

Trade-offs of SAPLING innovations

Initial and revised scoring results

Ethiopia – Dairy, Small Ruminants and Poultry value chains

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1 Introduction

SAPLING is one of the One CGIAR initiatives under the RAFS research area. SAPLING contributes to transforming livestock sectors in seven target countries (i.e., Vietnam, Nepal, Ethiopia, Kenya, Tanzania, Uganda, Mali) to make them more productive, resilient, equitable and sustainable. To support this transformation, SAPLING has three main pathways:

1. Co-creation and -delivery of sustainable productivity- and resilience-enhancing innovations that are expected to go to scale with the up-front involvement of demand and scaling partners.

2. Generation and communication of evidence that can influence policies and investments to support transformation.

3. Capacity building of partners to use the innovation packages and evidence to drive change. (<https://www.cgiar.org/initiative/17-sustainable-animal-productivity-for-livelihoods-nutrition-and-gender-inclusion-sapling/>).

A range of different interventions or innovations have been proposed for implementation in the SAPLING countries, sites and value chains. As time and resources are limited, there is a need for prioritization. To help decide on which innovations to focus for further research, implementation and the scaling readiness process, it is important to gain insight on the potential positive and negative impacts of the proposed innovations. Therefore, an ex-ante tradeoff analysis was conducted.

This report presents the results of the tradeoff analysis for the dairy, small ruminant and poultry value chains in Ethiopia, which was part of a broader exercise covering a total of 14 value chains in the seven SAPLING countries (Table 1). It captures expert opinions on possible positive and negative impacts of livestock innovations along five different sustainability dimensions or domains: productivity, profitability, environment, human condition and social impacts.

Table 1: Value chains per country

	dairy	beef	pig	poultry	small ruminants
Vietnam					
Nepal	buffalo				
Ethiopia	cattle				
Kenya	cattle				
Tanzania	cattle				
Uganda	cattle				
Mali					

2 Methods

2.1 Survey

In each country and for each value chain, innovations were defined during the initiative stakeholder and inception meetings. SAPLING country leads and consultants translated these innovations into expected practice changes (Annex 1). They further compiled a VC-specific list of topical experts on livestock health, animal genetics, animal nutrition, livestock markets, policy analysis, natural resource management, gender and livestock, who were sent an invitation to participate in an online trade-off scoring exercise.

An on-line survey (in Google forms) was carried out for each of the 14 VCs, capturing expert opinions on possible positive and negative impacts of livestock innovations along different dimensions (or domains) based on the sustainable intensification assessment framework (SIAF) including productivity, profitability, environment, human condition and social impacts (Musamba et al., 2017).

Productivity (PR)

The productivity domain is critical in capturing productivity both in cropping and livestock systems. Respondents were asked to keep the following three key indicators in mind when scoring the interventions: animal productivity, whole-farm productivity and variability of production. In terms of productivity, we thus consider not only animal productivity (birth rate, growth rate, milk production, health) but also whole-farm productivity (including trees, cash and food crops). In addition, we consider lower variability of production (seasonal and inter-annual) as a positive outcome. Innovations which increase the outputs of the farm and/or reduce the seasonal and annual variability would thus score higher.

Economic (EC)

Here we refer to the profitability (i.e., net returns) of agricultural activities for the producers and other actors along the value chain. Furthermore, consider the likelihood of generating return to investment, enhancing market participation, and creation of employment on-farm and/or along the value chain. Innovations likely to deliver greater monetary profits and create employment would score higher.

Environmental (EN)

Here we refer to the natural resource base (e.g., soil, water, biodiversity), the environmental services provided by the natural resource base (e.g., nutrient provision, water-holding capacity, genetic diversity), and the degree to which agricultural activities impact the natural resource base and environmental services. Consider impacts the innovation would have on biodiversity (including agrobiodiversity), water availability and water use, land use, vegetation and soil health, and greenhouse gas emissions per unit of product. Innovations which lead to lower environmental impacts would score higher.

Human condition (HC)

Here we refer to the welfare of individuals. Key indicators to consider are access to sufficient and nutritious foods, food safety and hygiene. Innovations which lead to better access to safe food and increased food and nutrition security would score higher.

Social (SO)

Here we refer to social interactions and the enabling environment. Key indicators to consider are women control over income and resources, equitable gender labor requirements and youth participation in, and benefit from livestock. Innovations which increase equity and opportunities within communities or value chains would score higher.

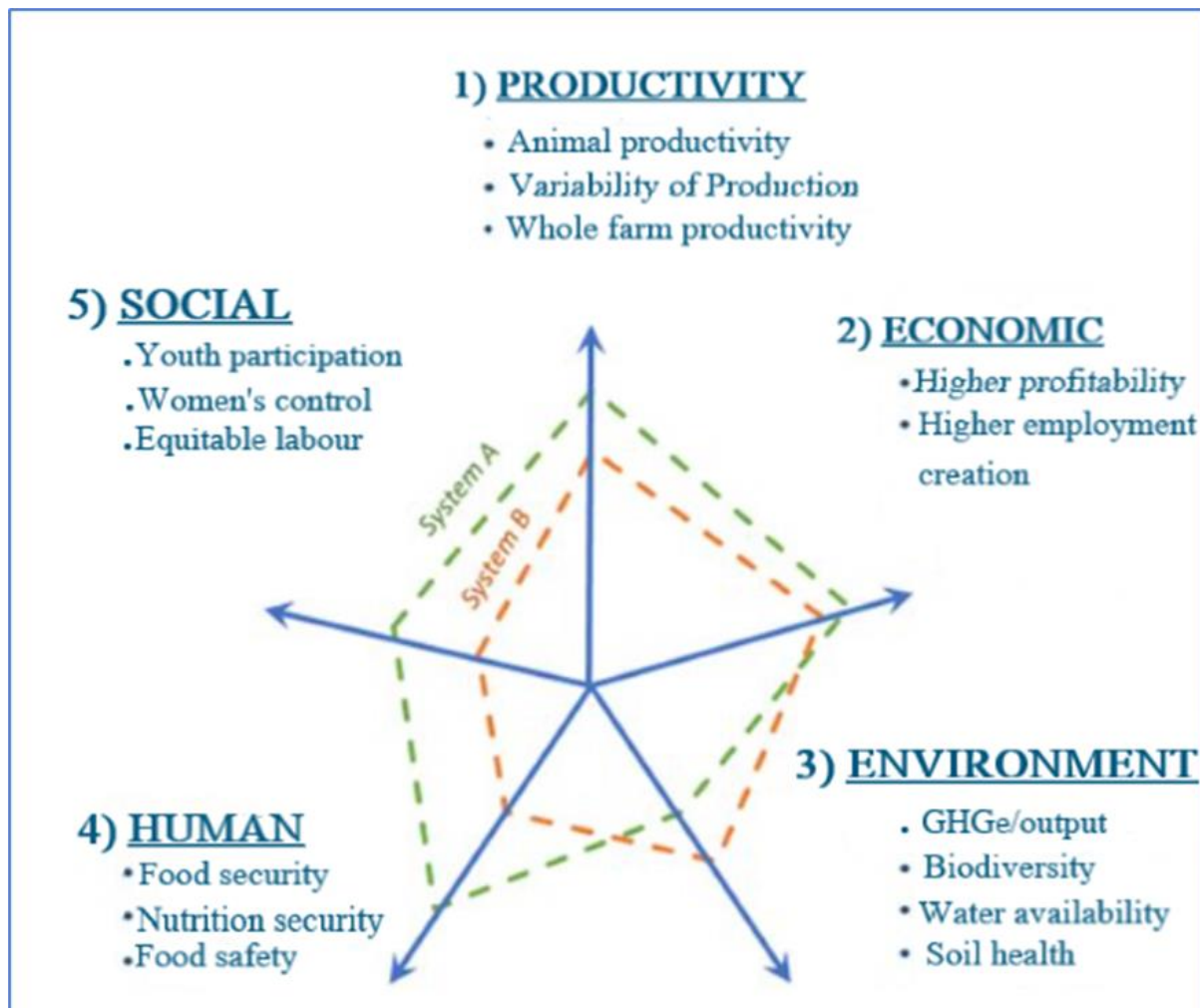


Figure 1: Sustainability domains and indicators for the tradeoff analysis

Table 2 shows an example of indicators and metrics for each of the dimensions.

Table 2: Examples of dimensions, indicators and metrics

Dimension	Indicator	Metrics
Productivity	Yield	Liters of milk/ cow/year
Economics	Profitability	\$/farm/year
Environmental impact	Water use	Liters/kg of produce/year
Human condition	Nutrition and food security	e.g., energy / protein availability versus requirements
Social	Labor requirement for gender	hours/person/day

Apart from the scoring for the different dimensions, participants were asked to identify possible knowledge gaps in terms of innovations and in terms of dimensions, to propose innovations that can address those and provide additional suggestions on the innovations.

Before sharing with the potential respondents, the survey was evaluated by the Institutional Review Board (IRB) of the Alliance of Bioversity International and CIAT and translated into French for Mali and Vietnamese for Vietnam. In each country, a consultant was hired to support the process.

2.2 Characteristics of respondents

Of the 446 experts (85 women, 362 men), 177 (33 women, 144 men) responded, with response rates varying between 16% and 72% and no difference between female and male respondents (Table 3).

Table 3: Response rates

	Approached			Responded					
	women	men	total	women		men		total	
Vietnam	17	28	45	7	41%	17	61%	24	53%
Nepal	2	23	25	1	50%	17	74%	18	72%
Ethiopia	3	35	38	2	67%	21	60%	23	61%
Kenya	26	74	100	6	23%	15	20%	21	21%
Tanzania	7	26	33	6	86%	23	88%	29	88%
Uganda	30	93	123	11	37%	38	41%	49	40%
Mali	0	82	82	0		13	16%	13	16%
Total	85	362	446	33	39%	144	40%	177	40%

The 177 experts who responded provided for a total of 206 data points across the 14 value chains, some responding for more than one value chain. In spite of several reminders to the potential respondents, the objective of at least 20 respondents per value chain was not always reached (Table 4). In Ethiopia, 8 experts scored the proposed dairy VC interventions, 13 small scored ruminant VC interventions, while 30 scored pig VC interventions.

Table 4: Responses per country and value chain

	dairy	beef	small ruminants	pig	poultry	
Vietnam		16		5	5	26
Nepal	18					18
Ethiopia	8		13		10	31
Kenya	18				4	22
Tanzania	29					29
Uganda	17	20		30		67
Mali			13			13
total	90	36	26	35	19	206

Tables 5 and 6 give insight into the institutional background and expertise of the respondents.

Table 5: Institutional background of respondents

	VN	NP	ET	KE	TZ	UG	ML	total
International Research Organization	3	2		6	2	3		16
Regional Research Organization		3	1					4
National Research Organization	11		10	1	9	1	2	34
Academia			2		2	6		10
Research	14	5	13	7	13	10	2	64
National Government	1	11	7	1	1	4	4	29
Local Government	8		1	3	6	9		27
Other Public Sector	1			1		2		4
Public Sector	10	11	8	5	7	15	4	60
International NGO						7	2	9
Local NGO				1	1	1	1	4
NGOs				1	1	8	3	13
Private Sector		2	1	7	7	16		33
Farmer Organization				1			2	3
Consultant			1				2	3
Other/Unknown					1			1
Total	24	18	23	21	29	49	13	177

Some findings on the institutional background of the respondents:

- 36% is working in research (international, national research organizations, academia), with stronger representations in Vietnam, Ethiopia, Kenya and Tanzania. Academia is particularly strongly represented in Uganda.
- 32% is part of local or national government, with similar proportions in all countries, except for Nepal with a strong representation.
- 19% is from private sector, mainly in East Africa (Uganda).
- Farmer organizations are very poorly represented (only in Kenya and Mali).

