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Contents

Table of Figures

Table of Tables

List of Acronyms

ACIAR	Australian Centre For International Agricultural Research
AEAS	Agricultural Extension and Advisory System
AEZs	Agro Ecological Zones
AIS	Agricultural Innovation System
ASLP	Agriculture Sector Linkages Program
AU $	Australian Dollar
AUS	Australia
AVCCR	Agriculture Value Chain Collaborative Research
BZU	Bahauddin Zakariya University, Pakistan
CABI	Centre For Agriculture and Bioscience International
CBR	Cost Benefit Ratio
CEO	Chief Executive Officer
CoP	Community of Practice
CSU	Charles Sturt University, Australia
CW	Carcass Weight
DETs	Digital Extension Tools
DFAT	Department of Foreign Affairs and Trade
DIFOT-Q	Delivering In Full On Time – Quality
DVCA	Detail Value Chain Assessment
EAS	Extension Advisory Services
FAO	Food and Agriculture Organization
FBGs	Farm Business Groups
FDP	Farm Dynamic Pakistan
FFGD	Farmer Focus Group Discussions
FMD	Foot and Mouth Disease
FRI	Fodder Research Institute, Pakistan
GDP	Gross Domestic Product
HH	Household
ICABB	International Congress On Advances in Bioscience and Biotechnology
JAEE	Journal of Agricultural Education & Extension
Kg	Kilo Gram
L&DD	Livestock & Dairy Development, Punjab
LDDB	Livestock and Dairy Development Board
Lit.Rev	Literature Review
LPP	Lodhran Pilot Project
LUMS	Lahore University of Management Sciences, Pakistan
LW	Live Wight
M&E	Monitoring and Evaluation
M/F	Male/Female
MDF	Management & Development Foundation
MERL	Monitoring, Evaluation, Reporting and Learning
MNFSR	Ministry of National Food Security and Research
MoU	Memorandum of Understanding
MTR	Mid-Term Review
NGO	Non-Government Organization

NRSP	National Rural Support Program
PARC	Pakistan Agricultural Research Council
PC	Partner Country
PEOU	Perceived Ease of Use
PKR	Pakistani Rupees
PMI	Prime Minister's Initiatives
PODA	Potohar Organization For Development Advocacy
PRA	Participatory Rural Appraisal
PU	Perceived Usefulness
R&D	Research and Development
RDF	Research and Development Foundation
REEDS	Rural Education and Economic Development Society
RFG	Research Focus Group
RNG	Ruminant Nutrition Guide
RQ	Research Question
RVCA	Rapid Value Chain Assessment
SAFWCO	Sindh Agricultural Forestry Workers & Coordinating Organization
SAU	Sindh Agriculture University, Pakistan
SFPL	Shakarganj Food Products Limited
SLD	Sindh Livestock Department
SOP	Standard Operating Procedure
SRSO	Sindh Rural Support Organization
TAM	Technology Acceptance Model
TBD	Tick Born Disease
TMR	Total Mix Ration
UAF	University of Agriculture Faisalabad, Pakistan
UMB	Urea Molasses Blocks
UoM	University of Melbourne, Australia
UoS	University of Sargodha, Pakistan
UVAS	University of Veterinary and Animal Sciences, Pakistan
VAs	Veterinary Assistant
VBSE	Village Based Seed Enterprise
VC	Value Chain
VCA	Value Chain Analysis
VO	Veterinary Officer
Vs	Versus
WASH	Water, Sanitation and Hygiene
WFEA	Whole Family Extension Approach
WWF	World Wide Fund

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2 Executive summary

The Dairy-Beef project builds on ten years of relationships and investment into capacity and understanding of the smallholder dairy farming system in Pakistan. This project followed on from two previous ACIAR projects (LPS/2005/132 & LPS/2010/007), facilitating consistency in terms of key in-country partners as well as scientists from both Australia and Pakistan. This supported continuity in understanding and learning about the livestock farming system, the markets they link to and the extension services that support those smallholder farming households.

This continuity allowed the project to build on an already established and locally tested extension innovation, the whole-family extension approach (WFEA), and ask some big picture, extension system level questions. These systems level questions are challenging to tackle in any country let alone one like Pakistan where there are many organisations involved, who work with a vast and immense population, which at the farm level, varies dramatically in terms of culture, environment and local governance. This made the project a unique learning exercise for both Australian and Pakistani researchers who were delving into social research theories and complexities of innovation system thinking and institutional change. Whilst supporting and understanding individuals with different roles as policy makers, researchers, value-chain actors and farm advisors all trying to engage and support smallholder farming households.

Within this context the Dairy-Beef project aimed to improve the livelihoods of smallholder farmers through enhanced on-farm efficiency of production and value chain management. The project focussed on two main research areas; (1) social inquiry to understand the challenges and benefits of integrating an extension innovation (the WFEA) within collaborating organisations' extension programs and (2) investigating opportunities for increasing the returns from smallholder beef systems by mentoring small groups of farmers and linking them with more profitable beef markets.

Gender inclusion was a core component of the Dairy-Beef project, with a gender mainstreaming strategy developed which was considered at all levels of the project, including in project design, the project team level, in all research activities and with our collaborating partners. A known challenge in rural Punjab and Sindh, is that the majority of smallholder farmers working with livestock are women who work primarily on pre-farm gate activities with limited engagement with value-chain actors beyond the farm gate. Given this scenario, the team provide equal attention to the distinct role of men, women and children in livestock activities and build their capacity to access the information according to their roles. This occurred across objectives where possible including tailoring interventions to address these differences, and capturing impacts to evaluate whether those interventions were truly equitable.

As part of the social research inquiry, the project has worked with twenty-two collaborating partners in Pakistan to establish a network of organisations (academia, research, private sector and NGOs) who are all working towards the common goal of improving the livelihood of smallholder farmers in Pakistan. Across the established extension network, the project implemented interventions at two levels to support the integration of the WFEA into their extension program; the first was a training and mentoring program with farm advisors from each organisation, and the second was building a 'community of practice' with the extension managers across the collaborating organisations. This network was a critical platform for participatory learning and driving discussions about challenges, opportunities and solutions to running extension programs in Pakistan. One common challenge that was identified across this network was that it is often more culturally appropriate for women farmers to talk to women extension workers. Hence, women farmers have reported that they were unable to utilise extension and advisory services delivered by male advisors. The WFEA was developed to explicitly address this challenge and now, as part of this project, the team have supported their collaborative partners to implement this approach in the field. This meant a focus on the inclusion of women farm advisors and their professional development

was a key design feature of the WFEA that enabled it to address the recognised need for gender inclusivity within participating partners.

The other major component of this project was investigating beef market opportunities for smallholders which was an applied research component with the project team understanding value-chains and how to support farmers to better engage with them. This component of the project acknowledges that farmer needs and challenges change, and hence wanted to address new and developing needs that related to pre-farm gate technology and management, as well as if and how farmers could better engage with the burgeoning beef market.

The value-chain research component involved capacity building activities of project team members and farm advisors to develop the knowledge and skills necessary for them to identify and evaluate new potential market opportunities for smallholder producers. This research concluded that; (1) meat processors were paying premiums for cattle that met their strict specifications, (2) sourcing of cattle that met these specifications was difficult and expensive, and (3) there were opportunities for smallholder livestock producers to engage in this superior value chain by dealing directly with traders, feedlot operators or meat processors.

Given this, the next question was to understand if smallholders could meet these requirements which linked in with the pre-farm gate research component of this project. To address this, the project ran numerous trials supporting local researchers and students to assess feeding, selling and management options to allow farmers to drive more profit from their farming business. This research indicated that farmers can make a profit when selling their buffalo and cattle calves to the local markets identified if they follow best-practice rearing and feeding practices. Furthermore, farmer can achieve five times the profit if they target and meet specifications of niche cultural markets.

The final component of the value-chain research was to see if, and how smallholders could engage with these new opportunities in the beef value chains in Pakistan. The knowledge and skills of the Dairy-Beef team that were developed through the value-chain research activities enabled them to mentor and support the formation of the Farm Business Groups (FBGs). Ten farm business groups (FBGs) were established across a total of five villages (in Punjab and Sindh), with a separate men's and women's group formed in each village. These groups were established via a participatory, farmer-led approach which was facilitated by local project staff. We believed that encouraging farmers to sell collectively would increase their economy of scale and enable them to engage in more profitable value chain opportunities. Whilst farmer groups were established effectively, farmers did not sell collectively but they did engage in more profitable value chain opportunities.

Building on the unique continuity of this project and the immense capacity, knowledge and experience of the project team, a major focus of this project was training, mentoring and integrating project lessons with project collaborating organisations partners. The final year of the project established a policy group who worked together in 'Science into Action workshops' to discuss high-level implications of the project's research into the livestock extension system and the associated value chains. This provided a platform to be able to take complex ideas and distilled research recommendations to critical leaders of national and provincial organisations to support integration into current and future projects.

2.1 Summary of Objective 1

2.1.1 Pakistan's agricultural extension and advisory system

Objective 1 investigated the support necessary to integrate the WFEA within the current dairy-beef value chain and evaluate the impacts on smallholder farming families. An analysis of the Pakistani Agricultural Extension and Advisory System (AEAS) was carried out to better understand the opportunities and challenges within it. The concept of Agricultural Innovation Systems (AIS) was used as a lens through which we considered the governance of AEAS in Pakistan. The term AIS emphasises the interaction and interdependence of the networks, institutions and systems that generate agricultural innovation.

Based on an evaluation of the livestock extension system (*n=42* organisations), Pakistan, like many other countries has a pluralistic extension system that is made of different organisations providing a range of services to farmers (Government, private sector, NGOs and research). As part of an inception workshop and semi-structured interviews with these different organisations, several challenges & opportunities were identified in governing the AEAS. These included;

- Challenges; policy environment, capacity of service providers, funding consistency, capacity of farm advisors, supporting access to markets, connecting research to farm practice change, advisory services characteristics, governance structures and advisory methods
- Opportunities; collaboration across the different types of organisations delivering extension, supporting advisory learning networks and role of women extension workers for enabling more inclusive advisory service delivery.

This research highlighted common goals across different groups and organisational types within the AEAS, who all aimed to improve the livelihoods of smallholder farmers in Pakistan. Based on this, the project team engaged 22 organisations as collaborators and facilitated the establishment of a network of extension partners providing a learning platform that could be used as part of project interventions. This project then aimed to integrate the WFEA with the collaborative partners which could then enable capitalising on the opportunities identified, whilst also establishing an inclusive learning platform to support a network of individuals sharing lessons to overcome these challenges.

2.1.2 Interventions & data collection

The project ran a training and mentoring program which sought to build the capacity of farm advisors and build a community of practice among those advisors and organisations involved in delivery of the WFEA.

Working with their collaborative partners, the project team requested organisations to nominate farm advisors (between 1-5) to be part of the training interventions. Where possible at least one man and one woman participated to align with the WFEA principles.

This program included three main interventions;

1. **Farm advisor training workshops;** consisting of a three-day workshop, held every six months (2018-2022). The workshops included a broad range of technical livestock information covering the whole-farming system. It also provided support for the integration of the WFEA into the extension programs of the collaborating organisations. An array of community development and engagement principles were also included.
2. **Community of practice;** organisation heads and their extension managers participated in up to four annual community of practice workshops taking place between February 2019 and March 2022. The workshops included panels with

farm advisors or organisation heads discussing their experience with the WFEA, facilitated breakout sessions to discuss the challenges, success and impacts of integrating the WFEA in their organisation as well as providing networking opportunities.

3. **Field follow-up visits;** were conducted by the project team every six months in-between the training workshops to further support and emphasise the information provided to farm advisors during these workshops. It involved one-to-one mentoring to the farm advisors which included discussion of strategies to support effective farm advisory services and monitoring of implemented activities relating to the WFEA.

The components of this program use applied social science with the aim of improving the productivity of smallholder farmers. Both participatory and action research were a part of the program, shaping how it was carried out. As part of this process, data was collected during each of the intervention activities including; facilitated discussions in breakout groups, reflective sessions with farm advisors and field data from one-to-one mentor visits relating to implementation and challenges. This data provided rich and broad information which was used as feedback into the training program for farm advisors. Furthermore, it provided an understanding of which approaches best supported the integration of the WFEA, as well as a variety of impacts; (1) at the organisation level, (2) with farm advisors and (3) with the farming communities that the organisations were working with.

2.1.3 Key results

To distil the breadth of results and information across 22 organisations is difficult, as each has a different workforce, mandate and working location. To measure its success, the project team focussed on its ability to engage with organisations and their field teams. It determined a 'rating of engagement' (Low/Moderate/High) for each organisation (based on participation in the COP), and an individual rating for each farm advisor (based on their participation and implementation of the WFEA into field activities). These have been summarised according to organisational type (see Table 2.1-1).

Table 2.1-1: Engagement of organisations and their farm advisors with the whole family extension approach.

Organisation Type	Total No.orgs	Rating of engagement with management			Total farm advisors (women/men)	Rating of farm advisor engagement		
		Low	Mod	High		Low	Mod	High
Government	2	0	1	1	11 (3/8)	1	5	5
NGO	11	1	5	5	21 (7/14)	3	7	11
Private	7	4	2	1	16 (0/16)	1	8	7
Research	2	1	1	0	2 (0/2)	1	1	0
Total	**22**	**5**	**9**	**7**	**50 (10/40)**	**6**	**21**	**23**

These numbers indicate that NGOs were the most engaged type of organisation, followed by Government and private organisations. They also show a lack of women field staff in general, but especially in private and research organisations that were part of this study. Supporting this engagement data is the qualitative data collected during the training interventions and semi-structured interviews from a household impact study. This data indicates that majority of the farmers working with NGOs and the private sector had implemented more on-farm practice changes compared to farmers who were linked with the government and research organisations. This related to the number of extension activities NGO/private organisations were already running. Hence, those farm advisors who already had established relationships or mandates working directly with farmers were able to apply new ideas about the WFEA more easily.

The data highlights that there are major differences between both the types of organisation as well as the individual organisations. Some of the more nuanced results, which vary across these range of contextual differences, can be seen in greater detail in the Results Section (see Section 7.1) and Appendix 11.1 of this report, a brief overview of these are provided here in response to the overarching research questions.

Research questions

RQ1. *How can the whole family extension approach be supported and integrated within the current smallholder dairy-beef agricultural extension and advisory system in Pakistan?*

This research found that a particular AEAS intervention, the WFEA helped address some of the challenges and opportunities for improved AEAS functions in the context of the Pakistani smallholder dairy-beef sector. Through a process of innovation in the incumbent extension and advisory services provision in the smallholder dairy-beef sector collaboration amongst extension and advisory services organisations across the government, commercial, NGO and R&D sectors has been supported. Capacity development for AEAS provision through changes in organisational practices as well as farm advisors' capabilities and impacts has supported the WFEA to be integrated into the current extension programs through the advisory services.

This research highlights three key design features of the WFEA that enabled and supported its integration into the existing pluralistic Pakistani smallholder dairy-beef AEAS. These are: new innovation forums for social learning and collaboration; a focus on the inclusion, participation and role/s of women farm advisors; and a focus on and recognition of the role/s and capabilities of all members of the family in smallholder dairy-beef farming.

The WFEA intervention was explicitly designed to establish and facilitate social (i.e. collective or group) learning processes between extension managers and farm advisors from different organisation with a role in extension and advisory services provision to smallholder dairy-beef farmers. It enabled and supported the alignment of government and non-government advisory services. Social learning was reported by members of the WFEA invention including the farm advisors, extension and advisory services managers and policy makers.

A focus on the inclusion of women farm advisors and their professional development was a key design feature of the WFEA that enabled it to address the recognised need for gender inclusivity within participating AEAS. CoP member organisations reported this as significant in assisting them to meet their goals and targets for gender inclusion in their AEAS programs.

RQ2. *What are the impacts of extension providers implementing the whole family extension approach?*

Specific impacts were identified by participants in this project from a number of data sources collected during the project. This includes the training and mentoring program, and a household impacts study. These are presented according to the different levels (groups of people) that were impacted (see Table 2.1-2)

Table 2.1-2 Impacts of extension providers implementing the whole family extension approach according to management level

Level *Evidence to supporting these claims*	Description of impacts
Organisation *CoP facilitated discussions & case study data*	• Improved job performance which meant they had an increased capacity. • The increased capacity led to financial and time savings • Growth in services delivered including milk production and quality increased
Farm advisors *Training workshop feedback sessions, case study data & field mentoring one-on-one visits*	• Increased capacity building in terms of technical, social and communications skills care of opportunities for farm advisors to network, exchange knowledge and information and identify and fill skills gaps. • This increased capacity meant that many advisors had the ability to solve farm issues independently. • These skills supported establishing and maintaining better links with farming communities. • Collectively, these skills, networks and connections with farmers helped farmer to improved their job performance.
Farming household *Household impact study & field mentoring one-on-one visits*	• Increased milk production and quality of products. • Improved animal health and welfare • Saved time and were able to spend it on other activities. • Better access to services and financial support to implement changes. • Better access to information because farm advisors knew more about the whole farming system. This led to more relevant and accessible extension messages for both men and women farmers.

Examples of impact:

Building on the ideas in the table above some specific examples are presented to support the ideas at each level.

Capacity impact, example the farm advisor level: The WFEA improved the technical, social and communication skills of 50 farm advisors. Majority of the farm advisors reported that they had worked within their own organisations to improve internal capacity building. For example; a farm advisor from a Government organisation shared that he was involved in a large project (the Prime Minister initiative) to save the calves and calf fattening. As part of the project, he attended an internal training and was given the opportunity to conduct a session on calf care based on his learning (from the Dairy-Beef project). He was able to showcase his understanding regarding calf issues and recommendations at the farm level. Due to this his he was promoted, making him the district focal person for the project.

Social impact, example at the farming household level: Farming communities reported that they made more decisions regarding on-farm practice change together (as a husband and wife or household team) after participation in the monthly farmers discussion groups. This was particularly evident when both the husband and wife of the same household participated in the respective monthly extension meetings. For example, a female farmer linked to an NGO, reported that construction of animal sheds was a mutual decision with her husband and other family members. Initially, her husband did not agree with her, but with support from her farm advisor they were able to come up with ideas to utilise various resources at their farm and build confidence regarding this decision by showing other farms who had already implemented this change. Gradually, the farmer and her husband planned and worked together to construct an animal shed.

Economic impact, example at the organisational level; many collaborating organisations noted changes in the capacity of their farm advisors after being part of the project. For example, a private sector farm advisor noted that their core job is milk

collection from smallholder farmers. Previously, when addressing on-farm issues they have needed to call technical persons to solve these on-farm issues which meant the farming communities had low levels of trust with him. After becoming the part of WFEA training, the farm advisor is feeling more confident, resourceful and technically sound to solve these farm-level challenges without any additional technical support. In the process, he is saving his organisation time and funds, whilst also regaining farmer confidence.

Example of organisational change; a farm advisor from one NGOs shared that all the technical lessons from the WFEA training become the basis of a new standard operating procedure (SOP) within his organisation including having farm level targets, along with monitoring and evaluation plans to assess these. The aim is that all the field staff within their organisation have to achieve those farm level targets with their registered farmers (e.g., calf mortality should aim to be less than 5%). As part of this new SOP the NGO is also providing support to their farmers (including loans and quality veterinary services) to assist community members in achieving these targets. This change has altered the scope and impact of the organisation with their farming communities who had previously not provided any advice or support for farmers regarding their animals.

Lessons

- Regular training, with follow-up sessions, are critical to implement any extension program, including in Pakistan. Once-off training usually has very little benefit to participants and can usually only convey a few key ideas.
- Feedback mechanisms and reflective sessions between farmers, field teams and extension managers are a key part of the learning process. Effective feedback can help to make more effective extension programs in Pakistan.
- Active engagement with management is critical for institutional change. For the best results in terms of implementing project activities and training approaches, it is critical to actively engage the organisation's higher management.
- Interaction between various heads of extension organisations provides a useful platform to share ideas about approaches to drive change in extension programs through communication strategies, enhanced cooperation and interactive learning opportunities.

Recommendations

- Plan for and invest in the participation and professional development of women farm advisors as a key means of improving innovation capabilities both within extension-advisory organisations and the farm scale.
- Maintain networking opportunities and forums for agricultural extension and advisory services provision to sustain the impacts of collaboration between organisations.
- Develop a process for certifying the WFEA training program for farm advisors as part of their professional development.

2.2 Summary of Objective 2

Objective; To analyse the current beef industry structure in Punjab and Sindh with a focus on identifying market opportunities for smallholder farmers

The value-chain approach

In a traditional farm produce selling system smallholder farmers in Pakistan have little market power, therefore, they may gain financially from increased output but may not be rewarded for the improved quality of their livestock. This project aimed to use a value chain approach to provide smallholder livestock producers with realistic opportunities to (1) produce more efficiently and (2) sell a more valuable product, both of which can contribute to raising farm profitability (LPS-2016-011 project proposal, p.11).

What we know about the beef industry structure in Pakistan

The literature review conducted by the Lahore University of Management Science provided an overview of the Pakistan beef industry and its structure. The main points emerging from the review were:

1. The demand for beef was increasing in both the domestic and export markets.
2. Beef meat production has increased from 1,829,000t (2012-13) to 2,017,000t (2015-16).
3. Structural and operational constrains were inhibiting the growth in these markets.
4. There were 4 major value chains (marketing channels) – road-side vendors (5.5%), retail butcher shops (91%), export (2%) and Eid (1.5%).
5. Smallholder farmers own 75-80% of cattle/buffalos; 20-25% of these smallholders are described as 'market orientated' farmers who raise and sell their male calves.
6. Smallholder farmers rely on the middlemen due to lack of integration between livestock value chain and weak farm-to-market linkages.

The increasing demand for beef would indicate that there are opportunities for small 'market orientated' farmers if they reduce their dependence on middlemen. Reducing the dependence on middlemen would require them to adopt a value chain approach.

