



FEED THE FUTURE

The U.S. Government's Global Hunger & Food Security Initiative

The U.S. Agency for International Development (USAID) awarded the University of Florida (UF) Institute of Food and Agricultural Sciences (IFAS) funds to establish the Feed the Future Innovation Lab for Livestock Systems. This five-year initiative (October 2015 to September 2020) supports USAID's agricultural research and capacity building work under Feed the Future, the U.S. Government's global hunger and food security initiative. The International Livestock Research Institute (ILRI) is the UF/IFAS partner in implementation of the program.

The vision of the Feed the Future Innovation Lab for Livestock Systems is to sustainably intensify smallholder livestock systems in order to improve human nutrition, health, and incomes. Initiated in October 2015, the program is now well established in its core target countries, Ethiopia, Rwanda, Burkina Faso, Niger, Nepal, and Cambodia. Competitively selected Reach and Focus projects based on priorities developed in a participatory manner are operational in the six core countries.

The Feed the Future Innovation Lab for Livestock Systems conducts annual Global Nutrition Symposia as its premier multi-stakeholder knowledge sharing platform for participatory priority development, dialogue, and research to development linkages, to ensure that the Lab's research has practical relevance and leads to solid developmental impacts. The first Global Nutrition Symposium took place in Gainesville, Florida, in March 2017, and focused on "Improving Human Nutrition With Animal-Source Foods". The second one explored the "Missing Link: Increasing Availability of Animal-Source Foods Through Greater Production and Marketing of Quality Feeds" and took place in Addis Ababa, Ethiopia, in January 2018.

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Feed the Future Innovation Lab for Livestock Systems

POSTER ABSTRACTS

Extending Our Reach

Symposium on Improving human nutrition and incomes through
effective livestock research and extension partnerships

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Theme 1:
**Innovative Approaches Linking Livestock
Research and Extension**

No.	Abstract Title
1	Factors affecting the productive and reproductive traits of indigenous goats in Nepal
2	Good livestock management practices to improve vegetable production, nutrition security and household income in rural Nepal
3	Dairy farmers' willingness to pay for mobile advisory services
4	Effectiveness of mobile advisory services in dairy farming: An innovative approach to link livestock research and farmers
5	Inclusiveness in access to livestock services (extension, animal health, and medicines) in Ethiopia: The case of dairy
6	Conditional cash transfers and embedded extension: A mechanism to promote adoption of improved goat shelter design principles in a post-emergency recovery context
7	Effect of planting methods on forage production of <i>Brachiaria</i> hybrid cv. "Mulato II", <i>Brachiaria ruziziensis</i> and <i>Megathyrsus maximus</i> cv. "C1" in a sub-humid zone of West Africa

1. Factors affecting the productive and reproductive traits of indigenous goats in Nepal

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Keywords: Breed, parity, conception, kidding, altitude, seasonality

Scientific information regarding the factors affecting the productive and reproductive performance of goats is important in relation to developing production and productivity improvement plans. The primary objective of this review article is to summarize the available literature regarding the effects of non-genetic factors on productive and reproductive traits of indigenous goats in Nepal. The review article was based on secondary information obtained through an in-depth study of over a dozen national and international online peer-reviewed journal articles, some departmental reports and technical bulletins, post-graduate and doctoral dissertations, and a few books. The study revealed that altitude, season of conception, season of kidding, numbers of kids at birth, parity, and size of doe are the major factors affecting productive and reproductive traits of indigenous goats of Nepal. These factors should be carefully considered to promote indigenous goat production on a commercial scale. Further, these parameters are important and worth considering by extension services because they directly help to improve the nutritional status of Nepalese people.



28. Characteristics and performance of community animal health workers in four central Terai Districts of Nepal

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Livestock contributes one-third of the agricultural GDP and serves as a savings mechanism for rural households in Nepal. The sector has high potential for poverty alleviation and improved maternal and child nutrition, yet production and productivity are low, as the sector suffers from insufficient access to needed veterinary services and technologies for small producers, including farm-level extension services. The purpose of this study is to assess the capacities and roadblocks of smallholder producers to increase livestock production in the central Terai of Nepal. The objective was to improve the design and implementation of training programs and producer linkages to veterinary services and technologies. For this qualitative study, 56 community animal health workers (CAHWs) were trained as extension agents to bridge the gap between input suppliers and smallholder producers in the remote areas in which they live. Data were collected through one-to-one interviews of CAHWs and key informant interviews with 4 government staff, 4 model farmers, 2 agro-vets, and 4 project staff members in the project districts (Bara, Rautahat, Sarlahi, and Mahottari). In addition, 8 focus group discussions (2 per district) were held with male and female producer's groups. The study showed that livestock services are delivered through various providers, such as VJTA, Veterinary doctor, and CAHWs, with a high percentage (74.31%) of services being delivered to producers by CAHWs. Producers also viewed the CAHW services as being very effective (52%) in the area of input supply, and CAHWs were broadly seen as able to provide appropriate services across all livestock subsectors. Lack of skills and knowledge in disease diagnosis was identified as a primary limitation for CAHWs, for which they identified refresher trainings and exposure visits as potential solutions. Aspects identified for future interventions include formal linkages to private clinics, veterinary doctors, and related government agencies to enable CAHWs to build essential skills and capacity.

2. Good livestock management practices to improve vegetable production, nutrition security and household income in rural Nepal

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Keywords: Livestock shed improvement, off-season vegetable production, nutrition security, Nepal

Assessing the impact of agricultural innovations on households' nutrition and income is complex. Our research examined relationships between level of vegetable production and consumption with adoption of four sustainable farming practices, i.e., livestock shed improvement, rain water harvest, vegetable production under poly houses, and marketing of farm products through grower-managed cooperatives. An objective was to determine the contribution of good livestock management practices to vegetable production, consumption and income. Our multi-year research focused on linking good livestock management practices with household vegetable production and consumption. The research was conducted in Rupa Rural Municipality of Kaski district, Western Nepal. Descriptive statistics and a *t*-test were used to determine the effect of the intervention on vegetable consumption and income. This innovative approach helped in linking good livestock management practices to outcome variables such as production, consumption, and income. A significant positive impact of livestock shed improvement was found on vegetable yield, household consumption of vegetables and income from sale of vegetables. Use of livestock waste was associated with increased yield of off-season vegetables. Our explanation is that use of livestock waste (urine and dung) as fertilizer improves vegetable production and income from the sale of vegetables, and alters the amount, composition and quality of food consumed. Livestock shed improvement allows for easier collection of waste (urine and dung), and application of the waste improves household vegetable production and consumption. This also represents an effective research-extension linkage that contributes to improved household nutrition.