Table 6: Expertise of respondents

	VN	NP	ET	KE	TZ	UG	ML	total
Animal Genetics	3	6	10	9	8	9	4	49
Animal Health	9	10	1	3	8	16	4	51
Animal Production			3		1			4
Feeds & Forages	10	8	5	12	10	15	9	69
Ruminant Nutrition				1				1
Small Ruminants			2					2
Livestock and Environment	5	4	3	5	10	17	7	51
Climate Change and Sustainability				1				1
Beef Value Chain	4		2	2	6	11	4	29
Dairy Value Chain		8	5	13	12	18	8	64
Pig Value Chain	2	1		4	2	24	1	34
Poultry Value Chain	1		3		1			5
Business Development Services						1		1
Business Models		2		1	4	16		23
Market Information						2		2
Gender and Equity	2	3	2	2	2	7	4	22
Agriculture	1							1
Agricultural Economy	1							1
Farm Management				1				1
Number of respondents	24	18	23	21	29	49	13	177

Some findings on the expertise of the respondents:

- Almost all respondents have expertise in animal production: 28% in animal genetics (especially in East Africa), 19% in animal health (especially in Asia and Uganda), 39% in feeds & forages (evenly distributed).
- Respondents with expertise on Livestock & Environment came mainly from Tanzania, Uganda and Mali.
- For the different livestock value chains 16% were experts on beef (TZ and UG), 36% on dairy (East Africa and Mali), 19% on pigs (UG) and 3% on poultry (mainly ET).
- Expertise on business models was mainly present in Uganda.
- On Gender & Equity, expertise was quite evenly distributed over the countries with about 10% of the respondents.

2.3 Analysis

The responses of experts were analyzed, collated and summarized as follows:

- The scores "large negative impact, small negative impact, no change, small improvement, large improvement and "I don't know"" were translated into numbers, -2, -1, 0, 1, 2 and "blank" respectively and linked to a color scale.
- For each value chain, the scores were aggregated per innovation (see Annex 2 for details).
- To be able to better compare the results per value chain type (dairy, beef, small ruminants, pig, poultry), the innovations were reformulated (summarized for different types of innovations) and "grouped" (See Annex 3).
- As the result of a review process, the innovations formulated in 2022 were (partially) reformulated for almost all value chains. To the extent possible, the initial innovations were reallocated to the revised ones and a reassessment was done along the five dimensions.

2.4 Multi-stakeholder feedback and refinement of scores and interventions

The results of the analysis were shared with stakeholders during Theory of Change (ToC) refinement workshops. These workshops were organized in each of the countries and brought multiple stakeholders together with the aim to validate the Theory of Change and the innovations. The scores were reviewed and in some cases refined by the workshop participants. In addition, the implications of the expected impacts across the different dimensions were discussed. If deemed necessary and feasible, innovations were refined to avoid expected negative trade-offs. In the case of uncertainty about the scores or clear knowledge gaps, ideas for follow-up action or research were elicited.

3 Results

3.1 General

Table 7 presents the summary of the results of the expert scores. In general, the implementation of the proposed innovations is expected to have a positive impact on productivity, profitability, and human welfare, particularly in terms of access to nutritious food, food security, and hygiene. The effects on the environment and social dimension are also expected to be mostly positive, albeit limited (e.g., Kenya dairy vc). Additionally, capacity development initiatives are anticipated to have a positive impact across all dimensions.

Table 7: Summary results of expert scores

	dairy-NP	dairy-ET	dairy-KE	dairy-TZ	dairy-UG		dairy
productivity	1.56	1.68	1.08	1.40	1.50	productivity	1.43
economic	1.51	1.70	0.95	1.33	1.44	economic	1.40
environmental	1.09	1.16	0.53	1.04	1.25	environmental	0.98
human condition	1.29	1.52	0.87	1.32	1.28	human condition	1.27
social	1.20	1.51	0.94	1.28	1.09	social	1.25
	beef-VN	beef-UG					beef
productivity	1.23	1.45				productivity	1.36
economic	1.20	1.52				economic	1.32
environmental	1.01	1.09				environmental	1.13
human condition	1.22	1.34				human condition	1.25
social	1.19	1.31				social	1.14
	SR-ET	SR-ML					small ruminants
productivity	1.68	1.80				productivity	1.74
economic	1.66	1.81				economic	1.73
environmental	1.43	1.06				environmental	1.25
human condition	1.56	1.69				human condition	1.63
social	1.56	1.67				social	1.62
	pigs-VN	pigs-UG					pigs
productivity	1.55	1.25				productivity	1.40
economic	1.61	1.22				economic	1.42
environmental	0.99	0.85				environmental	0.92
human condition	1.51	1.18				human condition	1.35
social	1.42	1.06				social	1.24
	poultry-VN	poultry-ET	poultry-KE				poultry
productivity	1.35	1.04	1.29			productivity	1.22
economic	1.45	1.04	1.29			economic	1.26
environmental	1.02	0.88	0.88			environmental	0.92
human condition	1.43	1.09	1.25			human condition	1.26
social	1.39	1.18	1.38			social	1.31

VN: Vietnam; NP: Nepal; ET: Ethiopia; KE: Kenya; TZ: Tanzania; UG: Uganda; ML: Mali

When considering specific value chains, the small ruminants value chain innovations are projected to yield the highest gains in productivity, economic benefits, improvements in human conditions, and social outcomes. In terms of environmental gains, the small ruminants value chain in Ethiopia is expected to experience the highest benefits, this in contrast to Mali.

Innovations for poultry value chains are expected to have the lowest impact. Pig value chains, overall, show the lowest environmental gains.

Identified knowledge gaps include limited access to financial guarantees, which hinders progress in implementing innovations. Moreover, there is a lack of integrated climate smart technology packages and livestock insurance schemes.

The following sections zoom into the Ethiopia dairy, small ruminant and poultry value chains and present:

- the average scores per (type of) innovation for the different dimensions, both for the initial and the reformulated innovations
- knowledge gaps in terms of innovations and dimensions
- proposed innovations to address knowledge gaps and expected low or negative impacts

3.2 Ethiopia

Dairy value chain

Table 8: Expert scores of innovations per dimension (Dairy VC – Ethiopia)

Type of innovation	Innovation	PR	EC	EN	HC	SO
Training		1.50	1.50	0.63	1.50	1.50
Value chain training		1.50	1.50	0.63	1.50	1.50
Business models	7	1.50	1.50	0.63	1.50	1.50
Interventions		1.67	1.71	1.23	1.52	1.52
Biophysical interventions		1.87	1.81	1.31	1.63	1.56
Animal breeding	1	1.88	1.88	1.50	1.75	1.75
Feeds and forages	3	1.86	1.75	1.13	1.50	1.38
Value chain interventions		1.67	1.71	1.21	1.55	1.59
Business models	6	1.63	1.63	1.29	1.63	1.86
Digital platforms and database	4	1.38	1.50	1.50	1.25	1.25
Financial products	8	1.75	1.75	0.88	1.63	1.63
Input supply and service delivery	9	1.75	1.63	1.13	1.29	1.43
Market linkage	5,10	1.75	1.88	1.25	1.75	1.69
Institutional interventions		1.50	1.63	1.19	1.31	1.25
Institution building	11, 12	1.50	1.63	1.19	1.31	1.25
Interventions – integrated packages		1.88	1.75	1.00	1.63	1.50
Herd health - package	2	1.88	1.75	1.00	1.63	1.50

PR: Productivity; EC: Economic; EN: Environmental; HC: Human Condition; SO: Social. The numbers in the second column “Innovation” refer to the original innovations, for details see Annex 1 and 2.

Training

- Training on business models is expected to have a strong positive impact on all dimensions except for environment.

Interventions

- Animal breeding and feeds & forages interventions are expected to largely improve all parameters, with a small positive effect of feeds & forages innovations on environment.
- Value chain interventions including business models are expected to improve productivity, income, human condition and social parameters, with less impact on the environment.
- Institutional building is expected to have a positive impact on all dimensions, especially on income.
- The Herd Health Package innovation is expected to strongly improve productivity, economic parameters, human condition and social aspects, with small impact on environment.

Table 9: Estimated expert scores of revised Innovation Packages (Dairy VC – Ethiopia)

Innovation Package	Innovation	PR	EC	EN	HC	SO
IP1. Institutionalizing national breeding improvement through use of ICT, genomic & sensor technology	1	1.88	1.88	1.50	1.75	1.75
IP2. Improving dairy herd health, biosecurity, and calf management	2	1.88	1.75	1.00	1.63	1.50
IP3. Promoting optimized animal feeding and nutrition, & forage development	3	1.86	1.75	1.13	1.50	1.38
IP4. Digital and offline tools to improve AI technician, AI centers, experts & dairy producers' capacities, and efficiencies						
IP5. Generating evidence to support the development of standards, guidelines, and regulations	12	1.38	1.50	1.25	1.25	1.13
IP6. Strengthen integrated digital platform, extension education and feedback delivery system	4	1.38	1.50	1.50	1.25	1.25

PR: Productivity; EC: Economic; EN: Environmental; HC: Human Condition; SO: Social. The numbers in the second column "Innovation" refer to the original innovations, for details see Annex 1 and 2.

Six revised innovation packages were defined. To the extent possible, the original innovations of 2022 were reallocated to these and a reassessment was done along the five dimensions with the following results.

- IP1, Institutionalizing national breeding improvement through use of ICT, genomic & sensor technology, is expected to have a strong positive impact on productivity, income, human condition and social aspects and a somewhat smaller positive impact on environment.
- IP2, Improving dairy herd health, biosecurity, and calf management, is expected to have a strong positive impact on productivity, income, to a lesser extent on human condition and social aspects and a smaller positive impact on environment.
- IP3, Promoting optimized animal feeding and nutrition, & forage development, is expected to have a strong positive impact on productivity, income, to a lesser extent on human condition and social aspects and a smaller positive impact on environment.
- IP4, Digital and offline tools to improve AI technician, AI centers, experts & dairy producers' capacities, and efficiencies, could not be reassessed as there were no corresponding initial innovations.
- IP5, Generating evidence to support the development of standards, guidelines, and regulations, is expected to have a positive impact on productivity, income, to a lesser extent on environment and human condition and a smaller positive impact on social aspects.
- IP6, Strengthen integrated digital platform, extension education and feedback delivery system, is expected to have a positive impact on income and environment, to a somewhat lesser extent on productivity and smaller positive impact on human condition and social aspects.