Adopting a value chain approach

A report by the Competition Commission of Pakistan[1] recommended that:

> *The government should train farmers at grassroots level where most of the meat production takes place. Small workshops should be conducted in villages to train rural farmers about animal breeding, disease control, feed and fodder and animal sale.*(p.35)

However, as a recent ACIAR report[2] concludes that *extension agents were also not well trained to enable small farmers to engage with modern food supply chains* (p.55). This conclusion raises the question – how is the capacity of extension agents developed so that they have the knowledge and skills to assist smallholder livestock farmers identify, evaluate, and participate in profitable market opportunities?

Building the capacity of extension agents in value chain approach

Activity 2.2 focused on developing the knowledge and skills of the Dairy-Beef team in the value chain approach so that they would be equipped to mentor and support smallholder livestock farmers in the development of Farm Business Groups under Objective 4. Since

[1] Competition Commission of Pakistan, (2016). Meat Study Report.

[2] *Khan et al, (2019) Enabling policies for developing smallholder agriculture in Pakistan. ACIAR Monograph 207.*

the members of the Dairy-Beef team shared the same background and training as many of the livestock extension agents, the capacity building program delivered under Activity 2.2 was an excellent *pilot to prove* initiative. The approach adopted in the capacity building program was built around experiential leaning and reflection for two reasons:

1. Experiential learning, learning by seeing and doing, is an established adult learning andragogy.
2. Reflecting on a learning experience promotes understanding of the principles and practices involved in the activity.

The impact of the capacity building process

The evaluation of this approach concluded that the capacity building process was partly effective but an inefficient use of resources.

For example, the Dairy-Beef team developed the skills to successfully conduct *walking the chain* activities and master some analytical tools such as gross margin analysis, but in areas such as marketing they struggled. In addition, the level of knowledge and skill development varied among the Dairy-Beef team due to their different individual levels of motivation and commitment.

The capacity building process was conducted over a period of 2 years. This extended training timeframe was influenced by:

- The commitments of the Dairy-Beef team to other components of the project.
- The participants' lack of knowledge and experience in downstream value chain activities.
- The participants' lack of knowledge and skills in financial analysis and marketing
- The lack of in-country mentoring and support.

The impact of this extended timeframe on the capacity building process was that the development of the knowledge and skills of the participants in the value chain approach was intermittent and required consistent revision and reinforcement.

Research question

> **RQ3:** *What are the predominant beef value chains and how can the families of smallholder livestock producers benefit from the increasing demand for beef?*

The capacity building activities of Objective 2 provided the Dairy-Beef team with the knowledge and skills necessary for them to identify and evaluate new potential market opportunities for smallholder producers. During their capacity building program the members of the Dairy-Beef team conducted three *walking the chain* activities which provided them with factual examples of how the consumer demand for beef was changing and the opportunities that these changes in demand provided for smallholder beef farmers. The reports concluded:

1. Meat processors were paying premiums for cattle that met their strict specifications in terms of age, sex, liveweight, health and soundness.
2. The sourcing of cattle that met these specifications was difficult and expensive.
3. Progressive livestock producers were changing their calf rearing strategies, including the establishment of feedlots, to meet this demand.
4. There were opportunities for smallholder livestock producers to engage in this superior value chain by dealing directly with traders, feedlot operators or meat processors.

The knowledge and skills of the Dairy-Beef team that were developed through the activities of Objective 2 enabled them to mentor and support the formation of the Farm Business Groups established under Objective 4.

2.3 Summary of Objective 3

A series of 'Research Focus Group' workshops to discuss on-farm research priorities to improve the farm efficiency (productivity and profitability) of smallholder dairy-beef farmers in Pakistan was facilitated by the Dairy-Beef Project. These workshops involved academics, private sector representative and farmers to prioritise ideas based on farmer needs and the likelihood of impact on farmer-profit. Research priorities were identified as: (1) improved understanding of consumer driven value chains for beef animals, (2) supporting new technology for fodder production (eg Rhodes grass) and (3) an android based feed formulation app for maximizing on-farm resources.

Based on these priorities proposals were developed and a number of trials were run in Pakistan;

- Three research projects were supervised by local Universities (2 men, 1 woman) with research conducted by 4 PhD/Masters students (2 men, 2 women).
- Three research projects were supervised by Australian Universities with research conducted by 3 Pakistani PhD students (2 men, 1 woman).

Research project examples and findings

Digital extension tools; do they support farm advisors?

The purpose of this study was to investigate the acceptance of a digital extension tool with farm advisors. The tool was developed based on feeding and ration formulation literature and the project team's extension material. An interactive tool was developed in CommCare, a digital data collection and display platform which supports the creation of application technologies accessible via tablets or smartphones.

All participants who tested the tool (*n=22*) in its development stage indicated their acceptance of the information it communicated and the tool itself. Farm advisors considered the tool to be both usable and useful in supporting extension due to the tool's capacity for engaging farmers. This research highlights the value of involving advisors in tool development as they are key 'intermediaries' between farmers and digital tools.

Assessing trade-offs for male calves

The purpose of this study was to assess trade-offs and options for selling dairy-beef animals from smallholder farms using evidence from research carried out in the Pakistani context. The growth rate of both buffalo and cattle calves when using traditional rearing practices is reported to be 150g/d. In comparison, when farmers follow best practice calf-rearing practices, growth rates can be as high as 705 g/day for cattle calves and 570g/day for buffalo calves.

Profit comparisons; selling age and market options

The profit (PKR/kg LW) when buffalo and cattle are sold at different ages using best rearing practices is much greater compared to using traditional practices (Table 2.3-1) When rearing both buffalo and cattle calves using traditional practices we expect a profit would only be made when buffalo are sold at the livestock market or local slaughterhouse at 180 days old, at all other times a loss would be incurred for the smallholder farmer. The Eid market is the most profitable option for the smallholder farmers using best practices if they have the buffalo or cattle that meet the specifications of the market (ie; >2 years old & over 320 kg). Communicating these results and supporting smallholders to utilise this information for decision making would be beneficial.

Table 2.3-1: Profit (PKR/kg) for buffalo & cattle under 'best practice' vs 'traditional' rearing of calves.

Sale options	Price (PKR/kg liveweight)	Profit at day180	Profit at day 730	Profit at day180	Profit at day 730
Buffalo		Best-practice		Traditional	
Beopari/local butcher	210	54.91	83.40	-11.94	-57.24
Livestock market/ local slaughterhouse	235	79.91	108.40	13.06	-32.24
Feedlot	235	NA	108.40	NA	NA
Eid-ul-Azha value chain	780	NA	653.40	NA	NA
Cattle		Best-practice		Traditional	
Beopari/local butcher	240	85.40	134.21	-78.19	-146.45
Livestock market/ local slaughterhouse	265	110.40	159.21	-53.19	-121.45
Feedlot	265	NA	159.21	NA	NA
Eid-ul-Azha value chain	780	NA	674.21	NA	NA

Profit values are in PKR/kg liveweight sold. Profits were calculated based on prices received by smallholders from value-chain actors in Pakistan and the cost of production using the best-practices or traditional practices

NA: Animals are not typically sold to these markets at this age as it does not meet the market specifications.

Impacts & outcomes

Capacity: 14 students gained experience and the capability to conduct applied research; four PhDs (all Pakistan nationals, 2 men / 2 women) and10 masters students (5 Pakistan-based/5 AUS based, 5 men/5 women).

Scientific: International journal publications (4 published, 3 submitted/drafted).

Economic: Several on-farm trials were run to demonstrate research applications directly with farmers. This included highlighting the profitability improvements relating to fodder seed production and calf-rearing. Collectively, these trials engaged over 60 farming households, all of whom had production and profit increases for that farm component.

Research questions

The applied research component of this project aimed to evaluate enterprise combinations which have the potential to improve on-farm efficiency and profitability of smallholder dairy-beef farms and answer the following research question;

> **RQ4;** *How can smallholder farmers best utilise their dairy animals to supply beef markets and increase their farm profitability?*

Smallholder dairy farmers in Pakistan have the animal resources, feed and in many cases, access to beef markets to help increase their overall farm profit. Gross margin analysis comparing sale times and markets, indicated that farmers can make a profit when selling their buffalo and cattle calves to the local markets if they follow best-practice rearing and feeding practices. Furthermore, if they can meet the animal specifications and timing for the Eid-market, the profit per kilogram of liveweight can be increased five-fold.

This research was supported by findings from on-farm trials, in particular calf-rearing competitions demonstrated that higher calf growth-rates are achievable for smallholders using their available resources. By following best-practices for rearing and feeding, 55% of participating smallholders in Punjab and Sindh achieved calf growth rates higher than those achieved during similar on-station trials. Collectively, the research trials indicate that a profitable beef enterprise from dairy animals is possible for smallholders in Pakistan. In contrast, smallholders are unlikely to make any profit when calves are reared following traditional rearing and feeding practices, regardless of the market they sell their animals to.

2.4 Summary of Objective 4

Key results

Ten farm business groups (FBGs) were established in three villages in Punjab (45 GD, 77D, 96D) and two in Sindh (Sidique Narejo, Beero Lunjwani). In each village, a separate men's and women's group were formed. These groups were established via a participatory, farmer-led approach which was facilitated by local project staff.

Approximately 15 activities were facilitated by the project team for each FBG, with a total of 46 women and 38 men considered to be FBG members (Table 2.4-1). On average, members participated for 42 months and participated in 79% of the activities offered to their FBG.

Table 2.4-1: Number of activities and members for each Farm Business Group (FBG)

	Farm Business Group									
Measure	45 GD		77D		96D		Beero Lunjwani		Sidique Narejo	
	women	men	women	men	women	men	women	men	women	men
Number of activities held	16	13	12	13	15	13	8	12	12	15
Number of members [a]	6	9	10	9	6	6	10	8	14	6

[a] Members were calculated based on the number who attended the 'walking the chain' & reflection activity

Most FBG members changed their practices in relation to fattening and selling cattle after participation in the FBG activities. All members changed their feeding practices, whilst most now believe they can meet customer preferences and have changed the person or market where they sell their cattle (Table 2.4-2). Whilst the FBGs have not sold their cattle collectively, members now have the capacity to independently calculate cost of production and gross margins to determine a fair sale price for their animals.

Table 2.4-2 The proportion of member households that changed their practices related to either fattening cattle or sale of cattle after participation in the Farm Business Group according to region

Relating to	Practice	Region	
		Punjab	Sindh
Fattening cattle	cattle bought for fattening	11/16 (69%)	5/11 (45%)
	feeding cattle	16/16 (100%)	11/11 (100%)
	meeting customer preferences	16/16 (100%)	7/11 (63%)
	other changes	15/16 (94%)	7/11(63%)
Selling cattle	discussion with FBG prior to sale	13/16 (81%)	7/11 (64%)
	sale to different market/ person	12/16 (75%)	9/11(82%)
	confidence in negotiating sale	12/16 (75%)	5/11 (45%)
	calculating gross margins	14/16 (88%)	8/11 (73%)
	other changes	9/16 (56%)	5/11 (45%)

The profitability of the beef businesses owned by FBG members increased after their involvement in the FBG, and in Punjab the number of cattle sold also increased (Table 2.4-3). By discussing sale prices as a group and collectively demanding better prices for their animals, the farmers participating in the FBGs received a greater return for their animals and are more confident participating in the beef value chain.

Table 2.4-3 Average profit data for the beef cattle businesses of member households before and after participation in the Farm Business Groups according to region

Measure	Punjab		Sindh	
	Before [a]	After [b]	Before [c]	After [d]
Number of cattle sold after fattening	2	4	2	2
Price received (PKR/ animal)	62667	268130	55000	73000
Cost of production (PKR/animal)	21000	153700	50000	46625
Profit (PKR/animal)	41667	114430	5000	26375

Subscripts relate to the number of households (HH) that provided complete data to support the calculations these values are based on; [a] 3 HH, [b] 10 HH, [c] 1 HH and [d] 4 HH.

Outcomes and impacts

Capacity: Farmers now have the capacity to understand their customer's requirements in terms of product specifications, raise animals to meet these specifications, determine a fair sale price and negotiate to receive that sale price.

Economic: By discussing sale prices and negotiation strategies together, market prices within the village are increasing. This is further encouraging farmers to sell more animals, more strategically. The improved sale prices have been reported by some FBG members to improve their standard of living. One female member reported that they have been able to buy laptops and phones for their children studying in college, buy land previously leased and buy more animals for fattening, all from the increased profits from their beef business.

Social: FBG members reported that they felt more confident selling their animals, were more respected within their household and village, and made more decisions on selling animals together (as a HH team) after participation in the FBG. This was particularly evident when both husband and wife of the same household participated in the respective FBGs.

Research questions

This study aimed to determine the impact of using FBGs as a way of improving small-holder dairy-beef farmer engagement in beef supply chains. We believed that encouraging farmers to sell collectively would increase their economy of scale and enable them to engage in more profitable value chain opportunities. Whilst farmer groups were established effectively, farmers did not sell collectively and thus they did not form true FBGs. However, they did engage in more profitable value chain opportunities as the results of practice changes and profit indicate.

> ***RQ5:*** *What impact does effectively engaging farmers in whole of market chain activities have on household income from beef production?*

Farmers have increased profits from their beef businesses after their involvement in the FBGs. This is likely to have been influenced by the practice changes that they have made in response to whole of market chain activities, which has increased the FBG participant's ability to understand and meet the requirements of the customer, and to know the value of their cattle through weighing and calculating cost of production and gross margins. With the combination of the new capabilities and practice changes, this has increased their bargaining power and the prices they receive for their cattle have increased.

> ***RQ6:*** *What are the critical success factors that underpin smallholder dairy-beef producers engaging in more profitable value chain opportunities?*

From the literature, we know that resources, agency, motivation, culture, and skills are critical success factors for effective FBGs, and thus the likelihood of engaging in more profitable value chain opportunities. These factors were incorporated into the selection process for establishing FBGs and from our results, still appear to be critical success factors. For example, we found that practice change was greater in Punjab than in Sindh where resources are limited. We also observed when a husband and wife were in the respective FBG groups more practice change occurred due to a culture more conducive to change and support.

2.5 Summary of Objective 5

Justification

The project added Objective 5 as part of a project variation (May 2021) in response to one of the recommendations from the mid-term review to undertake a more critical analysis of the extension services, as a whole, in Pakistan. The aim was to support the uptake of key lessons from the dairy-beef extension and value-chain research into policy discussions to improve sustained implementation of the whole family extension approach.

Science into Action workshops

The Dairy-Beef Project organised two 'Science into Action' workshops in August 2021 and May 2022. Departmental heads and senior leaders of livestock and extension organisations (national and provincial) participated in these workshops, and in doing so, formed the livestock policy discussion group that was critical for this component. These workshops provided a platform for the policy discussion group to share and learn about research on the Pakistan livestock extension system, including the various participating organisations' policies and lessons for implementing future projects.

Prior to the first 'Science into Action' workshop, the project team shared 'Key lessons' highlighting the main ideas the team wanted to convey at the workshop. Based on these lessons, and the outputs of the 'Science into Action' workshops, a policy paper was drafted and shared with group members for their input.

Outputs; policy paper

The paper "***The current role of livestock extension and future opportunities***" addresses the issue**:** How can a holistic training intervention, the WFEA, build on the fundamentals of quality extension programs in a smallholder farming context in the existing extension systems of Pakistan?

This paper describes the on-going extension challenges and needs in Pakistan. It includes a brief policy review which emphasises that policies are well articulated and clear at both the national level and across provinces. They all include;

- a core goal to improve smallholder farmer profitability and improve farm production
- a strong support to carry out farmer training or capacity building.

What is missing from these policies is documentation which describes how these goals will be reached. This is understandable as it is complex and is up to the management of each organisation to implement themselves, but highlights the need for this kind of information to support quality extension. This paper concludes with recommendations and potential solutions for some of these challenges and suggestions for how to better support improvements in the sector in the future.

Key challenges that organisations heads shared regarding implementation of their extension programs were at the organisation, farm advisor and farmer levels (Table 2.5-1). This extent of this list highlights that although the policy documents are clear at the national and provincial level, there are still many difficulties in implementing extension projects at the ground level with farm advisors and farmers.

Based on the extent of these challenges and the key lessons that had been shared by the Dairy-Beef team, the policy discussion group discussed and classified the most critical areas that they wanted to address. Furthermore, they were categorised according to the timeframe in which they could be achieved (Table 2.5-2).

Table 2.5-1: Key challenges for organisations to implement extension programs.

Level	Challenges
Organisation	- Human resource skills - Geographical placement of farmers & reach of organisations - Lack of communication channels with smallholder farmers (men and women)
Farm advisors	- Farmer advisors are lacking in communication and technical skills to motivate farmers for improving farm practice change, including a lack of awareness about the needs based extension services. - Challenging to include farm advisory services as a job target for themselves.
Farmers	- Farmers are reluctant to implement improved farm practice because of language barriers when farm advisors communicate extension advice to them. - Farmers have countless expectations from the concerned organisations and farm advisors. - Farmers take too much time to adopt any new ideas of marketing dairy and beef. - Lack of awareness of farmers related to improved health management practices including the necessity for timely treatment of animals.

Table 2.5-2: Priorities to be addressed to improve livestock extension services in Pakistan.

Short-term	Medium-term	Long-term
- Changing focus to work with farmers to support profit (not just treatment). - Developing extension material - Enhance/expand the WFEA	- Collaboration with other organisations - Engaging with smallholder farmers	- Capacity building of farm advisors

Impacts; taking the next step

One of the major outcomes of the 'Science into Action' workshops was to follow up with critical extension organisations and co-design 'Science into Practice' workshops. These workshops took the ideas from this policy engagement work and integrated recommendations to implementing partners by working with their middle/senior management. The team conducted three workshops (see Table 2.5-3) with the theme;

"To integrate the findings of the research and development modules within the Pakistan livestock extension system and share lessons for implementing future projects and policies within livestock development sector"

The objectives of each workshop differed slightly and was an important part of the co-design process. The project team made a point to value the inputs from these organisations and let them guide the focus topics and skills they wanted developed.

Table 2.5-3: Participants of the 'Science into Practice' workshops.

Science into Practice	Men	Women	Total participants
Livestock and Dairy Development Board Workshop	36	2	38
Sindh Livestock Department Workshop	21	4	25
National Rural Support Program Workshop	12	5	17

Lessons learned

The 'Science into Action' workshops and the associated discussions enabled the participants to engage and work with the material and ideas that were provided. This helped the livestock policy discussion group to better understand the different lessons that the Dairy-Beef team presented, and most importantly if/where they were applicable within their organisations.

The co-designing process with critical organisations in the 'Science into Practice' workshops was a time-consuming but worthwhile step. The different agendas that came out of this process highlighted the differences in projects and capacity across partners.

2.6 Gender considerations within the project

Gender inclusion is placed as a core component of the Dairy-Beef project. Early in the project the project team engaged in numerous training workshops and activities to help understand this theme across project components.

Gender mainstreaming/training activities

The project team were a part of the AVCCR Gender mainstreaming workshop supported by Gerard McEvilly, Munawar Kazmi and Noor Batool (November, 2017). This was run by Gender Consultant (Karen Iles) and organised on-behalf of the AVCCR program. Karen's workshop was an intense 3-day exercise which engaged 8 team members from the livestock projects (5 Pakistani [3F/2M] and 3 Australian [2F/1M] team members). The work carried out on these three days helped to clarify the team's understanding of gender research and how it will contribute to our project and how we can explain this importance to our collaborating partners. The workshop helped identify the skill gaps and research capacity to be developed within the team and collaborators to ensure our project is gender inclusive and creating the on-farm impact we are aiming for.

An output of this workshop was a gender mainstreaming plan which was developed by the project team. This plan specifies gender differences and needs are considered at the components and pillars of the project and its partners (Table 2.6-1). The team provided equal attention to the distinct role of men, women and children in livestock activities and build their capacity to access the information according to their roles.

Table 2.6-1: Gender mainstreaming pillars from gender mainstreaming plan.

Pillar 1: Project Cycle	Pillar 2: Core Teams	Pillar 3: Implementing Partners	Pillar 4: Program Coordination
Gender is mainstreamed into each stage of the project cycle, and linked to Aik Saath project objectives.	Each team has mainstreamed gender in all their activities as a team and for individuals' role and tasks.	Gender is mainstreamed into the activities, processes and systems of implementing partners, and they are held accountable for gender inclusivity.	mainstreaming of each project is enabled through a coordinated program of strategic oversight, review, capacity support, lesson learning, monitoring, and liaison with internal and external specialists.

As part of these above strategy, the team defined the project's gender outcome:

"The agency of members of the smallholder farming families is enhanced through equal engagement in the Dairy-Beef project activities".

Understanding resources, agency and relations

Our research team had carried out studies in Punjab and Sindh using a gender analysis framework (see Table 2.6-2) which was adapted from Naila Kabeer's research in 1999. The aim of her research was to determine how women have interacted with the extension service given the spatial dimensions of women's mobility in villages and the social structures that define women's interactions with places, people and livestock work. The study identified key factors that shape women's interactions with an extension service in rural Pakistan and provided feedback on the WFEA and ways to improve on making the activities even more inclusive.

Evidence from the two case study villages reveals how social differences (caste and class) shape women's access to extension meetings and the resources to implement practices. More details of this work can be found in the Appendix 11.6.2.

Table 2.6-2: Gender analysis framework used for this study. Source: Kabeer, 1999

Resources	Agency	Women-livestock relations
• Material - land, animals, money, machinery infrastructure • Social and institutional friends and family, market, community • Human education and training, information	• 'Power to' or the ability to define one's goals and act upon them • Practically understood and applied as decision making power	• Affective/emotional factors e.g. pride in animals/work or burden • Values and meanings attached to livestock care and production i.e. wealth and status; enables access to health and education; use as dowry, gifts and work animals

General recommendations from this study which fed back into Objective 1 activities relating to WFEA integration with partners included:

- Women farmers required women farm advisors to visit each village to disseminate the extension package.
- By understanding the local structure and dynamics of biradaris (family groups) across locations, the essential character of intra-household relations that define circumstances for women and their cattle can be incorporated into extension design.
- Hold extension meetings in a neutral location or identifying focal women that will invite different groups of women.

Examples of gender mainstreaming in Objectives

Objective 1 Household impact study; Towards the end of the project, a survey questionnaire was designed, and data was collected from the households in Objective 1 study locations. The was to assess the impact of the project trained farmers on the women and men members of the dairy and beef smallholder households. This study tried to understand if training farm advisors in WFEA deliver equitable impacts for women and men smallholder farmers in terms of improving their knowledge and skills and empower them to better manage and benefit from their dairy-beef animals.

