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CRP 3.7 Livestock and Fish

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CGIAR is a global partnership that unites organizations engaged in research for a food secure future. The CGIAR Research Program on Livestock and Fish aims to increase the productivity of small-scale livestock and fish systems in sustainable ways, making meat, milk and fish more available and affordable across the developing world. The Program brings together four CGIAR centres: the International Livestock Research Institute (ILRI) with a mandate on livestock; WorldFish with a mandate on aquaculture; the International Center for Tropical Agriculture (CIAT), which works on forages; and the International Center for Research in the Dry Areas (ICARDA), which works on small ruminants. <http://livestockfish.cgiar.org>

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1. Intermediate Development Outcomes (IDOs), Theories of Change (ToCs) and Impact Pathways (IPs)

CRP Livestock and Fish (LF) was designed to respond to development challenges through a research for development trajectory that would provide more milk, meat and fish by and for the poor. It has worked to develop livestock and fish value chains that enable smallholder producers to intensify and contribute to food security by increasing the availability of affordable animal source foods. LF develops and offers technology and innovation in animal health, genetics and feed to boost primary animal source food productivity and production efficiency among smallholders. Combined with a focus on transforming selected value chains, and using multidisciplinary research teams, LF collaborates with research and development partners to build an evidence base to introduce and adapt innovations in an integrated way, and achieve large scale impact across value chain systems. Nine focal value chains have been selected: dairy (Tanzania, India), small ruminants (Burkina Faso, Ethiopia), fish (Egypt, Bangladesh), dual purpose cattle (Nicaragua) and pigs (Uganda, Vietnam). These have been chosen for their potential to offer sustainable livestock solutions to food security through smallholder intensification and commercialisation. Solution-driven, research-with-development aims to discover pathways to scale that will enable significant impact on food and nutrition security. In the two years of operation, the LF program and the CGIAR as a whole have learned lessons and now LF builds on this to make four changes. These are

- a stronger focus on a theory of change that delivers IDO level impact in value chains
- a theory of change that generates International Public Goods (IPGs) for enabling wider delivery of IDOs
- a restructuring from themes into flagship programs, and
- the use of product lines to bundle diverse yet connected work and use these as a means to measure performance

Theory of Change¹

For the **first two program changes**, the program logic for impact is better focused using a Theory of Change whose outcomes are defined by six Intermediate Development Outcomes (IDOs). As shown in Table 1, these combine primary food and nutrition security ‘for the poor’, and enable this to offer meaningful poverty reduction potential by fostering such production to be ‘by the poor’ in sustainable ways. These IDOs identify key areas in value chains where research for development will enhance productivity of livestock and fish enterprises; deliver more and better quality animal resource foods; enable a more gender equitable distribution of income and employment; reduce the nutrition gap for poor consumers; lower environmental costs and foster better policy incentives. IDOs 1 – 5 directly contribute to reducing rural poverty (SLO1), increasing food security (SLO2), improving human nutrition and health (SLO3) and more sustainable management of natural resources (SLO4).

The program is working to discover and effectively deploy livestock and fish interventions. Using a process of technology innovation design, testing and refinement LF is developing methods and tools for priority setting in and across value chain systems. LF has begun working with development and private sector partners to build capacity to enable value chain system actors to adapt innovations to become contextually fit-for-purpose. It stimulates the right combination of ownership and

¹ See Annex 1 for a full description of the LF Theory of Change

appropriateness that enables uptake at a scale for value chain transformation. LF will research ways and means whereby technical and institutional solutions reach significant scale in and beyond value chains, and seek to produce proof-of-concept as an IPG.

Table 1 – CRP Livestock and Fish IDOs and Key Indicators

IDO	Notes	Generic IDO Indicators
#1 Increased livestock and fish productivity in small-scale production systems for the target commodities (SLO2)	Reflects considerable investment in research to improve technologies related to livestock and fish productivity drivers: health, genetics and feeds. Targets capture aggregate and individual productivity.	• Yield of target commodity
#2 Increased quantity and improved quality of the target commodity supplied from the target small-scale production and marketing systems (SLO2)	Targets based on a combination of expected productivity gains across different social groups, food safety indicators and density of production in our target markets.	• Quantity of target commodity supplied from small-scale producers
#3 Increased employment and income for low-income actors in the target value chains, with an increased share of employment for and income controlled by low-income women (SLO1 and SLO3)	Targets based on income generation opportunities created within the target value chains, to be set based on planned participation levels. Gender disaggregated data collected in terms of participation in the value chain, and in the consumption of the value chain products. These targets focus on the nature of participation of women in the value chains.	• Total household income • Total household income in value chain actor household controlled by women • Employment in value chain actor households
#4 Increased consumption of the target commodity responsible for filling a larger share of the nutrient gap for the poor, particularly for nutritionally vulnerable populations (women of reproductive age and young children) (SLO3)	Targets nutritional benefits of commodities and anticipated research to ensure these benefits are realized under CRP4. A preliminary nutritional analysis will be required to understand the appropriate form of targets to adopt.	• Dietary Diversity (DD)
#5 Lower environment impacts in the target value chains (SLO4)	Targets GHG per unit produced as a proxy for enhanced productivity and value chain efficiency that contributes to reduced pressure on natural resources.	• Emission Intensity of Green House Gases (GHG)
#6 Policies (including investments) support the development of small-scale production and marketing systems, and seek to increase the participation of women within these value chains (SLO2 and SLO4)	Targets the level of public and private investment in the sector as a proxy of increased prioritization of the sector.	• Conducive policy and legislative environment in support of small-scale production and marketing systems • Private, donor and public investment

Consistent with the original approved program proposal, two causal pathways are followed from program outputs. Firstly, within target value chains, LF will work with development partners to identify and co-create contextually appropriate solutions, develop value chain actor capacity to work

with these for equitable impact. Here, LF will work with development partners to seek substantial investment to support increasingly relevant R4D interventions. With the right mix of appropriate and demanded innovations, investment and capacity enhancement, the program has been working to stimulate higher productivity, higher overall production, effective fair and inclusive markets, higher and more gender equitable distribution of income for producers, more affordable consumer prices and equitable distribution and use of animal source foods. LF will use participatory and iterative learning approaches to assure that this trajectory brings widespread behaviour change in target value chain systems, marked by improved uptake of livestock and fish innovations and better coordination along targeted value chains.

Secondly, IPG outputs will include models to promote targeted dissemination of results through publications, social and mass media, to provide sufficient supporting evidence and platforms for global promotion and adoption of innovations. LF will work with 'next users' such as the NARES and their regional equivalents, NGOs, civil society organizations and public and private service providers in countries outside of the selected value chains as a way of building and strengthening institutions for accelerated downstream testing, adaptation, and scaling of research outputs. LF will engage key partners in disseminating research-for-development outputs and in ensuring they are widely accessible and used. LF's communication and dissemination strategy will target specific messages and channels to influence policy makers, especially those that determine development investments, to promote wider deployment of LF's proven interventions. Improving international access to and use of program outputs will ultimately, over a longer term horizon, contribute to desired and commonly identified IDOs.

These two pathways lead to an increase in productivity in ways that reduce (or do not increase) environmental costs per livestock and fish unit. Such increases by smallholder producers will raise household income and employment, and will improve both the supply and quality of produce, and the quality of household nutrition. Evidence from successful work will be documented to inform and shape enabling policy. LF will monitor IDO indicators to track the nature and rate of change. These form the basis of LF's theory of change validation framework and are mainly those relating to work in value chains. Measurement of such progress will be correlated with the observation of shifts in national data, noting that differences many exist in measuring these in different countries.

The LF Monitoring, Evaluation and Learning (MEL) strategy will be aligned with the CGIAR M&E strategy and designed to measure R4D towards impact over a long period with many development partners working over large areas. It will work to validate whether program outcomes are delivered transparently, accountably and cost effectively (value for money). LF will track progress towards achieving IDOs and impact, facilitate iterative learning, and build capacity for problem solving with development partners. In each value chain, LF will define a specific theory of change and impact pathway as the basis for monitoring progress towards achieving the IDOs. Early on, progress will be monitored using secondary data from ongoing research and situational analyses. Later assessments will use evidence from intervention-related change to inform, strengthen and validate theories of change.

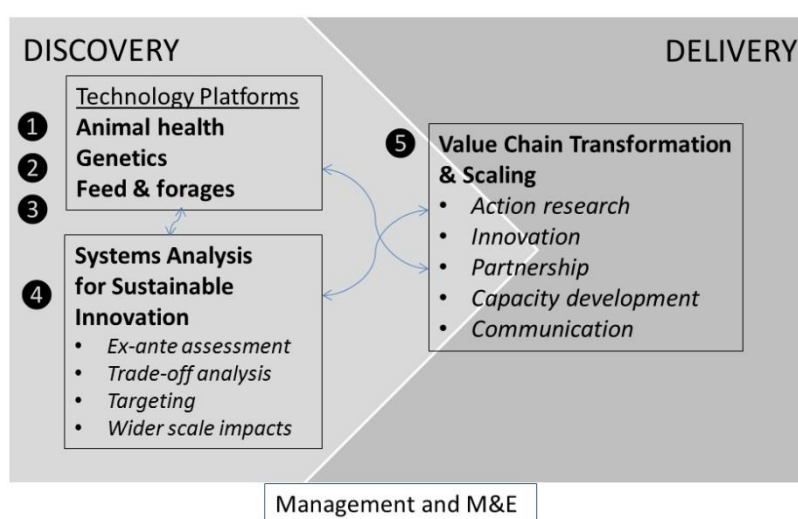
The **second program change** strengthens the LF theory of change to focus both on animal source foods as essential elements in food systems, and as commodities.

For the former, LF anchors its work in carefully selected sites and, where possible in collaboration and through co-location with other CRPs, develops specific theories of change within country value chains

involving wider research and development stakeholders. This offers a bespoke AR4D model for assessing specific value chain constraints and opportunities. In these contexts, LF conducts research to test and validate technological and institutional innovations, and design interventions that can reach scale and transform value chains and animal source food systems. This stylised approach works to evolve value chain systems in a development process that builds on local evidence that, with other CRPs and partners, achieves scale. Within each value chain that LF engages, an exit strategy is adopted to enable the program to decrease its direct involvement. This also offers an opportunity carry its learning to new value chains.

For the latter, the theory of change recognizes the commodity dimension of animal source foods in order to generate IPGs that can be used more broadly. These will include the development of vaccines and food safety interventions, genetically improved breeds and strains, and improved feeds and forages for wider use beyond the target value chains. These will require the development of a different set of targets that transcend specific localities.

The **third program change** involves a restructuring of LF to better align resources and efforts according to the theory of change. The six themes are consolidated to become 5 flagships. Four of these relate to the discovery of new innovations through the alignment of systems analysis with technology generation. The remaining flagship works to deliver innovation and research this process to identify methods and approaches that enable sustainable scale.



The diagram shows how these relate. Although limited in its portrayal of inter flagship dynamics, it shows how discovery research processes lead to the delivery of appropriate solutions. Three technology flagships, animal health, genetics and feed & forages, work to develop and offer technical options that fit with value chain demand. The Systems Analysis for Sustainable

Innovations flagship helps to evaluation candidate technologies. The Value Chain Transformation and Scaling flagship integrates and targets these within value chain systems and works with value chain actors and development partners to innovate and adapt these for contextual fit. This process entails the formation of alliances, the development of critical capacities and the communication of results.

The **fourth program change** accordingly adjusts the way in which program management is exercised. Here, within each flagship, research is framed as a series of product lines to sharpen focus on the achievement of essential outputs and outcomes. This bundles heterogeneous activities and outputs and the timing of their deliverables according to key steps and milestones, and seeks an expected scale of impact at any given moment. Therefore, monitoring and evaluation systems are based on flagship and value chain theories of change to monitor key evidence to demonstrate progress towards delivery and the achievement of planned outputs and impact. This is the heart of creating proof of concept for the theory of change.

2. Flagship Projects

Five flagship projects combine to deliver research results that will lead to development results as defined by the IDOs. Four of these principally relate to the discovery of new technology and innovation, and one relates to the delivery of innovation into value chains. All flagships are research based, exploring and testing ways and means of achieving wide-scale transformation in selected value chains. All flagships will work closely with one another to ensure that mutual potential of the improved health, genetics and feed are harnessed and intelligently deployed within value chain systems in ways that transform and significantly spread.