3. Dairy farmers' willingness to pay for mobile advisory services

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Keywords: Willingness to pay, advisory services, dairy farming

As governments and international agencies think about the balance between public and private provision and financing of mobile advisory services, they are becoming more interested in conducting and considering the results of studies about individual and household willingness to pay (WTP) for such services. At the same time there is concern about the reliability and validity of studies that focus on hypothetical WTP as well as a need to consider who is able to pay. The study objectives were to examine the Farmers' WTP for dairy farming services through mobile telephony. The contingent valuation method (CVM) was used to estimate the willingness of dairy farmers to pay for different scenarios. Scenario 1: Push only service - Service of text as well as voice messages; Scenario 2: Push and Pull service -Service of text as well as voice messages; Scenario 3: SMS service along with field visit. An open ended 'WTP' questionnaire was used so that responders would not be restricted by defined values (as in binary choice or closed-ended questions). Face-to-face interviews were conducted to minimize missing responses and to more clearly explain the hypothetical scenario used to estimate the WTP for mobile advisory services. Responses to open-ended questionnaires are likely to minimize standard errors and lower estimates of central tendency preventing bias. Results indicated that about 46 percent of the respondents were willing to pay one rupee per day for push only service as observed in a bidding process. About 39 percent of the respondents were willing to pay one rupee per day for the push and pull service. More than 37 percent of the respondents were willing to pay one rupee per day for the service. The majority (83%) of respondents agreed to buy the services at the offer prices (SMS service along with field visit) at Rs 120 for 360 days. This was followed by 63 % of the respondents who agreed to purchase the service at Rs 121-180 for 360 days. Almost 37 percent of the respondents were willing to pay one rupee per day for the services. The share WTP declined to 2 percent for the service in case of highest price bid. Livestock owners were willing to pay for the mobile telephony services, if they got demand driven advisory services.

27. Popularizing fodder cultivation practices among rural women and youth: The case of Bajra Napier Hybrid

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India owns about 15% of the world's livestock population, yet livestock productivity is very low and the consumption of animal protein is dismal. Livestock productivity can be enhanced through better breeding practices, improved animal nutrition and rapid transfer of livestock technologies to the farmers. Green fodder availability (35.6%) is very low and area under fodder cultivation is also very limited (5.23%). To improve green fodder availability, a massive promotional activity was undertaken to popularize the nutritious perennial Bajra Napier Hybrid (B-N Hybrid) with protein rich varieties (CO 5 and CO 4) among the farmers. Influential/lead farmers as well as women farmers and rural youths were targeted for empowering technical know-how of production technology of B-N Hybrid and benefits of green fodder in livestock productivity. A series of extension education programs exposed farmers and other stakeholders to plots (30 acres) of B-N Hybrid created at the institute's fodder farm, workshops and training sessions, motivational videos (https://youtu.be/Ro_HJb2UGGc), technical know-how via radio talks, etc. After watching videos, 450 farmers demanded planting materials, which were supplied to them in the form of stem cuttings and rooted slips. Total sample size of pre-assessment of the fodder production at the farmer's level was 200. In order to assess the impact of popularization of B-N Hybrid for fodder cultivation practices among rural women and youths, 10 farmer beneficiaries from each of two villages were selected. The study found that in Bareilly District of Uttar Pradesh located in northern parts of India, green fodder growth remains static during 4 to 5 months yearly (September to November and April to May). Considering the total crop sown in the area season-wise, fodder crops occupy only 1.02%, 1.54% and 0.78% in *Rabi* (3384 hectare), *Kharif* (5113 hectare) and *Zaid* (2593 hectares), respectively, whereas the total livestock population of Bareilly District is 1,125,743, as per the 19th livestock census in 2012. Videos and extension activities have influenced the farmers to grow B-N Hybrid. The total area under B-N Hybrid cultivation changed from 0 to up to 50 hectares in Bareilly District. Many rural youth and women have established entrepreneurships in B-N Hybrid cultivation and are supplying the chaffed and whole Napier to the dairies situated in city and town at varying price. The B-N Hybrid not only increased the availability of green fodder but also increased the employment opportunities among the rural youth and farmers, and household income. The farmers indicated that regular availability of green fodder has increased the length of lactation period of milk animals, which has helped them in enhancing their household income up to 15%.

26. It's not enough to talk about it: Increasing women's nutrition outcomes through simultaneous, multiple interventions

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Keywords: Livestock service providers, livestock productivity, nutrition, decision-making

In rural Bangladesh, food insecurity and malnutrition are severe. Improved livestock productivity could increase incomes and access to nutritious foods, especially for women. Gender norms, however, often prevent women from fully engaging in livestock production. Additionally, while low-cost messaging options are often employed, research suggests it improves knowledge but not behavior. This study evaluates Feed the Future Bangladesh Livestock Production for Improved Nutrition (LPIN) project activities, which include initial and reinforced low-cost messaging and training, animal health and nutrition camps, and male engagement through partnerships with local religious leaders. The project's goal is to increase the use and production of livestock products in rural Bangladesh to improve rural household nutrition. Relying on data gathered from a baseline and annual survey, this research indicates a relationship between multiple communication-related interventions and an increased uptake of agricultural technology, women's decision-making power concerning agriculture and finances, and increased consumption of meat and dairy. Researchers and practitioners looking to improve women's nutrition outcomes should consider including multiple layers of information, activities, and engagement in their projects.