Relating to impact from practice change; ‘untying the animals and providing them free access to water and feeding’ was the most common practice change reported. Women and men mentioned that this change saved time (as much as 8 hours/day for farmers with >10 animals) which subsequently gave them greater time flexibility. Women said this allowed them to spend more time with their family members and complete other household chores. Men used their saved time to socialise and spend on other income generating activities.

Objective 4 Needs assessment & training; Farmer needs assessments were held to understand the barriers to effective engagement in beef fattening and beef value chains, thereby providing guidance for subsequent extension activities to be held in the villages. These were run with separate women’s and men’s discussion groups, giving each group a chance to discuss and rank issues relating to calf fattening. The outputs from these activities guided the extension visits in each village, which were very different for men and women, and were part of the process for establishing FBGs. Furthermore, during some of the exposure visits that were part of the training program, some women were unable to participate in all the visits due to the social norms of their village. Pictorial sessions were arranged in the village with these women, this gave them the opportunity to increase their understanding about the beef market, demand and required product specifications.

Similar information regarding interventions, training, and impacts and how it differed between men/women were collected (where appropriate) in each objective. Details of these can be seen reported in each section relating to each objective.

3 Background

The current Pakistani situation

Pakistan is the sixth most populous country in the world, with an estimated population of 185 million[3]. Currently, two thirds of people live in rural areas, 68% of rural households are employed in agriculture, and agriculture related enterprises employ 45% of Pakistan's overall labour force. Pakistan's people and its economy depend hugely on its rural industries with agriculture contributing 21.4% to GDP[4] and accounting for 60% of export earnings[5]. According to the Government statistics the annual growth rate of the agricultural sector has remained constant at 3.3% over the last three decades. There is also overarching and engrained inequity in parts of Pakistani society that limit access to key resources that would enable farm growth, gender biases that further limit opportunities for women, and an increasing population (2% pa[6]) that compounds existing poverty and food insecurity. These issues of stagnant agricultural growth and disadvantage are serious limitations to development and livelihoods. Hence for the estimated 45% of the population living in multidimensional poverty, the reliance on agriculture and livestock in rural areas is an imperative[7].

The importance of the dairy and beef sectors

Dairying is practiced by 8.8 million smallholder households and is a fundamental component of Pakistan's mixed crop-livestock farming systems and the economy. Thirty eight percent of the dairy farmers are landless, and for those that do own land, the distribution is strongly skewed, with 89% of the households having less than 5 hectares. This means that the majority of farming families depend heavily on domestic animals for food security[8] and in Pakistan, where 91% of farmers have less than 10 dairy animals, these animals form a critical component of their food supply and household wealth. While the primary product of the 72 million[9] buffaloes and cows in Pakistan is milk, these same animals are also a key source of meat. Dairy production contributes $23 billion to GDP; combined with meat from dairy animals, the economic value exceeds that of all cash crops. Increasing demand for high quality meat[10] and milk in urban and larger rural centres in Pakistan provides significant economic opportunities and challenges for smallholders.

This project ran from April 2017 to June 2022 (valued at AU $2.93M) and was a collaboration between the University of Melbourne (lead organisation), Charles Sturt University (CSU, collaborating partner) and the University of Veterinary & Animal Sciences Lahore (UVAS, lead in-country partner). It is a continuation of two previous ACIAR and DFAT dairy projects focussed on production (LPS/2005/132 & LPS/2010/007).

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[3] World Population Review, 2015

[4] Farooq, O. (2013). Agriculture, Economic Survey of Pakistan 2012-13. Islamabad: Ministry of Finance Retrieved from http://www.finance.gov.pk/survey_1213.html

[5] Ahmad J. 2014. Economic Survey of Pakistan & Livestock Sector (2013-2014) in Finance Mo, ed. Islamabad: Government of Pakistan.

[6] World Bank (2015) World Bank Open Data http://data.worldbank.org/ (Accessed Dec 2016).

[7] UN Development Program (2015) http://hdr.undp.org/en/countries/profiles/PAK (Accessed; Feb, 2016)

[8] Drucker, A. G., V. Gomez, and S. Anderson. 2001. The economic valuation of farm animal genetic resources: a survey of available methods. Ecol. Econ. 36(1):1-18.

[9] Aleem and Arocha (2013) Competitive Assessment of the bovine meat value chains in Pakistan. Report for USAID; The Agribusiness Project (TAP)

[10] UNIDO (2012) Enhancing livestock sector export competitiveness

The Dairy-Beef Project aims to improve the livelihoods of smallholder farmers through enhanced on-farm efficiency of production and value chain management. The project is focussed on two main research areas; (1) social inquiry to understand the challenges and benefits of integrating an extension innovation (the WFEA) within collaborating organisations' extension programs and (2) investigating opportunities for increasing the returns from smallholder beef systems by mentoring small groups of farmers and linking them with more profitable beef markets.

The main impact pathway is through the integration of the WFEA with collaborating partners and benefitting the farm advisors within their teams and the farming communities they each work with.

Gender inclusion is a core component of the project. Therefore, as part of the project's gender mainstreaming strategy, gender is considered at the project team level, in all research activities, and with the collaborating partners. For more detail see 'Gender considerations within the project' from the summary section of this report, or Appendix 11.6.

The initial objectives of the project were:

1. To investigate the support necessary to integrate the whole-family extension approach within the current dairy-beef value chain and evaluate the impacts on smallholder farming families.
2. To analyse the current beef industry structure in Punjab and Sindh with a focus on identifying market opportunities for smallholder farming families.
3. To evaluate alternative enterprise combinations which have the potential to improve on-farm efficiency and profitability.
4. To support smallholder dairy-beef farmers to engage in more profitable value chain opportunities.

Following the mid-term review (MTR) recommendations were made to expand strategic engagement with large provincial and national organisations to improve integration, sustainability and support institutional change. Thus, an additional objective was added with associated activities:

5. To support the uptake of key lessons from Dairy-beef extension and value-chain research into policy discussions (at both National & provincial Government levels) to improve sustained implementation of the whole-family extension approach.

This additional Objective and Activities were added as part of a variation (V1), which included an additional 12-months project time but no additional funds.

This project is part of the Aik-Saath Collaborative Research program. It builds on LPS/2010/007 *Strengthening dairy value chains in Pakistan through improved farm management and more effective extension services*, which was part of the Agriculture Sector Linkages Program (ASLP) in Pakistan.

The goal of the program was:

> *That rural poor, particularly women, living in the Punjab and Sindh significantly and equitably benefit from improvements in strategic value chains.*

The Dairy-Beef projects goals, objectives and impact pathways align with this overarching goal where appropriate.

The results of the LPS/2010/007 project and review recommendations, along with local stakeholder workshops with researchers, private sector representatives and smallholder farming families were used to develop the research questions for the Dairy-Beef project. These questions build on the extension and farming systems research work from the LPS/2010/007 project and target beef value chains:

Relating to Objective 1

1. How can the whole- family extension approach be supported and integrated with the current smallholder dairy-beef farming system?
2. What are the impacts of extension providers implementing an integrated whole family approach within their own programs?

Relating to Objective 2

3. What are the predominant beef value chains and how can the families of smallholder livestock producers benefit from the increasing demand for beef?

Relating to Objective 3

4. How can smallholder farmers best utilise their dairy animals to supply beef markets and increase their farm profitability?

Relating to Objective 4

5. What are the critical success factors that underpin smallholder dairy-beef producers engaging in more profitable value chain opportunities?
6. What impact does effectively engaging farmers in whole of market chain activities have on household income from milk and beef produce?

These questions are addressed in the Results section of each corresponding Objective.

4 Objectives

Overall Project Goal: To improve the livelihoods of smallholder farming households in the Punjab and Sindh provinces of Pakistan through on-farm efficiency gains and development of dairy and beef market opportunities.

Project Objectives and Activities

Objective 1: To investigate the support necessary to integrate the whole-family extension approach within the current dairy-beef value chain and evaluate the impacts on smallholder farming families (35% effort, addressing RQs 1 and 2)

1.1: Evaluate organisational arrangements related to extension and establish collaborative partnerships for integrating whole-family approaches within their extension programs

1.2: Establish a community of practice to train and mentor partner organisations to implement an integrated whole family extension approach

1.3: Evaluate impacts of training and mentoring program on the effectiveness of each organisation

1.4: Investigate the impact of the extension programs at the household level

The activities within Objective 1 will form the basis of the expansion of the whole-family extension approach into different organisations and geographical locations of Pakistan. Research outputs from Objectives 2, 3 and 4 (when completed) will be developed into extension material to help the program mature to the evolving needs of the smallholder farmers. Figure 1 at the end of this section helps to describe how the objectives and activities are linked together.

Objective 2: To analyse the current beef industry structure in Punjab and Sindh with a focus on identifying market opportunities for smallholder farming families (15 % effort, addressing RQ 3)

2.1: Review of current dairy-beef value chain literature in Pakistan

2.2: Conduct an intensive training program in value chain analysis (VCA)

2.3: Map traditional livestock chains in selected districts of Punjab and Sindh

2.4: Detailed value-chain analysis of specific chains linked to smallholder farming families

2.5: Document and publish the outcomes of adopting a value chain analysis methodology to identify market opportunities for smallholder dairy-beef farmers

The capacity building of project staff and partners within Objective 2 will help the project team implement activities within Objective 4. Furthermore, the outputs from Activity 2.3 will help to carry out Activity 2.4 and these outputs will be used for engaging with farmer groups in Objective 4.

Objective 3: To evaluate alternative enterprise combinations which have the potential to improve on-farm efficiency and profitability (25 % effort, addressing RQ 4)

3.1: Review current understanding and efficiency in the dairy and beef operations on smallholder farms

3.2: Assess the trade-offs between the cost of rearing calves for beef and selling the milk that is required to rear them effectively

3.3: Implement on-station research initiatives addressing research gaps from 3.1.

3.4: Implement on-farm field trials to test and evaluate recommendations from 3.2 and 3.3

3.5: Develop a farm-based decision-support tool comparing production, management and selling options

The outputs of Activities 3.2 and 3.5 will be used to help stimulate discussion with farmer groups in Objective 4. Furthermore the research outputs and tools from Objective 3 will be developed into extension material in the latter stages of the project to be incorporated within the extension programs of Objective 1.

Objective 4: To support smallholder dairy-beef farmers to engage in more profitable value chain opportunities (25 % effort, addressing RQs 5 and 6)

4.1: Identify & establish 'farm business groups' (FBG) with the potential to engage further in developing alternate pathways to market

4.2: Build the capacity of FBG to enable them to more effectively engage with the value-chains they supply

4.3: Support FBG to initiate and evaluate value-chain enhancement opportunities

4.4: Document and evaluate the engagement and subsequent impact on the FBG and the value-chains they engage with

Research outputs describing value chain engagement activities in this objective will be developed into extension material in the latter stages of the project to be incorporated within the extension programs of Objective 1.

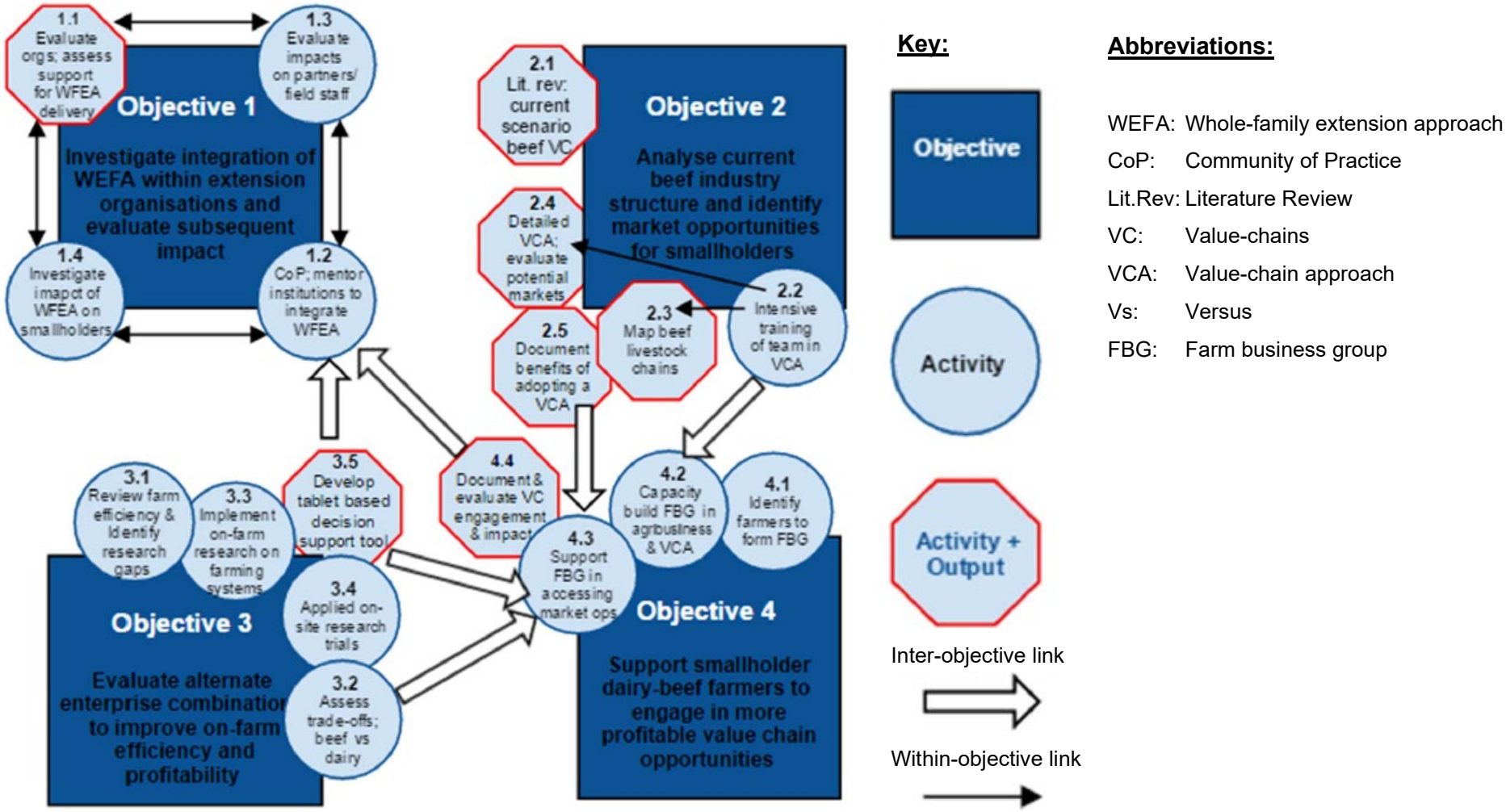
See Figure 1 (next page) for a diagram of these objectives and how they link together.

Objective 5: To support the uptake of key lessons from Dairy-beef extension and value-chain research into policy discussions (at both National & provincial Government levels) to improve sustained implementation of the whole-family extension approach (25 % effort in final year of project timeframe)

5.1: Establish and facilitate a 'livestock policy' discussion group to address challenges, needs and opportunities in the Pakistani livestock extension system (including private & government organisations).

5.2: Develop a discussion paper describing extension policy in Pakistan including; the role of private and public funding in service provision; extension support for mixed crop-livestock systems; and the implications for future agricultural development projects.

5.3: Develop recommendations which include how the insights from the project can inform and contribute to policy; based on the advice and expertise of the livestock policy discussion group.



Abbreviations:

WEFA: Whole-family extension approach
CoP: Community of Practice
Lit.Rev: Literature Review
VC: Value-chains
VCA: Value-chain approach
Vs: Versus
FBG: Farm business group

Figure 1; Flow chart highlighting the different Objectives and Activities and which are linked together (depicted by arrows) in terms of outputs and timelines. Objective 5, not included in this diagram, is essentially taking lessons from Objective 1, Activity 3.2 and 4.3 and sharing these in an overarching policy level discussion group to establish recommendations pertinent to National and provincial partners.

5 Methodology

5.1 Investigating interventions to support the integration of WFEA

Objective 1 investigated the support necessary to integrate the whole-family extension approach (WFEA) within the current dairy-beef value chain and evaluate the impacts on smallholder farming families. To conduct this investigation, Objective 1 included three main methodological components:

1. Analysis of the Pakistani agricultural extension and advisory system.
2. A training and mentoring program.
3. Evaluation of the impacts of the WFEA program for farmers.

In this section of the report, we give a broad overview of the Methods relating to Objective 1. Following this, we define and outline different research components, their associated activities (from the project proposal which are also reported against in Section 6.1.1; Outputs/Milestones) and the outputs (reports or papers) that these activities have yielded (see Table 5.1-1). The results section of this report (Section 7.1) refer back to these general Methods, but also highlight the specific data collection used for different research papers.

The Whole Family Extension Approach

Many of the research components in Objective 1 utilised the WFEA, which was developed during a previous project (LPS/2010/007) and applied in the Punjab and Sindh provinces since 2012. The WFEA aims to include all men, women and youth that participate in dairy and beef livestock rearing by offering extension that is adapted to their particular roles within the family. A central element of the WFEA is the empowerment of women, which is supported in this program by improving the integration of women into market-driven enterprises.

Typically, women are responsible for milking, feeding, cleaning, oestrus detection and calf rearing, men are responsible for agricultural farming operations, and children contribute to calf rearing. Due to the different information needs of family members, training is offered to men, women and youth in separate sessions that focus on those aspects of farm operations for which they are each responsible. This training was also designed to be a prompt for informal discussion of farming practices among participating family members. Research has shown that success can be achieved when implementing the WFEA, including on-farm practice change, leading to overall productivity increases of up to 25-30% on smallholder dairy farms (Warriach et al. 2018). This highlights the value and opportunity of this WFEA when working towards enhancing Pakistan's agricultural innovation system (AIS).

Table 5.1-1: Project components, associated project activities, data collection methods and associated research publications for Objective 1 to address research questions 1 and 2.

Methodology section	Project component	Associated project proposal activity	Data collection methods	Paper(s) in which this data was used or where discussion ideas come from (Reported in Appendix 11.1.1)	Results section
5.1.1	Analysis of the extension system	1.1	Desktop review	*Paper 1: Pakistan's livestock extension; understanding the pluralistic nature of a complex system*	7.1.1
			Interviews with employees of organisations participating in CoP	*Paper 2: Perspectives and insights on governing agricultural advisory services in smallholder dairy-beef farming in Pakistan*	7.1.1
5.1.2	Community of Practice (CoP) workshops	1.1, 1.2	Facilitated discussions	*Paper 2: Perspectives and insights on governing agricultural advisory services in smallholder dairy-beef farming in Pakistan*	7.1.1
	Advisor training workshops	1.2, 1.3	Interviews with farm advisors participating in program	*Paper 3: How a novel intervention in Agricultural Extension and Advisory Systems supported productivity and profitability of Pakistani smallholder dairy/beef farmers in Punjab and Sindh provinces*	7.1.1
			Facilitated training workshop discussions	*Paper 4: Strengthening the role of innovation brokers in the livestock advisory services system of Pakistan*	7.1.2
	Field follow-up visits	1.3	Interviews with farm advisors participating in the training program; project team notes about visit	*Paper 4: Strengthening the role of innovation brokers in the livestock advisory services system of Pakistan*	7.1.2
5.1.3	Household and village survey	1.4	Interviews with village head/leader to understand village context & Interviews with farming families (men and women from households)	*Paper 5: The impact on smallholder livestock households of the WFEA implemented through different farm advisory service providing organisations.*	7.1.2
				Paper 6: Gendered impacts of Whole Family Extension Approach on the smallholder dairy farmers of Pakistan	7.1.2

Conceptual framework for the different research components

The research components and papers outlined in Table 5.1-1 have broadly used the conceptual framework proposed by Birner *et al.* (2009) to frame the ideas, and components operating across agricultural extension services within Pakistan. The Birner *et al.* (2009) conceptual framework extension services by separating components in the extension chains into governance structures, capacity, management, and advisory methods. By creating an impact chain in the conceptual framework, Birner *et al.* (2009) seek to provide a foundation of creating, designing and facilitating extension services. They argue that through extension models, there is a necessity to acknowledge and appreciate the diversity of smallholder farmer practices and needs and to adopt services accordingly.

The Birner *et al.* (2009) framework, see Figure 5.1-1, lays out the key advisory systems within agricultural extension services. By distinguishing between governance structures, capacity, management and advisory methods, Birner *et al.* (2009) put forward assessment pathways for extension services and to assist in research approaches. This framework has been adopted by a range of studies (see Prager *et al.* 2017; Nettle *et al.* 2017) to analyse and evaluate the impact of pluralistic services.