Flagship 1 – Animal Health: This flagship aims to ensure that smallholder livestock and fish production systems can withstand the impact of disease and form a reliable basis for smallholders to produce good quality and safe products for sale and consumption. Critical animal diseases substantially constrain livestock and fish productivity. This work aims to identify priority disease constraints, develop appropriate and equitable solutions and deliver these in ways that fit within various local contexts. The principal products of animal health research will be new or improved vaccines, diagnostic assays, herd health interventions and evidence-based assessments of disease priorities. This discovery agenda includes both upstream science (e.g. molecular biology, immunology, epidemiology) and applied science (assessment, herd health, delivery). Animal health research work will focus on four clusters of activity:

1. Animal Health Assessment and Prioritisation
2. Animal population health and food safety
3. Vaccines and diagnostic assay developments
4. Equitable animal health services delivery.

Flagship 2 – Genetics: This flagship aims to ensure that improved and appropriate livestock and fish breeds and strains are widely available, used sustainably by women and men, and are equitably providing nutritious, affordable food and income for the poor. The genetic characteristics of livestock and fish are fundamental to their performance in farming systems. A major challenge in meeting future needs for sustainable food and nutrition security is developing robust strains and breeds that can perform in a range of farming systems, across the gender divide, and in challenging and changing environments. This requires the development of novel approaches to inform the design of breeding programs to meet these goals. This in turn requires new methods and metrics of measuring the performance of strains and breeds in production systems and value chains. Improved technologies and institutional frameworks will be needed to multiply and sustainably disseminate improved strains and breeds. This flagship will identify and promote improved appropriate breeds and strains, and develop new ones, accompanied by robust delivery systems to ensure that poor women and men livestock and fish keepers can access these genetic resources. This will involve proven and new ways of using traditional animal breeding approaches, including the latest technologies on phenomics², genomics and reproduction. Genetics research work will focus on four clusters of activity that form key stages to deliver on its objective as follows:

² The measurement of the physical and biochemical traits of organisms as they change in response to genetic mutation and environmental influences.

- 1) System, strategy, and genome assessment
- 2) Improved breeds and strains
- 3) Delivery and use systems
- 4) Breakthrough technology and information systems.

Flagship 3 - Feed and Forage: This flagship aims to ensure that fish and livestock-owning smallholders can access the feed and forages they need to support profitable and sustainable livestock and fish production, that non-livestock and fish owning smallholders can benefit from small-scale feed businesses and that the wider feed sector benefits from improved tools, analyses and information to facilitate better decision making at all levels.

Feed is often the main input into livestock and fish production and largely determines the economic viability of animal-sourced food production. Feed resourcing and feeding play a key role at the interface where beneficial impact and negative implications from livestock are negotiated and decided, in terms of natural resource use efficiency, greenhouse gas emission (GHG), competition with food security and loss of biodiversity. Forage science has great potential to reduce environmental costs through breeding adaptation to various stresses (drought, waterlogging, pests) while mitigating GHG. Feed resourcing and feeding is often a female task and many gender equity issues in livestock and fish production are shaped by feeding practice. Feed production, processing and trading offers income generation and employment opportunities and increased economic benefits from mixed crop animal systems. This facilitates the engagement of smallholders in the animal chain as service providers to livestock and fish production. This flagship will be organized around the following three clusters of activities:

- 1) Feed technology platform to guide and support feed and forage work needs in LF and other systems and commodity CRPs.
- 2) Assessing current feed resources and devise options for using them more efficiently
- 3) Producing more and higher quality feed and forage biomass

Flagship 4 – Systems Analysis for Sustainable Innovations (SASI): The SASI flagship will enable the program to understand complex value chain system dynamics and ensure that innovations formed through the animal health, genetics and feed & forages flagships are positioned to stimulate transformative system change that benefits women and men. It seeks to develop critical intelligence from a systems perspective, conducting value chain context and ex-ante analysis of innovations within specific contexts. It will guide the formation of best-bet strategies to address key system blockages that, if overcome, promise to tip value chain system dynamics to enable sustainable impact at scale. It acts at the interface between technology generation and value chain transformation. Across the value chains, this flagship consolidates understanding and learning to create regional and global knowledge.

This flagship will combine the perspectives of multiple stakeholders, from value chain and development actors to researchers and regulators. This flagship brings together multidisciplinary teams to combine cross-program learning across each of the technology flagships. SASI will provide information and tools for researchers, practitioners and decision-makers to assess and intervene in value chains to improve equitable performance. Research outputs offer intelligence that enables well-targeted priorities to be set and to guide development engagement in value chain systems and beyond, towards pro-poor gender equitable outcomes. Here, SASI will undertake multi-scale and multi-dimensional assessments of potential interventions in value chain systems, considering these

within their wider global and regional contexts. It will take an interdisciplinary approach to theoretical, empirical and methodological work on value chain economics, policy, innovation, foresight, gender, nutritional and food security, environmental assessment, ex-ante and ex-post impact assessment and trade-off analysis. The flagship will work at two levels. In target countries, it will support intervention targeting to improve country value chain functioning in the interests of poor women and men, and assess how actions within value chain systems might generate potential wider-scale impacts. Across countries it will examine how external megatrends (e.g. global market prices, climate change, and urbanization) might over time impact value chain function for different stakeholders. This will be undertaken through two clusters of activity:

- 1) Value chain intervention research
- 2) System assessments around, between and beyond value systems.

Flagship 5 - Value Chain Transformation and Scaling: This flagship will research the extent to which value chain innovations achieve transformative scale, and enable poor, small and medium scale entrepreneurs and consumers to use and equitably benefit from program research products. Located at the delivery end of the research to development process, this flagship will interface with development, business and government actors, and put research into use to generate new understanding as to how poor women and men in value chains own and adapt technology in contextually appropriate ways. Using action research, this flagship deploys tools, methods, approaches and interventions developed and tested in the discovery flagships (1 to 4), and through innovations, facilitate positive changes in value chain dynamics that stimulates widespread sustainable change at scale. It researches the extent to which value chains are an effective framework for ensuring better food security and nutrition.

Underpinning this research is iterative reflective learning as feeds and forage, animal health, and genetics innovations are deployed within value chains, exploring who uses and adapts them and how, the extent of use, existing social and economic constraints to their use, and their outcomes on resource poor men and women in small and medium scale enterprises in program value chains and beyond. Research here will generate learning and deployment tools, methods and approaches to test and adapt interventions, generating learning on what technologies, institutional interventions and dissemination strategies work well, where and for whom. Using participative knowledge platforms, innovations will be deployed with the intention of transforming target value chains to achieve program IDOs at sustainable scale. Multi-disciplinary teams consisting of Animal Health, Genetics, Feeds & Forages, Social and Gender Sciences, and Systems Analysis for Sustainable Innovation (SASI) researchers will work with development practitioners and investors to achieve the practical translation of promising technology into sustainable, equitable and viable solutions. This flagship will build and research development alliances, and create and strengthen the innovation capacity of partners to facilitate ownership and technology and institutional development and adaptation processes.

Action research within value chains will be led by Value Chain Coordinators who will work with multiple stakeholders to identify locally critical gender responsive value chain issues and articulate demand for solutions. This process will question and test the applicability and appropriateness of interventions at various scales and among different stakeholder groups and value chain actors, paying particular attention to issues of equity and inclusion of marginalized groups. Action research will draw lessons from engagement and provide real-time feedback to the discovery flagships to refine

interventions and develop new solutions. This multi-stakeholder action research process will seek to galvanise interest and enthusiasm across value chain actors, development partners and key stakeholders in a bid to stimulate their commitment and search for investment to take interventions and their effect to scale. The flagship will have three major clusters of activities, namely:

- 1) Intervention testing
- 2) Capacity development for value chain transformation
- 3) Implementation actions.

3. Gender

LF managed Gender mainstreaming and transformation as a theme until 2013. In 2014, with themes restructured into flagships, a Special Gender Initiative was conceived to oversee the planning and delivery of gender-related outputs and associated reporting. This will ensure that gender considerations are mainstreamed and researched in all flagships and value chains, will continue to pursue the outcome stated in LF Gender Strategy through this extension period. “Poor women, men and marginalized groups have improved and more equitable access to affordable animal source foods through gender equitable interventions.” To accomplish this, the focus will remain on the four identified outputs and their milestones:

Output 1: Increased gender capacity within CGIAR centers, partner organizations and value chain actors to diagnose and overcome gender based constraints within value chains.

The focus will be on the development of interventions for building gender capacity with partners using the tool created to identify gender capacity gaps. Gender modules and trainings will be created and adapted to meet the needs of partners to enhance both integration of gender as well as understanding of the significance of gender and agriculture implications in R4D. The goal is that LF and its partners will routinely and systematically include gender analysis and monitoring in all their programmatic work.

Output 2: Strategies and approaches through which women and marginalized groups improve the nature and level of participation in livestock and fish value chains

This output will focus on the implementation and evaluation of interventions that overcome gender-based constraints in LF value chains, with particular emphasis on issues of gendered access and control of resources. The intent is to increase the numbers of LF value chain countries using and adapting the gender-sensitive value chain tool kit to identify constraints and opportunities in the value chain, as well as implementing technologies for improved opportunities related to income generation and food security.

Output 3: Strategies and approaches that increase women and marginalized group’s entitlement to access markets and control resources, technologies, labour, power and the benefits of their work.

This output has a research focus - identifying gender transformative approaches (GTAs) that will move value chains from traditional ‘accommodating’ approaches in gender analysis and research to new and more impactful ways of creating gender equity. Identifying and working with donors and partners to fundraise and write proposals will be a primary focus as there are few funds currently. We will also develop tools for GTA analysis and implementation of new approaches and train partners on collecting data and designing research in R4D development programs. In addition, a knowledge sharing platform on GTAs will be created.

Output 4: Strategies and approaches to promote increased level and equity in animal source food consumption within poor households

This output focuses on developing strategies to explore the gendered patterns related to animal source food (ASF) consumption in poor households, with the intent of increasing the protein consumption of women and children. Tools and training are being developed and shared with partners in value chain countries to examine these patterns and develop strategies to assist with helping to increase diet diversity (with particular focus on ASF) as well as improve the growth and reduce stunting of children under 2 years, and pregnant and lactating women.

4. Partnerships

Partnership lies at the heart of LF. The program has adopted a very intentional partnership strategy that recognizes the differences between tactical collaboration and more fundamental strategic partnerships, and the different nature of partnership with research versus development actors. While scanning widely and engaging in numerous tactical collaborations, particular attention is being given to establishing the foundation for selected strategic partnerships, both globally and within the selected value chains. Partnership for the program occurs at three levels, namely Operational, Research and Developmental

Operational Partnerships: Four CGIAR centres have worked seamlessly in partnership for two years to jointly deploy appropriate research within 9 country value chains. Through a well-structured program planning and management committee, the work of ILRI, Worldfish, CIAT and ICARDA has been consolidated around common thematic planning: work sites and research agendas have been allocated and coordinated as one. This arrangement of common shared planning and action has proven successful and will continue.

Research Partnerships: In addition to the combined and aligned research capability of the four operational partners, research partnership negotiations have been initiated with Wageningen University Research (WUR) and the Swedish Agricultural University (SLU) to broaden the breadth of research offered. ILRI has renewed its agreement with SLU in 2013 with a special clause to provide the basis for a joint program with the LF CRP. Careful consideration is being given to appropriate arrangements that might allow WUR and SLU to become full partners in the CRP. We envisage that these relationships will broaden the program's capability across all flagships.

Within the animal health flagship, collaboration has enabled ILRI to attract funding from the Bill & Melinda Gates Foundation (BMGF) for a new East Coast fever vaccine initiative. This consortium builds on earlier collaborations with the Center for Ticks and Tick-Borne Diseases (Malawi), GALVmed (UK), the Institute of Tropical Medicine at Antwerp (Belgium), the Institute for Genome Sciences at the University of Maryland (USA), the Roslin Institute at University of Edinburgh (UK), the Royal Veterinary College (UK), the United States Department of Agriculture-Agricultural Research Service (USA) and Washington State University (USA). Under the SASI flagship, another project funded by BMGF is allowing the program to tap into complementary expertise at CSIRO (Australia) and the Stockholm Environment Institute (Sweden) to address methods needed for assessing environmental impacts associated with development of our target value chains. At value chain level, the program works with national research partners. For example, LF has established a strategic partnership with Sokoine University of Agriculture (Tanzania) to bring a broad range of faculty expertise and student research to the successful extension of a joint project funded by Irish Aid, supported by the signing of a long-term

MoU and the inauguration of an ILRI project office on its Morogoro campus. A long term MoU has also been signed with the Tanzania Livestock Research Institute (TALIRI). In Vietnam, collaboration in program sites has led to MoUs with Nong Lam University in Ho Chi Minh City and Tay Nguyen University in Dak Lak. In Bangladesh, collaboration with the Agricultural University and USAID is working to develop integrated fish systems.

