com](mailto:tek_fisheries@hotmail.com)

Nathu Ram Sarker, Director General, Bangladesh Livestock Research Institute, Dhaka, Bangladesh. Email: [sarkernr62@yahoo.com](mailto:sarkernr62@yahoo.com)

For India – The Director General of ICAR through Dr Habibar Rahman, ILRI New Delhi

ILRI: Sita Ram Ghimire ([s.ghimire@cgiar.org](mailto:s.ghimire@cgiar.org)) and Michael Blummel ([m.blummel@cgiar.org](mailto:m.blummel@cgiar.org))

## *Animal health*

### **Desired outcomes**

1. Control of transboundary zoonotic and economic disease prevention
2. Prudent use of AMR
3. Available quality biologicals
4. Available effective diagnostics
5. Effective vet/extension services
6. Improved knowledge of disease control – vets and farmers
7. Mitigated ghg emissions from livestock

### **Challenges**

1. Inadequate resources
2. Remoteness
3. Illegal trade animals and products
4. Weak surveillance systems, incl. diagnosis
5. Small scale livestock production systems
6. Low policy attention to animal disease
7. Poor legislation (eg drug use)
8. Poor cool chain management
9. Low quality vaccine
10. Counterfeit products
11. Insufficient lab facilities
12. Not enough vet capacity in rural areas
13. Weak vet services
14. Low levels of biosecurity
15. No control of imported vaccine and pharmaceuticals

### **Potential interventions**

1. Molecular characterization of important pathogens
2. Develop diagnostics (point of care)
3. Risk assessment based on surveillance data
4. Socio-econ analysis of vaccination (eg, gender, willingness to pay)
5. Identify benefits to data providers
6. Vaccines and delivery systems (safe, affordable, efficacious, appropriate)

## **Project idea - Develop a pen-side/point of care test for PPR in sheep and goats**

- Scope
  - SAARC
  - Control of transboundary diseases
- Benefits
  - Contributes to the PPR Global Control and Eradication Strategy (PPR GCES).
  - Rapid, cost-effective, cheaper
  - Immediate diagnosis in the field
  - Early detection
  - No need to transport samples
  - No need for laboratory testing
  - No need for highly-trained personnel
- Project summary
  - Public and private partnerships will be sought for the research and development process for this test.
  - Field validation will be required.
- Speaks to donor strategies
  - This project is completely aligned with donor strategies because it contributes to the PPR GCES.

## **Animal health project idea – next steps**

- All 4 interventions will be shared with the participating countries. The lead national research centers - ICAR, NARC, BLRI, PARC – will then decide on their priorities and interest in participating.
- Subsequently, ILRI and the interested partners will develop extended concept notes, incorporating feedback of the countries.
- The revision process will take account of feedback received in the meeting - on One Health, on missing elements like biosecurity and financial viability, and better articulation of the objectives.

# Annex 1. Agenda

<b>13 November: TUESDAY</b>	
0830	Registration
0900-0910	Lighting of Lamp and Felicitation of the Guests
0910-0915	Welcome: Dr. Habibar Rahman, ILRI Regional Representative for South Asia
0915-0930	Opening Remarks: Dr. Jimmy Smith, Director General, ILRI
0930-0940	Speech by Sh. Prakash Mathema, Secretary, Ministry of Agriculture and Livestock Development, Government of Nepal
0940-0955	Keynote Address: Dr. Trilochan Mahapatra, Secretary, Department of Agricultural Research and Education, Government of India and Director General, Indian Council of Agricultural Research
0955-1000	Release of ILRI South Asia Newsletter
1000-1015	Address of Chief Guest: Dr. Dil Bahadur Gurung, Member, National Planning Commission, Government of Nepal
1015-1020	Signing of MoU – ILRI and BLRI
1020-1025	Vote of thanks: Mr. Bolek Stawicki
1025-1030	Official photo
1030-1100	Break
1100-1130	Agenda, introductions and process – facilitator
1130-1145	ILRI's livestock R4D approach – Bolek Stawicki
1145-1300	Country priorities – presentations on sustainable livestock outcomes and opportunities in the priority intervention areas in Bangladesh, Nepal, Pakistan.  Purpose: share information per country and get everyone on the same level.
1300-1400	LUNCH
1400	LR4D outcomes and challenges – participatory exercise  Purpose: identify LR4D priority outcomes, needs, and what the critical bottlenecks to achieve these.
1530	BREAK
1600	LR4D outcome examples – short presentations  Purpose: stimulate and motivate by showing what's achievable
1630	Promising LR4D interventions - participatory exercise  Purpose: Identify most promising LR4D opportunities by priority intervention areas across countries.
1730	CLOSE
1830	COCKTAIL DINNER at the Kumari Hall, Hotel Annapurna