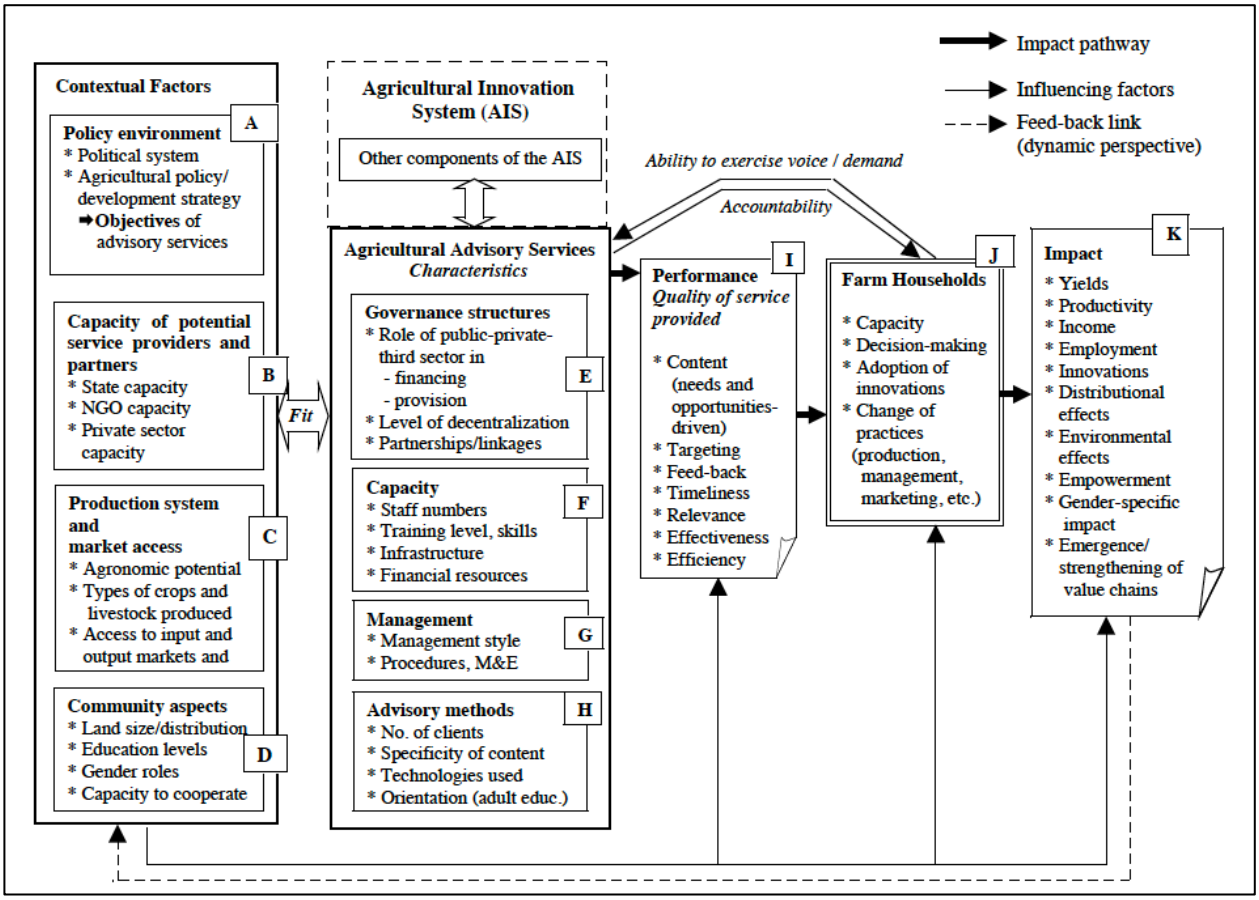


Figure 5.1-1: Conceptual framework for agricultural advisory services (source; Birner *et al.* 2009, p. 344).

Contextual factors which incorporate boxes A-D include the range of structural and governance systems in place, such as policies, markets, and service providers. The AIS, which includes boxes E-H incorporates the advisory governance and capacity structures, such as organisational staff numbers, methods and partnerships. Boxes I-K show the local accountability and impact. The different studies outlined in Table 5.1-1 and reported on in the Results section of this report (Section 7.1) aim to understand different components

outlined in this framework and address gaps or challenges that have been highlighted within them.

5.1.1 Analysis of the Pakistani extension system

The Pakistani agricultural extension and advisory system was examined through two research processes that address Activity 1.1. Firstly, the organisations working in the livestock extension sector across Pakistan were identified during a desktop review that took place in 2018 (see Section 7.1.1). From 60 organisations working in the extension sector, 42 provided services related to livestock in Pakistan.

The following criteria was used for the selection of extension providing organisation:

- Working with smallholder farmers.
- Having the field staff/extension worker for the extension activities
- Willing to be part of extension related research activities
- Open to share the research data/information

Organisations were grouped into one of four categories: government programs, non-governmental organization (NGO), research-based institutions, and private businesses. Each organization's scope, methods of providing extension, team size and farmer interaction were recorded.

The concept of AIS was used as a lens through which we considered the governance of agricultural extension and advisory services in Pakistan. The term AIS emphasises the interaction and interdependence of the networks, institutions and systems that generate agricultural innovation. This research followed the framework of Birner *et al.* (2009) to support analysis of the agricultural extension and advisory system (see Figure 5.1-1), which forms a sub-system of the Pakistani AIS. The case study of agricultural extension and advisory services governance in the Pakistani smallholder dairy/beef farming was based on semi-structured interviews with employees of key extension and advisory service organisations participating in the community of practice and data collected at the community of practice workshops. The Birner *et al.* (2009) framework allowed inclusion of not only characteristics of agricultural advisory services in the analysis, but also contextual factors. The research paper outlines the key challenges and opportunities for governing agricultural extension and advisory services to provide effective support for increased productivity and profitability to smallholder farmers.

5.1.2 Training and mentoring program

The training and mentoring program sought to build the capacity of farm advisors and build a community of practice among those advisors and organisations involved in delivery of the WFEA as part of Activities 1.1, 1.2 and 1.3 (see Section 6.1.1 for simplified reporting of Outputs/Milestones). The components of this program use applied social science with the aim of improving the productivity of smallholder farmers. Both participatory and action research were a part of the program, shaping how it was carried out. Participating farm advisors and management of their organisations collaborated on the design of the advisor training and the WFEA more broadly through their reflections shared with the project team and other participants at different stages of the program.

Participants in this program came from organisations that met three criteria:

1. Provided farm advisory services or were linked with smallholder farmers.
2. Employed advisory service/extension staff.
3. Had a goal to improve the livelihoods of smallholder farmers.

The project team from the University of Veterinary and Animal Sciences (UVAS, Lahore) established collaborative partnerships with 22 organisations from Pakistan's livestock advisory system. Where possible, organisations nominated at least one man and one woman to participate in the training program and community of practice workshops to align with the WFEA principles. Farm advisors who were part of this program had diverse backgrounds in advisory services, with varied prior technical knowledge.

Farm advisor training workshops

The training program applied a 'programmed learning' approach (Murray-Prior 2013) to 'develop and deliver specific knowledge and skills'. This training focussed on supporting participants to understand the WFEA and build capacity around engaging and communicating with smallholder livestock farmers, with the aim to improve productivity and profitability in smallholder dairy and beef production".

The farm advisors took part in a training program which consisted of a three-day workshop every six months (from early 2018 until early 2022, modules and further details of this training program are linked to in the Achievements/Milestones document). The workshops included a broad range of technical livestock information covering the whole-farming system and – to support the integration of the WFEA into the extension programs of the collaborating organisations – an array of community development and engagement principles were also included. Hence, the training workshops incorporated activities to help participants understand social mobilisation, gender mainstreaming, participatory communication skills and participants were able to engage in a collaborative learning environment where individuals reflected on their own experiences and challenges. All training interventions were organised and facilitated by the project team from UVAS, who are Pakistani nationals with expertise in veterinary sciences, livestock farming systems and farmer extension.

Semi-structured interviews were conducted with two extension officers from one organisation of each type (government, NGO, private businesses and research institutions). Thematic analysis of interview reports was conducted to allow identification of the design features of the WFEA program that support productivity and profitability of Pakistani smallholder dairy/beef farmers in Punjab and Sindh provinces.

Community of practice

In September 2017, 31 participants from 22 Pakistan-based extension organisations were engaged in an inception workshop to demonstrate the WFEA and share the experiences and success stories from earlier Australian Sector Linkages Program (ASLP) projects. Based on the workshop discussions, participants identified key challenges faced by participating organisations during their extension work. Following the inception workshop, the project team identified mutual benefits for organisations who would be involved, with 21 MoUs signed between extension organisations and the Dairy-Beef Project, to provide training and mentoring support to these extension organisations.

A series of community of practice workshops were established including both senior management and extension staff from these organisations. A community of practice is a group of people who learn about their shared interest and develop associated skills through regular interaction (Wenger 1998). In addition to this interaction, the community of practice workshops also applied participatory methods (Kumar 2002) to engage stakeholders in discussions on small holder dairy and beef farming in Pakistan. The community of practice workshops were established to: improve understanding of the WFEA and its impacts including institutional learning; provide a place/opportunity for sharing of experiences with the WFEA; explore the value and challenges to organisations of incorporating the WFEA; and support organisations to plan integration of the WFEA.

Extension heads and managers participated in up to four annual community of practice workshops taking place between February 2019 and March 2022. Representatives from

26 organisations participated at these workshops. The workshops included project updates, panels with farm advisors or organisation heads discussing their experience with the WFEA, presentations on recent research by the project team, facilitated breakout sessions to discuss the impacts and integration of WFEA in their organisation as well as the research presented and networking opportunities.

Field follow-up visits

Field follow-up visits were conducted by the project team every six months in-between the training workshops to further support and emphasise the information provided to farm advisors during the training workshops. During these follow-up visits, project team members provide one-to-one mentoring to the farm advisors which included discussion of strategies to support effective farm advisory services and monitoring of implemented activities relating to the WFEA.

5.1.3 Household impacts survey

The methodology for the household impacts survey is associated with Activity 1.4 (see 6.1.1). Both primary and secondary data was collected for this research. Primary data was collected through key-informant interviews, group discussions and semi-structured household interviews across four sites. Secondary data was collected through a literature review and other online and offline sources.

Key informant interviews (4) were conducted with the extension officers trained in WFEA and who were responsible for training and extension activities across the four study sites. The main information collected from them included – number and frequency of trainings conducted in a year, main topics on which the trainings were conducted, number of villages where the trainings were conducted, criteria for selection of the participants, differences in participation of female and male members in trainings, practices adopted and challenges/barriers to adoption. Group discussions (8) were conducted across the four villages, separately for male and female farmer groups to collect village level information (main economic activities in the village, average land holding, major castes, civic amenities in the village). Personal interviews were conducted at household level with one female and one male member of the family (who were responsible for cattle in the household) across the four villages. A total of 72 farmers were interviewed (50% female) with a schedule across 4 villages (2 villages from Punjab and 2 villages from Sindh province).

The purpose of the interviews was to collect data on the impacts of extension trainings on individual knowledge & skills, practice change, production, social benefits, economic wellbeing and technical skills of the female and male farmers.

Further details of the methods and results of these two papers evaluating household impact can be seen in the Results (Section 7.1.2) of this report.

References:

Birner, Regina, Kristin Davis, John Pender, Ephraim Nkonya, Ponniah Anandajayasekeram, Javier Ekboir, Adiel Mbabu, David J Spielman, Daniela Horna, and Samuel Benin. 2009. "From best practice to best fit: a framework for designing and analyzing pluralistic agricultural advisory services worldwide." Journal of Agricultural Education and Extension 15 (4):341-55.

Murray-Prior, R. (2013). "Developing an agricultural innovation system to meet the needs of smallholder farmers in developing countries." Extension Farming Systems Journal 9(1): 258.

Nettle, Ruth, Laurens Klerkx, Guy Faure, and Alex Koutsouris. 2017. "Governance dynamics and the quest for coordination in pluralistic agricultural advisory systems." In.: Taylor & Francis.

Prager, Katrin, Rachel Creaney, and Altea Lorenzo-Arribas. 2017. "Criteria for a system level evaluation of farm advisory services." Land Use Policy 61:86-98.

Warriach, H.M., Wynn, P.C., Ishaq, M., Arif, S., Bhatti, A., Latif, S., Kumbher, A., Batool, Z., Majeed, S., Bush, R.D., Pasha, T.N. and McGill, D.M. 2018. “Impacts of improved extension services on awareness, knowledge, adoption rates and perceived benefits of smallholder dairy farmers in Pakistan.” Animal Production Science, 59(12): 2175-2183.

5.2 Value-chain capacity building and current beef market opportunities

5.2.1 Activity 2.1; Review of current dairy-beef sector literature

Completed by; Lahore University of Management Sciences, September 2017

In the context of the Dairy-Beef Project there were 3 significant reports identified in the review of literature conducted by the Lahore University of Management:

1. Bradfield, M. & Ismail, T. (2012). Meat Value Chain Assessment of the Livestock Sector in Pakistan. USAID Agribusiness Project
2. Batti, A & Arocha, M. (2014). Bovine Meat - Value Chain Competitiveness Assessment. USAID Agribusiness Project
3. Competition Commission of Pakistan, (2016). Meat Study Report.

The main points highlighted in these reports were:

- The demand of meat has been growing both in the domestic and the international markets. The main factors responsible for this demand are increase in population, consumer preference for meat, and higher per capita income.
- Meat production is considered a secondary activity when compared to crops and milk production, Consequently, the meat market is unorganized and underdeveloped.
- There are four principal industry value chains (see Figure 11.2-1 in Appendix 11.2.1):
    - Road-side vendors
    - Retail butcher shops
    - Export
    - Eid
- Small-scale farmers rely on the middlemen due to lack of integration between livestock value chain and weak farm-to-market linkages.

The reports also identified the important factors that were inhibiting the development of the meat sector, such as poor infrastructure and the lack of effective health and hygiene standards and offered a range of policy options to address these deficiencies.

The recommendation most relevant to the Dairy-Beef Project was Recommendation 6 of the Competition Commission’s report:

> *The government should train farmers at grassroots level where most of the meat production takes place. Small workshops should be conducted in villages to train rural farmers about animal breeding, disease control, feed and fodder and animal sale.*(p.35)

5.2.2 Activity 2.2: Conduct an intensive training program in value chain analysis (VCA)

Dr Tony Dunne conducted three training workshops (between 2016-2018) to build the capacity of the UVAS project team to understand the VCA approach and evaluate beef value chains to identify opportunities for smallholders. The original plan was to engage update to five external researchers to be part of this training program. Two external organisations were involved in the initial training, but they showed little interest in being involved in a continuous process or collecting field data. Due to this, the focus of the VCA training component was on the Dairy-Beef Project team.

A summary of the major training activities can be found in Table 5.2-1. The pedagogical approach adopted in these training activities was experiential – *learning by doing and reflection* (Figure 5.2-1).

The Dairy-Beef team produced three reports as a result from these training activities that are discussed in Activity 2.3 relating to a rapid value-chain assessment (Section 11.2.3) & Activity 2.4 a detailed value-chain assessment (Section 11.2.4).

Scaling out the capacity building program

As mentioned earlier, the project had originally hoped to engage and train potential value-chain research collaborators to be involved in the project. Despite attempting to do this at the start of the project, the collaborators at that time were not interested in continuing with the training and subsequent expectations around field work.

To address this situation, a value chain mentoring program was developed for partner organisations who were involved in Objective 1.

The first stage in this process was a two-day ‘awareness’ workshop which was attended by 28 individuals (18 males, and 10 females) from 12 different partner organisations.

The objectives of the workshop were:

1. To provide farm advisors with an understanding about principal concepts of beef value chains
2. To provide an overview of the steps of how to identify and link smallholder farmers to profitable market opportunities.
3. To highlight success and challenges of working with smallholder farm business groups

Following this workshop, partner organisations were invited to participate in a 6-month mentorship program where nominated individuals from their organization would be trained and supported in their application of the VCA approach to assist smallholder livestock farmers to identify and engage in more profitable beef value chain opportunities. Four partner organisations accepted this invitation and 13 individuals (7 males, and 6 females) participated in a walking the chain workshop held in Lahore in October 2021.

The objectives of this workshop were:

1. To expose farm advisors to beef value chain activities (plate to paddock) to build the understanding of the walking the chain concept.
2. To facilitate the farm advisors to understand the role of different beef value chain actors, including:
    a. Risks which these beef chain actors take.
    b. The value they add.
3. To develop the capacity of farm advisors to:
    a. Identify and assess value chain opportunities for smallholder farmers.

b. Link smallholder farmers to the profitable market opportunities.

The original intention of the mentorship program was that the participants would return to their organizations and engage with local livestock farmers in applying the principles of VCA. The Dairy-Beef team would keep in regular contact with the participants and provide them with guidance and support. Unfortunately, the participants struggled to engage with farmers as planned and the Dairy-Beef team had to engage more actively with individual participants.

This outcome reinforced two points that had emerged from the initial capacity building program for the Dairy-Beef team:

1. Capacity building process is a slow and intensive process.
2. Awareness of the VCA approach is relatively easy to achieve, the understanding and ability to apply the necessary skills involved is a more difficult process.

Table 5.2-1: Schedule of capacity building workshops and activities.

Activity	Focus
Introductory Workshop (April 2016)	Basic marketing and value chain analysis principles Basic principles of undertaking qualitative research Field work to reinforce these principles
Activity 1 (February 2017)	Revision of basic value chain analysis principles Fieldwork: 'Walking the Chain' Analysis and presentation of results.
Activity 2 (April-June 2017)	Fieldwork: Rapid Value Chain Assessments of 2 District beef value chains
Activity 3 (October 2017)	Review of Rapid Value Chain Assessment Reports Identification of potential new market opportunities for smallholder farmers Planning of fieldwork: detailed Value Chain Assessments of potential new market opportunities
Activity 4 (November 2017-February 2018)	Fieldwork: Detailed Value Chain Assessments of potential new market opportunities
Activity 5 (February 2018)	Review of Detailed Value Chain Assessments Identification of data deficiencies Establishment of a timeframe to complete Activity 4
Activity 6 (March 2018-December 2018)	Finalization of reports: 1. District Rapid Value Chain Assessments 2. Preliminary investigation of the Eid-ul-Azha market 3. Detailed Value Chain Assessments of new market opportunities.

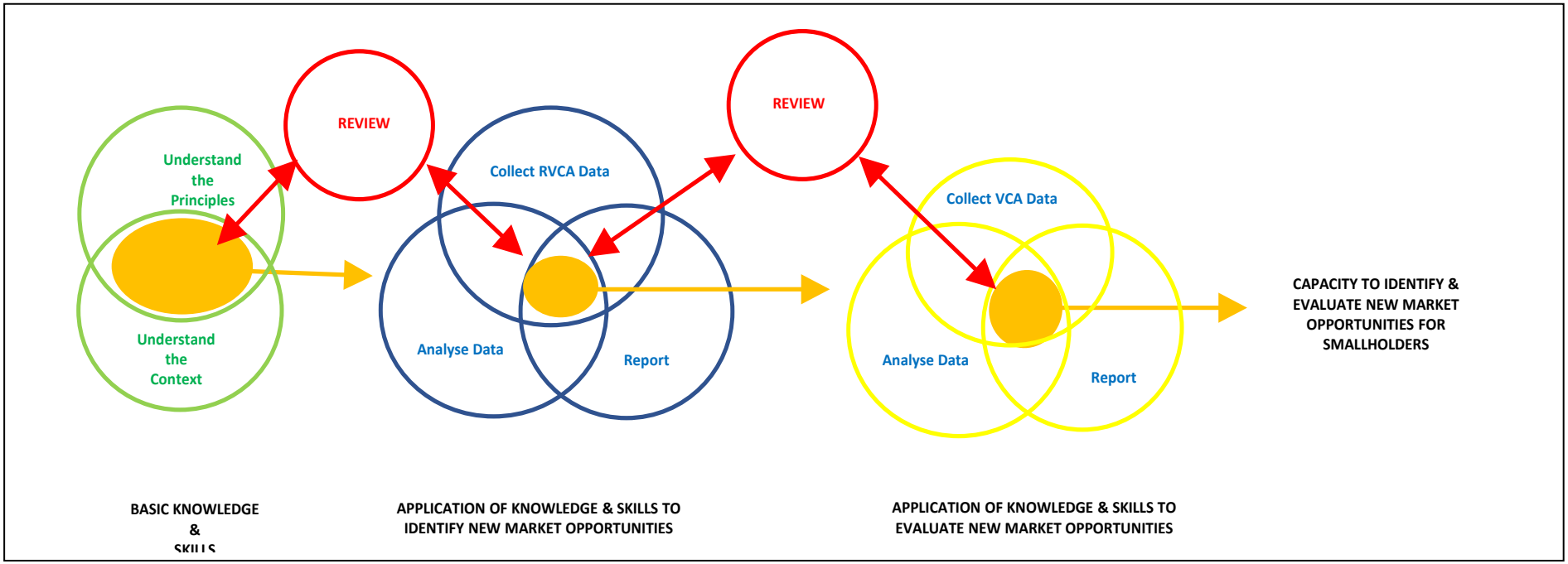


Figure 5.2-1: The Capacity building process. The pedagogical approach adopted in these training activities was experiential – *learning by doing and reflection.*

5.3 Applied research initiatives

A series of 'Research Focus Group' workshops to discuss on-farm research priorities to improve the farm efficiency (productivity and profitability) of smallholder dairy-beef farmers in Pakistan was facilitated by the Dairy-Beef Project. These workshops involved academics, practitioners and farmers to prioritise ideas based on farmer needs and the likelihood of impact on farmer-profit. Research priorities were identified and appropriate University partners were pursued to carry out the relevant on-site (as part of Activity 3.3) or on-farm work (as part of Activity 3.4).

This section highlights the Methods of two different research components that were part critical part of this objective and linked to other Objectives of the project. Details of the other studies and applied research that was carried out in this objective can be seen in Appendix 11.3. The Results for these two components can also be seen in Section 7.3.

5.3.1 Assess trade-offs for rearing calves for beef

Aim: This research aims to understand these trade-offs for rearing beef animals on smallholder dairy farms in Pakistan and carry out the sensitivity analysis to provide options to support the decision-making process for farmers to increase their household profitability.

Objectives:

- To investigate and compare growth rates of calves through building simple growth models based in local-research data in Pakistan.
- Establish evidence-based profit table to help evaluate the trade-offs to support decisions for farmers interested in assessing their own farm management and market options.

Description of data

Growth rate of buffalo and cattle calves

Growth rate was based on previously run calf rearing trials in Pakistan that had be coordinated by the Pakistan Dairy-Beef Project team at the University of Veterinary and Animal Sciences, Lahore. Data of 16 buffalo calves were obtained from the Pakistan team which compared the growth rate buffalo or cattle milk treatment before weaning and hay or fresh fodder post weaning, the treatment is summarised in Figure 5.3-1.