Development Partnerships: Development partners are engaged to help adapt innovations for wider impact at scale. The adoption of innovations across value chain system is a complex process that requires robust ways and means of engaging across complex adaptive systems. Solutions that are generated in one space often do not work in another: the issues they address are not regarded with the same importance elsewhere, are not always appropriate, and not adapted to user demands. For our research to take hold, value chain actors must participate in shaping innovations since appropriate, owned and enthusiastically adopted innovations quickly reach sustainable scale. This process requires careful nurturing by development practitioners over time. It is with such development partners that this strand of partnership works.

Our experience with working with development actors in the value chains has given rise to significant strategic development partnerships with international NGOs: SNV, the Netherlands Development Organisation, and CARE International. LF will work with these to integrate research and development efforts more systematically, globally. At value chain level, partnerships have been formed with local development actors such as VEDCO, SNV, NAADS, BRAC and AFRISA in Uganda, SNV, Land O'Lakes and Heifer International in Tanzania and CARE in Egypt. LF works closely with the Tanzania Dairy Board to support it in its stewardship of the national Dairy Development Forum. In Bangladesh, collaboration with Save the Children will provide nutrition training to households involved in aquaculture training. LF will continue work with private sector actors Skretting, Aller Aqua and MAKRO and local private hatcheries to improve business skills among commercial farmers in Egypt; and with DOW AgroSciences to support the breeding of improved Brachiaria grasses.

In the coming two years, the program will extend its development partnerships in value chain sites by establishing multi-stakeholder learning and action platforms that form the basis of joint action in India, Mali, Ethiopia, Nicaragua and Bangladesh, and will continue to form new tactical partnerships in Uganda, Tanzania, Vietnam and Egypt.

Governance and Partnership: Governance of LF has been jointly undertaken through a cross operational partner 'program planning and management committee' (PPMC) assisted and advised by a Science and Partnership Advisory Committee (SPAC). This will remain in its current form with some modest adjustments, namely that the link between the SPAC and the ILRI Board of Trustees will be strengthened, and the role of SPAC will be enhanced to also make critical approvals. Approval areas will likely include program plans of work and budget and program annual reports.

<u>Indicative shares of W1/W2 budget, by partner or partner category</u>	
Investment into Operational Partners	
- ILRI	58%
- CIAT	11%
- WorldFish	10%
- ICARDA	4.35%
Strategic Investment into Research and Development Partners	10%

The balance of resources (7%) is used for management.

5. Regional Collaborations

In the pursuit of impact at scale, LF works with regional and global partnerships alliances, according to operational, research and development categories as described above. Operational collaboration covers cross country joint work with other CRPs. Research collaboration covers regional and global collaboration with research centres of excellence in the pursuit of widening and strengthening the research base, and for leverage. Development collaboration covers regional and global alliances with major development players in the pursuit of achieving broader appropriateness and reach of research findings.

Operational: Within the feed and forages flagship, considerable joint research is being undertaken with CRPs 1.2 (Humid Tropics), 3.3 (GRISP), 3.1 (Wheat), 3.2 (Maize) and 3.6 (Dryland Cereals) in the pursuit of identifying, breeding and disseminating improved varieties of superior dual purpose feed-forage cultivars. With the Global Cassava Partnership (GCP21), CRP 2.4 (RTB) and CRP 1.2, a line of research has been developed on exploiting the underuse of cassava peels for animal and fish feed, with a particular focus on exploring the potential of small scale processing of this so-called 'waste' product. To support work towards IDO2 (Increased quantity and improved quality) an operational alliance is in place with CRP4 (A4NH) to address food safety and zoonosis issues across several value chains. This joint work forms the basis for the development of comprehensive IPGs. ILRI generated program feed assessment tools FEAST and Techfit are being taken to wider scale through collaboration with CRP 1.1 (Dryland Systems). Collaboration with CRP 2 (PIM) is framed around the development and use of value chain tools for assessment and foresight, and gender inclusion in the value chain. Within this latter area, collaboration is underway with the CGIAR Gender Network. Within LF aquaculture research and deployment, collaboration is being formed with CRP 1.3 (AAS) to explore ways of mutual reinforcement through the combination of efforts and development of an integrated program of work in Bangladesh. In the case of improved forages, for the adaptation of forages to climate change and the realization of the mitigation potential of forages, links exist with CRP 7 (CCAFS).

Research: Collaboration cited above with WUR and SLU is underway to form an alliance that will broaden the LF research base. The nature of such collaboration will expand and widen to cover research needs on innovation systems research. In order to align our work with East African research initiatives, LF works in collaboration with ASARECA to monitor regional action, develop the use of NIRS³, develop Napier grass, and will explore aquaculture development possibilities. Within the animal health flagship, a Global PPR⁴ Research Alliance has been established to develop thermostable vaccines, and identify and coordinate research issues relating to scale and deployment. LF will further engage with CAADP and FARA to disseminate new technologies. In South Asia (Bangladesh) the program may explore cooperation with the Agriculture Centre of the South Asian Association for Regional Cooperation (SAARC) and possibly the Network of Aquaculture Centres in Asia-Pacific (NACA).

Development: Collaboration cited in section 4 with CARE and SNV are framed around regional and global agendas. In addition, LF will work with IFAD on the development of scaling initiatives, with Irish

³ NIRS – Near Near-infrared spectroscopy

⁴ Pestes des Petites Ruminants

Aid in the practical application of research applications in development programs and with FAO on the deployment of tools, methods and approaches.

6. Phased Work Plan Covering the 2 Year Extension Period Until 2016

Over the proposed 2015-2016 extension period, LAF will complete nine comprehensive target value chain assessments and thereby be positioned to focus on testing, refining and out-scaling of packages of best bet interventions. These comprise the technologies developed by the Animal Health, Genetics and Feeds flagships and delivered into test situations through the delivery mechanisms supported by the Value Chain Transformation and Scaling Flagship. Assessments will continue to inform the research agendas of the program's three technology flagships (Animal Health, Genetics and Feeds and Forages) that are predominantly focused on supporting achievement of IDO1 - increased productivity and IDO2 – increased production and quality.

The Animal Health flagship will continue long-term work to develop and improve vaccines and diagnostic assays and identify priority diseases that impact livestock productivity, following an established sequential process. New initiatives to investigate the feasibility of developing vaccines against CCPP⁵ and ticks will commence in 2015 with a view to continuing this work in Phase 2. Rapid assessments of animal and herd health work that started in 2014 will be developed into in-depth assessments in Tanzania, Ethiopia, Vietnam and Uganda for targeted species. Results from these will either validate current research avenues or inform changes to the research agenda. Animal Health will focus on practical application of the research agenda through a cluster of activities that closely link herd health and public health safety issues with a linkage to CRP4.3 (Agriculture for Nutrition and Health (AN4H)). Here, WorldFish will conduct work on management practices for improved bio-security and food safety in fish value chains. More attention is now placed on the delivery of Animal Health products into the value chains, especially through private sector actors and in harmony with Flagship 5 - Value Chain Transformation and Scaling. The outputs of the Animal Health flagship contribute directly to a reduction in animal mortality and increased productivity.

The Genetics flagship continues to balance a research agenda with monitoring the practical application of its outcomes in field situations. Earlier work on designing, implementing and assessing feasible and tailored breeding programs continues for small ruminants in Ethiopia where an evidence base related to the genetic and phenotypic characterization of heat tolerance in small ruminants, is being built up. Partnership and business models for sustainable national genetic improvement programs will continue to be developed and used to inform stakeholder and policy debate on the appropriate use of animal and aquatic genetic resources. In aquaculture, new work is planned on deeper investigation of the yield gap in tilapia production and on a small indigenous species known as Mola which is particularly rich in calcium and holds great potential to improve the nutritional status of women and children. This will be investigated with a view to possible genetic improvements. Similar work on improving tilapia, major Indian carps, and African catfish will be continued. Support to on-going genetic work on tilapia in Ghana is incorporated in this program with a view to including it as an additional value chain country in the future. A dedicated cluster of activities investigates novel technologies for improving livestock and fish reproductive success. Examples here include work to develop room temperature methods for bovine and ram semen storage, and development of a

⁵ Contagious Caprine Pleuropneumonia

combined closed and open source system for movement-based oestrus detection in cattle. Work on the prospects for fish sperm and gene banking will be initiated in 2015 with a view to attracting donor funding. In addition molecular and genomic methods will be introduced to fish genetic improvement. Work in this flagship continues to support IDOs related to increased productivity and increased quantity and quality of animal source foods.

The Feeds and Forage flagship will continue to expand its technology platform through the inclusion of additional NIRS equations derived from price-quality assessments and provide analytical support to a range of stakeholders (including other CRPs), and advice on sustainable feed interventions to actors in livestock and fish target value chains. A stronger focus on taking research into practice is seen in activities relating to fodder processing. CIAT's successful *Brachiaria sp.* breeding program and selection of forage legumes and grasses will be continued and refined through biophysical assessments of tolerance to a number of environmental conditions and assessment of the GHG mitigation potential of improved forages (linked with Flagship 4). Novel feed resources including algae, insects and agro-industry by products, will be initially assessed for their nutrient value and potential use as animal feed. Practical applications are underpinned by socio-economic studies on the feed value chain and fodder and forage markets. Work on low-impact nutritious pond systems with WUR and Nutreco will continue and expand.

One of the program's new flagships, Systems Analysis for Sustainable Innovation (SASI), encompasses a wide scope of activities, including the Special Gender Initiative to enable LAF to focus on program-related research. Global and regional socio-environmental-economic modelling activities take off in 2015 with preliminary model runs ready by the end of the year to which refinements will be made through 2016 as also gaps in the data sets are identified and filled. This flagship will continue to assist with site selection within targeted value chains and make a contribution to the creation of tools to do this. Ex-ante assessments of the potential effects of the program will provide management and development partners with the data needed to mitigate undesirable equity and environmental effects and strengthen the case for positive impacts on employment, income and productivity. As the initial work on value chain assessment is completed and the focus shifts to the selection and refinement of a package of potential best bet interventions, this flagship will conduct trade off analyses, impact assessments and adoption studies to expand the related evidence base.

The strategic gender research agenda is housed in this flagship, and will be led by a dedicated research manager mandated to implement the gender agenda, and support the integration and mainstreaming of gender research into the other flagships.

The Value Chain Transformation and Scaling flagship will focus on the practicalities of innovation deployment and adaptation in target value chains. The flagship is implemented through an interdisciplinary team of technical staff, sociologists and economists who together diagnose constraints within the target value chains, test potential solutions and monitor interventions to arrive at a comprehensive and refined package of interventions. This is supplemented with support to, and research on, innovation platforms and delivery systems. The flagship will generate evidence of the ways in which innovations are adapted and adopted, and spread to achieve scale and transform the effectiveness and efficiency of the value chains. This evidence will be based on outcomes and impacts associated with piloted interventions, consistent with the program's Theory of Change. Measurement of the program's success in transforming value chain performance commences with the development of a framework and methodology for doing this. The flagship also will establish the mechanisms for

cross-CRP and cross-flagship communication and feedback. Criteria for the selection of development partners that can take LAF innovations to scale will underpin the completion of the mapping activity.

A full work plan for 2015 and 2016 can be found in Annex 2.

7. Budget 2015-2016

The total budget for the LF extension period, consisting of W1, W2, W3 and bilateral funds stands at US\$81.9 million, as defined in Table 2. Of this, W1 and W2 will provide US\$34.7 million

INDICATIVE 2015-2016 BUDGET FOR LIVESTOCK AND FISH EXTENSION PERIOD

TOTAL BUDGET BY IDO	Total Program Budget (W1/W2 + Bilateral)		% Budget Share
	2015	2016	
IDO1: Increased productivity	19,572,821	21,388,757	50
IDO2: Increased quantity and quality	3,914,564	4,277,751	10
IDO3: Increased employment and income	9,786,410	10,694,378	25
IDO4: Improved nutrition	1,957,282	2,138,876	5
IDO5: Equivalent or improved environment	1,957,282	2,138,876	5
IDO6: Enabling policy and investment environment	1,957,282	2,138,876	5
	39,145,641	42,777,513	100

Table 2

INDICATIVE 2015-2016 BUDGET FOR LIVESTOCK AND FISH EXTENSION PERIOD - W1/W2 BUDGET BY FLAGSHIP

Table 3 displays budget allocation from W1/W2 sources, broken down by flagship, and is indicative of proportions allocated to gender research and integration. A total of 11.3% is allocated to gender work.