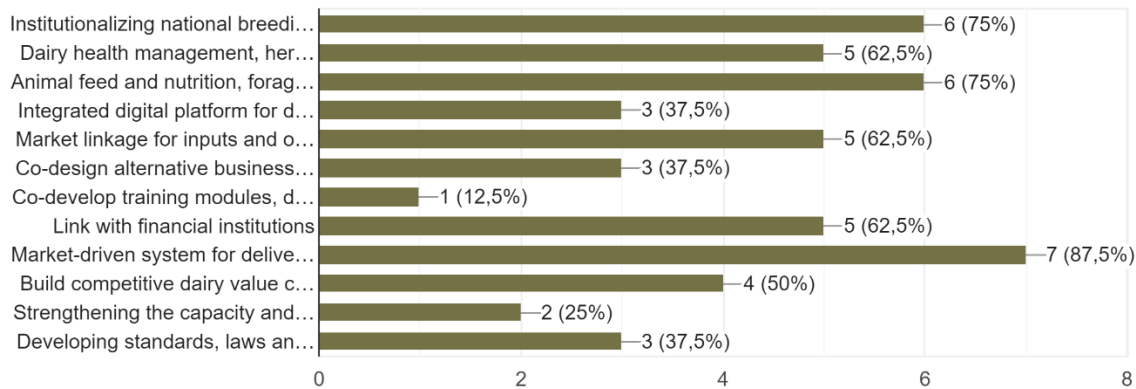


Figure 2: Knowledge gaps in terms of innovations (Dairy VC – Ethiopia)

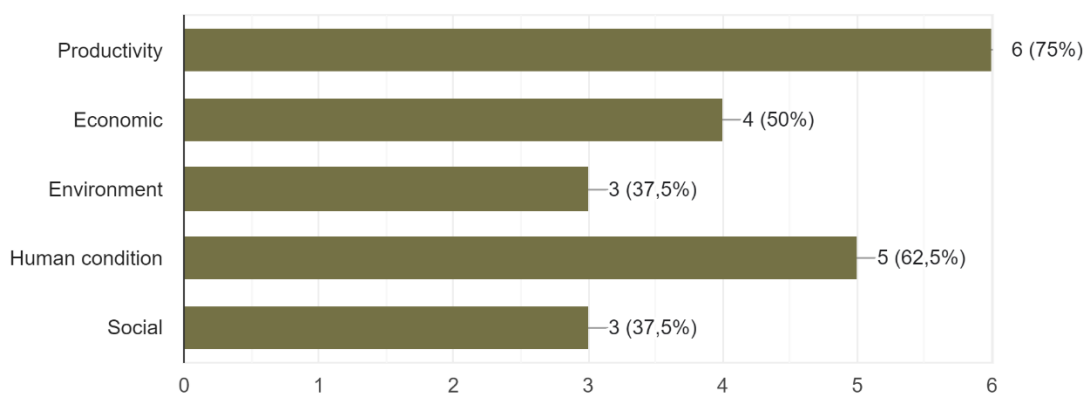


Figure 3: Knowledge gaps in terms of dimensions (Dairy VC – Ethiopia)

Proposed innovations that can address the biggest knowledge gaps:

- Innovation 1: Institutionalizing a national breeding program through the use of ICT, recording systems, genomic technology, and phenotypic data to improve breeding input supply and service delivery.
- Innovation 3: Focus on animal feed and nutrition, as well as forage production.
- Innovation 5: Establishing market linkages for inputs and outputs.
- Innovation 6: Co-designing alternative business models for input production, marketing, animal health input supply and service delivery, milk marketing and value addition, and genetic gain-related input supply and service delivery, with a specific focus on private sector involvement, youth, women, and organized groups.
- Innovation 8: Creating linkages with financial institutions.
- Innovation 10: Building a competitive dairy value chain.

The main concerns include the need for a detailed understanding of the dairy sector and proper interventions at each node of the value chain. This includes addressing issues related to genetics, nutrition, access to animal feed, veterinary services, and ensuring healthier marketing practices. Genetic improvement through public-private partnerships is also emphasized.

Additionally, respondents mention the importance of innovations related to animal feed, nutrition, and forage production. It also references the need for a market-driven system that delivers farmer support, advice, and coordination of input supply services (Innovation 9).

Additional suggestions on innovations:

- The milk collection scheme in Ethiopia lags behind due to underdeveloped rural infrastructure. There is a need for improvements in the collection system.
- The development of animal feed production through public-private partnerships. This indicates the importance of collaboration between the public and private sectors to enhance feed quality and availability.
- An improved investment package that includes government provision of land, finance, and other necessary resources. It also suggests mobilizing interested groups into cooperatives to facilitate the development of the dairy sector.

Small Ruminant value chain

Table 10: Expert scores of innovations per dimension (Small Ruminants VC – Ethiopia)

Type of innovation	Innovation	PR	EC	EN	HC	SO
Training		1.77	1.69	1.58	1.62	1.69
Technical training		1.77	1.69	1.58	1.62	1.69
(Herd) health	6	1.77	1.69	1.58	1.62	1.69
Interventions		1.61	1.63	1.33	1.49	1.45
Value chain interventions		1.66	1.69	1.39	1.54	1.49
Business models	4	1.85	1.85	1.67	1.77	1.69
Quality control	3	1.46	1.46	1.15	1.31	1.31
Market linkage	2	1.67	1.77	1.36	1.54	1.46
Institutional interventions		1.53	1.54	1.23	1.42	1.38
Nutritious food	5	1.67	1.62	1.23	1.62	1.54
Institution building	8	1.38	1.46	1.23	1.23	1.23
Interventions – integrated packages		1.77	1.69	1.69	1.75	1.85
Smart pack (Climate)	1	1.77	1.69	1.69	1.75	1.85
Knowledge delivery		1.85	1.77	1.54	1.69	1.69
Adapted technical knowledge	7	1.85	1.77	1.54	1.69	1.69

PR: Productivity; EC: Economic; EN: Environmental; HC: Human Condition; SO: Social. The numbers in the second column “Innovation” refer to the original innovations, for details see Annex 1 and 2.

Training

- Training on herd health is expected to have a strong positive impact on all dimensions.

Interventions

- Value chain interventions are expected to improve productivity, income, environment, human condition and social parameters. Especially improved business models are expected to have an important impact.

- The innovation related to nutritious food is expected to have a strong impact on productivity, income and human condition. Institutional building is expected to have a positive impact on all dimensions, especially on income.
- The climate smart pack and the development of adapted technical knowledge innovations are expected to strongly improve all dimensions.

Table 11: Estimated expert scores of revised Innovation Packages (Small Ruminants VC – Ethiopia)

Innovation Package	Innovation	PR	EC	EN	HC	SO
IP1. Smart pack	1	1.77	1.69	1.69	1.75	1.85
IP2. Marketing model	2,3,4	1.66	1.69	1.39	1.54	1.49
IP3. Capacity building	6,7	1.81	1.73	1.56	1.65	1.69
IP4. Policy influence	8	1.38	1.46	1.23	1.23	1.23

PR: Productivity; EC: Economic; EN: Environmental; HC: Human Condition; SO: Social. The numbers in the second column “Innovation” refer to the original innovations, for details see Annex 1 and 2.

Four revised innovation packages were defined. To the extent possible, the original innovations of 2022 were reallocated to these and a reassessment was done along the five dimensions with the following results.

- IP1, Smart pack (consisting of CBBP interventions, reproductive technologies, herd health, fattening and smart marketing), is expected to have a strong positive impact on all dimensions.
- IP2, Marketing model (consisting of a digital platform and other modalities to link buyers and sellers, collective action on quality control and profitable business model for services on animal health and input delivery), is expected to have a positive impact on productivity, income, to a somewhat lesser extent on human condition and social aspects and a smaller positive impact on environment.
- IP3, Capacity building (consisting of curriculum development and development of modules and technical guidelines), is expected to have a positive impact on productivity, income, human condition and social aspects and to a somewhat lesser extent on environment.
- IP4, Policy influence (consisting of a review of the existing enabling environment and engaging with policy makers through existing platforms) is expected to have a positive impact on productivity, income, and to a lesser extent on human condition, social aspects and environment.

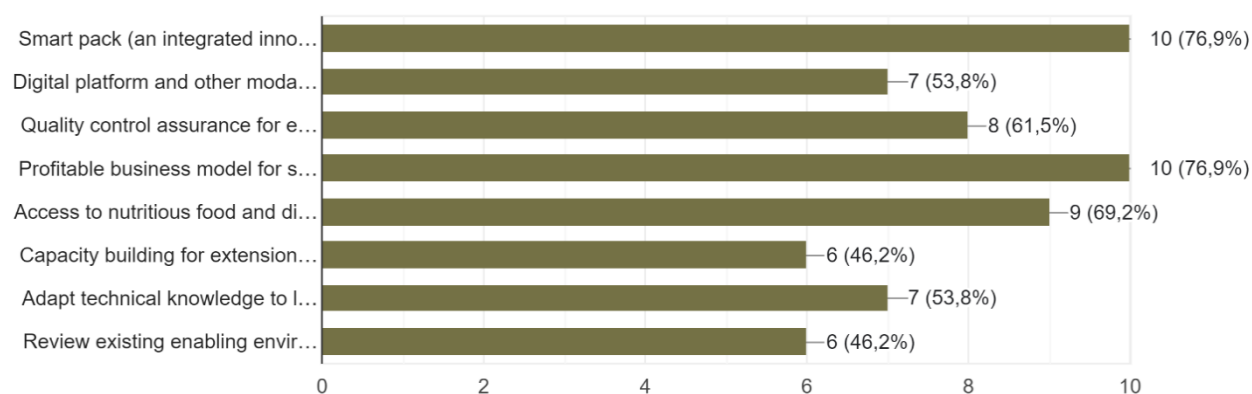


Figure 4: Knowledge gaps in terms of innovations (Small Ruminants VC – Ethiopia)

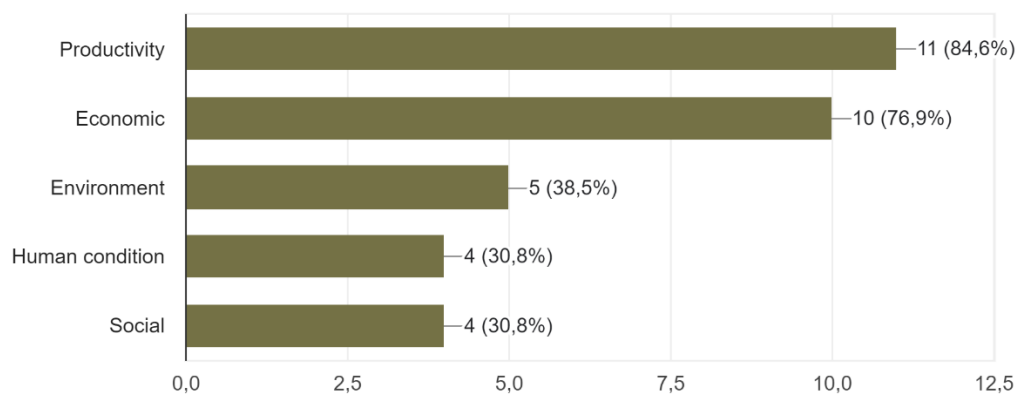


Figure 5: Knowledge gaps in terms of dimensions (Small Ruminants VC – Ethiopia)

Proposed innovations that can address the biggest knowledge gaps:

- Innovation 1: Smart pack - an integrated innovation package that encompasses all innovations along the small ruminant value chain. This comprehensive approach aims to address multiple aspects of the value chain and improve overall productivity.
- Innovation 3: Quality control assurance for enhanced marketing - emphasizes the importance of collective action to ensure quality control in the small ruminant products for better market outcomes.
- Innovation 4: Profitable business model for services on animal health and input delivery - focuses on developing a sustainable and profitable business model for providing animal health services and delivering inputs, thereby enhancing the overall profitability of the value chain.
- Significance of genetic improvement is highlighted in combination with feed development to enhance productivity in small ruminant production. It also underscores the importance of market linkages to boost productivity.
- Additionally, capacity building for extension agents is mentioned as a means to enhance their knowledge and skills in implementing these innovations. Respondents emphasize the need to adopt and adapt technologies and packages that are suitable for the local context.
- Overall, the integrated Smart pack, capacity building, and profitable business models are identified as important drivers of innovation and productivity improvement in the small ruminant value chain.

Additional suggestions on innovations:

- Innovation 3: This innovation holds significant relevance for both the local and export markets, but its importance is particularly crucial for the export trade. Ensuring quality control and assurance is vital for meeting export standards and enhancing market competitiveness.
- Utilization of biotechnology for fast improvements in productivity and income: they can contribute to enhanced breeding, genetics, and other aspects of small ruminant production.
- Animal housing to reduce feed wastage: this innovation focuses on improving animal housing practices to minimize feed wastage and mitigate the impact of climate change.

By providing suitable housing conditions, feed efficiency can be enhanced, and measures can be taken to adapt to the changing climate.

- Quality-based marketing and payment: in Ethiopia, there is currently a lack of quality-based marketing and payment systems. As a result, the impact of Innovation 3, which focuses on quality control assurance for enhanced marketing through collective action, may be limited in the local context.