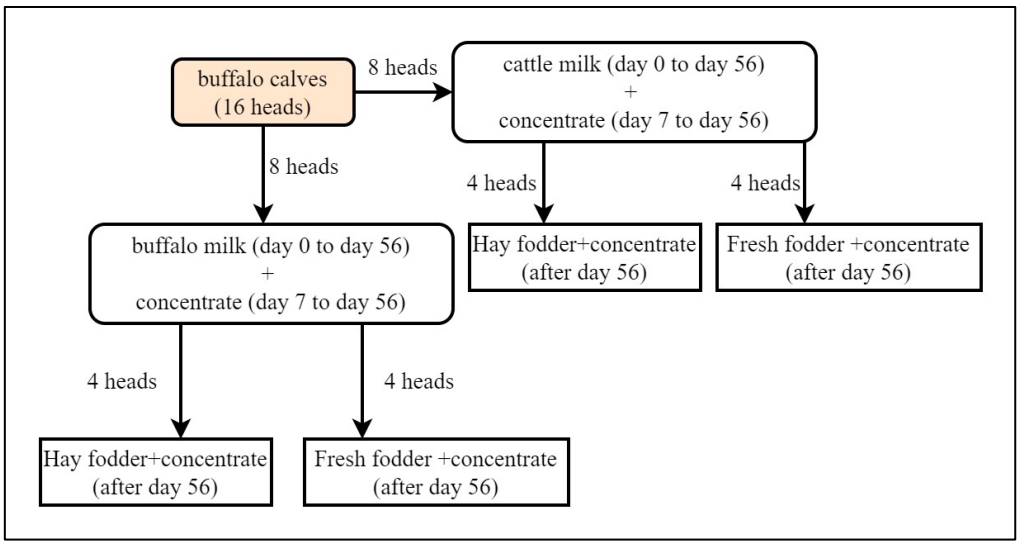


Figure 5.3-1: The treatment of 16 heads buffalo calves from day 0 to day 98.

The treatment and growth data of cattle calves were collected and assumed by the data from Bhatti *et al.* research paper (2011) which assessed growth rate and pre-weaning diets.

The subsequent data analysis and assumptions for this study are based on the growth rates obtained from these data sets as 'best practice' recommendation targets.

Following processing and analysis would be based and assumed on these buffalo and cattle data:

- For rearing the buffalo, the traditional treatment would be assumed as: 2L buffalo milk per day before weaning (day 56) and fed hay fodder and concentrate after weaning. The hay and concentrate intake would be same as the 'best practice'.
- For rearing the cattle, the traditional treatment would be assumed as: 2L buffalo milk per day before weaning (day 84) and fed TMR after weaning. The TMR intake would be same as the 'best practice'.

The local beef market options in Pakistan

The types of livestock buyers, relative offering price and specifications for the smallholder farmers were collected by the Pakistan team using a semi-structured interview to understand. These values were used to compare the local market options for selling animals on a per kilogram liveweight basis in subsequent data processing and analysis.

The cost of calves rearing and treatment

The price of milk type, concentrate, fodder type, starter ration, TMR (total mixed fodder) and relative fixed cost (labour, vaccine etc.) were provided by the Pakistan team based on farm level gross margin activities (see below).

Variable Costs	price
Buffalo Milk Cost (PKR/L)	50
starter ration (PKR/kg)	20
Price Concentrate (PKR/kg)	35
price TMR (kg)	20
Price Hay Berseem (PKR/kg)	4

Other Assumed Costs	price
Labour	500
Medicine	100
Bedding cost	20
Utility bills	200
Miscellenous	100

Data processing

Various factors (such as birth weight, milk type, forage type) influencing the growth rate of calves would be analysed and compared in the way of linear model in R. The traditional and recommend ('best practice') treatment on weight gain visualising growth according to time and treatment. The cost and profit of buffalo and cattle in different market options and selling days would be processed in Excel in the form of basic gross margins calculations using tables.

Data analysis

The results would be presented in the form of table and figures (from Excel). The sensitivity analysis will then be conducted to provide clear comparisons evaluating the impact of different factors (milk market price and feeding regime) on the overall profit of the smallholder famers.

To see the results of this analysis, please see 7.3.

5.3.2 Digital extension tools to support farm advisors

The project has co-developed two digital extension tools;

1. on animal nutrition; called the 'Ruminant Nutrition Guide' utilising the project's extension materials and a thorough literature review of 'nutrition recommendations' from the research for development space.
2. on 'beef market options' given location, calf-rearing practices and animal age based on research and data collected in Objective 2 (market options Activities 2.3 and 2.4) and Objective 3 (Activity 3.2) of this project.

Both applications were built in CommCare by the UVAS project team, with support from the project leader and students at the University of Melbourne. The first application underwent a rigorous study to assess the acceptance and utility of the digital extension tool. A brief overview of the Methodology can be found here.

App Development

The following is an account of the design and development process for the Ruminant Nutrition Guide (RNG) app tool (please note – that a similar process was undertaken for the for the 'Beef Market Options' too, except the literature review step). In the first stage of the design process, findings from the review of the literature for feeding recommendations applicable to crop livestock systems in Pakistan, as outlined in the literature review of this paper, were compared against existing extension material in the form of fact sheets and an English translation of several extension modules that were applicable to livestock feeding. This comparison was done to triangulate findings from the review and to determine the tone and amount of detail that was appropriate for the digital extension tool.

Based on this comparison a paper-based outline of the tool was constructed, themes of digestibility, balanced feeding, and targeted feeding were also established as communication objectives of the tool.

An evaluation of the paper-based design was undertaken by an experienced extension officer and researcher who provided feedback. Following a review of the design the components of the design were translated into CommCare, a digital data collection and display platform which supports the creation of application technologies accessible via tablets or smartphones. This platform was chosen for its existing presence within the Dairy-Beef Project where it had been used previously to generate an app communicating calf-management recommendations. However, the app primarily used by the team were primarily for data collection. Familiarity with the platform and the format of Commcare-generated apps meant that the tool was 'technically' accessible and Dairy-Beef team members were familiar with its capabilities and could comment on them (Van Meensel *et al.* 2012). CommCare was also suitable for this research due to its intuitive app-design interface that did not require extensive IT skills to generate.

Once the tool had been generated as an app within the CommCare project space this prototype was tested with another Dairy-Beef team member. Here changes were made to the structure of the tool. Feedback relating to the length of the tool led to it being broken down into two modules. The first module addressed digestibility and balanced Feeding and the second, targeted feeding.

At this stage in the development cycle, the tool underwent testing by extension workers as part of an investigation into how the tool might support communication of ruminant feeding messages. This participatory evaluation took place as part of 'lab testing' for the verification and validation of the tool. Verification here refers to building the 'right' tool, while validation, which builds on verification, ensures that the stakeholders, both developer and user, needs are met (Van Meensel *et al.* 2012).

Data collection

Structured interviews were conducted with 22 advisors in September and November of 2020 as part of the participatory co-development of the tool. Interviews are a well-established method for generating rich qualitative data for understanding individuals' real-world experiences in under-explored contexts such as that of extension systems in Pakistan (Mackrell, Kerr and von Hellens 2009; Shibl, Lawley, and Debuse 2013).

The 22 advisors were sampled from two cohorts based on organisational background. Cohort A was made up of the seven members of the UVAS Dairy-Beef Project team and two members the Small-Ruminants Project team, both being research for development projects. In addition to strong organisational ties this cohort was defined by their experience with the software platform and app interface used for RNG. Snowball sampling from this first cohort was then used to recruit thirteen participants for Cohort B which consisted of farm advisors, university lecturers and NGO staff, all collaborating partners of the Dairy-Beef Project

Data analysis

This research employed thematic analysis, drawing on the concepts from the Technology Acceptance Model and related literature by which the data was coded (Bryman 2016). Combinations of constructs, intrinsic and extrinsic to the digital tool, act on the constructs of Perceived Ease of Use (PEOU) and Perceived Usefulness (PU). Through the thematic coding of the qualitative data in this study, the constructs that emerged were consistent with those in the technological, organisational, and personal contexts from Mir and Padma's (2020) framework in their investigation of agricultural decision support systems.

For further details of the Results/Conclusions from this work, please see Section 7.3.3. Further details on the paper that has been submitted for publication can be found in Appendix 11.3.5.

5.4 Establishing and supporting farm business groups

FBGs were established via a participatory, farmer-led approach which was facilitated by local project staff. These groups were then supported to evaluate and initiate value-chain enhancement opportunities. For details on this research component, please see the Results (Section 7.4) or Appendix 11.4 of this report.

The methodology for this follows (see Section 5.4.1) and then the major activities for the implementation of this can be seen Section 5.4.2.

5.4.1 Methodology for FBG

Selection process

Village selection

Purposive village selection was used to preferentially select villages with the greatest potential for effective engagement in the beef value chain during this pilot phase of establishing FBGs. Villages were initially selected based on their previous involvement with the Agriculture Sector Linkages Program (ASLP) dairy project between 2011 and 2015. Thirty-four villages (18 in Punjab and 16 in Sindh) were compared based on the project team's existing knowledge, including prior farmer engagement and adoption, and the resources within the community. Fifteen villages (7 in Punjab and 8 in Sindh) with the greatest engagement, adoption and resources were shortlisted.

Farmer focus group discussions (FFGDs) were held in these 15 villages with men and women separately. An adapted framework (Adapted framework used for village selection) was used to systematically analyse the qualitative data recorded to facilitate an assessment

of which villages would be most suitable for formation of FBGs. Key criteria included interest, capacity and resources in fattening and marketing cattle, involvement of women in dairy-beef farming, and cooperative relationships within the village and with value chain actors. One village (45GD in Punjab) was selected as the first village to pilot the FBG formation process, with an additional six villages (3 in Punjab and 3 in Sindh) selected for future FBGs.

Calf competitions were held in these six villages to engage with farming families and the community, and to promote changes to feeding practices to enhance calf production. The level of participation and interest in this activity was used to finalise the village selection, and maintain connections with the villages whilst the pilot phase was being conducted in 45GD. Ultimately, a total of ten FBGs were established in three villages in Punjab (45GD, 77D, 96D) and two in Sindh (Sidique Narejo, Beero Lunjwani). In each village, a separate men's and women's group were formed.

Within village self-selection by farmers

Smallholder dairy cattle farmers were encouraged to self-select for participation in the FBGs within their village. 'Selection pressure' was applied through engaging farmers in a series of activities to develop their cattle fattening and marketing capabilities, allowing farmers to determine their interest in becoming continuing their involvement with the project activities. Farmer needs assessments were carried out in each village with men and women separately, followed by needs-based extension visits. Subsequent extension visits focussed on the needs raised by each group. Initial extension visits firstly focussed on husbandry, health, and nutrition needs raised to support farmers to raise heavier calves more efficiently. This also allowed project staff to develop trust with the participants, that their needs were being addressed and assisted to help the group develop ownership over the FBG. Later extension activities then focussed on farm business management, such as using gross margins. Finally, farmers were provided with the opportunity to visit beef value chain actors to develop their understanding of the market system and to develop more effective linkages with their markets. This final activity required the greatest commitment from participants and therefore increased the 'selection pressure' applied for farmers to self-select to become a member of an FBG. Addressing the health, husbandry and nutrition needs raised first, also helped to focus the FBGs on the marketing and value chains aspects of the later extension activities.

Evaluation of value chain enhancement opportunities

Following the visits to beef value chain actors, farmers were supported to evaluate the market opportunities identified. During this process and all extension activities, the necessity of collective action to take advantage of the opportunities was discussed. The concept of forming an FBG was introduced to farmers, and the process of formalising member participation and planning a marketing approach was undertaken. Farmers formalised their FBG by setting rules and regulations for the group, finalising group members and roles/ responsibilities for each of them [45 GD, 96D, Beero Lunjwani, Sidique Narejo (men only)].

During formal group formation, the marketing strategy for each FBG was initiated. Farmers confirmed whether new market opportunities identified during their visits to value chain actors were economically and logistically viable. This included confirming the specifications of the market opportunity and completing an evaluation of the opportunity. The FBG in 45 GD was used as a case study for developing a detailed marketing strategy which was then adapted for the subsequent villages (See Appendix 11.4.10).

Evaluation of engagement and subsequent impact

An FBG member survey was carried out at the conclusion of the FBG activities to capture detailed practice changes and impacts, enabling comparisons between FBGs and their members. A subsection of members from each FBG were interviewed; three members from

each FBG with a total of 30 members. Members were selected for interview based on their level of activity within the FBG. For each FBG, one very active member, one moderately active member and one less active member were selected. In addition, reflective sessions were conducted at the end of each visit by the project team with each participating village. This was used to evaluate engagement of FBG members on a regular basis, allowing for activities to be adapted as indicated and for the project team to subjectively assess the success of each FBG.

5.4.2 Activities

Establishment of Farm Business Groups

Initial village selection based on previous interaction

The project team initially considered farming communities that had previously been involved in the ASLP project (between 2011 and 2015) for engagement in this objective. Engaging with previous project participants helped to ensure that potential members were already familiar with each other, and with project staff. Through their engagement in the ASLP project, these villages had also already been exposed to extension which promoted improved animal husbandry practices. Therefore, these villages were also more likely to be producing better quality animals than villages that had not participated in the ASLP Dairy project. The ability to produce a higher quality animal to sell is essential to effective engagement in the beef value chain. Therefore, village participation in the ASLP Dairy project was considered a prerequisite for village level selection.

A total of 18 villages in Punjab and 16 villages in Sindh, which had participated in the ASLP Dairy project were initially considered. These villages were assessed based on the project team's existing knowledge of the village, including on prior farmer participation, adoption of extension messages from the ASLP Dairy project and the resources within the community. The project team listed these factors as positives or negatives for each village and those villages that ranked highest were shortlisted for the next step of the selection process. Seven villages from Punjab and eight villages from Sindh were shortlisted for participation in the next step of the village selection process.

Second level village selection based on discussion groups

Further selection from the 15 shortlisted villages registered under the ASLP Dairy project occurred via analysis of qualitative data collected from farmer focus group discussions (FFGDs). The key objective was to identify villages suitable for development of FBGs. A framework was developed and used to assess the most likely villages where FBGs would be successfully established and beneficial to the participant farmers (Figure 5.4-1: Adapted framework used for village selection). This framework included several important factors which were used to assess the likelihood of success of the FBG based on evidence from the literature review. This included access to resources, and the motivations, culture and skills of the group and its members. A series of questions were used to guide the semi-structured FFGDs within the 15 shortlisted villages based on the framework described above (Appendix 11.4.7; Figure 5.4-1).

Responses to these questions were assessed to determine which villages best met the key criteria of interest and capacity in fattening and marketing cattle, adoption of messages and cooperation with the ASLP Dairy project, and involvement of women in dairy-beef farming. The qualitative data from the FFGDs was used to rank villages based on the extent to which they met these key criteria. For example, a village with greater resources such as more cattle and better access to feed received a higher ranking because it was more likely that they would be able to fatten a greater number of quality animals to market in the value chain.

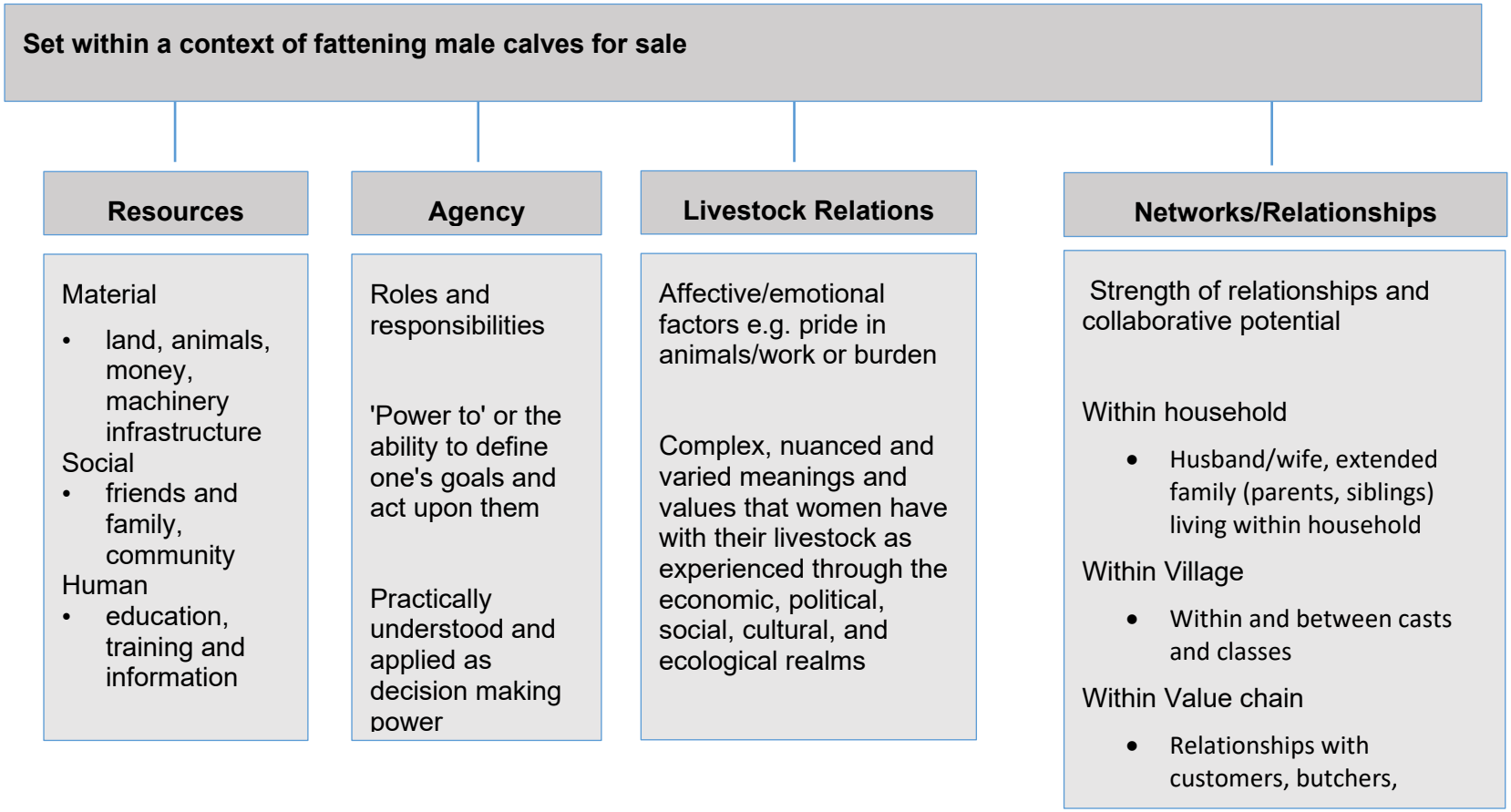


Figure 5.4-1: Adapted framework used for village selection

Within village selection and self-selection by farmers

Following village selection, farmers were invited to participate and participants were allowed to self-select for participation in the FBGs. 'Selection pressure' was applied through engaging farmers in a series of activities to develop their cattle fattening and marketing capabilities. Activities progressed in the following order to sequentially build the capacity of farmers in skills required to form a successful FBG and to apply selection pressure:

- Activities focussed on husbandry, health, and nutrition to support farmers to raise heavier calves more efficiently (calf competitions, needs based extension visits)
- Activities focussed on farm business management, such as calculating cost of production and using gross margins (needs based extension visits)
- Activities focused on engaging farmers with value-chain actors, such as the 'walking the chain' activity (value chain activities)

Increasing the business and marketing focus and the technical nature of the activities facilitated the farmers that were innovative and were seriously interested in developing their cattle fattening businesses to remain active within the group, whilst those that were not, to cease participation.

Calf competitions

Calf competitions were held in the villages selected for future FBGs [96D, 77D and Chak 34 (Mundeki) in Punjab and Sidique Narejo, Beero Lunjwani, and Khalifo Ahmed in Sindh] whilst the pilot FBG was established in 45GD. Calf competitions enabled the project team to engage with the community, demonstrate the weight gain potential of calves when good calf rearing practices are employed, and to finalise the village selection. The aim was to improve farmers' knowledge and drive on-farm practice change to support higher calf growth rates using the available feed resources and to involve the whole family in the activity.

Each farming family reared one calf (n=35) from birth to approximately three months of age and maintained calf management, health, feeding and weight records (in the presence of local judges). Recording sheets and weighing scales were provided to monitor the progress of the calves bimonthly over three months. Extension training support was provided to farmers on best calf husbandry and nutritional practices (e.g., naval cord disinfection, offering *adlibitum* colostrum, providing hay and green fodder, weaning claves), and record keeping (health, feed and weight records for the calves) as outlined in the calf fattening protocol over two extension visits (Appendix 11.4.8).

A closing ceremony was held in each village with cash prizes awarded to the three farmers with the highest calf growth rates (Figure 5.4-2). The local livestock departments and lead farmers of Punjab and Sindh were invited, and all families within the village could attend.

Figure 5.4-2 Calf competition held in 77D, Pakpattan

Farmer needs assessments

Farmer needs assessments were held to understand the barriers to effective engagement in beef fattening and beef value chains, thereby providing guidance for subsequent extension activities to be held in the villages. They were held in the final villages selected for FBGs (Punjab: 77D, 96D, and 45GD, Sindh: Sidique Narejo, and Beero Lunjwani) with separate women's and men's discussion groups held in each village for all interested farmers. A participatory rural appraisal approach was used with specific techniques of creative facilitation employed (Creative Facilitation, Uni of Melb, April 2019). There was a facilitated discussion and ranking of issues related to calf fattening in each group (Appendix 11.4.9). This approach to determining the extension activities to follow was used to give farmers ownership over the process.

Needs-based extension visits

A series of needs-based extension visits were held in the villages selected for FBGs. The participant numbers, topics and locations are described in the results. This enabled farmers to develop their capacity to fatten and market cattle and determine their interest in participating the project activities. The topics for the extension visits were selected based on the results from the farmer needs assessments as described in the section below. Thus, visits were tailored to the specific needs identified for each village. However, a similar approach was used in all villages to support the development of farm business management skills, particularly the use of gross margins to equip farmers with the ability to financially assess opportunities for fattening cattle for sale.

A total of 4 to 6 visits were carried out in each village, progressively building capacity in health, husbandry, animal nutrition, and cost of production/gross margins (7 main topics; Table 5.4-1). Men and women participated in separate group discussions and did not necessarily discuss the same topics as each other where different issues had been determined from the farmer needs assessment. Practical, participatory activities were used to facilitate inclusive adult education ensuring that illiterate farmers could learn. These visits also allowed the project team to better understand the current practices used in the villages. In each village at least one visit occurred to discuss gross margin calculations, this visit occurred as the final extension visit before marketing and value chain topics were approached as an entry into discussing these topics.