4. Effectiveness of mobile advisory services in dairy farming: An innovative approach to link livestock research and farmers

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Key words: Advisory services, dairy farming, effectiveness, adoption

Dairying is an integral component of social and economic development in India, where milk supply comes from millions of small scale milk producers, dispersed throughout the rural areas. However, many rural areas are characterized by limited or no accessibility to veterinary and advisory services leading to a big gap between technologies available at research institutes and farmers' door steps resulting in low productivity per animal. To bridge this gap, mobile telephony could be a useful Information Communication Tool (ICT) for disseminating technologies to farmers effectively, timely and economically. Thus, the adoption of technologies disseminated through mobile telephony was studied to examine its effectiveness. The National Dairy Research Institute (NDRI), Karnal, India developed a Messaging Portal-NDRI-MS (Messaging Service) using a software to send computer-based text and voice messages to farmers' mobile phones. The objective was to see if receiving messages from the NDRI portal would increase adoption of livestock feeding and management practices. After a gap of one year, adoption (mental preparedness for the adoption of dairy farming practices/ technologies by the dairy farmers) of advisories on dairy farming practices delivered through Short Message Service (SMS) among the recipients was assessed through interviews pre (before messages) and post (after messages) assessments to determine the percentage of adoption and change in practices. Increases in adoption of practices was observed in the following areas: 16.73% in breeding, 17.74% in feeding, 14.16% in health care, 21.21% in management, and 17.49% in fodder production practices. Overall, there was an increase (18.49%) of the respondents who adopted livestock practices after receiving SMS messages from the NDRI portal. The increase in the number of farmers adopting good livestock production practices could lead to improvements in per animal productivity and, as a result, per capita availability of milk and meat. This study showed that adoption of dairy farming practices could be improved through the use of mobile-based advisory services.

5. Inclusiveness in access to livestock services (extension, animal health, and medicines) in Ethiopia: The case of dairy

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Keywords: Extension, dairy, Ethiopia, inclusiveness

Given the importance of providing services that might stimulate adoption of improved practices in the dairy sector in Ethiopia, we analyze factors that are associated with access and use of dairy-related services. Relying on a combination of diverse large-scale datasets and methods, we analyze in particular inclusiveness of access to services by dairy farmers supplying Addis Ababa, the capital and biggest city of Ethiopia. We focus on two important factors of inclusion. First, we look at the issue of location and market access as measured by remoteness from Addis Ababa. Second, we assess the importance of farm size, as measured by the number of cows on the farm. We apply non-parametric models as well as a multi-variable regression framework to allow us to control for multiple variables at once. We find that small farms with dairy animals as well as those in more remote areas benefit significantly less from access to services (and adopt less modern practices). For these more disadvantaged farmers, stagnation in milk yields and even declines—depending on the data source used—are observed and they are therefore less involved in the ongoing dairy transformation process.

25. Gender roles in livestock rearing: A case from the Kanachanpur District of Nepal

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Keywords: Gender, livestock rearing, Nepal, milk, cow dung

Between September and October 2017, a study was carried out to examine gendered participation in livestock activities. Eighty farmers were selected purposively from Majhgau-14, Bhuda-02 and Baghpata-19 village of Kanchanpur district using a simple random sampling technique. Results showed gender specific domains in different livestock activities. Activities like feed preparation (83.78%), feeding (83.78%), cleaning of shed (95.94%), milking (89.18%) and milk processing (95.94%) are mostly carried out by women. Cow dung collection was done only by women. Only 10.81% and 20.27% of men are engaged in milking and selling of the milk, respectively. However, in taking care of sick animals, men (48.64%) have a more dominant role than women (31.08%). Females were found to have higher independent decision making power for rearing of livestock, buying and selling of small and large livestock. It was found in the surveyed area that 30% household had no access to bank, 26.25% had no access to co-operatives, 43.75% had no access to extension services, 56.25% had no access to government subsidy, 13.75% had no access to labor, and 23.75% had no access to training and services. None of the female of the surveyed area had control over banking services. Only 3.75% female had control over land, 6.25% had control over extension services and 10 % to government services. Male had significantly greater control over resources as compared their counterpart female in land (90%), bank (70%), loan for agriculture (56.25%), extension services (23.75%), and government subsidy (20%). Majority of female (46.25%) had control regarding co-operative resources as compared to their counterpart male. Therefore, suitable policies and positive interventions are required from the government to address the needs of women in livestock rearing activities.

Theme 6: Youth, Gender, and Livestock Extension Systems

No.	Abstract Title
25	Gender roles in livestock rearing: A case from the Kanachanpur District of Nepal
26	It's not enough to talk about it: Increasing women's nutrition outcomes through simultaneous, multiple interventions
27	Popularizing fodder cultivation practices among rural women and youth: The case of Bajra Napier Hybrid
28	Characteristics and performance of community animal health workers in four central Terai Districts of Nepal

6. Conditional cash transfers and embedded extension: A mechanism to promote adoption of improved goat shelter design principles in a post-emergency recovery context

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Keywords: Nepal, cash transfer, extension, goat, shelter, adoption, emergency recovery

After the earthquake of 2015, reconstruction of damaged goat shelters was a key need in many communities. Due to poor ventilation and hygiene in the existing shelters, the goats suffered. Catholic Relief Services supported conditional cash transfers, provided in two tranches (upon beneficiary selection, and construction completion), along with extension (group orientations, mentoring) focused on shelter design principles, to help beneficiaries reconstruct hygienic goat shelters. Extension on improved goat shelters focused on promoting two design principles: 1) raised platform and 2) adequate ventilation to reduce the incidences of respiratory diseases due to harmful gases emanating from feces and other waste material. The goat shelter interventions were implemented over a period of two years. The study objectives were to assess the effectiveness of conditional cash transfers combined with targeted extension on adoption of improved goat shelter principles. The methodology was comprised of visual verification of shelters constructed through cash transfer, focus group discussions with beneficiaries and non-beneficiaries, and key informant interviews with government livestock extension officials. These methods were used to identify the key lessons learned on targeting, shelter maintenance and adoption of improved design principles among non-beneficiaries. The results of the study were that 100% of cash transfer beneficiaries (3304) reconstructed shelters adopting hygienic shelter principles, beneficiaries co-invested \$80-100 in-addition to \$100 received from project, and strong ownership of the goat shelters was evident from regular upkeep and maintenance. In addition, non-beneficiaries have started adopting improved shelter design principles after witnessing reduction in respiratory diseases due to improved shelter design, and there was a 20-30% increase herd size among most beneficiaries after the earthquake due to availability of safe shelter, reduction in morbidity and decrease in distress sale. In conclusion, earthquake recovery provided an inroad to strengthen livelihoods through goat shelter reconstruction using hygienic principles. Cash transfers through two tranches nudged beneficiaries to prioritize goat shelters and catalyzed faster reconstruction. Focused messaging on design principles allowed beneficiaries to choose construction materials of their choice, promoting use of local materials and reducing cost.