Poultry value chain

Table 12: Expert scores of innovations per dimension (Poultry VC – Ethiopia)

Type of innovation	Innovation	PR	EC	EN	HC	SO
Training		1.00	1.10	1.00	1.30	1.30
Training on inclusiveness and gender		1.00	1.10	1.00	1.30	1.30
<i>Inclusiveness and gender</i>	6	1.00	1.10	1.00	1.30	1.30
Interventions		1.09	1.08	0.82	1.02	1.14
Biophysical interventions		1.00	1.00	0.55	0.89	1.05
<i>Animal breeding</i>	1	1.10	1.00	0.50	0.89	1.00
<i>Feeds and forages</i>	2	0.90	1.00	0.60	0.90	1.10
Value chain interventions		1.13	1.10	0.89	1.03	1.16
<i>Business models</i>	8	1.20	1.10	0.89	1.10	1.22
<i>Digital platforms and database</i>	4	0.90	1.00	1.00	1.10	1.20
<i>Financial products</i>	9	1.30	1.20	0.78	0.90	1.10
<i>Input supply and service delivery</i>	3	1.10	1.10	0.90	1.00	1.11
Institutional interventions		1.10	1.10	0.89	1.00	1.10
<i>Stakeholder platforms</i>	10	1.10	1.10	0.89	1.00	1.10
Inclusiveness and gender interventions		1.10	1.10	1.00	1.30	1.30
<i>Inclusiveness and gender</i>	7	1.10	1.10	1.00	1.30	1.30
Interventions – integrated packages		0.90	0.90	1.11	1.30	1.30
<i>Behavioral change packages</i>	5	0.90	0.90	1.11	1.30	1.30
Knowledge delivery		0.80	0.80	1.00	1.20	1.20
<i>Adapted technical knowledge</i>	11	0.80	0.80	1.00	1.20	1.20

PR: Productivity; EC: Economic; EN: Environmental; HC: Human Condition; SO: Social. The numbers in the second column “Innovation” refer to the original innovations, for details see Annex 1 and 2.

In comparison with the other value chains, expected impact of the poultry value chain innovations, although positive, is rather limited. A significant number of respondents have responded that the innovations could have a negative or no impact on the environment. In the Climate Resilient Green Economy strategy (CRGE) poultry is one of the priority interventions with the objective of replacing about 30% meat from ruminants by 2030 and thereby reduce emissions. The responses in relation to negative impact need therefore to be revisited.

Training

- Training on inclusiveness and gender is expected to have a positive impact on human condition and social parameters.

Interventions

- Biophysical interventions on breeding and feeds are expected to have a relative small impact on most dimensions, and hardly any positive impact on environment.
- The value chain and institutional interventions are expected to have relative small positive impacts on all dimensions.
- Promoting inclusiveness and behavior change are expected to impact positively on human condition and social parameters.

Table 13: Estimated expert scores of revised Innovation Packages (Poultry VC – Ethiopia)

Innovation Package	Innovation	PR	EC	EN	HC	SO
IP1. Improving smallholder farmers' access to high producing indigenous and crossbred chickens	1	1.10	1.00	0.50	0.89	1.00
IP2. Enhancing smallholder farmers' access to, and promoting the adoption of tropically adapted and high producing chicken breeds through public-private partnership and stakeholders' engagement	1	1.10	1.00	0.50	0.89	1.00
IP3. Promoting best-cost chicken feed packages and building smallholder farmers' capacity in feed formulation	2	0.90	1.00	0.60	0.90	1.10
IP4. Strategies and approaches for improving poultry vaccine and other health services delivery to smallholder farmers	3	1.10	1.10	0.90	1.00	1.11
IP5. Women and youth-focused business models for mass multiplication and delivery of improved technologies and other services to enhance sustained adoption of poultry innovations.	7,9	1.20	1.15	0.89	1.10	1.20
IP6. Approaches for enhancing animal source food consumption in school feeding programs and promoting integrated poultry production practices						
IP7. Promoting poultry products consumption through integrated nutrition education in rural and urban areas						
IP8. Tools and approaches for enhancing smallholder farmers' access to output market and support systems	4	0.90	1.00	1.00	1.10	1.20
IP9. Platforms, policies, and technical capacities for enhancing the competitiveness and inclusiveness of smallholder poultry value chain	6,10	1.05	1.10	0.94	1.15	1.20

PR: Productivity; EC: Economic; EN: Environmental; HC: Human Condition; SO: Social. The numbers in the second column "Innovation" refer to the original innovations, for details see Annex 1 and 2.

Nine revised innovation packages were defined. To the extent possible, the original innovations of 2022 were reallocated to these and a reassessment was done along the five dimensions with the following results.

- IP1, Improving smallholder farmers' access to high producing indigenous and crossbred chickens, is expected to have a moderately positive impact on all dimensions, except for environment with a small positive impact.

- IP2, Enhancing smallholder farmers' access to, and promoting the adoption of tropically adapted and high producing chicken breeds through public-private partnership and stakeholders' engagement.
- IP3, Promoting best-cost chicken feed packages and building smallholder farmers' capacity in feed formulation, is also expected to have a moderately positive impact on all dimensions, except for environment with a small positive impact.
- IP4, Strategies and approaches for improving poultry vaccine and other health services delivery to smallholder farmers, is expected to have a moderately positive impact on all dimensions.
- IP5, Women and youth-focused business models for mass multiplication and delivery of improved technologies and other services to enhance sustained adoption of poultry innovations, is also expected to have a moderately positive impact on all dimensions.
- IP6, Approaches for enhancing animal source food consumption in school feeding programs and promoting integrated poultry production practices, could not be reassessed as there were no corresponding initial innovations.
- IP7, Promoting poultry products consumption through integrated nutrition education in rural and urban areas, could also not be reassessed as there were no corresponding initial innovations.
- IP8, Tools and approaches for enhancing smallholder farmers' access to output market and support systems, is expected to have a moderately positive impact on all dimensions, and especially on social aspects.
- IP9, Platforms, policies, and technical capacities for enhancing the competitiveness and inclusiveness of smallholder poultry value chain, is expected to have a moderately positive impact on all dimensions, especially on human condition and social aspects.

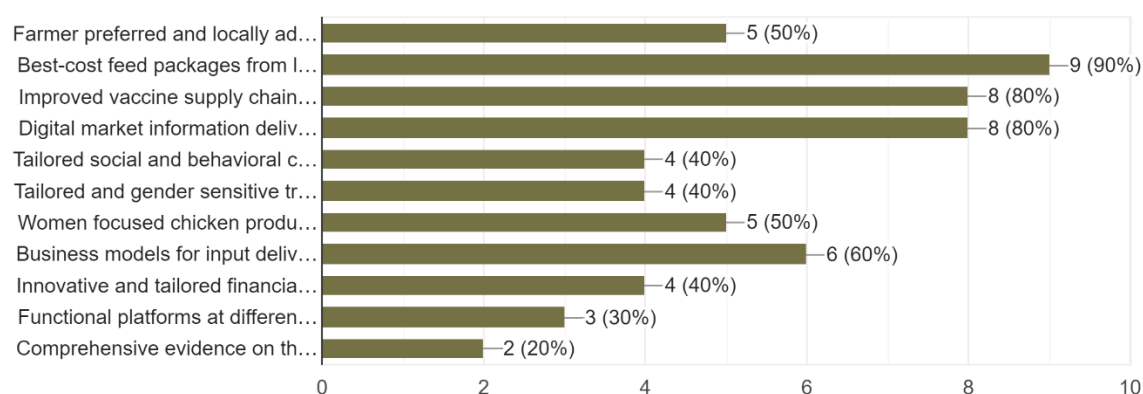


Figure 6: Knowledge gaps in terms of innovations (Poultry VC – Ethiopia)

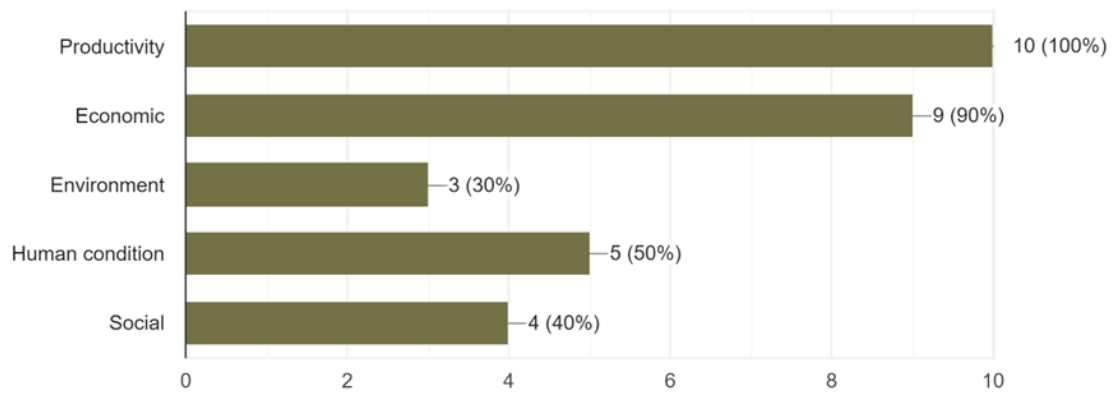


Figure 7: Knowledge gaps in terms of dimensions (Poultry VC – Ethiopia)

Proposed innovations that can address the biggest knowledge gaps:

- Innovation 1: identifying, testing, and delivering chicken breeds that are preferred by farmers and adapted to local conditions, including establishing a grandparent stock.
- Innovation 2: Identifying, testing, delivering cost-effective feed packages from locally available ingredients.
- Innovation 3: this innovation focuses on enhancing the vaccine supply chain and developing efficient delivery models to improve disease control in chicken farming.
- Innovation 8: development and deployment of business models that support input delivery and enable small-scale commercial production in the chicken industry.
- Innovation 9: develop and deploy financial products and services tailored to the specific needs of chicken farmers, supporting their production and business activities.

Additional suggestions on innovations:

- In relation to innovation 1 and innovation 2 the delivery aspect of these innovation is the most important one in transforming the poultry sector.

4 Next steps

Next steps:

- Share report/findings with country, WP and Innovation Packages and Scaling Readiness teams
- Include findings in refinement/adaptation of country activities
- Plan follow-up research and assessment activities

References

Musumba, Mark & Grabowski, Philip & Palm, Cheryl & Snapp, Sieglinde. (2017). Guide for the Sustainable Intensification Assessment Framework. 10.13140/RG.2.2.13048.75521.