Animal health

The purpose of this topic was to discuss the key cattle diseases of concern for the farmers within the village. This included identifying the ways that these diseases were managed in the past and present, and to develop plans for management in the future. This was facilitated by small group discussion and an engagement technique of wave analysis (Figure 5.4-3). When discussing ectoparasites, these were observed on cattle where possible (Figure 5.4-3).

Figure 5.4-3 a) Wave analysis activity to describe disease management in Beero Lunjwani, b) Identification of ticks when discussing ectoparasites and endoparasites in Sidique Narejo

Table 5.4-1: Number of women and men who participated in needs-based extension visits in Punjab (45 GD, 77D and 96D), and Sindh (Beero Lunjwani and Sidique Narejo)

Topic for extension visit	Village participants									
	45 GD		77D		96D		Beero Lunjwani		Sidique Narejo	
	women	men	women	men	women	Men	women	men	women	men
nutrition- dry matter, protein, energy	~9	~9			8	6			10[c]	10[c]
nutritional requirements of beef animals	10	10							10[c]	10[c]
calf nutrition			4		7		12[a]		12	
animal feed resources & gut fill effect	9	14	7		8				10	12
animal health	5	4	9					12[b]	13[b]	13
calf diarrhoea	9							12[b]	13[b]	
gross margin calculations	8	~9	~9	~9	~9	~9		12[d]	12	12[d]
revision								~9		~9
~9: approximately 9 participants										
[a] Visit also included discussion of water quality; [b] visit included animal health and calf diarrhoea; [c] visit included nutrition- dry matter, protein and energy and nutritional requirements of beef animals; [d] gross margin calculations discussion was repeated										

Calf diarrhoea

The purpose of this topic was to discuss the signs and management of diarrhoea in calves, emphasising the importance of this condition for fattening calves. Activities included small group discussion, pictorial cards for scoring the consistency of diarrhoea and for assessing the severity of dehydration (Figure 5.4-4).

Figure 5.4-4 a) Small group discussion in Sidique Narejo, b) pictures used to depict progression of severity of dehydration in 45GD

Calf nutrition

The purpose of this topic was to encourage farmers to ensure calves received colostrum as early as possible, and that grain be fed from around seven days old to help develop the rumen. Activities included identifying when colostrum was commonly fed after birth using a timeline from sunrise to sunset, and a demonstration of the difference in rumen papilla according to calf age (Figure 5.4-5).

Figure 5.4-5 a) Timeline activity in Sidique Narejo to demonstrate when colostrum is fed, b) Towel used to demonstrate rumen papilla development in Beero Lunjwani

Nutrition: dry matter, protein, energy

The purpose of this topic was to build the capacity of the farmers in understanding the nutritional value of the feeds that they were using to feed their calves. Activities included weighing calves and the feed given to them (Figure 5.4-6) and understanding how dry matter differed according to feed type and the dry matter requirements of an animal.

Figure 5.4-6 a) Farmers in Sidique Narejo estimate the weight of a 6-month-old calf, b) The amount of Berseem clover fed to the calf is weighed

Animal feed resources and gut fill effect

The purpose of this discussion was for farmers to gain an understanding of the differences in nutritional value of commonly used feeds, and the limitations to productivity if only feeding low quality feeds. Activities included a practical demonstration of gut fill effect, discussion of feed resources and how they can be used to fulfil nutritional requirements (Figure 5.4-7).

Figure 5.4-7 Farmers engaged in gut fill simulation using a bucket and locally available feed resources in a) 45 GD, and b) Sidique Narejo

Nutritional requirements of beef animals

The purpose of this topic was for farmers to gain an understanding of the nutritional requirements, including protein and energy for different animal classes. This included activities to understand how dry matter feed requirements increased as calf liveweight increased, comparing feeds according to their metabolisable energy and protein contents (Figure 5.4-8), and learning about the feed rations options which can be used to meet nutritional requirements.

Figure 5.4-8 a) Practical demonstration of increasing fodder requirements as calves get older in Sidique Narejo, b) Comparing nutritional value of berseem clover and wheat straw in Sidique Narejo

Gross margin calculations

This was the key topic discussed to help farmers develop skills to be used for calf fattening business management. Current costs of commonly used inputs were identified (price is right activity; Figure 5.4-9) and then a gross margin was developed for a calf owned by one of the participants. Being more technical in nature, this activity was not only used to increase the capacity of the group, but apply selection pressure, as farmers not interested in marketing or fattening would not be interested in this activity. The activities were still designed to be as inclusive of illiterate members as possible. This step involved introducing the idea of exploring alternative markets and marketing strategies to the group, which led into the value chain based activities.

Figure 5.4-9 Farmers engaged in the 'price is right' activity to identify input costs for fattening calves in a) 45 GD and b) Beero Lunjwani

Value chain activities

This step involved several activities to further develop the skills of the participating farmers to facilitate their engagement with the value-chain. Farmers were provided with the opportunity to visit beef value chain actors to develop their understanding of the market system and to develop more effective linkages with their markets. A market or feedlot farm visit (45 GD only) and “Walking the Chain” activity exposed farmers to the value chains that their cattle were entering, enabling them to understand product movement along the chain, the product specifications of each chain actor and the different ‘value’ that was added along the way. The activities required greater commitment from participants and therefore further increased

the ‘selection pressure’ applied within each village for farmers to self-select to become a part of an FBG.

Animal market/ farm visit

Male and female farmers interested in fattening and marketing in 45 GD were invited to participate in value chain exposure visits, these exposure visits required the participants to leave the village to participate, therefore provided additional selection pressure. The men visited an animal market (mandi) in Lahore, whilst the women visited a dairy farm in Khanewal, which is managed by a woman farmer and includes a beef fattening enterprise. For the men, this provided an opportunity to compare selling their cattle to local middlemen as opposed to selling their cattle directly in an animal market (Figure 5.4-10). Traders provided them with information about the specifications of cattle sold in the market and prices.

Figure 5.4-10 Participants of the animal market visit in Lahore (8 men from 45 GD)

For the women, this provided an opportunity to learn about calf fattening strategies, market specifications and prices. Two progressive women who managed successful dairy and beef businesses shared their experiences and provided a tour of the farm (Figure 5.4-11). This facilitated a discussion on the costs of production, formed linkages with these farmers and inspired the farmers of 45 GD to pursue beef cattle fattening opportunities themselves. Specific practices likely to make cattle fattening profitable were also shared.

Figure 5.4-11 Participants of the dairy farm visit in Khanewal (14 women and 2 men from 45 GD)

Walking the chain

A 'walking the chain' activity was arranged for the male and female farmers of the villages selected for FBGs (3 villages in Punjab [45 GD, 77D, 96D] and 2 villages in Sindh [Sidique Narejo, Beero Lujwani]). These visits occurred from March to April 2021, except with male farmers in 45 GD which occurred earlier (2020) as a pilot study. The key objective was to enable farmers to identify additional and alternative market opportunities within their current beef value chain and understand the specifications of each opportunity. The need for collective action by the farmers to take advantage of these opportunities was also highlighted. This formed the basis to inspire the farmers to form an FBG.

Small groups of male and female farmers from each village visited and interviewed a retailer, meat processor, middleman (Beopari) and feedlot farmer in their local or nearby value chains (Table 5.4-2; Figure 5.4-12). In three villages, women were unable to participate in all the visits due to the social norms of their village, and thus pictorial sessions were arranged in the village so women had the opportunity to increase their understanding about the beef market, consumer demand and required product specifications.

Table 5.4-2 Beef value chain actors visited by each village during 'walking the chain' activity

Province	Village	Farmer group	Retailer	Meat processor	Middleman (Animal trader)	Feedlot farmer
Punjab	45GD	Male group: 9 men	Meat Dukan	Abedin international	Animal supplier at Abedin international	Oasis
		Female group: 2 men, 6 women				
	77D	Male group:10 men	Zenith	Abedin international	Animal supplier at Abedin international	Oasis
		Female group: 9 women	Pictorial session conducted			
	96D	Male and female group: 6 men, 6 women (participated together)	UVAS meat shop	Katco	-	Ever fresh
Sindh	Siddique Narejo	Male group: 6 men	Zabeeha	Fauji meat	Animal supplier at Fauji meat	Asif Khanzada farm
		Female group: 14 women	Pictorial session conducted			
	Beero Lunjwani	Male group: 8 men	Meat one	Al-Shaheer	Animal supplier at Al-shaheer	Asif Khanzada farm
		Female group: 10 women	Separate visit to feedlot farm only			

Figure 5.4-12 a) Discussing customer demand at Aberdin International, beef export slaughterhouse in Lahore, b) Observing consumer demands at Meat Dukan, retail shop in Lahore

5.4.3 Supporting FBGs to initiate and evaluate value-chain enhancement opportunities

Evaluation of value-chain enhancement opportunities

Following the 'walking the chain' activity, the project team facilitated the farmers in evaluating the market opportunities identified through interacting with value chain actors during the 'walking the chain' activity. The value chain approach described in objective 2 was used here. During this process, the idea and necessity of collective action to take advantage of the opportunities was discussed with the farmers. It was at this point that the idea of a FBG was introduced, and the farmers were asked by the project team if they would like to form an FBG.

Formalising the FBG through rules and regulations

Once the farmers agreed to form an FBG, the process of formalising member participation and planning a marketing approach was undertaken for each FBG as outlined below. Farmers formalised their FBG by setting rules and regulations for the group, finalising group members and roles/ responsibilities for each of them. Rules and regulations were determined by the group (with some guidance from the project team), and a group leader, general secretary and financial secretary were appointed by consensus within the group of farmers.

FBG marketing strategy

During formal group formation, the marketing strategy for each FBG was initiated. Farmers (with support from the dairy-beef project team) confirmed whether opportunities identified during the 'walking the chain' activity were economically and logistically viable. This included confirming the specifications of the market opportunity identified during the 'walking the chain' activity and completing an evaluation of the opportunity. A plan was developed by the FBG to consistently deliver a product that meets the customer's specifications on time, to communicate effectively with the customer and to be adequately rewarded. The FBG in 45GD was used as a case study for developing a detailed marketing strategy which was then adapted for the subsequent villages (Appendix 11.4.10).

FBG monitoring and guidance

After the FBG marketing strategy was initiated, each village was monitored by the project team; project staff offered advice and assistance where requested, however, the FBGs were left to pursue any market opportunities themselves.

5.4.4 Evaluation of engagement and subsequent impact

A member survey was carried out at the conclusion of the FBG activities that had been supported by the project team. This was designed to capture detailed impacts and enable comparisons between FBGs and their members. A subsection of members from each FBG were interviewed; three members from each FBG with a total of 30 members surveyed. Members were selected for interview based on their level of activity within the FBG. For each FBG, one very active member, one moderately active member and one less active member was selected. In addition, reflective sessions were conducted at the end of each visit by the project team with each participating village. This was used to evaluate engagement of FBG members on a regular basis, allowing for activities to be adapted as indicated and for the team to subjectively assess the success of each FBG.

See Section 7.4 for the results of this research component.

For more details, see 11.4 of this report.

5.5 Policy engagement

The project added Objective 5 as part of a project variation (V1, May 2021). This new objective follows from one of the recommendations from the mid-term review (MTR, September 2019) about undertaking a more critical analysis of the extension services as a whole in Pakistan, as this will help prioritise the basis of engagement with partner organisations and positively impact the sustainability of the interventions of Objective 1. Following this, the team has started communication with in-country key personnel from various organisations such as the Ministry of National Food Security and Research (MNFSR), Pakistan Agricultural Research Council (PARC) and provincial livestock departments to establish a 'livestock policy' discussion group to address challenges, needs and opportunities for the Pakistani livestock extension system (including private & government organisations). The activities regarding the 'livestock policy' discussion group started in June 2021. The project lessons and recommendations, developed and endorsed by this group will support the integration of these lessons into policy with national bodies (MNSFR and PARC) as well as implementation plans for provincial livestock departments.

Details of these Activities can also be seen in the, 'Achievements against Outputs/Milestones' (see Section 6.1.5), Results (see Section 7.5) and Appendix (see Section 11.5) of this report.

5.5.1 Science into Action workshops

These workshops were part of Activity 5.1 from the project proposal. The outcomes of these workshops formed the basis of the policy paper (Activity 5.2, reported in the Results 7.5) and the 'Science into Practice' workshops (part of Activity 5.3, reported in Methodology 5.5.2).

Details on the number of participants and links to the reports can be seen in Table 5.5-1.

First 'Science into Action' Workshop" (August, 2021)

In August, 2021, we conducted the first policy discussion group and named it a 'Science into Action' workshop under the leadership of Hassan Warriach and the University of Melbourne social research team. All the departmental heads and senior management of livestock and extension organisations (national and provincial) have participated in this workshop. The overall workshop was facilitated by Hassan Warriach while the Australian team (David McGill, Margaret Ayre, Kaitlyn Height, Alex Russell from UoM, and Anna Okello from ACIAR) participated online (via zoom).

The workshop remained highly instrumental to enhance the knowledge and understanding of the participants regarding livestock extension services, the WFEA and key recommendations related to extension/farm advisory services of the project during the last 15 years in Pakistan. The main theme of the workshop was to provide a platform to share ideas relating to the Pakistan livestock extension system, and what the participants could learn for implementing future projects and their own organisation's policies.

The objectives of the first workshop were to (1) provide an opportunity to participants to learn and share experiences with each other regarding livestock extension and veterinary services in Pakistan with a specific focus on policies/programs targeted at smallholder farmers, (2) share key project lessons from the Australian Government supported Dairy-Beef Project, regarding smallholder farmer support services and the Pakistani livestock extension system and (3) to co-design national, provincial and organisational policies recommendations to positively impact the extension system and smallholder farmers.

Prior to the first 'Science into Action' workshop, the project team shared a 'Key lessons' document (see in the box below) which highlights some of the main ideas the team wanted to convey at the Science to Action workshop.

Participants clearly understood the following key lessons following the day's proceedings;

- the value of the WFEA in the Pakistani system
- that capacity building of farm advisors is a process and takes time
- different farmer engagement approaches and how these help within the extension system.

Furthermore, the participants have discussed and agree that in general, the role of veterinary officers (extension staff) within government livestock departments is traditionally to deliver veterinary services (vaccinations, treatment of sick animals and artificial insemination). It was also discussed that farmers need farm advisory services to improve their on-farm production through improved farming practices. Most participants outlined that the focus of all livestock departments needs to restructure their roles and responsibilities to consider the whole family farm advisory services which they may learn from NGOs particularly Rural Support Networks (NRSP etc.). There was also a consensus that the main bottleneck to moving forward on this are departmental hierarchy and differing priorities.

Second 'Science into Action' Workshop (May, 2022)

The following objectives were similar to the first workshop with an additional focus on:

- To provide the opportunity for participants to reflect on incorporating key extension strategies within their organisation.
- To develop recommendations based on insights from the Dairy-Beef Project and the livestock 'Science into Action' discussion group

The participants considered the following opportunities and challenges pertinent to positively impacting the extension system for smallholder farmers, and the timeframes in which opportunities could realistically be achieved.

- More focussed engagement, through capacity building of advisors and researchers, with smallholder farmers is the most significant objective across all groups.
- Greater incorporation of research in the extension system for smallholder farmers is a high-level consideration of research and government organisations.
- Engagement between research, government, private and non-government organisations, is recognised as an important step for enhancing smallholder farming systems.
- Building the capacity of farm advisors in (a) their knowledge of market mechanisms, (b) their ability to engage with farmers, and more generally is recognised as important to enhancing smallholder farming systems.
- Barriers associated with bureaucracy and securing funding was highlighted as a challenge to implementing these objectives.

The participants were put into groups which were facilitated by 'lead' group members and co-facilitated by one of the project team members. The groups were given the opportunity to reflect on incorporating key extension strategies within their organisations. The main aim was to prioritise key extension lessons which impact smallholder farmers that could be included in the policy recommendations paper.

The ideas and outcomes of the discussions from the Science into Action workshops are reported on further in the drafted policy paper *'The current role of livestock extension and future opportunities for improving outcomes for smallholder farmers in Pakistan'* (as part of Activity 5.2).

Table 5.5-1: Participants of the 'Science into Action' workshops.

Science into Action	Men	Women	Total participants	Report Link
Workshop 1 (August 2021)	22	2	24	Sci2ActionT1_WorkshopReport_Aug2021.docx
Workshop 2 (May 2022)	14	4	18	Sci2ActionT2_WorkshopReport_May2022.docx

5.5.2 'Science into Practice' workshops

These workshops were part of Activity 5.3 from the project proposal. The activities, content and associated recommendations are based on the outputs & outcomes of Activity 5.1 (see Methodology Section 5.5.1) and the policy paper (Activity 5.2, reported in the Results 7.5).

Details on the number of participants and links to the reports from these training activities can be seen in Table 5.5-2.

Strategic training initiatives

Based on the first 'Science into Action' workshop, there were a number of key action points and steps for the project team among which the major action was to co-design 'Science into Practice' workshops with each key national extension providing organisations including provincial livestock departments and NGOs. The idea of the 'Science into Practice' training workshops, were to take the lessons and discussions from the 'Science into Action' workshops and integrate these more closely with the critical extension organisations. The way this was done was by working with these groups to design workshops targeted at their middle/senior management so that they could engage with the information presented and come up with their own action plans for applying recommendations that were presented to them.

The details of those workshops are following:

1. The project team conducted individual meetings/workshops with the heads of collaborating organisations (livestock departments Punjab & Sindh, LDDB, NRSP) to discuss the specific details according to the need of that particular organisation before conducting this 'Science into Practice' workshops.
2. After understanding the organisational needs, the project team conducted a three-day training workshop with 15-20 senior management of each organisation including the livestock departments Punjab & Sindh, LDDB and a two-day workshop with NRSP to share key Dairy-Beef Project lessons regarding smallholder support services and the broader extension system.

The team has conducted a three 'Science into Practice' workshops with LDDB, SLD and NRSP as planned as follow up of the 'Science into Action' workshop. The theme of these workshops was;

> *"To integrate the findings of the research and development modules within the Pakistan livestock extension system and share lessons for implementing future projects and policies within livestock development sector"*

The objectives of these workshops differed slightly, but generally they aimed;

> *"To learn and share experiences regarding livestock extension, beef value chain, applied large and small ruminants research in Pakistan with a specific emphasis on policies/programs focusing smallholder production system"*

"To share key findings of Dairy-Beef Project for livestock projects regarding smallholder, support services and the entrepreneurship models"

Reports from these training workshops are listed below and can be accessed. The project team have planned to run a Science into Practice workshop with L&DD Punjab, and have had preliminary meetings to initiate the co-design process. However, the dates could not been finalised due to their senior management having other priorities during the allocated timeframe (ie Jan-Jun 2022).

Table 5.5-2: Participants of the 'Science into Practice' workshops.

Science into Practice	Men	Women	Total participants	Report Link
Livestock and Dairy Development Board Workshop	36	2	38	LDDB_ScienceIntoPracticeWorkshopReporT.pdf November, 2021
Sindh Livestock Department Workshop	21	4	25	SLD_.0Sci2PracticeWorkshopReport.pdf December, 2021
National Rural Support Program Workshop	12	5	17	NSRP_Sci2PracticeWorkshopReport.pdf January, 2022

5.5.3 Key lessons: For implementing organisations & projects

The list below are the main ideas from the 'Key Lessons' document which were discussed at both Science to Action Workshops. These lessons are targeted at organisations implementing extension programs and projects. You can see the whole list, including the evidence collected in the Pakistani context to support these, in the following document:

KeyLessons_Science2Action.docx

Lessons regarding training approaches

Participatory approaches are an important aspect of training which benefit participants at all levels of engagement (farmers, advisors & management). Participatory training approaches are superior to the standard 'knowledge transfer' as it enhances horizontal learning processes where participants learn from each other through informal discussions and social interactions.

Regular training, with follow-up sessions, are critical to implement any extension program, including in Pakistan. Once-off training usually has very little benefit to participants and can usually only convey a few key ideas. The training program should cover the diverse range of skills needed to be an effective farm advisor (including technical knowledge, social mobilisation techniques, communication skills and marketing strategies).

Lessons regarding extension material

Extension information and recommendations are ideally simple to understand, applicable to smallholder farmers and lead to observed impacts on-farm. Developing extension material is not a once off job, instead, it requires regular updates so the information it presents can include new technology or updated applications of ideas.

Extension services work best when the information they are presenting is research-based and take into account local resources and experience.

Lessons regarding working with farming households

Extension services should ideally involve the whole-family (men, women and children). Household members perform different activities on the farm, and therefore have different technology and information needs.

On-farm practice change is a long process and starts with establishing a level of trust with farmers you are working with. It is best to start with simpler ideas, like untying animals, and then build to more complex ideas, like linking with more profitable markets.

Support smallholder farmers to develop common interest groups where you can demonstrate income generating opportunities from improved production and markets access.

Lessons regarding strategies to support effective extension

Feedback mechanisms and reflective sessions between farmers, field teams and extension managers are a key part of the learning process. Effective feedback can help to make more effective extension programs in Pakistan.

Training of extension workers on the whole-farming system can enhance the scope of extension services of organisations in Pakistan which can lead to a significant impact at the farm household level, and within the organisation itself.

Lessons regarding collaboration within the extension system

Pakistan, like many other countries has an extension system that is made of different organisations providing services to farmers (Government, private sector, NGOs and research). Although they have diverse objectives, they all have one common goal and that is to improve the livelihood of smallholder farmers in Pakistan. This common goal can be used as an opportunity to establish a network of extension organisations which can be used as a learning platform.

Interaction between various heads of extension organisations provides a useful platform to share ideas about approaches to drive change in extension programs through communication strategies, enhanced cooperation and interactive learning opportunities.