7. Effect of planting methods on forage production of *Brachiaria* hybrid cv. “Mulato II”, *Brachiaria ruziziensis* and *Megathyrsus maximus* cv. “C1” in a sub-humid zone of West Africa

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Keywords: Biomass, tropical forages, sub-humid zone, planting methods, West Africa

In order to promote forage production among smallholder farmers in Burkina Faso, we conducted a trial to assess the effects of planting methods on forage production of three tropical grasses. The experiment was conducted at the INERA research station located in Farakoba/Bobo Dioulasso, Burkina Faso. Annual rainfall and temperatures ranged from 900-1200 mm and 25-30 °C, respectively. The experimental design used a split plot, with planting method as main plots (3 x 3 m) and three grasses as subplots. Seeding rates were 5 kg ha⁻¹ for C1 and 10 kg ha⁻¹ for the two *Brachiarias*. Two planting methods were tested: planting *continuously along rows* and *planting evenly along rows*. Forage was harvested 8 weeks after planting. Results showed that planting methods have a significant effect on forage production of C1 ($p \leq 0.01$), but there were no significant differences for both *Brachiarias* for the two planting methods ($p > 0.05$). The cultivar C1 biomass production was greater (2.6 Mg ha⁻¹) for the “*continuously along rows*” method ($p \leq 0.001$) than the “*evenly along rows*” method (1.6 Mg ha⁻¹). Regardless of planting methods, the greatest forage biomass production was obtained for *Ruzi* and *Mulato II* as compared to C1 ($p \leq 0.05$). Evaluation is ongoing to identify appropriate planting methods for each forage species for optimizing their forage production.

24. Development of a nutrition-sensitive agriculture training manual for use by extension staff in Ethiopia: The experience of the Feed The Future Growth Through Nutrition Activity livelihoods team

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Keywords: Livestock, nutrition-sensitive, Ethiopia, manual, animal-source foods

In 2017, a multidisciplinary team developed a nutrition-sensitive livestock and agriculture manual for use by Ethiopian extension workers, as part of a core objective in the Feed the Future Ethiopia Growth through Nutrition Activity. We evaluated the development of a comprehensive training-of-trainers manual and captured lessons learned during the vision, crafting, refinement and use of the manual. We interpreted feedback from trainers and extension staff using the manual and monitoring households trained in nutrition-sensitive concepts. This study applied a mixed methods approach incorporating: 1) retrospective analysis of the manual development process; 2) key informant interviews with manual contributors, organizational staff, and extension officers; and 3) interpretation of project collected monitoring and evaluation data. Using a Training of Trainers approach, 304 Agricultural Extension Workers cascaded nutrition-sensitive training to 2245 Development Agents, who then train households. Project partners monitored adoption of nutrition-sensitive behaviors, including consumption of animal-source foods. Manual development was a year-long process driven by an expert team with backgrounds in nutrition, livestock, crops, and livelihoods; a common vision for the manual was paramount to success. Funders and implementers must recognize the importance of training needs assessment and the time scale necessary for integrated, multi-sectoral programming to realize effects on nutrition outcomes.

23. Effect of feeding herbal medicinal residue on the performance, slaughter -carcass traits, meat quality and fatty acid composition of goats

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Keywords: Carcass characteristics, digestibility of nutrients, Ksheerabala Thailam residue, polyunsaturated fatty acids

We evaluated the effect of feeding Ksheerabala thailam residue (KTR), a herbal medicinal residue, on performance, slaughter-carcass traits and meat quality in goats. Eighteen male kids were divided into three equal groups in a completely randomized design and allotted to three dietary treatments. The kids of the control group (K0) were fed a concentrate mixture (CM) containing soybean meal (SBM) and groundnut cake (GNC) as the main source of protein while in the treatment groups the SBM and GNC protein of the control CM was replaced by KTR protein either at 20 (K20) or 40 (K40) percent in the test CM. Finger millet straw was offered as sole roughage. There was no significant difference ($p>0.05$) in the growth parameters, digestibility of major nutrients and serum biochemical profile. The slaughter and carcass characteristics as well as proximate composition of longissimus dorsi muscle were similar ($p>0.05$) among treatments. The fatty acid profile of the longissimus dorsi muscle showed that feeding of KTR had significantly increased the polyunsaturated fatty acids (PUFA) content of the muscle compared to K0. The feed cost per kg weight gain was reduced by Rs 21 in K40. Our study has shown that KTR, a by-product of the extraction process for herbal medicine preparation, which is rich in protein and unsaturated fatty acids can be safely included in the concentrate as a feed ingredient and is a new addition to the existing feed basket for livestock. Also, inclusion of KTR in the concentrate will definitely improve human health by lowering the incidence of coronary heart diseases because of higher PUFA content in such meat. The use of KTR in the concentrate also helped to economize the feeding cost, the major cost involved in livestock production system. Thus, it will be more remunerative for livestock farmers.