Annex 1: Innovations and expected impacts

Dairy

Innovation as listed	Expected change in practice
Innovation Package 1: Good dairy practices	
1: Institutionalizing national breeding program through use of ICT, recording system, genomic technology, and phenotypic data, improved breeding input supply and service delivery	Good dairy farming practices awareness and practices leading to increased productivity and income Evolution of Sustainable breeding program
2: Dairy health management, herd health, biosecurity and calf management	Good dairy farming practices awareness and practices leading to increased productivity and income Increased production of milk of the required standard
3: Animal feed and nutrition, forage production	Increased feed availability and quality at a reasonable price leading to increased productivity and income
4: Integrated digital platform for data capture, extension education, & feedback delivery	Evidence made available for informed decision of policy makers to draft policies, regulations and review organizational structure
5: Market linkage for inputs and outputs,	Well-structured and facilitated dairy product and dairy input market system
Innovation Package 2: Alternative business models	
6: Co-design alternative business models on input production, & marketing, animal health input supply and service delivery, milk marketing and value addition, and genetic gain related input supply and service delivery, for private sector, youths, women, and organized groups.	Alternative and inclusive profitable dairy business model identified,
7: Co-develop training modules, deliver training on business management and entrepreneurship to input and service providers, producers (youth and women).	Smallholder farmers, women and youth trained on alternative business models Capability of Smallholder farmers, women and youth in dairy business is strengthened.
8: Link with financial institutions	Financial institutions interest to support the different business improved Inclusive and workable financial system is developed where financial institutions support dairy production and processing businesses
Innovation Package 3: Generating and sharing evidence of SAPLING innovations to support the creation of an enabling environment	
9: Market-driven system for delivery of farmer support and advice, & coordination of input supply services, in smallholder dairy systems in tropical countries	Service and institutional arrangement on delivering dairy input and service improved

10: Build competitive dairy value chain	Efficiency of the dairy value chain improved
11: Strengthening the capacity and regulation capacity of public and private institutions	Farmer cooperatives/association strengthened Regulatory capacity of government institutions strengthened
12: Developing standards, laws and regulations	Evidence made available for informed decision of policy makers to draft policies, regulations and review organizational structure

Small Ruminants

Innovation as listed	Expected change in practice
1. Smart pack (an integrated innovation package which includes all innovations along the small ruminant value chain)	Improved genetics, nutrition, health, value addition and marketing conditions lead to increased productivity and income.
Marketing model	
2: Digital platform and other modalities to link buyers and sellers	Increased access to information for all value chain actors leads to increased market efficiency and profitability
3: Quality control assurance for enhanced marketing (collective action)	Improved quality leads to better prices and increased income
4: Profitable business model for services on animal health and input delivery	Increased access to inputs and health services leads to increased productivity and profitability
5: Nutrition package - access to nutritious food and diet (possible link with national nutrition/diet packages/policy initiatives)	Increased access to high quality food leads to improved nutrition
6: Capacity building for extension agents, universities (curriculum development – possible link with programs on Nutrition sensitive agriculture and CBBP)	Improved contents of curriculum and extension messages lead to improved nutrition and increased productivity and profitability
7: Adapt technical knowledge to local contexts – development of modules and technical guidelines	Increased knowledge of value chain actors adapted to local contexts leads to increased productivity and profitability
8: Review existing enabling environment for each of the innovations and provide the evidence needed for change through ongoing platforms e.g., REDFS (Rural Economy and Food Security) platform	Identified evidence increases the impact and adaptability of innovations in different environments

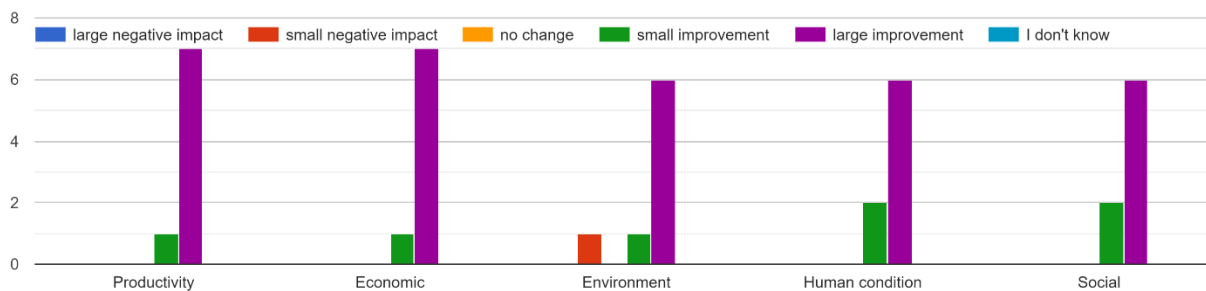
Poultry

Innovation as listed	Expected change in practice
1: Farmer preferred and locally adapted improved chicken breeds (identifying, testing, delivering)	Increased smallholder chicken meat and egg production and productivity and improved consumption
2: Best-cost feed packages from locally available ingredients (identifying, testing, delivering)	Increased availability and Decreased feed costs leading to increased income from poultry production
3: Improved vaccine supply chain and efficient vaccine delivery models (assessment and model building)	Decreased chicken mortality and increased smallholder chicken meat and egg production and productivity and improved consumption
4: Digital market information delivery models and improved marketing infrastructures (slaughtering services, egg processing)-developing, pilot testing, deploying	Efficient collective action and coordination along the chicken value chain leading to increased productivity and profitability Improved processing and marketing of value-added poultry products
5: Tailored Social and Behavioural Change communication packages (developing, delivering)	Increased consumption of chicken meat and egg and improved nutrition
6: Tailored and gender sensitive training modules, including couple training and male sensitization training packages (developing and deploying)	Empowered women (i.e., increased role in decision making, improved access to inputs and technologies, increased income, increased access to jobs and employment opportunities) along the chicken value chain.
7: Women focused chicken production business models (developing and deploying)	Empowered women (i.e., increased role in decision making, improved access to inputs and technologies, increased income, increased access to jobs and employment opportunities) along the chicken value chain. Gender transformative changes in social norms
8: Business models for input delivery and small-scale commercial production (developing and deploying)	Increased job and employment opportunities for youth along the chicken value chain
9: Innovative and tailored financial products and services and delivery models (developing and deploying)	Improved access to financial sources and services to small scale actors of the poultry value chain.
10: Functional platforms at different level (facilitating and supporting)	Efficient collective action and coordination to co-create solutions to constraints along the poultry value chain
11: Comprehensive evidence on the efficiency and alignment of the federal and regional extension systems	Improved and well-integrated national poultry extension system

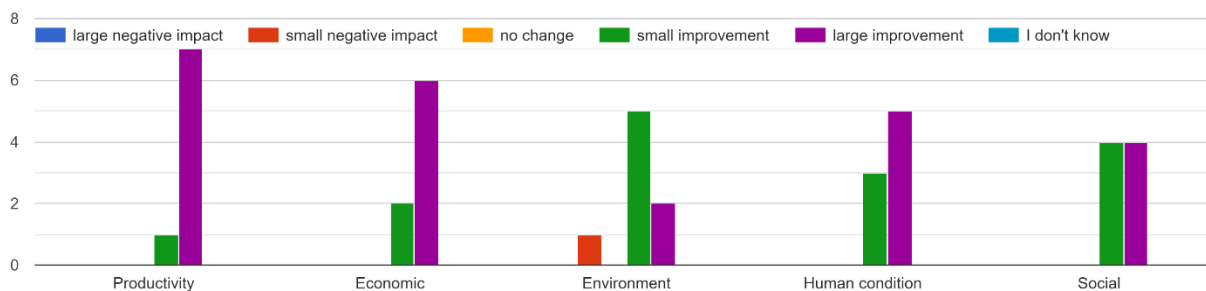
Annex 2: Results of trade-off analysis per country and value chain

Dairy

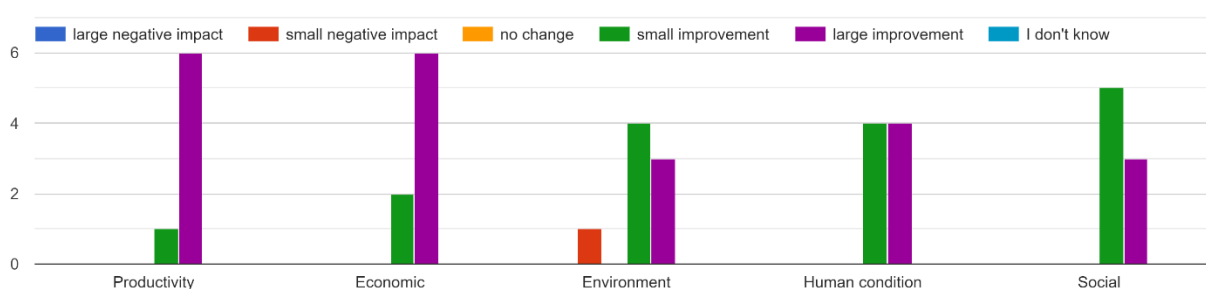
Innovation 1: Institutionalizing national breeding program through use of ICT, recording system, genomic technology, and phenotypic data, improved breeding input supply and service delivery



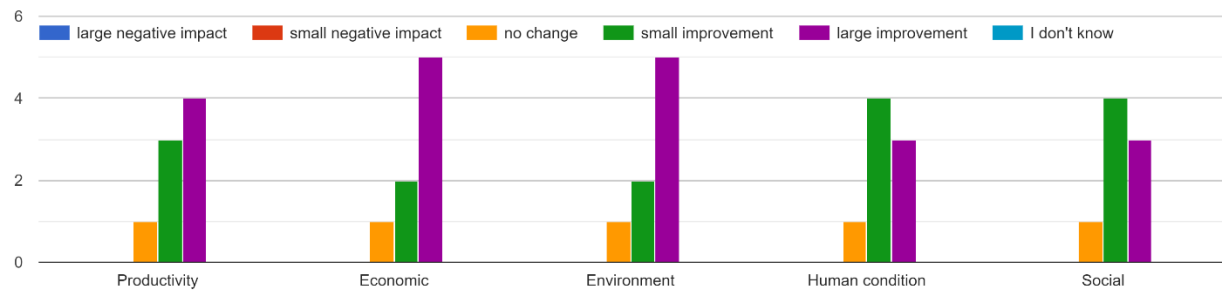
Innovation 2: Dairy health management, herd health, biosecurity and calf management



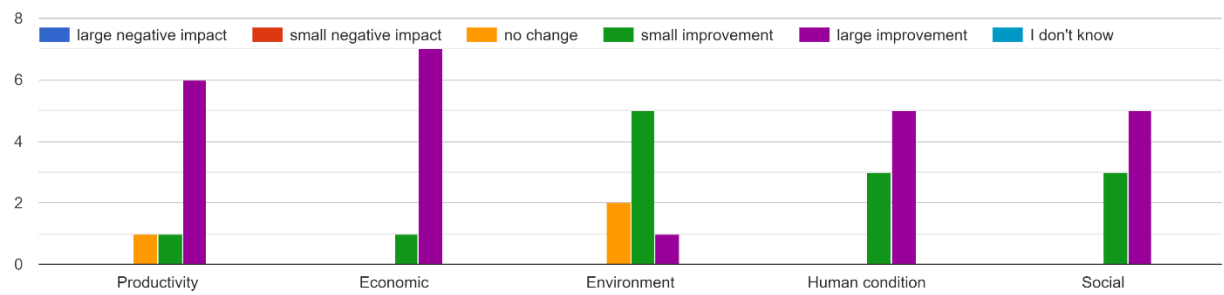
Innovation 3: Animal feed and nutrition, forage production



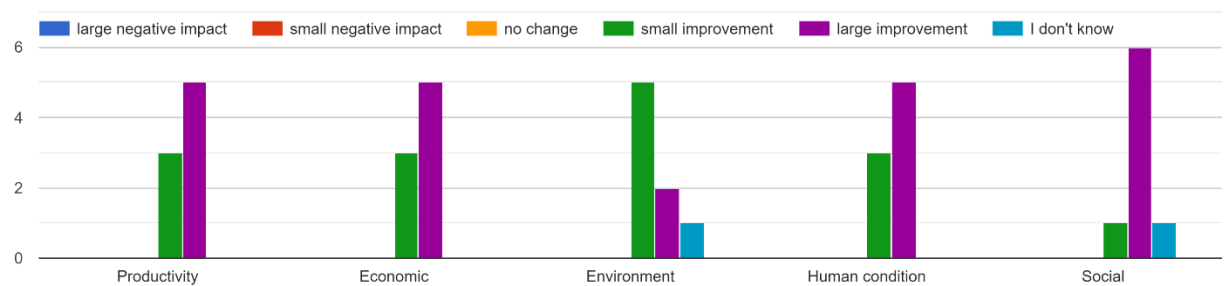
Innovation 4: Integrated digital platform for data capture, extension education, & feedback delivery