<b>14 November: WEDNESDAY</b>	
0845	Recap and plans
0900	Outcomes, opportunities, interventions – Stocktaking  Purpose: Produce a coherent overview matrix showing potential country/intervention interests
1000	Outcomes, opportunities, interventions – Promising investment areas  Purpose: Produce a short list of intervention ideas, some of which can be fleshed out
1030	BREAK

1100	LR4D promising interventions – initial business cases  Purpose: Produce a set of specific short investment cases that could be more fully developed after
1300	LUNCH
1400	LR4D into the 'lion's den' – pitching exercise  Purpose: obtain initial feedback and suggestions from representatives of potential investors
1530	BREAK
1600	Recap, synthesis, actions and next steps
1700	CLOSE



## Annex 2. Participants

1. Ajay Kumar, Deputy Chief of Mission, Embassy of India, Nepal
2. Arjun Thapa, Program Officer, Food and Agriculture Organization of the United Nations, Nepal
3. Baidya Nath Mahto, Executive Director, Nepal Agricultural Research Council
4. Bheshraj Pandey, Presenter, Krishi TV, Nepal
5. Bimal Kumar Nirmal, Director General and CVO, Department of Livestock Services, Ministry of Agriculture and Livestock Development, Nepal
6. Bishnu Bibek Biswakarma, Ujjayo Radio Network, Nepal
7. Bolek Stawicki, Head, Business Development Unit, ILRI
8. Damayanti Shrestha, Deputy Director General, Department of Livestock Services, Nepal
9. Dhan Raj Ratala, Livestock Expert, Food and Agriculture Organization of the United Nations, Nepal
10. Dieter Schillinger, DDG Biosciences, ILRI, Kenya
11. Dil Bahadur Gurung, Member, National Planning Commission, Nepal
12. Dilli Ram Sedai, Project Director, National Livestock Sector Innovation Project, Nepal
13. Habibar Rahman, ILRI Regional Representative for South Asia
14. Jenny Hutchison, Director & Executive Consultant, AUSVET, Australia
15. Jimmy Smith, Director General, International Livestock Research Institute (ILRI), Kenya
16. Karishma Wasti, Agriculture Specialist, World Bank, Nepal
17. Keshav Prasad Premy, Livestock Coordinator, Improved Seed for Farmers Programme-ISFP, Nepal
18. Keshav Sah, Heifer International, Nepal
19. Khadak Singh Bisht, Animal Health Specialist, Food and Agriculture Organization of the United Nations, Nepal
20. Kiran Pandey, Livestock Development Officer, Department of Livestock Services, Nepal
21. Kishan Lal Bhatt, Joint Secretary, Ministry of Agriculture and Livestock Development, Nepal
22. Md Ainul Haque, Director, Livestock Research Institute, Department of Livestock Services, Bangladesh
23. Md. Nure Alam Siddiky, Bangladesh Livestock Research Institute
24. Michael Blummel, Deputy Program Leader, Feed and Forage Development, ILRI, Ethiopia
25. Mohammad Farooq, Additional Principal Veterinary Officer, Livestock and Dairy Development Department, Pakistan
26. Mohammad Rafiqul Islam, Principal Scientific Officer (Livestock), Bangladesh Agricultural Research Council
27. Muhammad Nuruzzaman, Project Management Specialist, United States Agency for International Development, Bangladesh
28. Mwai Okeyo, Deputy Program Leader, Livestock Genetics, ILRI, Kenya
29. Nama Raj Adhikari, Associate Program Manager, Japan International Cooperation Agency, Nepal
30. Nanda Ritsma, Senior Advisor Value Chain Development, German Corporation for International Cooperation, Nepal
31. Nathu Ram Sarker, Director General, Bangladesh Livestock Research Institute, Bangladesh
32. Neena Amatyu Gorkhali, Head and Senior Scientist, Animal Breeding Division, Nepal Agricultural Research Council
33. Peter Ballantyne, Communications and Knowledge Management, ILRI, United Kingdom
34. Pradip C. Bhattarai, Ministry of Agriculture and Livestock Development, Nepal
35. Prakash Mathema, Secretary, Ministry of Agriculture and Livestock Development, Nepal
36. Purn Bahadur Chhetri, Senior Agriculture Specialist, World Bank, Nepal
37. Raj Kumar Gera, Vice President - Sales and Marketing, Hester Biosciences, India
38. Rajan Acharya, Asian Development Bank, Nepal
39. Roma Oli, Administrative Officer, ILRI, India
40. Samjhana Kumari Kifle, Deputy Director General, Department of Livestock Services, Nepal

41. Sita Ram Ghimire, Principal Scientist, ILRI, Kenya
42. Steve Staal, Program Leader, Policies Institutions and Livelihoods, ILRI, Kenya
43. Sulochana, CEO, Hester Biosciences, Nepal
44. Suman Panth, Sub-Editor, Kanripur TV, Nepal
45. Sushil Adhikari, Photographer, Department of Livestock Services, Nepal
46. Tej Bahadur Rijal, Project Director, Department of Livestock Services, Nepal
47. Tek Bahadur Gurung, Director (Livestock and Fisheries), Nepal Agricultural Research Council
48. Trilochan Mohapatra, Secretary, Department of Agricultural Research and Education and  
Director General, Indian Council of Agricultural Research, India
49. V. Padmakumar, Project Supervisor, ILRI, India
50. Vijayalakshmy Kennady, Technical Officer, ILRI, India