Theme 2: Behavioral Change and Animal-Source Food Consumption

No.	Abstract Title
8	Empowering women and improving nutrition through livestock transfer: Lessons from Senegal
9	“Our food may not be very safe, because nowadays everything uses chemicals.” Women’s perceptions of food safety and nutrition in Phnom Penh, Cambodia
10	Evaluating the impact of sending SMS messages to increase egg consumption among children 1-2 years of age, a cluster-randomized controlled trial in Kanchanpur, Nepal
11	The gift of chickens: An innovative behavior change strategy to improve infant and young child nutrition through increased egg consumption in Burkina Faso
12	“More milk, please!” Does increased milk consumption lead to better child growth and development in rural Nepal?
13	Multisector community development improves child diet quality relative to other household members more than nutrition training alone in rural Nepal
14	Turning barriers into opportunities: Improving the consumption of meat and dairy in the rural households of Southwest Bangladesh
15	Nutrition sensitive poultry programming and egg consumption behavior
16	Assessment of existing milk production, consumption and marketing patterns for milk produced by dairy cattle in Chitwan, Nepal

8. Empowering women and improving nutrition through livestock transfer: Lessons from Senegal

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Keywords: Animal-source foods, small ruminants, poultry, women's empowerment, economic livelihoods, advisory services, nutrition-sensitive, resilience, asset accumulation

The USAID | Yaajeende Food Security and Nutrition Program in Senegal implemented a small livestock transfer activity targeted to women as part of an integrated approach combining agriculture, economic growth and nutrition interventions. This activity intended to strengthen resilience and sustainability by increasing women's empowerment, diversifying livelihoods and improving nutrition through sustained livestock production and animal-source food (ASF) consumption. To help program designers create more effective Livestock Transfer Interventions, USAID Advancing Nutrition reviewed a mixed methods study on the USAID | Yaajeende project conducted by Michigan State University (MSU) and explored implications of the study's recommendations by comparing them to other activities with small livestock components. USAID Advancing Nutrition compared recommendations through a desk review of evaluations and quarterly, annual and final reports from eight USAID activities from the last five years. The experience of the livestock transfer activity on the USAID | Yaajeende project as described in the MSU study showed that the activity spurred modest improvement in income and access to ASFs, promoted more economic independence among women and improved family diet. In comparing USAID | Yaajeende learnings with the results of other projects, common recommendations were identified including improved pathways to nutrition, increased education for livestock recipients, reliable extension and advisory services, participatory beneficiary targeting, careful context assessment and stronger intervention design. Lessons from other projects indicate that the involvement of community animal health workers, either through private sector or government livestock extension support, improves outcomes. Implementation research would increase understanding of the complex conditions necessary for effective livestock transfer activities and the characteristics of adequate support services.

Theme 5: Partnerships to Improve Human Health and Nutrition through Extension

No.	Abstract Title
23	Effect of feeding herbal medicinal residue on the performance, slaughter-carcass traits, meat quality and fatty acid composition of goats
24	Development of a nutrition-sensitive agriculture training manual for use by extension staff in Ethiopia: The experience of the Feed The Future Growth Through Nutrition Activity livelihoods team

22. A three-step process for evaluating livestock and nutrition research for development projects

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Keywords: Evaluation, innovation, lessons learned, innovation dissemination, research for development

The Feed the Future Innovation Lab for Livestock Systems employs, within the USAID evaluation framework, a three-step program evaluation process. The overall aim of the evaluation framework is to improve program performance and to assess progress towards achieving the program's goal to enhance the production, marketing, and consumption of safe and nutritious animal-source foods. The three steps are as follows: (1) Innovation Evaluation, which investigates the livestock research for development process; (2) Dissemination Studies, which investigate the diffusion and uptake of research and innovations by extension and development organizations or institutions; and (3) Impact Evaluation. The three-step process was constructed to obtain a comprehensive understanding of the short-, mid-, and long-term outcomes of project efforts, and to improve the understanding of the processes necessary for conducting impactful research for development. The development of the evaluation framework is original work developed by the monitoring and evaluation team of the Livestock Systems Innovation Lab, and its associated tools were informed by Rogers' diffusion of innovations theory (2003). Specifically, the four main elements of diffusion (i.e., the actual innovation, the communication channels, the social system, and the effect of time) and the five attributes of innovations (i.e., relative advantage, compatibility, complexity, trialability, and observability) were fundamental for the conceptualization and creation of the framework and tools. This framework is unlike others as it spans the livestock research for development continuum—research processes and implementation; innovation and results dissemination; and program and capacity building impacts.

9. “Our food may not be very safe, because nowadays everything uses chemicals.” Women’s perceptions of food safety and nutrition in Phnom Penh, Cambodia

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Keywords: Nutrition, food safety, pesticides

Foodborne disease and malnutrition are critical public health issues in Cambodia, but there is limited evidence on effective integrated food safety and nutrition interventions. This study was conducted as formative research for a market-based intervention that aims to improve the safety of animal-source foods sold in informal markets. The study objective was to determine perception of the risk of food safety and how it relates to diet, health, and decision-making. Twenty-four in-depth interviews with female caregivers of children under five in Phnom Penh, Cambodia were analyzed using MAXQDA. Preliminary results suggest that women believe chemicals in animal-source foods impact the health of their families by causing diarrhea and problems during pregnancy. Their primary food safety concern was chemicals in food, creating a lack of trust in markets, which affects food purchasing behaviors and strategies for making the food safer for families. Interventions that aim to decrease rates of foodborne illness and increase animal-source food consumption should also address the belief that the food system has been compromised by the addition of chemicals and pesticides.

10. Evaluating the impact of sending SMS messages to increase egg consumption among children 1-2 years of age, a cluster-randomized controlled trial in Kanchanpur, Nepal

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Keywords: Behavior change, child nutrition, dietary diversity, egg consumption, Nepal

Dietary diversity, and specifically consumption of animal-source foods, remains low in Nepal. Research shows that consumption of eggs has many nutritional benefits, particularly for women and children in the 1000-day period between conception and a child's second birthday. However, what is unknown to date is how to increase consumption of eggs through particular social and behavior change interventions; one opportunity is sending SMS messages to remind and encourage households to engage in optimal dietary practices. Through formative research with mothers, we found acceptability and interest to be high, but evidence to show effectiveness of nutrition interventions is lacking globally. Thus, a two-arm randomized controlled trial in Kanchanpur, Nepal will evaluate the effectiveness of using an SMS push-message intervention, layered onto a large pre-existing package of behavioral change interventions, which has shown to have a positive impact on egg consumption among children 1 to 2 years of age. Multivariable logistic regression will be used for intent-to-treat analysis to assess impact on child egg consumption (24 hour dietary recall), controlling for clustering. Impact will be estimated and tested using a difference-in-differences model in which survey (baseline vs. endline), arm (control vs. intervention), and their interaction are specified as fixed effects. Secondary analysis will explore the effect of the intervention on other nutrition-related behaviors and whether there is variation in impact between households in which multiple adult household members, versus only the mother, received and read the SMS messages.