6 Achievements against activities and outputs/milestones

6.1.1 Objective 1: Outputs/milestones

Objective 1: To investigate the support necessary to integrate the whole-family extension approach within the current dairy-beef value chain and evaluate the impacts on smallholder farming families

For a useful reference point to connect Activities 1.1-1.4 (from the project proposal) with the paper outputs (in Appendix 11.1) and the Methodology and Results of this report please also refer to Table 5.1-1 and Table 7.1-1.

no.	Activity	outputs/ milestones	completion date	comments
1.1	Evaluate organisational arrangements related to extension and establish collaborative partnerships for integrating whole-family approaches within their extension programs	Desktop review report of organisations (~40) engaged in livestock extension and their governance arrangements	Proposed: Y1 M3 Actual: Jul-Sept 2017 (Y1 M4-6)	Completed and has been shared in annual report July 2019. Report link: Desktop_review_ReportPunjab-Sindh 4-10-17 (A.A).pdf This information has contributed to a draft paper manuscript that is being prepared that defines and explains the "Pakistan Extension System" (see Paper 1 in Appendix 11.1.1).
		Semi-structured interviews of selected key extension organisations (22) to assess their capacity, reach and interest in collaboration	Proposed: Y1 M7 Actual: Mar-Jun 2018 (Y1 M12 – Y2 M3) Updated: Dec 2018	Completed and has been shared in annual report July 2019. Qualitative data from these interviews have been used to support a research study assessing the opportunities and challenges for Pakistani extension organisations (see Paper 2 in Appendix 11.1.1).
		Initial partner workshop discussing partnership arrangements 5-10 organisations agree to collaborate with the project	Proposed: Y1 M9 Actual: Oct 2017 – Jan 2018 (Y1 M6-9)	Completed and has been shared in annual report July 2019. Prior to the start of training program on whole family extension approach, semi-structured interviews were conducted with the organisations. MOUs were completed and signed by all 22 organisations from late 2017 to 2021. Four new organisations were added into this network during 2021.

		A report assessing organisational arrangements in the dairy-beef extension system and the process of engaging collaborating partners for implementation	Proposed: Y1 M12 Actual: April 2018 (Y2 M1)	Preliminary, framework report completed by Margaret Ayre (UoM) based on her April 2018 visit. Report link: ConceptualBasis Obj1DairyBeef.docx Compiled final report of inception workshop by Margaret in December 2017. Report link: InceptionWorkshopReport.docx Data from this process, inception workshop and semi-structured interviews were used in Paper 2 (see Appendix 11.1.1).
1.2	Establish a community of practice to train and mentor partner organisations to implement an integrated whole family extension approach	Initial training workshop held with field officers of 5-10 partner organisations. Establish six-monthly review and planning workshops Field staff (3 to 8) from each organisation (5 to 10) trained	Y2 M5 Initial: Y2 M6 Y2 M12 Continuing until the final year of the project ((2018 to 2022) Y1 M12 – Y5	Completed initial farmer training in early 2018.. The farm advisors training workshops are being conducted after every 6 months. Overall ~50 farm advisors from 26 organisations (2-3 from each organisation) participated in these training workshops. This varied slightly as organisations joined/left the group. See Section 7.1.1 for a summary of these numbers. Completed. The team has conducted eight farm advisors training workshops during 2018 to 2022 on several modules. Under the COVID-19 situation, project also continued the farm advisor's capacity building process through virtual platforms on a need basis. A community of practice (COP) was also set up and established with Management from each of these organisations to support the farm advisor training workshops. Overall there were 4x COP events. Further details of the COP and the training workshops can be found in this report; Objective1_TrainingInterventionSummary.docx

		Assist collaborating extension staff to update and adapt extension material outputs from LPS/2010/007	Y2 M6 Continuous adaptation until the end of the project	As part of the support and mentoring role, our field team have observed trained farm advisors in the field and followed-up with engaging communities with them. Based on these follow-up meetings, 60% of collaborating extension organisations have been utilising the extension material developed by the Dairy-Beef Project within their own extension programs. Some organsations (approx. 3) have adapted the project extension material but with little modification according to their ongoing projects need. The project team has made significant changes in already developed extension material which includes; • Gender considerations depending upon the nature of the technical messages. Gender mainstreaming factsheets • Shifting to digital communication tools. One student from UoM investigated the farm advisor acceptance of a digital extension tool for communicating ruminant feeding recommendations. For more detail; see the paper summary in Appendix 11.3.5. • The project extension material is available on ACIAR website. This site will be updated with updated material as it becomes available. **Website link: Extension material**

1.3	Evaluate impacts of training and mentoring program on the effectiveness of each organisation	Assessment of staff capacity to implement their own extension programs Baseline completed Final report completed	Proposed: Y1 M12 to Y4 M2 Actual Baseline: Initiated in Jan 2018 (Y1 M8) Case study data to support baseline & final reports (Mar/April 2021) Mentoring follow-up visits: Continues Y1 M2 visit each farm advisor every 6 months	Baseline data collected from each farm advisor at the initial training workshop (Jan 2018). At each farm advisor training workshop, participants were involved in qualitative data collection during reflection sessions. This process captured evidence based on their own observations of the impact on their extension role(s), learning outcomes and farm-level practice change. This reflection data helped to shape the subsequent training activities with the farm advisors. Semi-structured interviews of 8 farm advisors (5 in Punjab and 2 in Sindh) from collaborating organisations (UVAS, LPP, Shakarganj foods and SLD) have been conducted as case studies to assess the impacts of WFEA interventions on farm advisor capacity, farmers and organisation advisory services. This data is utilised in the Paper 3 (see Appendix 11.1.1). The team provided field follow up support to farm advisors after each training workshop. Field follow-up visits were conducted (6x completed between Jun, 2018 to Feb, 2022) by the project team who were the trainers in the workshops and in charge of these field follow-up visits. This reflection data & field follow up reports were utilised in the Paper 4 (see Appendix 11.1.2).
1.4	Investigate the impact of the extension programs at the household level	Longitudinal farmer survey capturing changes in knowledge and practice change - commenced - completed	Proposed: Y2 M3 Y4 M12 Actual: Y4 M12 to Y5 M3	Completed. Gayathri Mekala (UoM) and Hassan Warriach designed the strategy. It has the following sections: Section A (Village level data collection from key informants/farmers/notables) Section B (One to one interview with farming families) The team has collected data from key informants/farmers/notables of four partner organisations (CABI, SLD, LPP & SFPL). Including 89 households (45 M & 44 F) of smallholder farming families. This household data and village level data is being used to prepare two papers assessing impacts (See Paper 5 and Paper 6 in Appendix 11.1.3). Note; Only one household data collection took place. The team was unable to collect the second due to COVID-19 related restrictions and lockdowns. Hence, the data collected used a ‘before/after’ approach regarding practice change.

PC = partner country, A = Australia

6.1.2 Objective 2: Outputs/milestones

Objective 2: To analyse the current beef industry structure in Punjab and Sindh with a focus on identifying market opportunities for smallholder farming families

no.	activity	outputs/ milestones	completion date	comments
2.1	Review of current dairy-beef value chain literature in Pakistan	Literature review report of the current state of the beef value chains in Pakistan		Completed: Lahore University of Management Sciences. Report is ready **Report link:** Review of literature LUMS_Beef value chain.docx
2.2	Conduct an intensive training program in value chain analysis (VCA)	5 project personnel and 5 from external organisations will be trained in VCA	Y1-Y3	Dr Tony Dunne conducted three training workshops (between 2016-2018) to build the capacity of the UVAS project team Additional follow-up cross training events have occurred with our Pakistani project team and MDF/FAO (Quetta, March 2018) and AusABBA (Quetta, Jul 2018) **Reports link:** REPORT Market Systems Development Training Workshop Quetta.docx FAO FMC visit report.docx
			Y3 M1	Completed: Walking the chain activity has been conducted to provide further training to the team in a different context (Wagga Wagga Australia (Apr, 2019).
			Y3 M2	Tony Dunne successfully conducted a workshop of team on beef marketing strategies to support FBG farmers to link them with identified opportunities from the DVCA report, Lahore (May, 2019).
			Aug 2021-Mar 2022	Completed: The project has successfully completed the 6-month mentorship program to on develop the skills farm advisors on value chain analysis and farm business support to farmers. This was an additional training activity to support value-chain research and sustainability with partner organisations. The reports from these activities are available here. **Report links:** ValueChainTrainingWorkshopReport.docx Walking the Chain Workshop Report of Farm Advisors.docx

2.3	Map traditional livestock chains in selected districts of Punjab and Sindh.	Report of two district beef value chain analyses. (1 in Punjab, 1 in Sindh).	Completed: Reported in an annual report in July 2019.	Completed: Successfully conducted a rapid value chain assessment report (RVCA) in Okara, Punjab and Badin, Sindh provinces **Report link:** Rapid Value Chain Assessment Report.docx
2.4	Detailed value-chain analysis of specific chains linked to smallholder farming families	Detailed value-chain report on one major chain in each of two districts (1 in Punjab, 1 in Sindh). Identified value-chain opportunities for smallholder dairy-beef producers	Completed, May 2019. Reported in an annual report in July 2019.	Completed: Tony Dunne successfully conducted a workshop of team on beef marketing strategies to support FBG farmers to link them with identified opportunities from the DVCA report, Lahore (May 2019). Report link: Detailed Value Chain Assessment Report.docx The findings of the report showed that there is a shortage of young beef animals that are healthy and exhibit good body conformation. The shortage of young animals creates an opportunity for smallholder farmer, or a group of smallholders, to rear their young male calves. These findings used in objective 4 to link FBG farmers to profitable beef markets.
2.5	Document and publish the outputs of adopting a value chain analysis methodology to identify market opportunities for smallholder dairy-beef farmers.	Two case studies of the application of VCA in identifying market opportunities for small-holder farming communities Published results combining the VCA, district maps, specific value-chains and identified opportunities	Proposed; Y1 M10 Completed; Y3 M4 Proposed Y2 M3 Completed Y3 M1	Completed: The data has been collected and analysed. For specific market opportunities the team worked with farm business groups (in Objective 4). **Also assessed the Eid market as an opportunity (August 2018). Report link:** Eid-ul-Azha Report.docx Completed: A document on beef marketing strategy for FBG farmers of village 45GD, Okara. Based on learning from this experience, similar marketing strategy documents (in Obj 4) are preparing for each FBG in Punjab and Sindh depending upon their opportunity analysis and market situation. Reports are ready and available online. Report link: Marketing Strategy_FBG45GD_Okara.docx Completed: Capacity building paper is written by Tony Dunne (mentioned in 2.2) which captures the training process outlined in this objective. It documents the process and challenges in adopting the value chain methodology. See section 11.2.5 in this report.

PC = partner country, A = Australia

6.1.3 Objective 3: Outputs/milestones

Objective 3: To evaluate alternative enterprise combinations which have the potential to improve on-farm efficiency and profitability.

no.	activity	outputs/ milestones	completion date	comments
3.1	Review current understanding and efficiency in the dairy and beef operations on smallholder farms	Review report of current status of beef-dairy operations.	Proposed - Y1 M3 Actual – Y1 M12	Completed: The project team has prepared a summary document on the major findings of on-farm research on dairy and beef production in Pakistan conducted by the project and other sources.
		Identify knowledge gaps addressing on-farm efficiency	Proposed & Actual - Y1 M4,	Completed: A planning meeting was conducted to identify the knowledge gaps addressing on-farm efficiency. (July 2017). The findings of this report were helpful to develop a plan for research projects under Activity 3.3.
		Applied research action plan	Proposed - Y1 M6	Ran participatory research trial to help understand health and production issues in the Pakistan context. See Topic 1 in Appendix 11.3.3 Conducted research focus group (RFG) meeting where 18 participants (Academia, research, private sector, farmers) were invited to identify and prioritise the research ideas to improve the efficiency of beef operation of smallholder farmers. Report link: RFG Workshop Report-Final Version (1).docx Conducted an expert panel meeting on local Rhodes grass seed production in December 2108. There were 16 participants from various organisations. Report link: Seed Production Workshop Report (1).docx

3.2	Assess the trade-offs between the cost of rearing calves for beef and selling the milk that is required to rear them effectively	A model of cash flow implications for allocating resources to beef and dairy. Strategic management plans for farmers to rear animals to target weights and market segments	Proposed; Y1 M 12 (Initiate after Obj 2 complete) Actual; Initial version Y2 M10. Updated version Y5 M1 Proposed: Y2 M 3 Actual; Drafted Y4, Completed version Y5 M1	Completed: Project team develop a cash flow model for allocating resources to dairy-beef operations. The first draft of the report was developed by Hafeez in March 2019. This was then built on by Masters student (Yuxi Ji, UoM) refined this model along with sensitivity analysis based on more recent field data. A Masters thesis was submitted in June 2021. A summary of this work can be seen in the Methodology (5.3.2) & Results (7.3.2) of this report. Further detail can be seen in Appendix 11.3.2. The outcomes of this activity was utilised in Activity 3.5. Completed: Based upon various pre-weaning trials conducted during the ASLP- II phase of the project, animal husbandry, nutrition management practices and sale options plan have been developed. The data for preparing the recommendations is taken from the value chain reports considering the age, specifications and markets to sell young animals to (from Obj 2) & ASLP extension material. Further description & links can be found in Appendix 11.3.2. Links to these documents can be found here: FatteningProtocol_DBTeam_English.pdf FBG_CalfFatteningModule_Urdu.pdf
3.3	Implement on-station research initiatives addressing research gaps from 3.1.	Completed and published experiments addressing specific on-farm challenges Extension advice on profitable dairy-beef efficiency	Proposed; Initiate Y2 M1 Actual; Between 2017-2022 Proposed; CompleteY4 M12 Actual; in final year of project, some delayed due to COVID-19 lockdowns	Six different applied research topics were addressed with a number of studies or student projects. - Three topics were lead by Pakistani based researchers (2 men, 1 woman lead) and these incorporated Masters theses from 5 students (3 men, 2 women). - Three topics were covered by PhD students (2 men, 1 woman) working in collaboration with the project (through UoM or CSU). Further details of the topics and outputs can be seen in Table 5.5-1 and further information in Appendix 11.3.3.

3.4	Implement on-farm field trials to test and evaluate recommendations from 3.2 and 3.3	On-farm experimental results ground truthing extension advice On-farm research-based learning opportunities for farmers	Proposed; Initiate Y2 M4 Actual; Between 2017-2022 Proposed; CompleteY4 M12 Actual; in final year of project, some delayed due to COVID-19 lockdowns	Three different farm demonstration components were addressed with a number of on-farm studies or student projects. - The on-farm water quality component was lead by a Pakistani based researcher and incorporated 3x Masters students (1 men, 2 women). - Fodder research was lead by the UVAS team in collaboration with other University partners. See Table 11.3-3. - The last was a calf rearing competition which was carried as a farmer engagement and data collection exercise in conjunction with Objective 4 farm business group activities. See results in Table 11.3-5 and Report link; Calf_Competion_Analytical_Report_Sindh-Punja.docx A brief overview of these research components can be seen in Appendix 11.3.4.
3.5	Develop a farm-based decision support tool comparing production, management and selling options	Key research outcomes and farm recommendations incorporated into a tablet-based app. Interactive app; providing tailored information to farmers	Proposed Develop; Y3 Test and adapt; Y4 Actual; Y4/5 Complete Y5 M3 Actual; Nutrition App Y5 Selling options App Y6 M3	The project has co-developed two digital extension tools; (1) on animal nutrition and (2) on beef selling options given location, calf-rearing practices and animal age. A brief overview of these apps can be seen in Appendix 11.3.5. The first application has been utilised in a research project to understand the 'acceptance/utility' of the app. This paper has been submitted (and accepted, not yet published); a summary of this paper can be found in the Appendix. *Title; Investigating the use of a novel digital extension tool in communicating ruminant nutrition recommendations to smallholders in Pakistan*.

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6.1.4 Objective 4: Outputs/milestones

Objective 4: To support smallholder dairy-beef farmers to engage in more profitable value chain opportunities

no.	activity	outputs/ milestones	completion date	comments
4.1	Identify & establish 'farm business groups' (FBG) with the potential to engage further in developing alternate pathways to market	Research paper developed on co-operative smallholder marketing activities in Pakistan	Prior to MTR in May 2019	Completed: Literature review consist of research based in Pakistan and other countries regarding cooperatives and farmers group formation For more detail on this review, please see the Appendix 11.4.1, or you can access the **report here:** FBG_LiteratureReview_DairyBeef.docx
		Initial FBG formed; 1 in Punjab and 1 in Sindh	First in Punjab, late 2019 (follow up activities in early 2020). First in Sindh, early 2020.	Completed: The team collected qualitative data from villages engaged in the previous phase of the project through farmer focus group approach. The team carried out an analysis of this data using an updated FBG framework. The major outcomes of this is summarised in 11.4.1. Completed: The first FBG in village 45GD, Okara, was established following a member selection process and has started collective actions. The FBG development process involved various steps including needs assessment, development of decision support tools, gross margins, inclusion of women in the value-chain (where appropriate) and assessment of the suitability of changes to beef operations. The project implemented the learning from the first FBG into the other nine FBGs across Punjab & Sindh.
		Additional FBG formed (target 3 in Punjab and 2 in Sindh)	Needs assessments completed in early 2020. Market exposure and subsequent visits (mid 2020 – late 2021).	Completed: The team has completed extension activities based on needs assessment in these additional villages (3 total, 2 Punjab and 1 in Sindh). Furthermore, the team completed exposure visits to beef value chain actors to understand the role of different actors, risks involved, value creation and evaluate the available market opportunities. See Appendix 11.4.1 for more details.

4.2	Build the capacity of FBG to enable them to more effectively engage with the value-chains they supply	Training manual developed and finalised on smallholder business management	Completed; Dec 2021.	Completed: 'Training Manuals' developed about beef value chain assessment, calf fattening and FBG/marketing plan for farm advisors/farmers. Key business management topics included: identification of appropriate marketing channels, gross margins, risk assessment, value creation, group functioning and marketing strategy. Document link: FatteningProtocol_DBTeam_15012021 (1).pdf Further details can be seen in Appendix 11.4
		FBG trained in farm business management		Completed: 93 FBG farmers (59 M & 34 F) trained in Punjab and Sindh. FBG farmers were trained on production and marketing topics related to farm business management. This included animal nutrition, gut fill, animal health and gross margins during five extension visits in the FBG villages of Punjab and Sindh (Objective 4 Methodology Section 5.4 & Results Section 7.4). Team facilitated farmers in the development of governance guidelines to manage their FBGs. Farmers from each FBG have developed these rules and regulations themselves through mutual discussions. They will try to implement these to avoid any conflicts for smooth working to meet delivering in full on time – quality (DIFOT-Q) criteria. Examples of these rules can be found in the Draft Final report in the Methods section.

		FBG trained in value-chain assessment		Completed: 7 FBGs were involved in the “walking the chain” activity. They gained exposure to retailers, meat processors, and feedlot farmers in March and April 2021 It enhanced the understanding of farmers regarding the beef market dynamics, product specifications and demand of beef animals. Exposure to the big city markets were a new experience for them which enhanced their understanding about the sale and purchase of beef animals in a larger market. (Questionnaire guide is available. The ‘walking the chain’ activity described above supported FBGs to initiate engagement with the value chain. Farmers were able to understand the role of various beef value chain actors including retailers, processors, large traders and feedlot farmers, and available market options to sell their beef animals. This activity helped the FBG farmers to interact with different beef chain actors, understand product specifications and beef market information. This also broadened the farmer’s thinking and awareness to sell animals to more profitable beef market opportunities. Team arranged a pictorial presentation on “walking the chain” for 2 female FBGs in Punjab and Sindh. These sessions ensured the direct flow of information to the female farmers. **Reports folder link** FBG trained in beef value-chain assessment - Reports Further details can be seen in Appendix 11.4

4.3	Support FBG to initiate and evaluate value-chain enhancement opportunities	FBG engaged to initiate discussions with VC actors to develop a market opportunity identified in Activity 2.4 Team support (every 6-8 weeks) and document on-going engagement between FBG and VC actors.		Completed: Team mentored and engaged the FBG farmers in the evaluation of the profitable opportunities for them. Farmers critically analysed the benefits and risks associated with each opportunity. This activity helped them to select the most suitable market option for them. They also understood the value creation and its importance to link with a profitable beef value chain. Report is ready **Report link:** Walking the Chain Activity Report_DBTeam.docx Dr Tony and Emma Hand monitored the whole process and guided the team on shortcomings. Team mentored and engaged the FBG farmers in the evaluation of the profitable opportunities for them. Farmers critically analysed the benefits and risks associated with each opportunity. This activity helped them to select the most suitable market option for them. They also understood the value creation and its importance to link with a profitable beef value chain. Further details can be seen in Appendix 11.4
		10 FBG engaged with the VC and piloted a value-chain opportunity		The walk in the chain activities have been completed in 10 FBGs and farmers are analysing the identified market opportunities in their respective areas. These FBGs have discussed the identified profitable market opportunities, but not yet engaged with the VC in a new manner. Team is now mentoring the FBGs Completed: Marketing strategy document (45-GD farmers, Okara). Dr Tony and Emma are guiding the team in preparing this document and delivered to the farm business group. **Document link:** Marketing Strategy_FBG45GD_Okara.docx Further details can be seen in Appendix 11.4

4.4	Document and evaluate the engagement and subsequent impact on the FBG and the value-chains they engage with	Semi-structured surveys of FBG to assess observed and potential impact Case studies of VC FBG intervention Publication report evaluating critical factors in VC enhancement process	Completed in May/June 2022	Completed: Baseline village data has collected (January 2019) to determine current practices and attitudes in relation to beef fattening. In the villages where FBG activities have initiated, further information has collected through a needs based assessment – thus identifying the greatest issues facing beef farmers in the villages. Team carried out an impact study in May/June 2022. There was a total of 15 men and 15 women surveyed at the conclusion of the project led FBG activities. In Punjab there were 18 members interviewed using survey questions, and in Sindh 12 members were surveyed. See Methods Section 5.4.4 and Results Section 7.4.3 relating to this activity. See Appendix 11.4.4 for more detail.