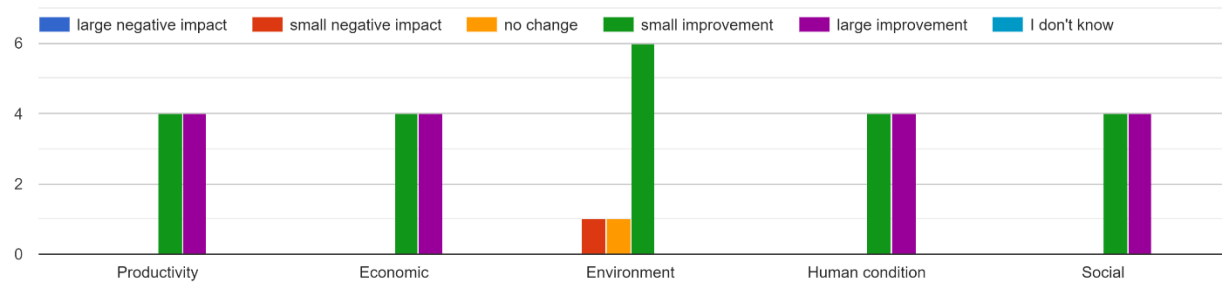
Innovation 5: Market linkage for inputs and outputs



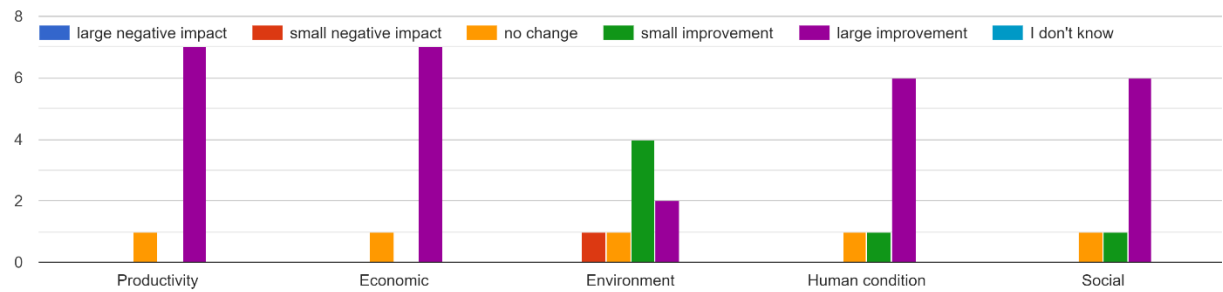
Innovation 6: Co-design alternative business models on input production, &marketing, animal health input supply and service delivery, milk marketing and value addition, and genetic gain relat... delivery, for private sector, youths, women, and organized groups



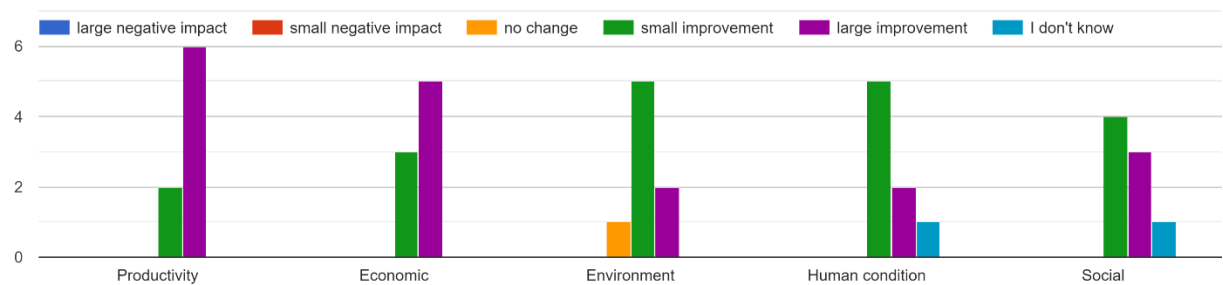
Innovation 7: Co-develop training modules, deliver training on business management and entrepreneurship to input and service providers, producers (youth and women)



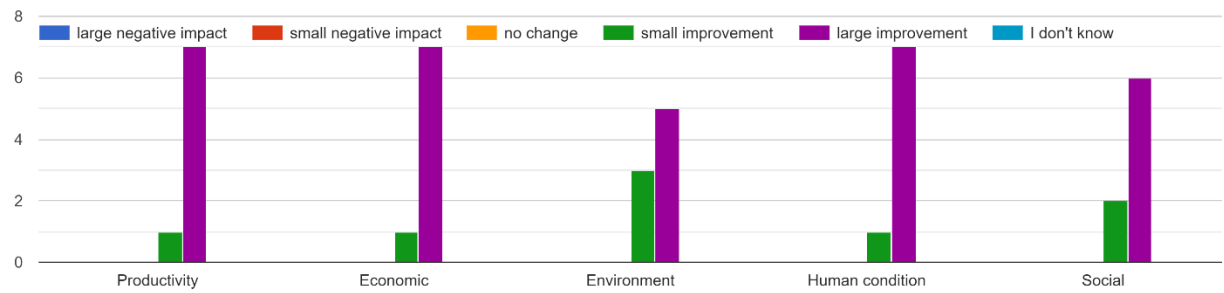
Innovation 8: Link with financial institutions



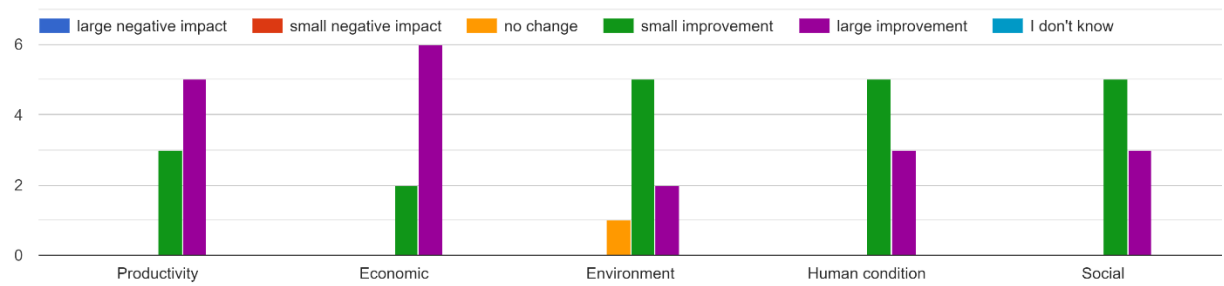
Innovation 9: Market-driven system for delivery of farmer support and advice, & coordination of input supply services, in smallholder dairy systems in tropical counties



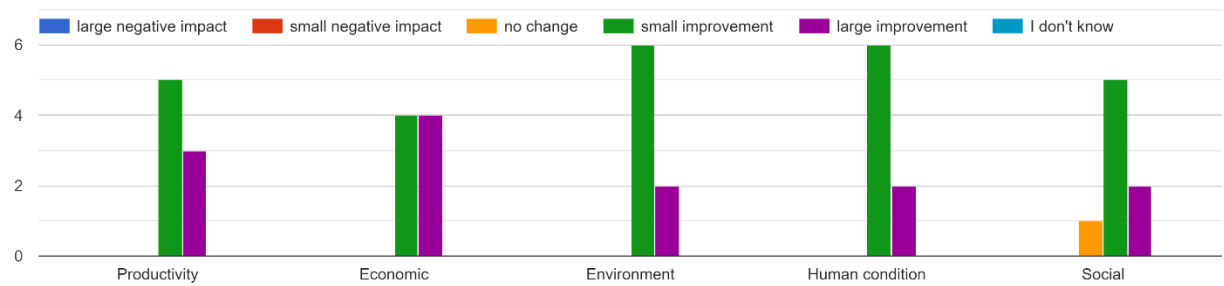
Innovation 10: Build competitive dairy value chain



Innovation 11: Strengthening the capacity and regulation capacity of public and private institutions

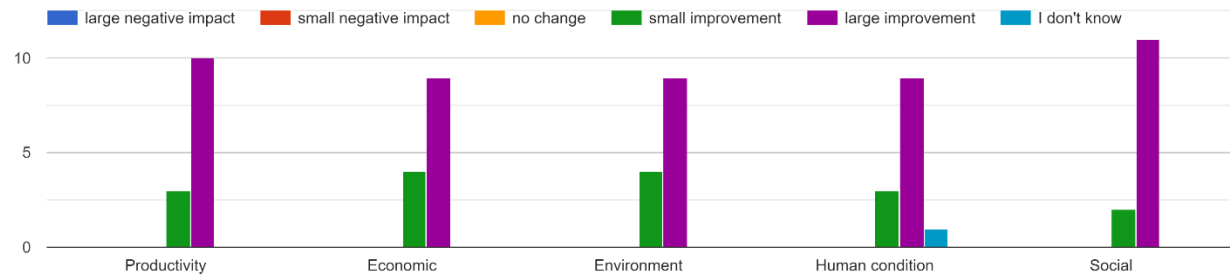


Innovation 12: Developing standards, laws and regulations

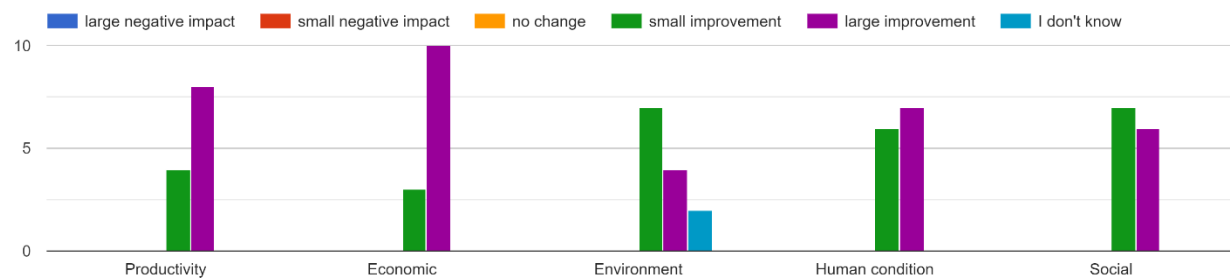


Small Ruminants

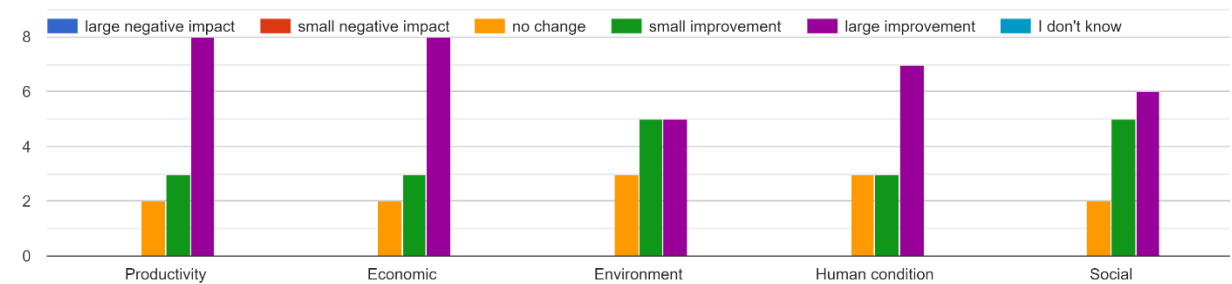
Innovation 1: Smart pack (an integrated innovation package which includes all innovations along the small ruminant value chain)



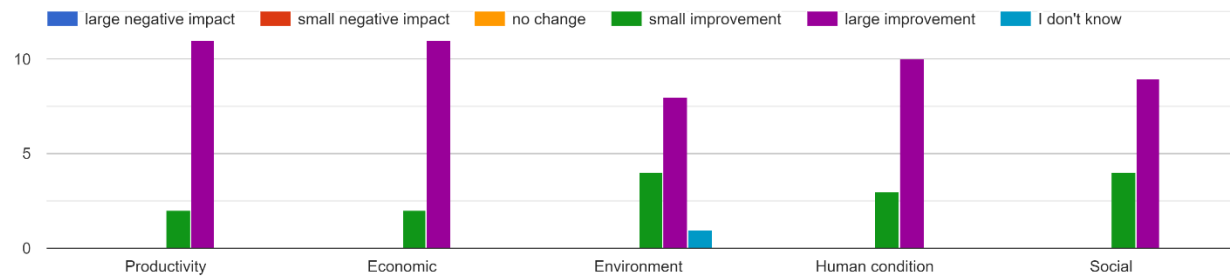
Innovation 2: Digital platform and other modalities to link buyers and sellers