Theme 4: Evaluation of Extension's Nutrition Efforts

No.	Abstract Title
22	A three-step process for evaluating livestock and nutrition research for development projects

21. Cross-country analysis of human and institutional capacity development challenges in livestock systems research: Problematizing training as a research capacity development solution

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Across development efforts, capacity development is used as a synonym for training. In food security efforts, this term includes training initiatives from the household and farm level up to the highest level of researcher and policy-maker. Despite the efforts of organizations and development agencies, training as a form of capacity development is often shown to be ineffective in the long-term. This study investigates the capacity-related blockages to conducting quality livestock research in a food security project. We used interviews, focus groups, and participatory workshops to determine the Human and Institutional Capacity Development (HCID) needs and challenges of the Feed the Future Innovation Lab for Livestock Systems' university partners in Nepal, Ethiopia, Niger, and Burkina Faso. We used a cross-case analysis to identify the challenges that are unique to and consistent across universities conducting livestock research. Our results show that training-only approaches to building research capacity are insufficient to address the organizational, infrastructure, and enabling environment blockages to conducting quality research. Research capacity development efforts must take a systems approach that is inclusive of needed infrastructure, supportive organizational arrangements, and appropriate and enforced policies, as well as addressing how these systems influence the capacity of the individual to participate in and utilize training.

11. The gift of chickens: An innovative behavior change strategy to improve infant and young child nutrition through increased egg consumption in Burkina Faso

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Keywords: Animal-source foods, Burkina Faso, children, empowerment, nutrition, poultry

Animal-source food (ASF) consumption can improve growth, nutritional status, cognitive development, and health in children. In Burkina Faso, ASF consumption is low, particularly among women and children. Chicken eggs are typically produced for hatching, income, gifting, and/or socio-religious practices, rather than for direct household consumption, and egg consumption is very low, particularly among children. A 10-month cluster randomized controlled trial examined the impact of an innovative behavior change communication (BCC) package, designed to address the barriers to ASF consumption and to improve smallholder poultry production practices in rural Burkina Faso. The BCC package included the gifting of chickens to children 6 and 12 months of age, monthly training sessions for mothers/caregivers of the targeted child, and use of a picture-based flipbook given to mothers/caregivers to reinforce monthly messages about nutrition and poultry production. The BCC package is designed to empower caregivers as poultry producers by improving their access to livestock production resources, providing tools for improved decision making, and enhancing knowledge of nutrition. Ninety women/child dyads were targeted in each of three research arms. The full intervention arm, described above, receives trainings, flipbooks, and gifted chickens; the partial intervention arm receives the same trainings and flipbooks, but does not receive the gifted chickens; and the control arm receives neither training, flipbooks, nor chickens. A total of 266 dyads were enrolled in the study. Preliminary results from the study, including poultry production, egg consumption of children, nutritional indicators of children, and household level resilience will be presented. In addition, implications of the study on extension services to improve human nutrition will be discussed.

12. “More milk, please!” Does increased milk consumption lead to better child growth and development in rural Nepal?

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Child undernutrition afflicts >150 million children worldwide, contributing to poor child growth, increased risk of infections, and loss of developmental potential. Animal-source foods (ASFs) can ameliorate these problems by providing high-quality, high-density, bioavailable protein and micronutrients. However, many children in developing countries lack ASFs in their diet. The objective of this study was to assess the impact of milk on child growth and development in rural Nepal and to specifically examine the impact of a Heifer Nepal intervention on child diet, growth, and development. Heifer Nepal, in collaboration with local Nepali NGOs in Banke district, conducted a four-year longitudinal randomized trial. The three treatment arms compared were: community development *plus* training on human nutrition/livestock production vs. training alone vs. control. Child 24-hour diet recall and anthropometry were obtained during 6 household visits (5854 observations, children ages 6-60 months); developmental assessments (Ages & Stages Questionnaire, ASQ) were performed on a subset of children at midline and endline. Results showed that few ASFs were consumed by children in the project area; milk most frequently (29%). The full intervention significantly increased diet diversity, but milk consumption remained relatively static despite many households having dairy animals. At endline, 15% drank milk 1-4 times/week, and 64% drank none. However, compared to milk non-consumers, children who consumed milk had significantly higher weight-for-height and head circumference z scores (-.75 vs -.66, $P = .005$; -1.14 vs -1.04, $P < .001$). Additionally, milk consumers had significantly higher ASQ scores (midline 232 vs 204, $P < .0001$; endline 211 vs 196, $P < .001$) than non-consumers. In this rural Nepali population, milk consumption was strongly linked to child growth and developmental performance. However, an educational intervention promoting ASFs did not increase milk consumption. Milk availability, cultural practices, and preference for sale over child intake may account for this finding. Further investigation of milk consumption practices in this setting are warranted, as the results indicate the fundamental importance of dietary milk to child well-being.

20. Utilization of information sources for organic waste management by dairy farmers of rural Punjab

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Keywords: Dairy farmers, extension, information and communications technology, information source, mass media, organic waste

In India, the production of organic waste is estimated to be 3000 million tons. Punjab being an agriculturally rich state contributes a major share to it. This study was conducted to analyze the sources of information utilized by dairy farmers of rural Punjab for obtaining information on organic waste management. A total of 80 farmers (small and large) were selected randomly for the study. Results revealed that small farmers have a low level of mass media exposure and extension agency contact with high ICT utilization. Contrarily, large farmers had medium mass media exposure and extension agency contact with high ICT usage. Pooled data revealed that the utilization of information sources by farmers is of medium level, but that ICT utilization was found to be the highest for obtaining information. The t-value was -3.998 which was significant at $p < 0.05$. Among the various information sources, majority of the farmers often use veterinary dispensary/hospital (75.00%), paravets (63.75%), phone call (67.50%), social media (57.50%), television (56.25%) and *kisan mela* (56.25%) for obtaining information on waste management. As ICT utilization among farmers is high, therefore, more ICT tools should be developed for efficient organic waste management, which will not only hasten information dissemination but also strengthen extension delivery in rural areas.