## Annex 3. Knowledge and communication materials

Interview on Nepal Krishi TV: <https://www.youtube.com/watch?v=FKVvt5KNyFQ>

Interview on Ujjayo Radio Network by Dr Jimmy Smith and Dr H Rahman:

<http://ujjaaloonline.com/show/1795>

ILRI South Asia Newsletter, November 2018: <https://hdl.handle.net/10568/98301>

ILRI news item: <https://asia.ilri.org/2018/11/28/nepal-nov2018/>

Photos from the meeting: <https://www.flickr.com/photos/ilri/albums/72157676138177058>

Presentations:

- Blummel, M., Sharma, G.V.M., Ravindranath, K., Padmakumar, V., Rahman, H. and Jones, C. 2018. Can we turn crop residues into concentrates? Presented at the Meeting on transforming livelihoods in South Asia through sustainable livestock research and development, Kathmandu, Nepal, 13-14 November 2018. Nairobi, Kenya: ILRI. <https://hdl.handle.net/10568/98270>
- Ghimire, S.R. 2018. Improved forages increase livestock productivity: Brachiaria grass a success story. Presented at the Meeting on transforming livelihoods in South Asia through sustainable livestock research and development, Kathmandu, Nepal, 13-14 November 2018. Nairobi, Kenya: ILRI. <https://hdl.handle.net/10568/98269>
- Padmakumar, V. 2018. Key lessons to deliver successful goat development programs in South Asia. Presented at the Meeting on transforming livelihoods in South Asia through sustainable livestock research and development, Kathmandu, Nepal, 13-14 November 2018. Nairobi, Kenya: ILRI. <https://hdl.handle.net/10568/98268>
- Schillinger, D. 2018. ILRI animal and human health activities. Presented at the Meeting on transforming livelihoods in South Asia through sustainable livestock research and development, Kathmandu, Nepal, 13-14 November 2018. Nairobi, Kenya: ILRI. <https://hdl.handle.net/10568/98267>
- Stawicki, B. 2018. Better lives through livestock: ILRI's livestock research for development approach. Presented at the Meeting on transforming livelihoods in South Asia through sustainable livestock research and development, Kathmandu, Nepal, 13-14 November 2018. Nairobi, Kenya: ILRI. <https://hdl.handle.net/10568/98266>
- Farooq Tareen, Muhammad. 2018. Livestock and Poultry Sectors in Pakistan. Presented at the Meeting on transforming livelihoods in South Asia through sustainable livestock research and development, Kathmandu, Nepal, 13-14 November 2018. Quetta, Pakistan: Government Poultry Farm. <https://www.slideshare.net/ILRI/southasia-ppt-pakistan>
- Gera, Raj Kumar. 2018. World's biggest project for immunisation of backyard animals. Presented at the Meeting on transforming livelihoods in South Asia through sustainable livestock research and development, Kathmandu, Nepal, 13-14 November 2018. Ahmedabad, India: Hester Biosciences Ltd. <https://www.slideshare.net/ILRI/southasia-ppt-hester>
- Gurung, Tek B. and Nirmal, Bimal K. 2018. Priority areas of livestock sector for strengthening food and nutrition security in Nepal. Presented at the Meeting on transforming livelihoods in South Asia through sustainable livestock research and development, Kathmandu, Nepal, 13-14 November 2018. Kathmandu: Nepal Agricultural Research Council. <https://www.slideshare.net/ILRI/southasia-ppt-nepal>

- Hutchison, Jennifer. 2018. Introducing Ausvet. Presented at the Meeting on transforming livelihoods in South Asia through sustainable livestock research and development, Kathmandu, Nepal, 13-14 November 2018. Canberra, Australia: Ausvet. <https://www.slideshare.net/ILRI/southasia-ppt-ausvet>
- Sarker, N.R. 2018. Transforming livelihoods in South Asia through sustainable livestock research and development: Bangladesh perspectives. Presented at the Meeting on transforming livelihoods in South Asia through sustainable livestock research and development, Kathmandu, Nepal, 13-14 November 2018. Dhaka: Bangladesh Livestock Research Institute. <https://www.slideshare.net/ILRI/southasia-ppt-bangladesh>
- Siddiky, Nure Alam. 2018. Livestock in South Asia: Challenges, priorities and way forward. Presented at the Meeting on transforming livelihoods in South Asia through sustainable livestock research and development, Kathmandu, Nepal, 13-14 November 2018. Dhaka: Bangladesh Livestock Research Institute. <https://www.slideshare.net/ILRI/southasia-ppt-saarc>