FLAGSHIP	2015	2015 Gender Budget	Gender Budget as % of 2015 CG Research Budget	2016	2016 Gender Budget	Gender Budget as % of 2016 CG Research Budget
Flagship 1: Animal Health	2,771,931	136,021	4.9	3,099,623	149,137	4.9
Flagship 2: Genetics and Breeding	2,341,054	136,021	5.8	2,196,534	149,355	7.0
Flagship 3: Feeds and Forages	2,801,869	136,021	4.8	3,077,081	141,774	4.6
Flagship 4: Systems Analysis for Sustainable Innovation	2,421,062	488,125	21.2	1,847,644	536,607	29
Flagship 5: Value Chain Transformation and Scaling	2,587,834	412,875	15.9	3,994,143	452,793	11.0
Management Unit	1,954,986			2,150,484		
Strategic Investments	1,672,137			1,839,356		
Total Research Budget	12,923,750			14,215,025		
Total Gender Integration Budget (flagships 1-3 + 5)	820,938	820,938	8.0	893,059	893,059	6.8
Total Gender Budget	1,309,063	1,672,137	10.5	536,607	536,607	11.3
Total Budget inclusive of Management Unit and Strategic Investments	16,550,873			18,204,865		

Table 3:

The budget broken down by cluster can be viewed at Annex 3.

8. Annex 1 A Generic Theory of Change

1. Introduction

Figure 1 is an illustration of the Livestock and Fish (LF) CGIAR research program Theory of Change. In a narrative, the program is implementing a model intended to accelerate Agricultural Research for Development (AR4D) by building better partnerships and capacity for generating evidence of pro-poor and gender-responsive technological and institutional innovations, developing methods and tools for prioritizing value chain sites and interventions, and creating mechanisms for scaling-up and scaling-out. This is being done with the primary objective of attracting investment for large-scale development interventions and incentivizing private sector actors to produce and disseminate the innovations which will lead to improved value chain performance and improved capacity of value chain actors, thus stimulating the widespread uptake of innovations. Better performing value chains will then become the primary channels through which intermediate development changes in terms of increased productivity, higher supply of ASFs, higher household income especially for women, reduced nutrient gap, lower environment impacts and better policy and investment environments, will be delivered. In addition, knowledge and innovations created to find solutions to localized constraints will also apply to constraints and the scientifically driven development process more generally. Through targeted dissemination of results and innovations and building the capacity of “next users” such as National Agriculture Research Services (NARES), International Non-Governmental Organizations (INGOs) and Civil Society Organizations (CSOs) in countries outside of the selected value chains the same intermediate development outcomes and eventually System-wide outcomes in terms of changes in food security, nutrition, poverty and sustainability of natural resources will be achieved. The program will deliver these outcomes via two distinct pathways.

1.1 Impact pathway 1: Value chain Theory of Change

By building strong and sustainable partnerships and capacity for generating evidence of pro-poor and gender-responsive technological and institutional innovations, methods and tools for prioritizing value chain sites and interventions, and mechanisms for scaling-up and scaling-out, the LF program prepares for the implementation of large-scale development interventions that translate research results into pro-poor and gender-responsive transformation of selected value chains. The program’s strategy sees the selected value chains as “innovation labs” where close collaboration with both research and development partners in an AR4D effort to design and test large-scale interventions are enhanced. This collaboration provides the foundation on which to build an evidence base that demonstrates how the intervention will lead to improved value chain performance, enhanced equity of the distribution of the benefits of improved performance, improved capacity of value chain actors, and greater uptake of innovations. The combination of an evidence base, the capacity established among development partners to implement the intervention and an intentional strategy to mobilize development funding will allow the intervention strategy to be deployed at scale in the target value chains, providing the mechanism by which the intermediate development changes (**Intermediate Development Outcomes: IDOs**) will be achieved. First of all, influencing the policy and investment environment will then enable the delivery of the remaining IDOs including increased productivity of livestock and fish production systems, increased quantity supplied of targeted animal-source foods (ASFs), a more equitable gender distribution of income and other benefits from the value chains across value chain actors-including for women and other marginalized groups, a reduction in the nutrient gap and lower impacts on the environment. These achievements will then progressively contribute to broader impacts at the system-wide level in terms of food and nutrition security, poverty reduction, and sustainable management of natural resources. The proof-at-scale will be replicated and generalized with additional development investments, encouraged by influencing development policy more widely.

CRP Livestock and Fish LF Generic Theory of Change

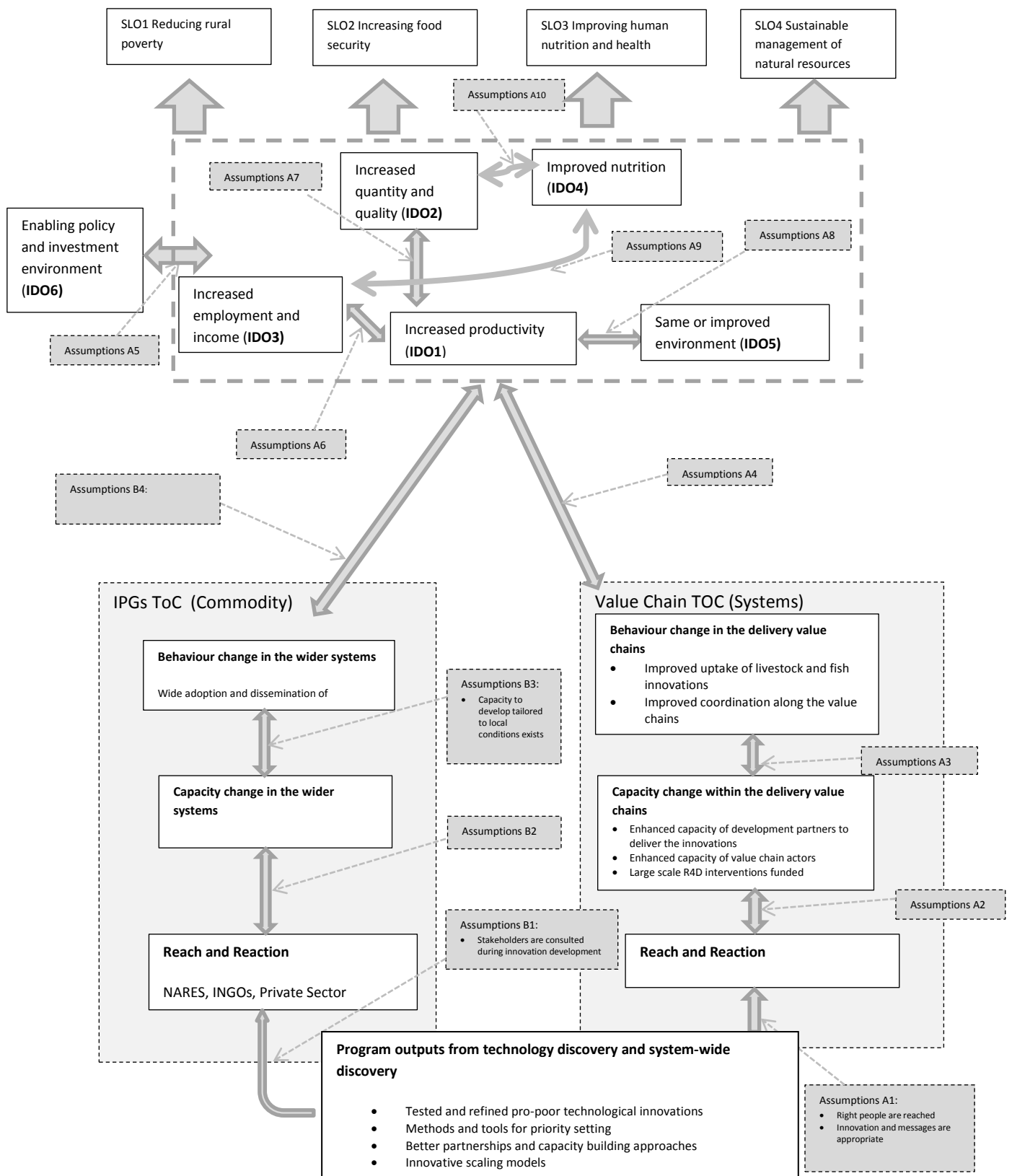


Figure 1

Impact pathway 1 - causal linkages and their assumptions

Please refer to diagram for stated assumptions

1.1.1 From program outputs developed through technology and system wide discovery to output reach and reaction in the value chains (Assumption - A1)

Program research and development outputs will come from CG pipeline research and work on emerging research areas in the focal value chains. Outputs will include:

- tested and refined pro-poor and gender responsive technological and institutional innovations;
- methods and tool for identifying and prioritizing appropriate value chain sites and interventions;
- innovative models of building partnerships and capacity;
- strategies and mechanisms for scaling-up and scaling-out;

1.1.2 From output reach and reaction to capacity change in the delivery value chains

Researchers develop seemingly appropriate models/research outputs but the outputs do not become fully compliant until they are tested or piloted. Piloting of models demands adequate and appropriate capacity for the innovations to be used and adapted. The assumptions at this level (**Assumption - A2**) are that (1) the knowledge and innovations delivered are understood by beneficiaries and “next users” and (2) that innovations are appropriate for value chain actors. Evidence to support the causal linkage will include documentation of CGIAR’s experience and successes of effectively working closely with development actors as knowledge partners on large development interventions and in ensuring that research is demand-led and provides direct channels for wider impact.

1.1.3 From capacity change to behavioural change in the delivery value chains

A key objective of this program is to improve the capacity of value chain actors and enable them to adopt superior innovations for better performing value chains and that these value chains should become the pathways for delivery of greater and sustainable impact. The most important assumptions being made include (**Assumption - A3**):

- new practices are perceived to have low risk potential i.e actors can easily see the benefits of shifting to the new technologies and innovations;
- new practices should be responding in real-time to the needs and constraints of the focal value chains;
- technologies should meet priorities of gender and other socio-economic categories;
- technologies are adapted to the wide variation in environmental contexts faced by location specific production systems

Supporting evidence for this causal link will include the documentation of how developments in science, better system-based understanding of problems and advances in social sciences have improved the CG’s capacity to influence technology adoption. Evidence on the effectiveness of recent

refinements of applications of participatory approaches and gender transformative approaches will also be crucial for this link. Also, evidence relating to how advances in biosciences are creating unprecedented opportunities to accelerate the process of discovery and adaptation for production technologies tailored to location and evolving system specific conditions will also provide a strong evidence base for this link. Besides, there are increasing opportunities being created to partner with the private sector, tapping into their research and business expertise to benefit the target value chains, while at the same time, ensuring that commercial provision of appropriately designed pro-poor gender inputs and services promote and support uptake of productivity-enhancing technologies by the target group. Evidence of success with this approach-especially for the CG-will further strengthen the plausibility of the causal link.

1.1.4 From behavioural change in the delivery value chains to increased productivity in the value chains

Increased use and adoption of improved innovations alone is not enough to cause significant improvement in productivity of smallholder pro-poor value chains. Several other preconditions need to be in place for the technologies to improve productivity. It assumed that (**Assumption - A4**):

- addressing the whole value chain will accelerate uptake and improve the effectiveness of innovations and thereby lead to higher productivity;
- smallholders will continue to access cheap labour since alternative opportunities for off-farm employment may not grow at the same pace as productivity
- farmers will access adequate supporting markets and services to fully capture residual benefits of combining innovative practices with quality inputs and
- that improved innovations and technologies will be accessible equitably to all genders and other socio-economic groups

Evidence in support of this linkage will include analyses of how smallholder producers are able to strongly compete with large scale commercial enterprises given their continued access to underutilized resources including under employed family labor. Analyses of the extent of gender disparities in accessing and using the new technologies and innovations will provide additional strands of evidence to strengthen this causal link.

1.1.5 Enabling Policy and Investment Environment (IDO6) Delivering all Other IDOs

Being able to influence the policy and investment environment within which poor value chain actors operate will subsequently deepen the gains in productivity, household incomes and employment creation, nutrition gains and the state of the environment. This is a result of the improved environment increasing and sustaining incentives, opportunities for smallholders and farmers and businesses. It is assumed that (**Assumption - A5**):

- Implementing demand-driven innovations in the right value chains with the right partners will accelerate program's progress towards achieving outcomes and impact;
- Focusing and targeting will increase efficiency and probability of achieving proof at scale;
- Smallholder value chains exhibit adequate benefits to attract private sector investment;

Evidence for this link will include analyses of how different packages of institutional and policy reforms have increased agricultural productivity and prepared the value chains for agricultural

transformation. Also, evidence of effective packaging of policy reforms to attract private-sector investments in program target value chains will be important in strengthening the case for this causal linkage.