19. Value chain analysis of backyard poultry in Nuwakot district of Nepal

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Keywords: Value chain, market, backyard poultry, rural farmers, livelihood, nutrition, extension

Backyard poultry production can significantly improve the livelihood and nutrition of rural farmers. Despite the tremendous opportunity it represents, its potential has not been fully developed due to lack of prioritization. The objectives of the study were to 1) highlight the economic significance of backyard poultry production, and 2) prioritize the major constraints and opportunities in backyard poultry. Primary and secondary data were collected from 50 household surveys, 5 focus group discussions (FGDs), and 50 key informant interviews (KIIs) with farmers, from different actors and enablers as well as government and non-government publications. Data analysis was done using SPSS. Gross margins were calculated and a logit regression model was used to identify factors influencing farmer's decisions to rear backyard poultry. This study found that 72% of the farmers surveyed rear backyard poultry. The sources of chicks were nearby vendors and local community. Products were sold mainly to local buyers and collectors. The major constraints for backyard poultry production are an unstable market and lack of basic technical knowledge, which causes farmers to stick to traditional practices. The demand for backyard poultry is high, which could potentially provide a substantial and sustainable business opportunity for rural poor. However, the skills and capital required to raise backyard poultry are insufficient. In conclusion, consumption of backyard poultry products can be significantly improved by conducting awareness activities via various means and forums. Information generated via this study is helpful for farmers, traders, service providers, investors, development planners and policy makers, as it can ultimately contribute to increased production and consumption of backyard poultry. Approaches to improve research to extension linkages that will enhance backyard poultry production should be investigated. This should include farmer and extension worker-led, on-farm research and extension programs, short courses and field days practiced in a group setting as innovative approaches to bridge the research to extension gaps.

13. Multisector community development improves child diet quality relative to other household members more than nutrition training alone in rural Nepal

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Keywords: Milk, child, Nepal, growth, development, community development

Inadequate child dietary quality remains a significant public health problem in Nepal; the relationship of child diet to that of other household members (OHHM) is uncertain. Moreover, it is not known if community interventions can improve child diet relative to OHHM. Objective: Explore child diet and intra-household food distribution in rural Nepal. Methods: A longitudinal randomized trial compared the impact of a Heifer Nepal intervention on child diet: community development plus nutrition/livestock training (FULL), nutrition/livestock training alone (PARTIAL), and CONTROL. Food consumption data for 2607 children age 6-60 months and OHHM were recorded 5 times over 3 years. Preferential or disadvantageous child feeding practices were analyzed. Results: Child consumption of animal-source foods (ASF) improved more than OHHM in FULL and PARTIAL vs CONTROL (respectively, +.24, +.16, and +.07, $p=.003$, $p=.01$, not significant). At endline, more FULL children exceeded minimum diet diversity (80%, vs 67% CONTROL, 65% PARTIAL, $p<.0004$). At endline, the percentage of FULL and PARTIAL children whose diet diversity score (DDS) matched or exceeded OHHM DDS increased (FULL and PARTIAL, each +12% vs CONTROL +7%, $p<.0001$). Conclusions: Families receiving the FULL multisector intervention adopted preferential feeding practices favoring increased child ASF consumption and DDS. Integrated livestock-based programs that include nutrition training and community development are associated with better child dietary outcomes than isolated training programs alone.

14. Turning barriers into opportunities: Improving the consumption of meat and dairy in the rural households of Southwest Bangladesh

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To better understand how to encourage households to eat more red meat and dairy, the Feed the Future Bangladesh Livestock Production for Improved Nutrition project conducted a barrier analysis. The analysis identified major constraints and motivators to meat and milk consumption by examining the dairy and meat consumption patterns of men and women. The study involved behavior selection, creating the questionnaire, data collection and analysis. Similar questions were asked to those who exhibit the behavior (doers) and those who do not (non-doers) to identify statistically significant differences between their perceptions, including: *perceived self-efficacy, perceived social norms, perceived positive or negative consequences, perceived access, perceived barriers, perceived enablers, reminders, perceived susceptibility, perceived severity, perception of divine will, policy, culture*. The research was conducted with 540 rural households of 3 Feed the Future regions in Bangladesh: Jashore, Khulna, and Satkhira. For each behavior, the responses of at least 45 doers were compared against the results of 45 non-doers. The results were disaggregated by sex to properly account for any significant differences in responses between men and women. The analysis identified self-efficacy as the critical barrier and perceived health benefits as the strongest motivating factors in all three regions. It provided insights into the beneficiary's perceptions of dairy and red meat consumption. The results supported the project design activities to effectively improve behavior adoption and identify appropriate and effective message delivery platforms. The targeted messaging increased households' awareness of the benefits of dairy/meat consumption, leading to increased livestock productivity, household income, and utilization of dairy and meat products. The project has reported an 18% increase in households with regular meat consumption, 37% increase in households that consume milk regularly, and a 46% increase in the number of women who provide input to income decisions since the baseline.

18. Role of females in agriculture related to work performance and decision making in Madi, Chitwan, Nepal

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Keywords: Feminization, gender, agriculture, livestock, labor

This research examined whether a “feminization of agriculture” has occurred in the study area of Madi, Chitwan. In 2018, a household survey was conducted to learn about the local agricultural system and the gendered division of agricultural labor and managerial responsibilities. The findings showed a strong gendered division of agricultural works in this area, with men and women having clear responsibilities and restrictions. Agricultural activities such as ploughing, irrigating, threshing and applying chemical fertilizer and some livestock production activities like housing, medication, selling eggs and milk products, are mostly considered as “men's work”. Women are predominantly involved in agricultural activities like weeding, hoeing, manuring, collecting firewood, and in livestock activities like collecting fodder, feeding and watering, cleaning of sheds and sanitation, milking, animal raising, care and maintenance. For some agricultural work, men are paid an average of about NRs. 208 more than women. Out-migration by men was common in the study area (about 20%), but few women were reported to have migrated. Due to out-migration, women are taking on tasks that are generally considered “men's work”. Although women are in charge of most of the activities of agricultural production and livestock, any major decisions including allocation and use of resource are still controlled by men, although there are differences based on caste. Women had higher workloads in low castes due to lack of awareness and male dominance. However, with the increase of education and training, women's decision-making power increased. If women's workloads increase, and they lack influence in decision-making processes, the “feminization of agriculture” will be a female exploitation not a feminization.