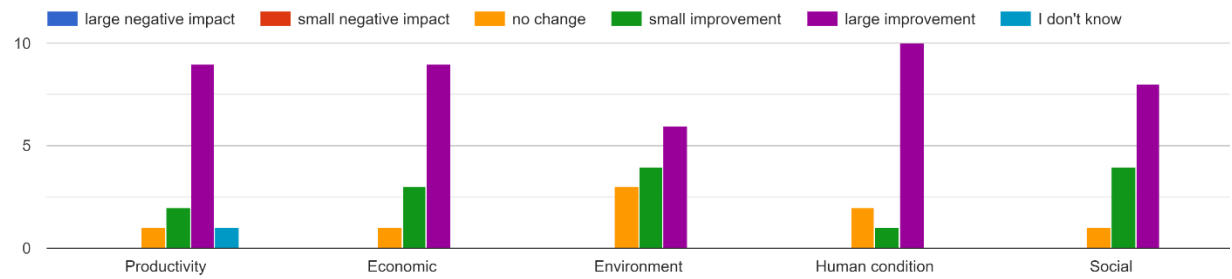
Innovation 3: Quality control assurance for enhanced marketing (collective action)



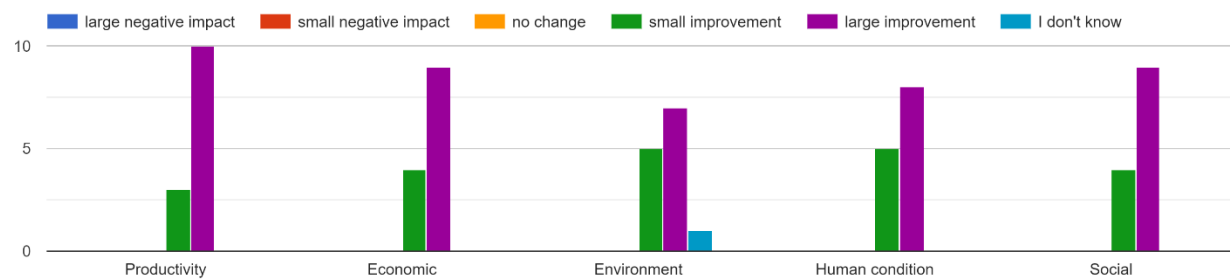
Innovation 4: Profitable business model for services on animal health and input delivery



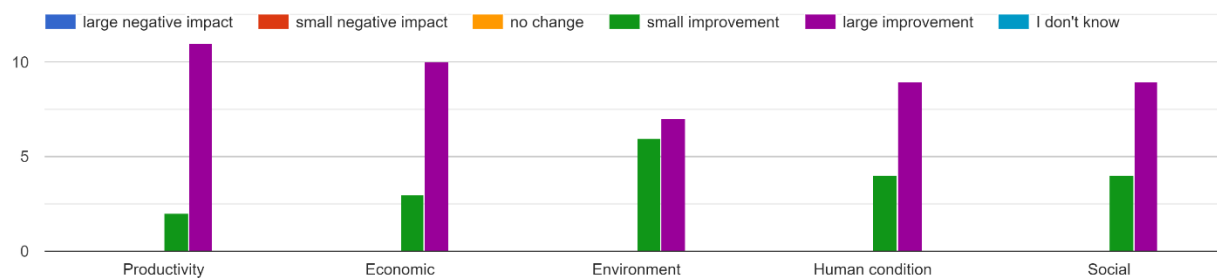
Innovation 5: Access to nutritious food and diet (possible link with national nutrition/diet packages/policy initiatives)



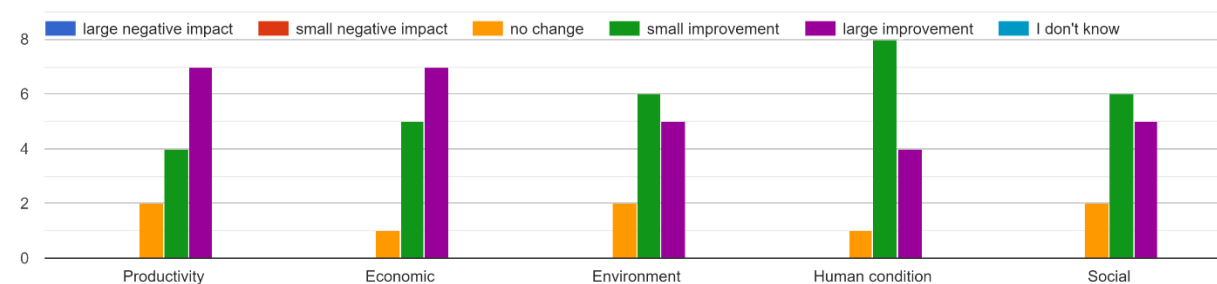
Innovation 6: Capacity building for extension agents and universities (curriculum development – possible link with programs on Nutrition sensitive agriculture and CBBP)



Innovation 7: Adapt technical knowledge to local contexts – development of modules and technical guidelines

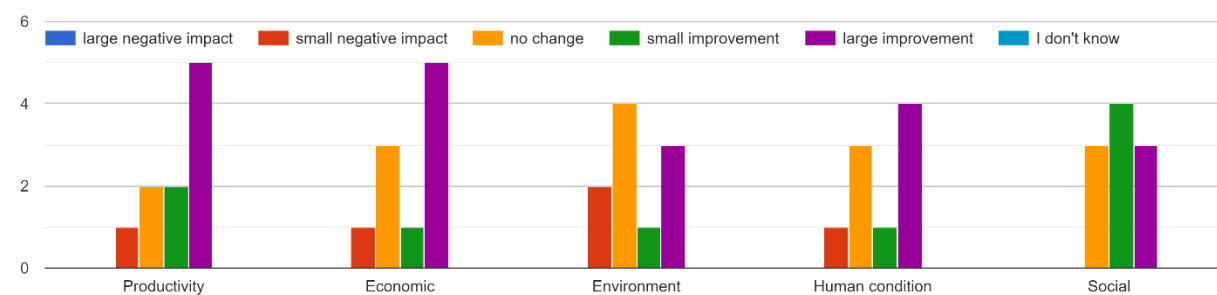


Innovation 8: Review existing enabling environment for each of the innovations and provide the evidence needed for change through ongoing platforms e.g. REDFS (Rural Economy and Food Security)

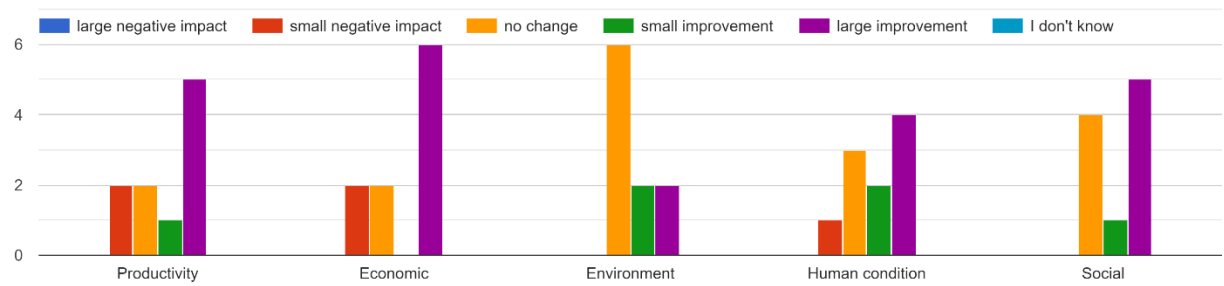


Poultry

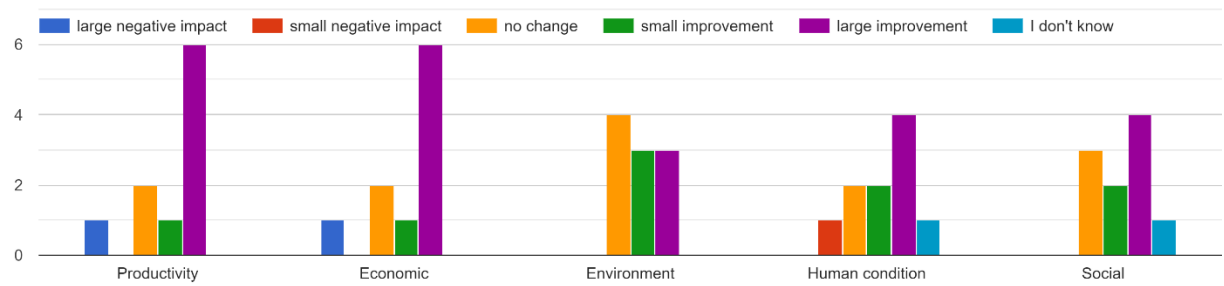
Innovation 1: Farmer preferred and locally adapted improved chicken breeds (identifying, testing, delivering)



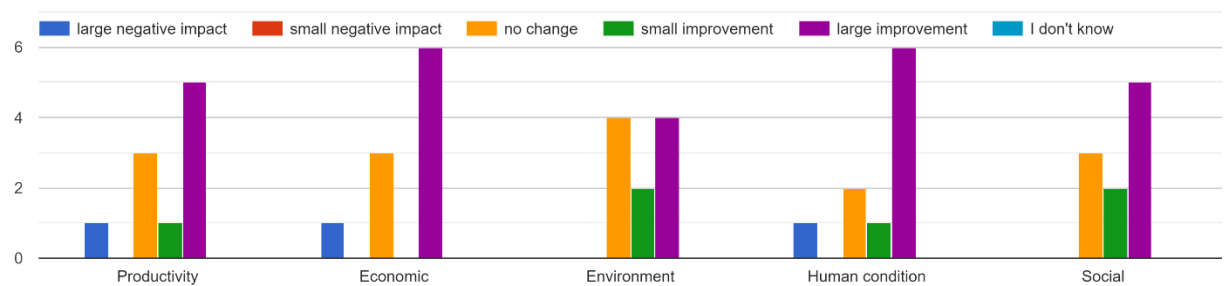
Innovation 2: Best-cost feed packages from locally available ingredients (identifying, testing, delivering)



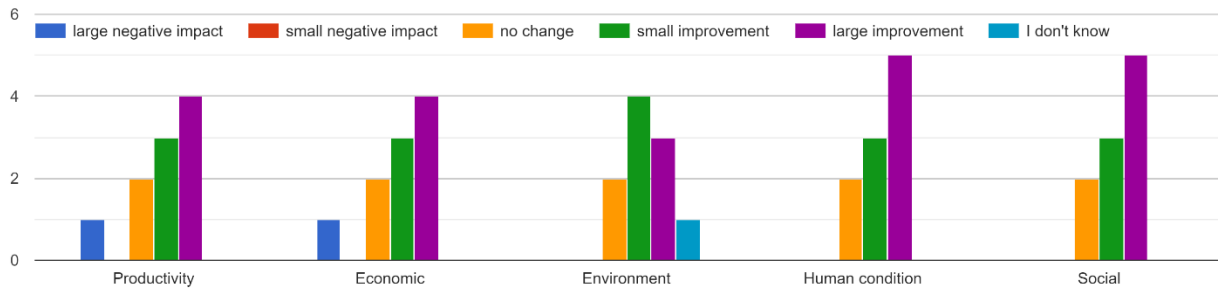
Innovation 3: Improved vaccine supply chain and efficient vaccine delivery models (assessment and model building)