1.1.6 From increased productivity (IDO1) to increased employment and income (IDO3)

Historical evidence shows that agricultural productivity is a primary driver of inclusive economic transformation delivering improvements in household employment and income. In this link it is assumed that (**Assumption - A6**):

- pre-commercial smallholders can become market-oriented and sustainably intensify production;
- pro-poor value chains can sustainably compete and generate sufficient incentives to promote investment in intensification;
- consumers in focal value chains will continue to rely on small scale and traditional marketing systems thus creating a sustained demand for target commodities;
- smallholders will actively participate in growing markets;
- that there will be a close link between high-value markets and the low-value markets to allow benefits to trickle through to the poor smallholders

Supporting evidence will include validation of pathways through which agricultural transformation leads to generation of significant benefits to smallholder farmer and poor households in program target value chains. Similarly, establishing the extent to which agricultural productivity interventions in ASFs value chains leads to improvements in on-farm income, consumption and off-farm employment, strongly improves the validity of this causal link.

1.1.7 From increased productivity (IDO1) to increased quantity and quality of target commodity (IDO2)

Increasing smallholder farmers' productivity can directly help meet one of food security's necessary conditions: food availability. With the support of strong ASFs distribution systems and market institutions, increased productivity can translate into increased quantity of ASF products. Productivity improvements, however, should also move in tandem with improvements in nutrition quality (**Assumption - A7**). There have been numerous settings in which agricultural productivity has increased, but nutritional outcomes such as child stunting have remained poor due to lack of improvements in diet quality. It is therefore assumed that:

- increased efficiency of poor livestock and fish farmers needs to translate into overall increase in farm output;
- pro-poor value chains have to compete and generate sufficient incentives to promote investment in intensification;

Supporting evidence will include characterization of institutions and systems that support the distribution of ASFs in focal value chains.

1.1.8 From increased productivity (IDO1) to same or better state of environment (IDO5)

Improving productivity and value chain efficiency will contribute to reduce the pressure on natural resources. For instance, widespread use of fodder, improved grazing management, vaccines replacing

acaricides for tick-borne diseases, more efficient use of crop residues, management of excreta, more efficient use of water can potentially reduce the emission of GHG per unit of product. Inefficient use of these innovations/inputs will likely compound mounting environmental pressures, including climate change, land degradation, and water pollution. Therefore, it is imperative that a balance is struck between increasing productivity and ensuring that the state of the natural environment is not compromised. For this link to be warranted (**Assumption - A8**) productivity enhancing interventions have to significantly contribute to reduced pressure on natural resources

Supporting evidence will include documentation of the performance of climate-smart technologies with potential for increasing productivity without also having a negative impact on the environment.

1.1.9 From improved employment and income (IDO3) to improved nutrition (IDO4)

Agricultural transformation can translate into better nutritional outcomes where the income from the sale of the target commodities is in turn used to further diversify household diets. However, for this to happen (**Assumption - A9**) significant additional production of ASFs and their products should deliver new opportunities for actors along the value chain and also the increase in demand for ASFs due to improved income should not impact on the provision of ASFs at affordable prices.

Supporting evidence will include analyses and comparisons of how different pathways of agricultural transformation and smallholder commercialization have had direct and indirect impacts on diets and nutrition.

1.1.10 From increased quantity and quality of target commodities (IDO2) to improved nutrition (IDO4)

There are several pathways through which agriculture transformation can lead to improved nutrition. In smallholder value chains, increased access to ASFs through production for on-farm consumption, and an overall increase in supply of the target commodity to markets deliver the biggest impact on nutritional outcomes. For this link (**Assumptions - A10**) to be warranted the following assumption will have to hold:

- The poor will rely on animal-source foods produced locally by smallholders and from less formal marketing channels;
- the poor will consume more ASF if availability, access and affordability of products from these systems improves significantly;
- there is equitable access and consumption of ASFs within households;
- there is enough disposable income for poor household to expand their consumption basket
- Improved farm and market efficiency exert a downward pressure on ASF prices without making smallholders less competitive.

Evidence to support this link will include characterization of sources of ASFs for poor households, characterization of the factors that affect poor people's consumption of ASFs and analyses of the effect of improved farm and market efficiency on ASFs market dynamics.

1.2 Impact pathway 2: International Public Goods (IPGs) Theory of Change

This pathway represents the more conventional process by which research results are expected to translate into uptake and impact more widely. The knowledge and innovation created to find solutions to the constraints in the program's selected value chains applies to constraints and the scientifically driven development processes more generally. This is achieved through targeted dissemination of results through publications, social and mass media to provide sufficient supporting evidence and platforms for widespread promotion (at the global scale) and adoption of innovations. In addition, the program seeks to build the capacity of 'next users' such as the NARES, NGOs, civil society organizations and public and private service providers in countries outside of the selected value chains as a way of building and strengthening institutions for accelerated downstream testing, adaptation, and scaling up of research outputs. LF will specifically engage with key partners in disseminating its research for development outputs and ensuring they are widely accessible and used. LF's communication and dissemination strategy will provide for targeting of specific messages and channels to influence policy makers, especially those who determine development investments, to promote wider deployment of the program's proven interventions. Improving international access to and use of program outputs will ultimately, over the 10-year horizon and beyond, contribute to the desired intermediate development outcomes

Impact Pathway 2 Causal Links and Assumptions

Kabur's (2001) definition of IPG as *"Research outputs of knowledge and technology generated through strategic and applied research that are applicable and readily accessible internationally to address generic issues and challenges"*⁶ draws the boundaries of this impact pathway's causal linkages and the assumptions.

1.2.1 Description of Program Research Outputs From Technology Discovery and System Wide Discovery Outputs

For this pathway program outputs will include models to promote targeted dissemination of results through publications, social and mass media, and so on, to provide sufficient supporting evidence and platforms for widespread promotion (at the global scale) and adoption of innovations.

1.2.2 From Program Outputs to Reach and Reaction

Innovations and technologies are not produced as international public goods. The key assumptions to warrant this causal link will include:

- the right intermediary actors are identified and reached;
- outputs are freely available and relevant to the international community;
- program outputs exhibit spill over potential across-location, commodity or socio-economic contexts.

⁶ Kamanda JO and Bantilan MCS. 2010. The Strategic Potential of Applied Research: Developing International Public Goods from Development-oriented Projects. Working Paper Series no. 26. Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics. 36 pp

Supporting evidence will include analyses of how IPGs can be effectively disseminated in such a way that they deliver more impact.

1.2.3 From Output Reach and Reaction to Capacity Change in Wider Systems

Assumptions for this link include:

- The messages and innovations are considered appropriate and acceptable by key actors
- Technologies are continuously tested through action research
- Capacity for conducting international research exists
- Production of IPGs goes hand in hand with production of National Public Goods (NPGs)
- Institutional contexts including policies and politics enable the introduction of research outputs

Evidence will include documentation of how the CGIAR itself has been a model for international research and has contributed to better international governance.

1.2.4 From Capacity Change in the Wider System to Behavioural Change in The Wider System

Assumptions for this link include:

- Outputs are available and accessible
- Innovations have applicability to other locations
- Capacity to develop tailored to local conditions exists
- The transaction costs of managing the network of partners is low
- CGIAR indirectly exert influence on the network of institutions along the pathways and builds capacity to ensure that the expected benefits materialize

1.2.5 From Behavioural Change in The Wider System to Delivering Increased Productivity (IDO1)

Assumptions for this link include:

- Implementation of appropriate innovations in the right value chains with partners will accelerate the program's progress towards achieving outcomes and impact

9. Annex 2 - 2015-2016 Indicative Work Plan

Flagship 1: Animal Health for Productivity	
<u>Cluster 1.1 Animal Health Assessment and Prioritization</u>: Identify and prioritize sustainable, pro-poor and gender-equitable animal health interventions for increased productivity and improved public health	
<u>Research and Development Outcomes</u>: Uptake of interventions and research priorities by other researchers and LAF flagships, and through them, development partners and value chain actors.	
Activities	Outputs
- In-depth assessments of animal health constraints including from a gendered perspective in smallholder systems in Tanzania dairy, Ethiopian SR and Uganda and Vietnam pig value chains and a fish value chain conducted (2015 and 2016)	- Draft in-depth assessment report for five value chain countries, including a gendered perspective (2015 and 2016)
<u>Cluster 1.2 Animal Population Health and Food Safety</u>: Develop tools and information to train and guide actors in the targeted value chains in using best practices to improve animal health and food safety through reviews, biological surveys and randomized control trials, resulting in enhanced productivity, equity, environmental and public health conditions.	
<u>Research and Development Outcomes</u>: Increased productivity and reduced public health risks through adapted and applied herd health interventions that are gender equitable, and increased capacity of VC actors to use these.	
Activities	Outputs
- Identify potential solutions to address prioritized disease constraints and public health risks through an inventory of successes and failures, and develop a protocol for comprehensively piloting selected interventions. These will be validated and adapted based on further testing and increased understanding in 2016. - Design interventions that address public health hazards at identified entry points in target value chains.	- Inventory of intervention successes and failures, including from a gender perspective (2015) - Final protocol for comprehensive pilot study (2015) - Review of policy regulations in respect of animal health and food safety issues (2016) - Report on better management practices for improved biosecurity and food safety in the fish value chain (2015)

Cluster 1.3 Disease Diagnostics and Vaccines: Generate chains through laboratory work and field trials, evidence and materials for use by vaccine and diagnostic assay researchers and manufacturers to design, make or ascertain the prospects for, new or improved vaccines and diagnostics of benefit to the target value chains through laboratory work and field trials.	
Research and Development Outcomes: Other researchers are using the evidence and materials generated by LAF to design new or improved vaccines and diagnostic assays that are being used to enhance livestock and fish productivity in the value chains.	
Activities	Outputs
• ECF immunogenicity trials, sporozoite and schizont antigen identification and p67 protection experiments (2015 and 2016) • Impact assessment of the “infection and treatment method” (ITM) for ECF (2015 and 2016) • Improving the live ECF vaccine, including assessment of an avirulent <i>T. parva</i> strain and of the severity of risks posed by buffalo-derived parasites through 2019. • Continued research on an improved CBPP vaccine with testing of mutants <i>in vitro</i> (2015 and 2016) • Two types of diagnostic assays for CBPP tested (2015) and transfer of the protocol to the Tanzanian dairy value chain (2016) • Identification of African Swine Fever antigens and the establishment of a challenge model (2015 -16) • Initiation of research towards an improved CCPP vaccine, including the identification of protective antigens and establishing a challenge model and biobank (2015 and 2016) • Financial support for a Tick Vaccine sought (2015 and 2016) and initial work on cloning a FERZ gene as potential vaccine candidate (2015) • Research initiated in vaccine improvement and diagnostic assay development to support progressive control of PPR (2015 – 2016) • Respond to other priorities identified	• ECF: Data on antigens and identification of potential improvements • ITM: Protocol for sporozoite viability and data on sporozoite attenuation • CBPP: Data on candidate vaccine antigens • Performance data and CBPP diagnostic assay protocol • ASF candidate antigens and challenge model • CCPP: Data on target vaccine proteins • Tick vaccine: Three cloned FERZ homologues • PPR: Identified research priorities to support progressive control programs

Cluster 1.4: Ensure equitable and adequate access for farmers in target value chains to animal health products and services through product development, socio-economic modelling, evidence-based assessments of institutional arrangements and partner landscaping.	
<u>Research and Development Outcomes:</u> Value chain actors are using gender-equitable decision support tools to enhance delivery of animal health products and services and manufacturers are using Standard Operating Procedures to produce animal health products.	
Activities	Outputs
• Live vaccine for East Coast fever (ECF) • Thermostable PPR vaccine • Improved diagnostic assay for Contagious Bovine Pleuro-Pneumonia (CBPP) • Improved production protocol for CCP • Feasibility study on access to and demand for SPF and PCR tested shrimp in Bangladesh (2015)	• Report on ECF live vaccine support activities • Project reports on support to transfer protocols for PPR thermostable vaccine and field use • Report detailing commercialization and distribution strategy for CBPP diagnostic assay • Improved production protocol for CCP vaccine production • Research strategy for veterinary service delivery agenda • Report on feasibility of delivery of SPF shrimp seed and PCR shrimp to small and medium enterprises in Bangladesh (2016)