17. Supply chain analysis for the Peste des Petits Ruminants vaccine in the Karamoja region to improve vaccine availability and reduce logistical costs

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Keywords: Livestock vaccine, Peste des Petits Ruminants, vaccines, food security, livestock health, supply chain

Peste des Petits Ruminants (PPR) is a disease that affects goats and sheep and a major cause of food insecurity and economical loss among pastoralist communities and livestock owners. It is targeted for eradication by 2030. The ambitious eradication program faces challenges, many of which are of interdisciplinary nature. They range from different social and gender dynamics of livestock owners among different cultures to being able to provide vaccines to livestock owners at a price they are willing to pay. Logistical challenges arise from the remoteness of pastoralist communities, dispersion of the livestock owners and poor infrastructure. The Feed the Future Innovation Lab for Livestock Systems at the University of Florida has an ongoing project for PPR vaccination in Uganda and Kenya. A supply chain analysis of the distribution methods could improve the vaccination coverage and reduce the cost, thus making it more accessible for livestock owners and improving the efficacy of vaccination programs. Identifying capacity constraints and key locations for storage and distribution will allow the project, and future vaccination projects, to optimize the use of resources and increase availability of the vaccine throughout the region.

15. Nutrition sensitive poultry programming and egg consumption behavior

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Keywords: Nutrition sensitive, egg consumption, undernutrition, behavior

In Nepal, the diets of mothers and young children often lack diversity and micronutrient quality and thus contribute to undernutrition. *Suaabara*, a large-scale multi-sectoral nutrition program funded by USAID, aims to improve maternal and child diets, and specifically to increase consumption of animal-source foods, as one behavioral pathway to reducing undernutrition in 42 of Nepal's 77 districts. *Suaabara*, in coordination with local partner NGOs and government stakeholders, implements improved backyard poultry as part of Helen Keller International's enhanced household food production (EHFP) model. This model includes trainings and follow-up visits, material inputs, and integrated agriculture, health, and nutrition behavior change interventions for increased production and consumption of eggs, particularly among poor households. This analysis aims to assess EHFP related progress to date in *Suaabara* intervention areas. Quantitative data from *Suaabara's* 2017 and 2018 annual monitoring surveys is limited to EHFP intervention areas. Descriptive analysis (percentages and means/standard deviations) examined changes in intervention coverage, outcomes, and outputs over time. Changes seen over time are tested for statistical significance and P-values are reported if $P < 0.05$. *Suaabara* qualitative research studies were used; thematic analysis conducted in Atlas.ti generated findings on barriers and facilitators for maternal and child egg consumption. The percentage of surveyed EHFP households (N=796) rearing above 10 chickens increased from 24% to 34% between 2017 and 2018. During the same time, maternal and child egg consumption also increased from 6% to 10% and 11% to 18% respectively. *Suaabara II* formative research shows that low chicken ownership and egg production; perceived high costs of purchasing eggs; limited availability of eggs in markets; and cultural and religious taboos and restrictions are barriers to egg consumption. The opportunity for immediate income by selling chicken among poor households was reported as a barrier to egg production and consumption, whereas chicken ownership was highly reported as a facilitator to regular egg consumption. Our findings highlight the potential for poultry programming to be used as an avenue to improve maternal and child dietary diversity. However, we found the adoption of good rearing practices and consumption of eggs is still low and that the barriers are quite diverse. These factors must now be considered to improve uptake of intended behaviors while programming in diverse agro-ecosystem and socio-economic contexts.

16. Assessment of existing milk production, consumption and marketing patterns for milk produced by dairy cattle in Chitwan, Nepal

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Keywords: Dairy, milk, yield, breed, average rate, production, per annum

Dairy farming has been established as an efficient method to meet nutritional and financial needs of the rural population through utilization of animal-source food (ASF). The main aim of this study was to assess the composition of milk produced and its utilization pattern in Phoolbari village of Chitwan. A structured questionnaire-survey was administered among 41 households. Each of these households reared at least one dairy cattle. Sampling and analysis of milk from each cow was done to determine the composition (solids non fat and fat%). Data analysis was performed using IBM SPSS. The average daily milk yield per cow was 9.24 ± 0.21 liters with $3.90 \pm 0.09\%$ fat and $7.92 \pm 0.07\%$ SNF, out of which 7.96 ± 0.48 liters of milk was sold per day. The majority of cows (46%) were Jersey crosses. Only 17% of respondents used urea molasses mineral blocks as a nutritional supplement. The average dry period was 61.55 ± 1.76 days. The average payment received by the farmer was Rs. 44.20/liter. A dairy farmer was thereby able to make an income of NRs. $107,114.64 \pm 6457.38$ per annum per lactating cattle. As a result, 98.45 ± 5.11 kg milk protein per lactating cattle per annum was supplied to the community. Thus, dairy farming has great potential as an efficient means to meet the economic and nutritional needs of the rural population. Furthermore, implementation of improved rearing and sales practices may increase the economic return without significantly higher costs.

Theme 3: Policy Directives and Field Realities

No.	Abstract Title
17	Supply chain analysis for the Peste des Petits Ruminants vaccine in the Karamoja region to improve vaccine availability and reduce logistical costs
18	Role of females in agriculture related to work performance and decision making in Madi, Chitwan, Nepal
19	Value chain analysis of backyard poultry in Nuwakot district of Nepal
20	Utilization of information sources for organic waste management by dairy farmers of rural Punjab
21	Cross-country analysis of human and institutional capacity development challenges in livestock systems research: Problematizing training as a research capacity development solution