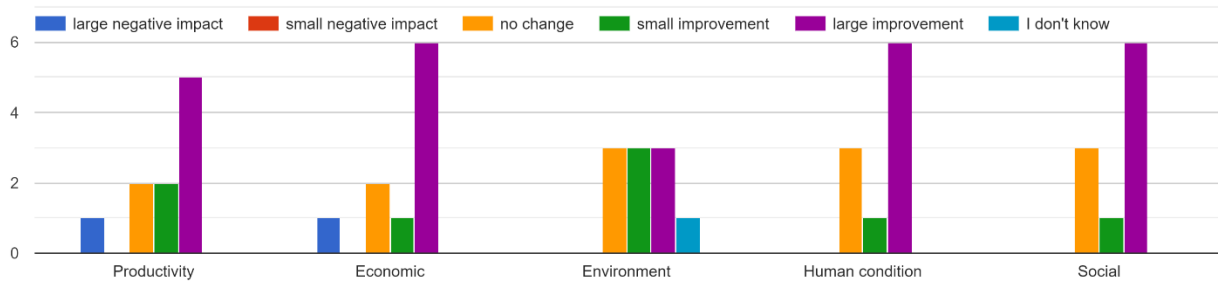
Innovation 4: Digital market information delivery models and improved marketing infrastructures (slaughtering services, egg processing)-developing, pilot testing, deploying



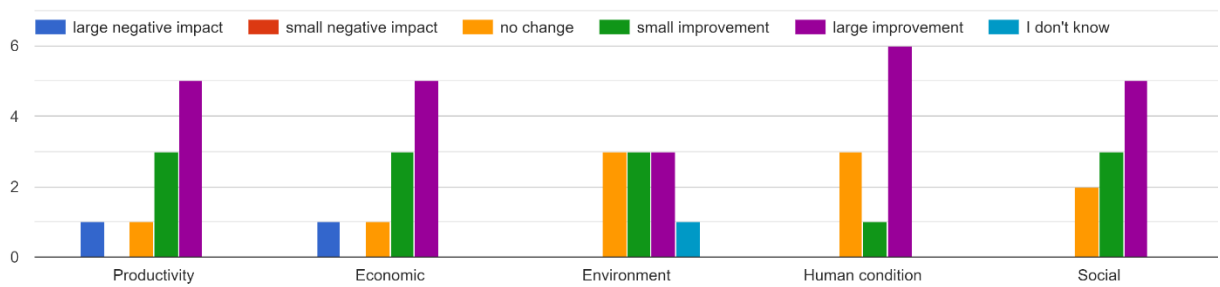
Innovation 5: Tailored social and behavioral change communication packages (developing, delivering)



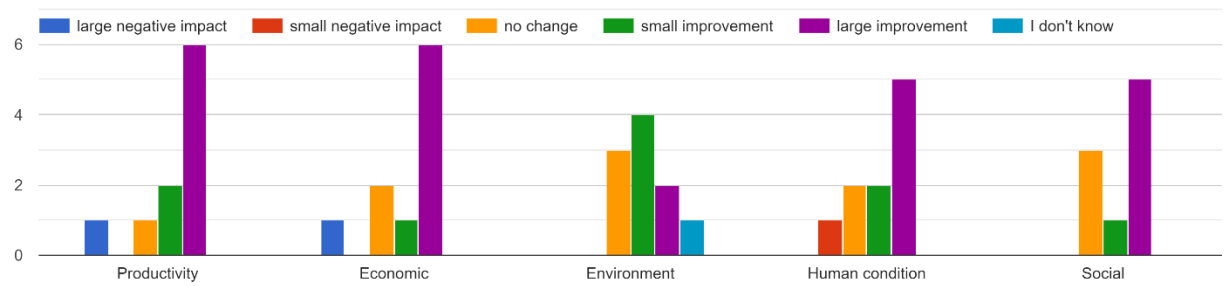
Innovation 6: Tailored and gender sensitive training modules, including couple training and male sensitization training packages (developing and deploying)



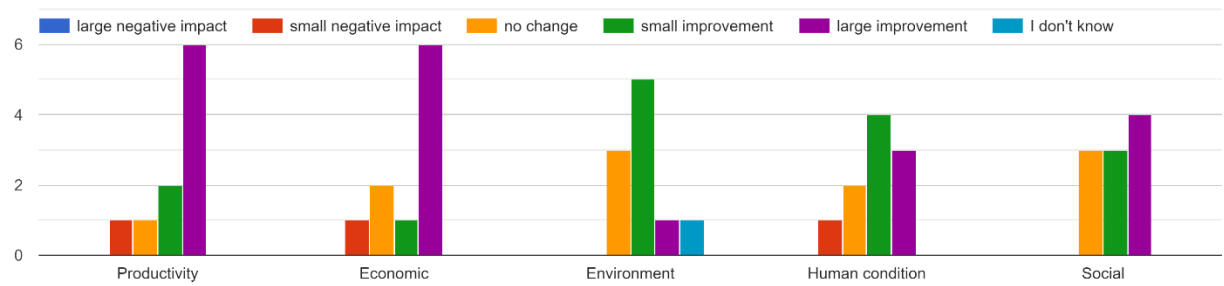
Innovation 7: Women focused chicken production business models (developing and deploying)



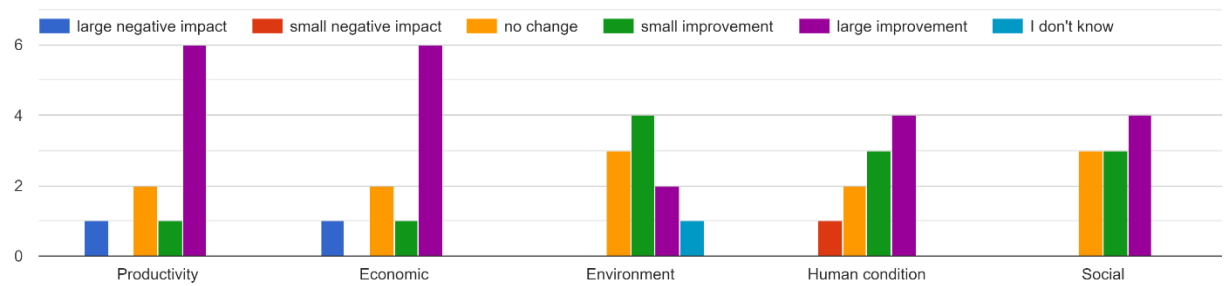
Innovation 8: Business models for input delivery and small-scale commercial production (developing and deploying)



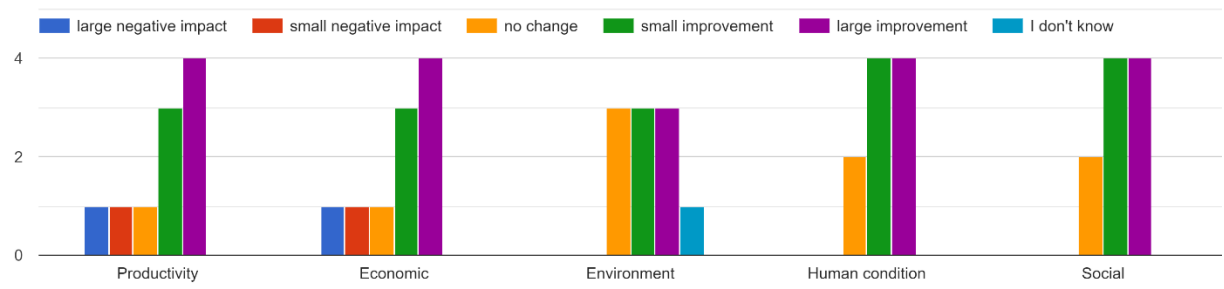
Innovation 9: Innovative and tailored financial products and services and delivery models (developing and deploying)



Innovation 10: Functional platforms at different level (facilitating and supporting)



Innovation 11: Comprehensive evidence on the efficiency and alignment of the federal and regional extension systems



Annex 3: Innovations – redefined and regrouped

Type of innovation	Redefinition	Regrouping
1 Access nutritious food	1 Nutritious food access	Assessments
2 Adapted technical knowledge	2 Technical knowledge - adapted	<i>Biophysical assessments</i>
3 Assessments – animal health, management	3 Assessments – animal health, management	3 Assessments – animal health, management
4 Assessments – feed/forage options	4 Assessments – feed/forage options	4 Assessments – feed/forage options
5 Assessments – Gender, social inclusion	5 Assessments – social inclusion	13 Assessments – feed quality
6 Assessments – value chains	6 Assessments – value chains	<i>Social inclusion and gender assessments</i>
7 Behavioral change packages	7 Behavioral change packages	5 Assessments – social inclusion and gender
8 Breeding program	8 Breeding program	<i>Socio-economic assessments</i>
9 Business models	9 Business models	6+10 Assessments – value chains
10 Competitive dairy value chain	10 Dairy value chain	Training
11 Digital platforms and database	11 Digital platforms and database	<i>Technical training</i>
12 Aligned extension systems and knowledge delivery	12 Knowledge delivery	2 Technical knowledge - adapted
13 Feed quality analysis (NIRS)	13 Assessment – feed quality	31 Livestock production options
14 Financial products, institutions linkage	14 Financial products	32 (Herd) health
15 Herd health package	15 Herd health - package	<i>Value chain training</i>
16 Improve nutritional quality crop residues	16 Crop residues -- quality	33 Business models
17 Improved feed	17 Feed & forages	<i>Training on inclusiveness and gender</i>
18 Improved feeds and forages	18 Feed & forages	29 Inclusiveness and gender
19 Input supply and service delivery	19 Input supply and service delivery	Interventions
20 Institution building	20 Institution building	<i>Biophysical interventions</i>
21 Investment strategies	21 Investment strategies	8 Animal breeding
22 Livestock insurance	22 Livestock insurance	16+17+18 Feeds and forages
23 Platform establishment	23 Stakeholder platforms	27 Reproduction management and AI
24 Quality control assurance	24 Quality control	<i>Value chain interventions</i>
25 Market linkage	25 Market linkage	9 Business models
26 Policy influencing	26 Policy influencing	11 Digital platforms and database
27 Reproduction management and AI	27 Reproduction management and AI	14 Financial products
28 Testing gender sensitive interventions	28 Inclusive interventions	19 Input supply and service delivery
29 Gender sensitive training	29 Training - inclusiveness	21 Investment strategies
30 (Climate) Smart Pack	30 Smart pack – (Climate)	22 Livestock insurance
31 Training- livestock production options	31 Training - livestock production options	24 Quality control
32 Training of trainers herd health	32 Training – (heard) health	25 Market linkage
33 Training – business models	33 Training – business models	<i>Institutional interventions</i>
		1 Nutritious food
		20 Institution building
		23 Stakeholder platforms
		26 Policy influencing
		<i>Inclusiveness and gender interventions</i>
		28 Inclusiveness and gender interventions
		Interventions – integrated packages
		7 Behavioral change packages
		15 Herd health - package
		30 Interventions – Smart pack (Climate)
		Knowledge delivery
		12 Knowledge delivery



The CGIAR Research Initiative on Sustainable Animal Productivity for Livelihoods, Nutrition and Gender inclusion (SAPLING) is working in seven countries focusing on livestock value chains to package and scale out tried-and-tested, as well as new, innovations in livestock health, genetics, feed and market systems. SAPLING aims to demonstrate that improvements in livestock productivity can offer a triple win: generating improved livelihoods and nutritional outcomes; contributing to women's empowerment; reducing impacts on climate and the environment. Its seven focus countries are Ethiopia, Kenya, Mali, Nepal, Tanzania, Uganda and Vietnam.

SAPLING forms part of CGIAR's new Research Portfolio, delivering science and innovation to transform food, land, and water systems in a climate crisis.