Flagship 2: Genetics and Breeding	
Cluster 2.1: System, Strategy and Genome Assessment: Develop strategies based on system and genome assessment techniques to ensure the best use of livestock and fish genetic resources in targeted value chain production systems.	
Research and Development Outcomes: Appropriate technical and institutional interventions are deployed and available for use. Key stakeholders are aware of appropriate Animal and Aquatic Genetics Resource use interventions and are making informed choices.	
Activities	Outputs
- Assessments of potential target fish species and traits for genetic improvement in Bangladesh, Egypt and Ghana (2015 and 2016) - Assessments of genetic improvement of dairy in Tanzania and India and dual-purpose cattle in Nicaragua with business models for delivering improved cattle (2015 and 2016) - Phenotypic and genetic characterization of heat tolerance and adaptation in small ruminants (2015 through 2016)	- Assessment report on small fish species, Bangladesh (2015) - Annual donor report on catfish assessment in Egypt, tilapia in Ghana and carp in Bangladesh (2015) - Preliminary report on mola genetic characterization in Bangladesh (2015) - Benchmark report for African catfish performance in Egypt (2016) - Assessment report on Identification of priority carp for Bangladesh (2016) - Publication on identification of priority carp for Bangladesh (2016) - Donor report on tilapia assessment in Ghana (2016) - Reports on breeding plans and business options for delivery of improved livestock in Tanzania, India, Nicaragua, Ethiopia and Vietnam (2015-2016) - Evidence base related to genetic characterization of heat tolerance in small ruminants (2016) - Publications and reports on the assessment of heat tolerance in small ruminants (2016)

Cluster 2.2: Improved Breeds and Strains: Develop more productive and adaptable breeds and strains of fish and livestock that fit the needs of the target value chain systems and markets using conventional breeding techniques, genomic technologies and participatory assessment	
Research and Development Outcomes: Improved breeds and strains are developed to meet the needs of target systems and users.	
Activities	Outputs
- Decision support systems and tools for the application of reproductive technologies in dairy cattle and sheep (2015 and 2016) - Ex-ante evaluation of dual-purpose cattle and pig breeding programs in Uganda and Vietnam undertaken (2015-2016) - Design and implementation of community-based breeding program for Asbi and Doyogena sites for SR in Ethiopia (2015 - 2016) - Bonga, Menz and Horro community breeding programs (2015 – 2016) - Ex-ante impact assessment of options for genetic interventions for dairy and dual-purpose cattle and pigs in target value chains (2015-2016) - Genetically improved Tilapia strains developed, consolidated and disseminated in SSA (2015-2016) - Genetically improved Nile Tilapia (Generation 13) strain developed, consolidated and disseminated. Genetically improved Blue Tilapia and catfish maintained in Egypt in 2015 and 2016. - Genetically improved tilapia strains developed, consolidated and disseminated in Asia in 2015 and 2016.	- Reports and publications on better resourced country DAGRIS in at least 5 of the 17 African countries (2016) - Reports and publications on novel gene networks for key adaptive and reproductive traits in targeted species (2016) - Reports on breeding and business plan options for targeted species (2016) - Evaluation report on implementation progress in sheep and goat improvement programs in Ethiopia (2016) - Reports on improved sheep and goat populations in Ethiopia (2016) - Reports and publications on breeding plans and delivery system options for targeted species in Nicaragua, Tanzania and Vietnam (2016) - Donor report on the production of generation 11 of Akosombo line in Ghana and generation 9 of Shiranus line in Malawi (2015) - Reports on dissemination activity (2015 and 2016) - Donor report on the production of generation 12 of Akosombo line in Ghana and generation 10 of Shiranus line in Malawi (2016) - Donor report on the production of generation 13 of Abbassa line in Egypt (2015). - Donor report on the production of generation 14 of Abbassa line in Egypt (2016) - Donor reports on the production of generation 14 of GIFT and generation 7 of Red tilapia, Malaysia; generation 7 of freshwater prawn and generation 4 of GIFT, India (2015) - At least two publications on the above (2015) - At least one PhD thesis on the above (2015) - Donor report on the production of generation 9 of GIFT, Bangladesh (2015) - Donor reports on breeding and dissemination activities related to two nucleus hatcheries and 10 satellite hatcheries producing quality seed (2015 and 2016) - Donor report on the genetics improvement program for Rohu, <i>Labeo rohita</i> (2015 and 2016) - Associated Briefs and news stories (2015 and 2016) - Donor reports on the production of generation 15 of GIFT and generation 8 of Red tilapia, Malaysia, generation 8 of freshwater prawn and generation 5 of GIFT, India (2016). - At least three publications on the above (2016). - Donor report on the production of generation 10 of GIFT, Bangladesh (2016)

Cluster 2.3: Delivery and use systems: Support delivery and end use through facilitated action research approaches and value chain and gender analysis so that appropriate breeds and strains are being widely used in targeted value chains in sustainable and equitable ways.	
Research and Development Outcomes: Appropriate improved breeds and strains are being equitably and sustainably used in target value chains.	
Activities	Outputs
- Value chain, gender analysis and action research on delivery systems and intra-household access to improved breeds and strains undertaken (2015-2016) - Improved mechanisms for dissemination of, and equitable access to, improved breeds and strains in Tanzania, Nicaragua, Ethiopia and Vietnam (2015-2016) - Assessments of genetic improvement of dairy and dual-purpose cattle with delivery business models for delivery in Tanzania and Nicaragua (2015 – 2016) - Develop farmer group organizational capacity and knowledge systems (2015-2016) - Assess dissemination systems in Bangladesh and Ghana and amount and amount and extent of dissemination in Bangladesh and Egypt (2015 – 2016) - Investigate on-farm performance, production efficiency and yield gap in improved tilapia in different farming systems (2015 and 2016)	- Reports evaluating gender aspects of participation and benefits from SR breeding programs (2015 and 2016) - Policy briefs on breeding policies to support sustained genetic improvement programs (2016) - Protocols for assessing production systems and genetic improvement options (2016) - Reports and publications on pilot business models for multiplying and delivering improved sheep strains in Ethiopia (2016) - Business model options for disseminating improved cattle genetics in Eastern Africa (2015 and 2016) - Management guidelines for breeds/strains (2015 and 2016) - Publication on utility of GIS approaches for determining patterns of tilapia dissemination in Philippines (2015) - Annual donor reports on dissemination systems of tilapia, small fish and carp in Bangladesh and tilapia in Ghana (2015) - Annual donor reports on the amount and extent of dissemination of improved tilapia in Bangladesh and Egypt (2015) - Final reports on dissemination systems of tilapia, small fish and carp in Bangladesh and tilapia in Ghana (2016) - Final reports on the amount and extent of dissemination of improved tilapia in Bangladesh and Egypt (2016) - Publication reviewing on-farm performance worldwide for improved tilapia (2015) - Funding proposal to investigate production efficiency and yield gap in improved tilapia (2015) - Donor reports on production efficiency and yield gap in improved tilapia (2016) - Protocols for assessing performance (2016)

Cluster 2.4: Breakthrough technologies and Information systems: Develop and implement breakthrough technologies and information systems using computer and molecular modeling, image analysis and bioinformatics for improved use of genetic resources in targeted value chains.

Research and Development Outcomes: Reproductive manipulation, gene discovery and more efficient genetic improvement methods are influenced by biotechnologies, molecular and bio-informatics analysis.

Activities	Outputs
- Continued work through 2016 on developing a method of room temperature storage for cattle semen. - Novel phenotyping tools and a prototype for heat selection in cattle commences in 2015 - Behavioural assessment of cattle in oestrus in 2015. - The DAGRIS database expanded to include data from 17 African countries - New genome editing platform developed starting in 2015. - Well-characterized genetic material and matching data collected and archived 2015-2016. - Genomic tools developed	- Protocol for novel methods of room temperature storage of bovine semen (2016) - Report and publications on bovine and ram semen storage methods (2015-2016) - Reports and publications on novel gene networks responsive for key adaptive and reproductive traits in target species (SR in 2016) - Reports and publications on novel phenotyping (measuring livestock performance) methods for cattle and small ruminants (2015) and field test results of such systems in Eastern Africa (2016) - Reports and publications on a better re-sourced country DAGRIS in at least 5 of the 17 African countries (2016) - Review report on application of sperm and gene banking of fish (2015) - Funding proposal on above (2016) - Publication on genomic assessment of Abbassa Nile tilapia nucleus (2015) - Publications on genetic linkage maps for Red tilapia and GIFT (2015) - Publication on molecular tools developed for Mola (2015) - Publication on molecular tools developed for carp (2016) - Publication on genes controlling sex determination in tilapia (GIFT) (2016)

Flagship 3: Feeds and Forages	
Cluster 3.1 Feed Technology Platform: Create a Feed Technology Platform and network, that develops and provides a set of tools for feed quality analysis, estimates of feed demand–supply scenarios, prioritisation of feed interventions, assessing & managing ecological foot-prints, ration balancing and socio economic analysis of feed demand and constraints to researchers, development practitioners, producers and private sector processors, within and beyond LAF.	
Research and Development Outcomes: Researchers and development practitioners follow structured interactive processes in feed interventions and are equipped with, and trained to, a range of tools	
Activities	Outputs
• Feed decision-support tools revised and tested in the light of gender concerns (2015) • Inputs for rational balancing tools suited to SSA supplied (2015) • Combined FEAST, TechFit and ration balancing tools tested in target value chains (2016) • Stationary NIRS platform complemented with additional equations originating from price-quality assessments (2015) and anti-nutritive factors and specific nutrients (2016) • Review opportunities and limitations of mobile NIRS instruments (2015) • Apply mobile NIRS approaches (2016) • Develop protocols for quality control systems for compound feeds and feed ingredients with private sector and policy makers (2015) • Protocols for feed safety control systems for compound feeds and feed ingredients adopted (2016) • Complete review of ecological footprint assessment methods for LAF value chains (2015) • Conduct ecological footprint assessments in selected value chains (2016)	• Draft gender-sensitive FEAST and TechFit tools (2015) and final set of tools (2016) • Pilot version of ration balancing tool for SSA (2015) • Final set of gender responsive tools (2016) • Updated NIRS feed analytical/phenotyping platform (2015 and 2016) • Comparative case studies of applications of mobile and stationary NIRS (2015) • Report on application mobile NIRS approaches • Evidence of availability of compound feed and feed ingredients with reliable composition (2015) • Evidence of availability of feeds compatible with food safety levels in animal sourced foods produced in target value chains (2016) • Assessment methods (2015) • Publication identifying management interventions for ecological footprint reduction in selected value chains (2016)

Cluster 3.2 Assess Current Feed Resources and Devising Options for Using Them More Efficiently: Undertake research and support implementation of options that make better use of available feed resources through feed supply-demand scenarios, smart supplementation and rational balancing, targeted allocation, preservation and processing and encouragement of fodder markets and feed surplus to deficit transactions.	
Research and Development Outcomes: Researchers, private sector actors and development practitioners establish context-specific feed supply – demand scenarios and come up with approaches to make better use of existing feed resources in closing of supply-demand gaps	
Activities	Outputs
• Analysis of feed resources relative to current and evolving demand in target value chains (2015 and 2016) • Exploration of smart supplementation through identification of most limiting nutrients and matching protein to energy components relative to production (2015) • Strategies to improve allocations of supplements to fewer animals (2016) • Investigation of feed preservation options (2015) and promotion (2016) • Viable strategies to match feed processing options with smallholder capacity (2015 and 2016) • Fattening strategies tested in the Ethiopian SR value chain through an equity and environmental lens (2015) • Options for improved production and supply of locally manufactured quality fish feeds researched and documented (2015)	• Feeds database for targets value chains (2015) and expanded database (2016) • Feed demand-supply scenarios for target value chains (2015 and 2016) • Publications on economic analyses of feed costs relative to production costs (2015) • Intensification strategies for the production of ASF (2016) • Publications on feed preservation options (2015) • Publications on feed processing options (2015 and 2016) • Report (2016) • Reports on prospects for enhanced local fish feed supply (2015) • Local fish feed options identified and strategies for improved fish supply under testing (2016)

Cluster 3.3 Producing More and Higher Quality Feed and Forage Biomass: Develop and provide more feed and forage biomass through breeding and dissemination of multi-purpose and resource-use efficient forages, food-feed-fodder crops with superior grain and fodder traits, novel feed resources from agro-business and unconventional feed resources such as algae and insects.

Research and Development Outcomes: Researchers, private sector actors and development practitioners come up with approaches to close feed supply – demand gaps by providing more feed biomass of higher forage and fodder quality.

Activities	Outputs
- Improved multipurpose and resource-use efficient forages selected and bred (2015 and 2016) - Improved multipurpose and resource-use efficient forages field tested and promoted (2015 and 2016) - Improved food-feed-forage cultivars selected and bred (2015 and 2016) - Improved food-feed forage cultivars field tested and promoted (2015 and 2016) - Potential of novel by-products from agro-business and biofuels assessed for feed value (2015 and 2016) - Exploratory research on generation of feed resources from unconventional sources (insects, algae, de novo synthesis of cells etc. (2015 and 2016) - Farmers' evaluations of <i>Pennisetum pedicellatum</i> grass and concentrates in Ethiopia and grass in Mexico (2015) - Field test feeding techniques for pond aquaculture that improves use of aquatic productivity in ponds and efficiency in use of external feeding inputs (2015 - 2016)	- Publication of list of superior forages and results of bio-physical evaluations (2015 and 2016) - Publication of candidate lines and at least 150,000 additional hectares of <i>Brachiaria</i>-bred lines sown in 2014/2015 season and 800,000 ha in 2016 by private sector partners in target value chains and beyond. - Publications of evidence related to increased livestock productivity and reduced GHG emissions (2016) - Publications related to potential of forage-based systems in improving GHG emissions (2015 and 2016) - Cultivars with superior grain/pod yields and crop residue quantity available (2015 and 2016) - Publications on the results of field testing 5 cultivars (2015 and 2016) - Publications on potential for increasing feed resource options (2015 and 2016) - Publications on identification of potential novel feed resources (2015 and 2016) - Evaluation report (2015) - Working paper and journal article (2015)

Flagship 4: Systems Analysis for Sustainable Innovation	
Cluster 4.1 Value Chain Intervention Research: VC interventions researched and prioritized using trade-off, gender, farm level and landscape analytical methods to develop integrated intervention packages for adoption by target beneficiaries in targeted value chains	
Research and Development Outcomes: Sustainable and scalable intervention strategies are available for implementation by value chain actors and development partners and intervention packages are adopted in the target value chains.	
Activities	Outputs
• Data collection and tool development for site selection, ex-ante assessments and out-scaling continued through 2015 and 2016 • Constraints, issues and opportunities identified in collaboration with stakeholders in 2015 and 2016 • Impact assessments of best-bets impacts on productivity, income and livelihood complemented with assessments of gender and environmental concerns • Formal adoption studies, trade-off analyses and assessments of out-scaling potential conducted on the preliminary packages of best bets • Ex-ante assessment of prioritized interventions or intervention packages on animal and flock productivity and household income and trade-offs between different effects in Ethiopian value chain (2015 and 2016) • Monitoring of pilot best bet intervention package implementation	• Reports documenting the characteristics of the value chains and the key actors across all nodes (2015) • Publication of ex-ante assessment of positive impacts on productivity, income and livelihoods and potential gender and environmental concerns (2015-2016) • Prioritized lists of best-bet interventions (2015: 3 VCs; 2016: remaining VCs) • Sustainable and scalable interventions identified and targeted in 3 value chains (2016) • Ex-ante assessment report for the Ethiopian value chain (2016)
Cluster 4.2 System Assessments Around, Between and Beyond Value Chain Systems: The research will apply modelling and scenario-building techniques to provide wider perspectives on impacts at higher scales from and systems feedback on targeted value chains. These system analyses will indicate how current or planned value chain activities are likely to impact the surrounding environment, other value chains and other agricultural systems.	
Research and Development Outcomes: Lessons and insights are available for policymakers and development actors.	
Activities	Outputs
• Model identification and development (2015) • Data collation and generation, including gender data (2015) • Initial model runs leading to preliminary scenarios (2015) • Refinement of preliminary scenarios (2016)	• Model complexes suitable for systems analysis and including a wide range of parameters related to livestock and fish value chains at sub-national and global scales (2015) • Preliminary global and regional economic scenarios that include impacts on gender dynamics (2015) • Refined global and regional economic scenarios (2016) • Preliminary assessments of competition for resources and wider scale impacts on the agricultural sector (2016)

Flagship 5: Value Chain Transformation and Scaling	
<u>Cluster 5.1 Intervention Testing:</u> Testing integrated packages in target value chains that are expected to foster value chain transformation using participatory action research approaches and experimental design.	
<u>Research and Development Outcomes:</u> Research and development partners jointly act to pilot and validate well thought out innovations. Development partners are more effective in delivering equitable and sustainable solutions and emergent changes in the IDO indicators are evident.	
Activities	Outputs
- Partners and development actors mapped in 2015 using social network analysis - Innovation platforms supported - Intervention packages designed and tested in close collaboration with Flagship 4 - Communications and knowledge management support and a set of research collaboration models tested in 2016 - Gender baselines completed by 2016 to provide evidence on how changes in gender equity influence the achievement of other IDOs	- Set of partner selection criteria (2015) - Guide to operation of R & D platforms (2015) - Communications and Knowledge Management Strategy (2016) - Online collaboration tools (2016) - Manual on design of integrated Gender Transformative Approaches (2016)
<u>Cluster 5.2: Capacity Development for Value Chain Transformation:</u> To increase capacity within CG centers, partner organizations and value chain actors to diagnose and overcome value chain constraints including gender, poverty, equity and sustainability and assess trade-offs.	
<u>Research and Development Outcomes:</u> Improved business management on the part of producer, farmer, women-led organizations within the private sector. An impact-change framework for measuring transformation is in use.	
Activities	Outputs
- Capacity assessment methodology and framework for assessing the transformational impacts of capacity development interventions in 2015 - Initial capacity assessment and support provided for selected flagships in certain value chains in 2015 and 2016 - Potential capacity development service providers identified in selected value chains (2015) - Value chain capacity development strategies developed (2015) - Additional capacity and training needs assessments completed and training modules developed and delivered, including social and gender analysis (2016)	- Capacity Assessment Methodology (2015) - Capacity Impact Framework (2015) - Capacity Assessments for Value Chains (2015 and 2016) - Value Chain Capacity Development Strategy documents (2015) - Comparative analysis of capacity development across value chains (2016)

<u>Cluster 5.3 Implementation actions:</u> Research and practice melded to satisfy a substantial demand for Livestock and Fish products in target value chains through practical actions.	
<u>Research and Development Outcomes:</u> LAF products are available and accessible to men and women in the target Value Chains and beyond and there is a substantial market-oriented uptake of the interventions. Research and Development partners are responsive to the demands of value chains and animal source food system actors.	
Activities	Outputs
• Alliances established (2015 and 2016) • Business Development Strategies and incentive structures enabled (2015 and 2016) • Feedback mechanisms between the value chains and the technical flagships and between the technology flagships and this flagship established to ensure delivery of their products to target beneficiaries (2015)	• Partnership landscape reports (2015) • Inclusive stakeholder platforms and fora for articulating demand for solutions and influencing policy (2016) • Innovations' uptake pathways for achieving scaling (2016) • Compendia of demanded solutions at value chain level with gender responsive assessment of the constraints and opportunities to leverage through technologies (2016) • Peer-reviewed publications and policy briefs (2015 and 2016)

10. Annex 3 – Budget for 2015 – 2016 Extension Period for Livestock and Fish; By Activity Cluster

a) Total Program

INDICATIVE 2015-2016 BUDGET FOR LIVESTOCK AND FISH EXTENSION PERIOD

BUDGET BY FLAGSHIP AND CLUSTER OF ACTIVITIES	Livestock and Fish Program					
	CG FUNDS	2015 BILATERAL	TOTAL	CG FUNDS	2016 BILATERAL	TOTAL
Flagship 1: Animal Health						
Cluster 1.1 Animal Health Assessment and Prioritization	484,377	1,325,000	1,809,377	541,540	1,325,000	1,866,540
Cluster 1.2 Animal Population Health and Food Safety	216,528	977,831	1,194,359	227,155	992,831	1,219,986
Cluster 1.3: Disease Diagnostics and Vaccines	1,565,196	6,850,834	8,416,030	1787715	7,650,834	9438549
Cluster 1.4: Delivery Systems	505,830	621,564	1,127,394	543,213	636,564	1,179,777
	<u>2,771,931</u>	<u>9,775,229</u>	<u>12,547,160</u>	<u>3,099,623</u>	<u>10,605,229</u>	<u>13,704,852</u>
Flagship 2: Genetics and Breeding						
Cluster 2.1: System, Strategy and Genome Assessment	212,178	280,000	492,178	198,395	425,000	623,395
Cluster 2.2: Improved Breeds and Strains	806,765	2,400,000	3,206,765	843,441	2,600,000	3,443,441
Cluster 2.3: Delivery and Use Systems	687,429	1,330,000	2,017,429	257,379	1,425,000	1,682,379
Cluster 2.4: Breakthrough Technologies and Information Systems	634,682	500,000	1,134,682	897,319	650,000	1,547,319
	<u>2,341,054</u>	<u>4,510,000</u>	<u>6,851,054</u>	<u>2,196,534</u>	<u>5,100,000</u>	<u>7,296,534</u>
Flagship 3: Feeds and Forages						
Cluster 3.1: Feed Technology Platform	693,027	435,564	1,128,591	747,855	449,870	1,197,725
Cluster 3.2: Feed Resource Assessment	707,583	594,787	1,302,370	779,842	415,386	1,195,228
Cluster 3.3: More and Higher Quality Feeds and Fodders	1,401,259	1,196,070	2,597,329	1,549,384	802,540	2,351,924
	<u>2,801,869</u>	<u>2,226,421</u>	<u>5,028,290</u>	<u>3,077,081</u>	<u>1,667,796</u>	<u>4,744,877</u>

Flagship 4: Systems Analysis for Sustainable Innovation						
Cluster 4.1: Value Chain Intervention Research	1,058,805	759,912	1,818,717	1,187,684	750,000	1,937,684
Cluster 4.2: System Assessment Around, Between and Beyond Value Chain Systems	1,362,257	554,798	1,917,055	659,960	564,857	1,224,817
	<u>2,421,062</u>	<u>1,314,710</u>	<u>3,735,772</u>	<u>1,847,644</u>	<u>1,314,857</u>	<u>3,162,501</u>
Flagship 5: Value Chain Transformation and Scaling						
Cluster 5.1: Intervention Testing	1,355,800	1,851,645	3,207,445	1,802,469	1,585,859	3,388,328
Cluster 5.2: Capacity Development for Value Chain Transformation	414,360	576,941	991,301	491,719	453,477	945,196
Cluster 5.3: Implementation Actions	816,674	2,340,822	3,157,496	1,699,955	3,845,430	5,545,385
-	<u>2,586,834</u>	<u>4,769,408</u>	<u>7,356,242</u>	<u>3,994,143</u>	<u>5,884,766</u>	<u>9,878,909</u>
<u>Sub-Total Research</u>	<u>12,922,750</u>	<u>22,595,768</u>	<u>35,518,518</u>	<u>14,215,025</u>	<u>24,572,648</u>	<u>38,787,673</u>
Management Unit	1,954,986	0	1,954,986	2,150,484	0	2,150,484
Strategic Investments	1,672,137	0	1,672,137	1,839,356	0	1,839,356
<u>Total</u>	<u>16,549,873</u>	<u>22,595,768</u>	<u>39,145,641</u>	<u>18,204,865</u>	<u>24,572,648</u>	<u>42,777,513</u>

b) ILRI

INDICATIVE 2015-2016 BUDGET FOR LIVESTOCK AND FISH EXTENSION PERIOD

BUDGET BY FLAGSHIP AND CLUSTER OF ACTIVITIES	ILRI					
	2015			2016		
	CG FUNDS	BILATERAL	TOTAL	CG FUNDS	BILATERAL	TOTAL
Flagship 1: Animal Health						
Cluster 1.1 Animal Health Assessment and Prioritization	467,877	1,300,000	1,767,877	524,540	1,300,000	1,824,540
Cluster 1.2 Animal Population Health and Food Safety	200,028	812,831	1,012,859	210,155	812,831	1,022,986
Cluster 1.3: Disease Diagnostics and Vaccines	1,565,196	6,850,834	8,416,030	1787715	7,650,834	9438549
Cluster 1.4: Delivery Systems	488,830	511,564	1,000,394	521213	511,564	1032777
	<u>2,721,931</u>	<u>9,475,229</u>	<u>12,197,160</u>	<u>3,043,623</u>	<u>10,275,229</u>	<u>13,318,852</u>
Flagship 2: Genetics and Breeding						
Cluster 2.1: System, Strategy and Genome Assessment	150,000	130,000	280,000	120,000	200,000	320,000
Cluster 2.2: Improved Breeds and Strains	320,000	1,200,000	1,520,000	330,000	1,300,000	1,630,000
Cluster 2.3: Delivery and Use Systems	558,309	630,000	1,188,309	105,347	750,000	855,347
	508,309	250,000	758,309	110,000	350,000	460,000
Cluster 2.4: Breakthrough Technologies and Information Systems	<u>1,536,618</u>	<u>2,210,000</u>	<u>3,746,618</u>	<u>665,347</u>	<u>2,600,000</u>	<u>3,265,347</u>
Flagship 3: Feeds and Forages						
Cluster 3.1: Feed Technology Platform	583,124	352,558	935,682	641,438	387,814	1,029,252
Cluster 3.2: Feed Resource Assessment	251,804	152,241	404,045	276,985	167,466	444,451
Cluster 3.3: More and Higher Quality Feeds and Fodders	480,355	296,469	776,824	539,391	326,116	865,507
	<u>1,315,283</u>	<u>801,268</u>	<u>2,116,551</u>	<u>1,457,814</u>	<u>881,396</u>	<u>2,339,210</u>

Flagship 4: Systems Analysis for Sustainable Innovation						
Cluster 4.1: Value Chain Intervention Research	388,158	0	388,158	426,973	0	426,973
Cluster 4.2: System Assessment Around, Between and Beyond Value Chain Systems	982,135	314,857	1,296,992	263,826	314,857	578,683
	<u>1,370,293</u>	<u>314,857</u>	<u>1,685,150</u>	<u>690,799</u>	<u>314,857</u>	<u>1,005,656</u>
Flagship 5: Value Chain Transformation and Scaling						
Cluster 5.1: Intervention Testing	825,000	1,050,000	1,875,000	1,232,090	675,000	1,907,090
Cluster 5.2: Capacity Development for Value Chain Transformation	251,000	350,000	601,000	308,023	225,000	533,023
Cluster 5.3: Implementation Actions	680,000	2,100,000	2,780,000	1,540,113	3,600,000	5,140,113
-	<u>1,756,000</u>	<u>3,500,000</u>	<u>5,256,000</u>	<u>3,080,226</u>	<u>4,500,000</u>	<u>7,580,226</u>
<u>Sub-Total Research</u>	<u>8,700,125</u>	<u>16,301,354</u>	<u>25,001,479</u>	<u>8,937,809</u>	<u>18,571,482</u>	<u>27,509,291</u>
Management Unit	-	-	-	-	-	-
Strategic Investments	1,954,986	0	1,954,986	2,150,484	0	2,150,484
	1,672,137	0	1,672,137	1,839,356	0	1,839,356
<u>Total</u>	<u>12,327,248</u>	<u>16,301,354</u>	<u>28,628,602</u>	<u>12,927,649</u>	<u>18,571,482</u>	<u>31,499,131</u>

c) CIAT

INDICATIVE 2015-2016 BUDGET FOR LIVESTOCK AND FISH EXTENSION PERIOD

BUDGET BY FLAGSHIP AND CLUSTER OF ACTIVITIES	CIAT					
	2015			2016		
	CG FUNDS	BILATERAL	TOTAL	CG FUNDS	BILATERAL	TOTAL
Flagship 1: Animal Health						
Cluster 1.1 Animal Health Assessment and Prioritization						
Cluster 1.2 Animal Population Health and Food Safety						
Cluster 1.3: Disease Diagnostics and Vaccines						
Cluster 1.4: Delivery Systems						
	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Flagship 2: Genetics and Breeding						
Cluster 2.1: System, Strategy and Genome Assessment						
Cluster 2.2: Improved Breeds and Strains						
Cluster 2.3: Delivery and Use Systems						
Cluster 2.4: Breakthrough Technologies and Information Systems						
	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Flagship 3: Feeds and Forages						
Cluster 3.1: Feed Technology Platform	51,218	53,006	104,224	56,340	27,056	83,396
Cluster 3.2: Feed Resource Assessment	384,136	397,546	781,682	422,550	202,920	625,470
Cluster 3.3: More and Higher Quality Feeds and Fodders	845,100	874,601	1,719,701	929,609	446,424	1,376,033
	<u>1,280,454</u>	<u>1,325,153</u>	<u>2,605,607</u>	<u>1,408,499</u>	<u>676,400</u>	<u>2,084,899</u>

Flagship 4: Systems Analysis for Sustainable Innovation						
Cluster 4.1: Value Chain Intervention Research	240,183	59,912	300,095	264,201	0	264,201
Cluster 4.2: System Assessment Around, Between and Beyond Value Chain Systems	160,122	39,941	200,063	176,134	0	176,134
	<u>400,305</u>	<u>99,853</u>	<u>500,158</u>	<u>440,335</u>	<u>0</u>	<u>440,335</u>
Flagship 5: Value Chain Transformation and Scaling						
Cluster 5.1: Intervention Testing	87,145	101,645	188,790	95,859	110,859	206,718
Cluster 5.2: Capacity Development for Value Chain Transformation	14,524	16,941	31,465	15,977	18,477	34,454
Cluster 5.3: Implementation Actions	43,572	50,822	94,394	47,930	55,430	103,360
-	<u>145,241</u>	<u>169,408</u>	<u>314,649</u>	<u>159,766</u>	<u>184,766</u>	<u>344,532</u>
<u>Sub-Total Research</u>	<u>1,826,000</u>	<u>1,594,414</u>	<u>3,420,414</u>	<u>2,008,600</u>	<u>861,166</u>	<u>2,869,766</u>
Management Unit	-	0	0	0	0	-
Strategic Investments	0	0	0	0	0	0
<u>Total</u>	<u>1,826,000</u>	<u>1,594,414</u>	<u>3,420,414</u>	<u>2,008,600</u>	<u>861,166</u>	<u>2,869,766</u>

d) ICARDA

INDICATIVE 2015-2016 BUDGET FOR LIVESTOCK AND FISH EXTENSION PERIOD

BUDGET BY FLAGSHIP AND CLUSTER OF ACTIVITIES	ICARDA					
	CG FUNDS	2015 BILATERAL	2015 TOTAL	CG FUNDS	2016 BILATERAL	2016 TOTAL
Flagship 1: Animal Health						
Cluster 1.1 Animal Health Assessment and Prioritization						
Cluster 1.2 Animal Population Health and Food Safety						
Cluster 1.3: Disease Diagnostics and Vaccines						
Cluster 1.4: Delivery Systems						
	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Flagship 2: Genetics and Breeding						
Cluster 2.1: System, Strategy and Genome Assessment	12,178	0	12,178	13,395	0	13,395
Cluster 2.2: Improved Breeds and Strains	166,765	0	166,765	183,441	0	183,441
Cluster 2.3: Delivery and Use Systems	79,120	0	79,120	87,032	0	87,032
	26,373	0	26,373	29,010	0	29,010
Cluster 2.4: Breakthrough Technologies and Information Systems	<u>284,436</u>	<u>0</u>	<u>284,436</u>	<u>312,878</u>	<u>0</u>	<u>312,878</u>
Flagship 3: Feeds and Forages						
Cluster 3.1: Feed Technology Platform	23,685	0	23,685	10,077	0	10,077
Cluster 3.2: Feed Resource Assessment	36,643	0	36,643	40,307	0	40,307
Cluster 3.3: More and Higher Quality Feeds and Fodders	45,804	0	45,804	50,384	0	50,384
	<u>106,132</u>	<u>0</u>	<u>106,132</u>	<u>100,768</u>	<u>0</u>	<u>100,768</u>

Flagship 4: Systems Analysis for Sustainable Innovation									
Cluster 4.1: Value Chain Intervention Research				60,464	0	60,464	66,510	0	66,510
Cluster 4.2: System Assessment Around, Between and Beyond Value Chain Systems				0	0	0	0	0	0
				<u>60,464</u>	<u>0</u>	<u>60,464</u>	<u>66,510</u>	<u>0</u>	<u>66,510</u>
Flagship 5: Value Chain Transformation and Scaling									
Cluster 5.1: Intervention Testing				158,655	100,000	258,655	174,520	100,000	274,520
Cluster 5.2: Capacity Development for Value Chain Transformation				88,836	60,000	148,836	97,719	60,000	157,719
Cluster 5.3: Implementation Actions				38,102	40,000	78,102	41,912	40,000	81,912
-				<u>285,593</u>	<u>200,000</u>	<u>485,593</u>	<u>314,151</u>	<u>200,000</u>	<u>514,151</u>
<u>Sub-Total Research</u>				<u>736,625</u>	<u>200,000</u>	<u>936,625</u>	<u>794,307</u>	<u>200,000</u>	<u>994,307</u>
Management Unit				-	-	-	-	-	-
Strategic Investments				0	0	0	0	0	0
Total				<u>736,625</u>	<u>200,000</u>	<u>936,625</u>	<u>794,307</u>	<u>200,000</u>	<u>994,307</u>

e) WorldFish

INDICATIVE 2015-2016 BUDGET FOR LIVESTOCK AND FISH EXTENSION PERIOD

BUDGET BY FLAGSHIP AND CLUSTER OF ACTIVITIES	WORLD FISH					
	2015			2016		
	CG FUNDS	BILATERAL	TOTAL	CG FUNDS	BILATERAL	TOTAL
Flagship 1: Animal Health						
Cluster 1.1 Animal Health Assessment and Prioritization	16,500	25,000	41,500	17,000	25,000	42,000
Cluster 1.2 Animal Population Health and Food Safety	16,500	165,000	181,500	17,000	180,000	197,000
Cluster 1.3: Disease Diagnostics and Vaccines	0	0	0	0	0	-
Cluster 1.4: Delivery Systems	17,000	110,000	127,000	22,000	125,000	147,000
	<u>50,000</u>	<u>300,000</u>	<u>350,000</u>	<u>56,000</u>	<u>330,000</u>	<u>386,000</u>
Flagship 2: Genetics and Breeding						
Cluster 2.1: System, Strategy and Genome Assessment	50,000	150,000	200,000	65,000	225,000	290,000
Cluster 2.2: Improved Breeds and Strains	320,000	1,200,000	1,520,000	330,000	1,300,000	1,630,000
Cluster 2.3: Delivery and Use Systems	50,000	700,000	750,000	65,000	675,000	740,000
	100,000	250,000	350,000	110,000	300,000	410,000
Cluster 2.4: Breakthrough Technologies and Information Systems	<u>520,000</u>	<u>2,300,000</u>	<u>2,820,000</u>	<u>570,000</u>	<u>2,500,000</u>	<u>3,070,000</u>
Flagship 3: Feeds and Forages						
Cluster 3.1: Feed Technology Platform	35,000	30,000	65,000	40,000	35,000	75,000
Cluster 3.2: Feed Resource Assessment	35,000	45,000	80,000	40,000	45,000	85,000
Cluster 3.3: More and Higher Quality Feeds and Fodders	30,000	25,000	55,000	30,000	30,000	60,000
	<u>100,000</u>	<u>100,000</u>	<u>200,000</u>	<u>110,000</u>	<u>110,000</u>	<u>220,000</u>

Flagship 4: Systems Analysis for Sustainable Innovation						
Cluster 4.1: Value Chain Intervention Research	370,000	700,000	1,070,000	430,000	750,000	1,180,000
Cluster 4.2: System Assessment Around, Between and Beyond Value Chain Systems	220,000	200,000	420,000	220,000	250,000	470,000
	<u>590,000</u>	<u>900,000</u>	<u>1,490,000</u>	<u>650,000</u>	<u>1,000,000</u>	<u>1,650,000</u>
Flagship 5: Value Chain Transformation and Scaling						
Cluster 5.1: Intervention Testing	285,000	600,000	720,000	300,000	700,000	1,000,000
	60,000	150,000	210,000	70,000	150,000	220,000
Cluster 5.2: Capacity Development for Value Chain Transformation	55,000	150,000	205,000	70,000	150,000	220,000
Cluster 5.3: Implementation Actions	<u>400,000</u>	<u>900,000</u>	<u>1,135,000</u>	<u>440,000</u>	<u>1,000,000</u>	<u>1,440,000</u>
-						
<u>Sub-Total Research</u>	<u>1,660,000</u>	<u>4,500,000</u>	<u>6,160,000</u>	<u>1,826,000</u>	<u>4,940,000</u>	<u>6,766,000</u>
	-					
Management Unit	0	0	0	0	0	0
Strategic Investments	0	0	0	0	0	0
<u>Total</u>	<u>1,660,000</u>	<u>4,500,000</u>	<u>6,160,000</u>	<u>1,826,000</u>	<u>4,940,000</u>	<u>6,766,000</u>