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6.1.5 Objective 5: Outputs/milestones

Objective 5: To support the uptake of key lessons from Dairy-beef extension and value-chain research into policy discussions (at both National & provincial Government levels) to improve sustained implementation of the whole-family extension approach.

no.	activity	outputs/ milestones	completion date	comments
5.1	Establish and facilitate a 'livestock policy' discussion group to address challenges, needs and opportunities for the Pakistani livestock system (including private & government organisations).	Online meeting to engage policy group Workshops to discuss lessons from COP and Dairy-beef training (WFEA).	August, 2021 & May, 2022 Incorporated as part of Science into Action workshops	All departmental heads and senior management of livestock and extension organisations (national and provincial) participated in the workshop. The project has provided a platform for the participants of various organisations to share ideas relating to the Pakistan livestock extension system, and what they can learn for implementing future projects and their organisation's policies. However, a national and provincial level livestock policy overview was given to them to share common policies across each province contrary to the implementation plan. The facilitated discussion sessions in the workshop provided the i) critical insights about extension research and experience in Pakistan, ii) share experiences of participants regarding major policies in place regarding extension services within their organisation and iii) share key ideas/lessons learnt and will be most applicable to achieve participant's organisational goals. See reports and summaries in Appendix 11.5.1.
5.2	Develop a discussion paper describing extension policy in Pakistan incl.; the role of private and public funding, mixed crop-livestock systems and support services for these in the wider development space.	Draft policy paper tabled for group feedback Policy paper completed and will be shared with National & provincial extension agencies	Drafted early 2022. Target; Oct 2022.	Sent to 2nd Science into Action workshop participants, May 2022. Summary of this paper can be found in Appendix 11.5.2. Target to submit this paper in October 2022.

5.3	Develop recommendations which include how the insights from the project can inform and contribute to policy; based on the advice and expertise of the livestock policy discussion group.	Distil recommendations from policy group for implementing partners Work with Provincial livestock departments to map out ways to integrate within their departments	Three workshops completed. LDDB in Dec 2021. SLD in Jan 2022. RSP	These recommendations formed part of the policy paper (Activity 5.2) and are different for each major organisation. Science into Practice workshops were run with each major organisation to support this process. The idea of the 'Science into Practice' training workshops, were to take the lessons and discussions from the 'Science into Action' workshops and integrate these more closely with the critical extension organisations. The way this was done was by working with these groups to design workshops targeted at their middle/senior management so that they could engage with the information presented and come up with their own action plans for applying recommendations that were presented to them. See description of these workshops and training activities in Section 5.5.2.

PC = partner country, A = Australia

7 Key results and discussion

7.1 Objective 1 Results

Key statistics and engagement from training interventions

To distil the breadth of results and information across 22 organisations is difficult, as each has a different workforce, mandate and working location. To measure its success, the project team focussed on its ability to engage with organisations and their field teams. It determined a 'rating of engagement' (Low/Moderate/High) for each organisation see Table 7.1-1 (based on participation in the COP), and an individual rating for each farm advisor see Table 7.1-2 (based on their participation and implementation of the WFEA into field activities). These have been summarised according to organisational type

Table 7.1-1: Number of organisations and their engagement with the project team regarding the whole family extension approach.

Organisation Type	Engagement from management			Total
	Low	Mid	High	
Government	0	1	1	3
NGO	1	5	5	11
Private	4	2	1	7
Research	1	1	0	2

Table 7.1-2: Number of farm advisors from each organisation type and their engagement with the project team regarding the whole family extension approach.

Organisation Type	Number of organisations	No. women Farm advisors	No. men Farm advisors	Engagement of Farm Advisors	Women	Men	Total
Government	2	3	8	High	0	5	**5**
				Moderate	2	3	**5**
				Low	1	0	**1**
NGO	11	7	14	High	5	6	**11**
				Moderate	2	5	**7**
				Low	0	3	**2**
Private	7	0	16	High	0	7	**7**
				Moderate	0	8	**8**
				Low	0	1	**1**
Research	2	0	2	High	0	0	**0**
				Moderate	0	1	**1**
				Low	0	1	**1**

These numbers indicate that NGOs were the most engaged type of organisation, followed by Government and private organisations. They also show a lack of women field staff in general, but especially in private and research organisations that were part of this study. Supporting this engagement data is the qualitative data collected during the training interventions and semi-structured interviews from a household impact study. This data indicates that majority of the farmers working with NGOs and the private sector had

implemented more on-farm practice changes compared to farmers who were linked with the government and research organisations. This related to the number of extension activities NGO/private organisations were already running. Hence, those farm advisors who already had established relationships or mandates working directly with farmers were able to apply new ideas about the WFEA more easily.

The data highlights that there are major differences between both the types of organisation as well as the individual organisations. Some of the more nuanced results, which vary across these range of contextual differences, can be seen in greater detail in the response to research question 1 (see Section 7.1.1) and Appendix 11.1 of this report.

Structure of this section

This section draws on the key results from Objective 1 which address research questions 1 and 2 from the project proposal;

> **RQ1:** *How can the whole family extension approach be supported and integrated within the current smallholder dairy-beef agricultural extension and advisory system in Pakistan?*
>
> **RQ2:** *What are the impacts of extension providers implementing the whole family extension approach?*

The results and examples that form these responses and discussion ideas are drawn from research papers that are described in further detail in Appendix 11.1. The appendix is laid out according to draft manuscript papers that are published, submitted or being prepared. Each 'Paper' addresses a different issue that forms part of the results contributing to the overarching research questions (listed above). A summary of the main findings of each of these papers is outlined in the table below (Table 7.1-1)

The responses to the research questions in this section of the report relate to Activities 1.1-1.4 (from the project proposal). The general methods for these research components are explained in more detail in the Methods (Section 5.1) of this report. For a useful reference point to connect the project proposal activities with both the Methodology and the research Results of this report please refer to Table 5.1-1 and Table 7.1-1.

Table 7.1-3: Paper summaries from Appendix 11.1.

Papers where discussion ideas & responses to research questions are drawn from (reported in Appendix 11.1.1)	Paper summary; outlining the major finding or new information garnered from each study	Activity (from proposal). Reporting sections (Methodology & Results)
Paper 1: Pakistan's livestock extension; understanding the pluralistic nature of a complex system	There is a range of organisations providing agricultural advisory services for smallholder livestock farmers across Pakistan. The size of the organisations provides insight to the breadth and scale of the reach of these groups, which indicate the potential for impact.	Act; 1.1 M; 5.1.1 R; 7.1.1
Paper 2: Perspectives and insights on governing agricultural advisory services in smallholder dairy-beef farming in Pakistan	This paper identifies key challenges and opportunities for governing agricultural extension and advisory services to provide effective support for increased productivity and profitability to smallholder farmers. This allows us to better understand what scope there is for integrating a unique advisory intervention, the WFEA, into the system.	Act; 1.1 & 1.2 M; 5.1.1 & 5.1.2 R; 7.1.1

Paper 3: How a novel intervention in Agricultural Extension and Advisory Systems supported productivity and profitability of Pakistani smallholder dairy/beef farmers in Punjab and Sindh provinces	This research collected evidence from farm advisors that identified three benefits from being part of the WFEA training interventions; (1) developing skills in communication and engagement thus supporting them to interact positively with farmer, (2) the mentoring process led to development in their problem-solving skills & (3) the WFEA program provided a professional network to draw upon when needed.	Act; 1.2 & 1.3 M; 5.1.2 R; 7.1.1
Paper 4: Strengthening the role of innovation brokers in the livestock advisory services system of Pakistan	The data collected from this study demonstrates that the WFEA supports farm advisors in the Pakistani extension system play numerous roles that are consistent with those identified in the innovation broker literature including; (1) articulation of problems & possibilities, (2) network building and (3) supporting negotiation and learning in networks.	Act; 1.2 & 1.3 M; 5.1.2 R; 7.1.2
Paper 5: The impact on smallholder livestock households of the WFEA implemented through different farm advisory service providing organisations.	80% of the participating smallholder farmers altered at least one on-farm practice. The most common were; providing free access to water/feed (54%), improved calf rearing (50%), regular shed cleaning (24%) and providing concentrate feed (20%). The data indicates that farmers working with NGOs and the private sector implemented more on-farm practice changes compared to others.	Act; 1.4 M; 5.1.3 R; 7.1.2
Paper 6: Gendered impacts of Whole Family Extension Approach on the smallholder dairy farmers of Pakistan	The results of the qualitative data analysis within the theoretical framework used for this study show that while some of the impacts have been similar for both women and men smallholder farmers, there were also some stark differences in terms of access to information/training and the capacity to benefit from this newly acquired knowledge between women and men.	Act; 1.4 M; 5.1.3 R; 7.1.2

7.1.1 Key results related to support for and integration of the WFEA

The section below addresses research question 1 for Objective 1 of the project:

> **RQ1:** *How can the whole family extension approach be supported and integrated within the current smallholder dairy-beef agricultural extension and advisory system in Pakistan?*

The Whole Family Extension Approach helps address challenges and opportunities of governing agricultural extension and advisory services (AEAS) in the Pakistani smallholder dairy/beef sector

Scholars have noted that in developing country contexts, the governance of agricultural extension and advisory systems (AEAS) is often characterised by fragmentation of and gaps in provision of agricultural advisory and extension due to resource constraints and governance capacity (Schut et al. 2015; Boogaard et al. 2013). This need to strengthen governance capacity is particularly relevant in pluralistic agricultural innovation systems (AIS) where there is a diversity of AEAS providers with both commercial and developmental goals and different institutional logics (Turner et al. 2016). This research has found that a particular AEAS intervention, the Whole Family Extension Approach (WFEA), has helped address some of the challenges of and opportunities for improved AEAS functions in the context of the Pakistani smallholder dairy-beef sector. It has done this by addressing some of these challenges and opportunities through a process of innovation in the incumbent extension and advisory services provision in the smallholder dairy-beef sector. This

innovation has been achieved as a result of key design features and processes which supported collaboration amongst extension and advisory services organisations across the government, commercial, NGO and R&D sectors The innovation observed takes the form of new capacity development for AEAS provision through changes in organisational practices as well as farm advisors' capabilities and impacts. The key design features and processes of the WFEA intervention and processes of collaboration that enabled this integration are highlighted below.

Key design features of the Whole Family Extension Approach (WFEA) enabled its integration into the Pakistani smallholder dairy-beef AEAS

This research highlights three key design features of the WFEA that enabled and supported its integration into the existing pluralistic Pakistani smallholder dairy-beef AEAS. These are: new innovation forums for social learning and collaboration; a focus on the inclusion, participation and role/s of women farm advisors; and, a focus on and recognition of the role/s and capabilities of all members of the family in smallholder dairy-beef farming.

The WFEA intervention established a Community of Practice (CoP) for Extension in Pakistani Smallholder dairy-beef Farming with member representatives of 22 organisations with roles and responsibilities for providing extension and advisor services to smallholder dairy/beef farming families. This CoP was a key design feature that enabled the representation of the full range of organisational roles and responsibilities for AEAS provision to smallholder farmers. Participants in the research and the CoP recognised the value of the CoP forum for: acknowledging and drawing on the diversity of perspectives and roles of its members; the focus on facilitation of group activities to encourage and support shared problem solving; and, the opportunity to share knowledge and identify opportunities for collaboration. The CoP was itself a mechanism for collaboration and social learning amongst diverse organisations who have different roles and responsibilities for supporting smallholder dairy-beef farming in Pakistan. See more on collaboration as a key process of the WFEA intervention below.

A focus on the inclusion of women farm advisors and their professional development was another key design feature of the WFEA that enabled it to address the recognised need for gender inclusivity within participating AEAS. CoP member organisations reported this as significant in assisting them to meet their goals and targets for gender inclusion in their AEAS programs. Where possible, participating organisations were asked to nominate both a male and female farm advisor to participate in the WFEA training program. However, participants from several organisations reported that their organisation would need more women extension workers before it could fully adopt the WFEA within their service provision due to the focus in the intervention on equal numbers of men and women.

Some interviewees in this research identified social conventions and norms related to gender as having limited women farmers' access to advisory services in the dairy-beef smallholding farming sector previously. In rural Punjab and Sindh, the majority of smallholder farmers working with livestock are women. It is often more culturally appropriate for these women farmers to talk to women extension workers. Hence women farmers have reported that they were unable to utilise extension and advisory services delivered by male advisors. Following from this, an increase in the number of women farm advisors is a key opportunity for enabling more inclusive and equitable extension and advisory service delivery by organisations to smallholder farming communities. Further inclusion of women also creates opportunities for a more effective Pakistani smallholder dairy-beef AIS because of the significance of women's involvement this system. For example, participants from several organisations reported that adoption of untethering of animals amongst smallholder dairy-beef farms was higher after they had included women extension workers within their extension and advisory service team.

The third key design feature was the focus in the WFEA intervention on smallholder dairy-beef farming as a holistic activity involving all members of the farming family. Participating

organisations reported that this focus led to the provision of more effective AES services in the provinces because more of the smallholder dairy/beef farming community was engaged than in previous AES programs. See the section on household impacts for more detail (Section 7.1.2).

As a result of the integration of the WFEA invention into the Pakistani smallholder dairy-beef AEAS, key impacts were reported by research participants at the organisational level (see below) as well as at the farm scale (see Section 7.1.2).

At the organizational scale, impacts were:

- Increased capacity building of extension workforce (i.e. farm advisors) through opportunities for farm advisors to network, exchange knowledge and information and identify and fill skills gaps.
- Better linkages between organisations with different roles and responsibilities in the Pakistani smallholder dairy/beef AEAS.
- Expansion of the range of services delivered by organisations.

Collaboration between AEAS organisations supported innovation for improved farm-scale outcomes for smallholder farming families

Collaboration is recognised as a critical process of innovation in complex systems (Hermans, Klerkx, and Roep 2015; Lang et al. 2012).The WFEA intervention supported AEAS organisations in the Pakistani smallholder dairy-beef AIS to interact, share knowledge and information and collectively address common challenges and opportunities of AEAS innovation.

Social learning was reported by members of the WFEA invention including the farm advisors, extension and advisory services managers and policy makers. Social learning has been widely recognised as an important governance mechanism for adaptation in complex innovation systems (Ison, Collins, and Wallis 2015; Colvin et al. 2014). The WFEA intervention was explicitly designed to establish and facilitate social (i.e. collective or group) learning processes and between extension managers and farm advisors from different organisation with a role in extension and advisory services provision to smallholder dairy-beef farmers enabled and supported alignment of government and non-government advisory services. Extension managers reported that as a result of engaging in discussions with their peers, that possibilities for sharing knowledge and resources and increasing efficiencies through collaboration were identified.

This research found that the roles of government and non-government (including commercial) advisory services are not well coordinated and aligned in the Pakistani smallholder dairy/beef AEAS. Participants in the CoP identified this coordination and alignment as a key issue for in their roles as AEA services managers. However, they also reported key impacts on the innovation capacity of their organisations through participation in the WFEA intervention which were:

- An ability to articulate and develop strategic alliances to address inefficiencies in AEA services to farmers, share resources and knowledge and target priority areas than before.
- Increased awareness and increased experience of the value and benefits of collaboration.

Non-public sector organisations identified that it helped them to address gaps in service provision to farmers, particularly to women farmers.

7.1.2 Key results related to the impacts of the WFEA

The section below addresses research question 2 for Objective 1 of the project:

> **RQ2:** *What are the impacts of extension providers implementing the whole family extension approach?*

As a result of the integration of the WFEA invention into the Pakistani smallholder dairy-beef AEAS, key impacts were reported at three different levels;

- the organisation (as already described in Section 7.1.1 and in **Paper 3** in response to research question 1).
- the farm advisor (as described in **Paper 4**).
- the farming household (as outlined in **Paper 5** and **Paper 6**).

This section elaborates briefly on some of the impacts the WFEA activities had at both the organisation and farm advisor level, then in more detail describes impacts at the farming household level.

The organisation level

At the organisation level, impacts were:

- Improved job performance which meant they had an increased capacity.
- The increased capacity lead to financial and time savings
- Growth in services delivered including milk production and quality increased

There are numerous sources of evidence in this project which clearly support that the WFEA supports farm advisors and their organisations to achieve their routine job targets and organisational goals in the Pakistani extension system. Regarding organisational benefits, one farm advisor from the private sector noted that their core job is milk collection from smallholder farmers and their employer doesn't require any technical (veterinary/animal sciences) background of their staff. Hence, when they have previously been faced with farm-based problems, they have needed to pay technical experts to assist in addressing the issue. However, after becoming part of WFEA training, the farm advisor is feeling more confident, resourceful and technically sound to solve these challenges without any additional technical support and in the process providing value to his organisation by saving time and funds (source; facilitated discussion July, 2018).

The farm advisor level

At the farm advisor scale, impacts were:

- Increased capacity building in terms of technical, social and communications skills care of opportunities for farm advisors to network, exchange knowledge and information and identify and fill skills gaps.
- This increased capacity meant that many advisors had the ability to solve farm issues independently.
- These skills supported establishing and maintaining better links with farming communities.
- Collectively, these skills, networks and connections with farmers helped farmer to improved their job performance.

The WFEA interventions helped farm advisors to improve their technical, social and communication skills which subsequently helped to achieve both their routine job targets and

organisational goals. These improved skills have huge impact on-farm practice change and efficiency of the farming communities they work with. For example, one female farm advisor from a NGO mentioned that “She achieved her high job targets of working with farmers to build more than (24) farm fences in less than 1 year. Compare this with her professional senior manager who was unable to convince (8) farmers during last 10 years within same working villages (source: case studies March 2021).

The farming household level

At the farming household scale, impacts included:

- Increased milk production and quality of products.
- Improved animal health and welfare
- Saved time and were able to spend it on other activities.
- Better access to services and financial support to implement changes.
- Better access to information because farm advisors knew more about the whole farming system. This led to more relevant and accessible extension messages for both men and women farmers.

Evidence supporting impacts from implementing practice changes

The three most common on-farm practice changes and their associated impacts, based on semi-structured interviews (total 90) with both men and women from 45 households.

Practice 1: Over half of the farmers in this study (54%) provided free access to water and feed which resulted in increases of milk production (an average 2 lit/animal/day) and a reduction in time required to manage animals (an average time saving of 4 hours/day/farm).

Example 1: One woman from a NGO-based community mentioned that she used to spend this spare time doing home chores, socialize, meet her relatives, attend marriage ceremonies etc.

> *“Before adopting this practice, we had to spend our time in tying and untying the animals to offer feed and water especially, when we had to tie them in shade in summers and tie them out in sun in winters. But now animals are free to move wherever they want and have free access to feed and water which has not only saved their time but also increased milk production and improved animal health”* (Source; NGO, woman farmer 2021).

Practice 2: Half the farmers (50%) in the study adopted improved calf rearing practices resulted increase in average growth rate of 250 to 500 gm/day and milk saving average 1 to 1.5 lit/day/calves.

Example 2: High calf mortality and poor growth rates are one of the main issues of calf rearing in Pakistan and farmers tend to have limited knowledge regarding calf rearing practices. One female farmer mentioned that she;

> *“…did not have to spend any money for making this practice change of improved calf care. Neither had it taken her much time and efforts. She said that the reduced calf mortality has an addition to her herd size and also saved farmer from loss of calf. This also has saved their cost for treatment for the diseased calf”* (Source; NGO, woman farmer 2021).

Practice 3: Farmers (20%) providing concentrate feed to their animals resulted in reduced calving intervals and better milk production. Majority of the farmers are not feeding animals according to their requirement which result into low milk production and poor reproduction

including low conception rate, delayed puberty, longer postpartum period and long calving interval (Warriach et al., 2015).

Example 3: There are numerous accounts of farm advisors from various organisations took steps to ensure the availability of concentrate feed to their farmers door step. For example, one farm advisor from the private sector mentioned that majority of his farmers were more interested in technical information related to increase milk production (for example animal nutrition and husbandry practices). After becoming part of WFEA training, he provided the farming community with the desired technical information and used his connections within his organisation to launch a scheme to provide concentrate feed to the farmers on credit and at a subsidised rate to increase milk production. Due to this success, this scheme has now been allocated additional resources and has been replicated in 23 villages (source; facilitated discussion, December, 2019).

Reduce work burden after on-farm practice change

The practice change of 'untying the animals and providing them free access to water and feeding' was the most commonly practice change across the study sites. Both women and men respondents mentioned that this practice change has not only saved their time (as much as 8 hours for farmers with more than 10 animals), but also gives them greater flexibility in terms of how they organize their day's activities. Women said this allowed them to spend more time with their family members and complete other household chores. Women also mentioned that they felt a greater sense of animal wellbeing to see the animals being well-fed and watered. Men used their saved time to socialize and spend on other income generating activities. The other practices change include, silage making, making Urea Molasses Blocks (UMB), providing colostrum to young calves and feeding concentrates to animals. Both women and men who were involved in these activities and neither of them felt that it increased their work burden after these practice changes.

Benefits of association with their farm advisors

Both women and men farmers benefitted not only related to the information and training that they received on various aspects of livestock management, but also indirectly through their association with their farm advisors and the additional services/support they were able to provide.

Some farmers were provided with better access to financial support which helped them to fund the resources/time needed to implement farm practice changes. For example, one farm advisor from an NGO noted that the majority of farmers he worked with were unable to make animal sheds at their farms to implement improved husbandry practices due to financial constraints. Therefore, he advocated for those farmers and negotiated with his organisation to provide access to funding to support these changes. His organisation launched a scheme to provide interest free loans to farmers (between Rs. 50,000-200,000) to build the animal sheds. This scheme is now successfully running (source; facilitated discussion, December, 2018) and illustrates an important role this farm advisor has played as an intermediary between the organisation and the farming communities he works with.

Examples from men: One farm advisor from NGO linked farmers with relevant veterinarian in that area, provided free of cost Rhodes grass seed initially to trial and later on at subsidised prices; provided information on a slaughterhouse where farmers could sell their cattle on live weight basis; arranged the delivery of high-quality animal feed/wanda at the village shop and linked the farmers to the private seed companies.

"One male farmer started his own business of commercial feed for dairy animals in the Sukkur region based on the advice of his farm advisor. Feed concentrate rations are essential for increasing production of his animals and there are no such retail outlets exist within his village or the

surrounding areas. So he started his business as well". Source; male farmer linked to a Government farm advisor.

Examples from women: One female farmer said that her farm advisor shared the information of milk prices of nearby city, which helped her to negotiate a better price with her milkman and received better price. Another farmer said that because of her strong links with her farm advisor, she initially got free seed of Rhodes grass and then could procure it at subsidized rate.

"One female farmer mentioned that she is not only getting the technical knowledge from her farm advisor, but she is also benefiting from her social and professional networks for her animal's health". Source; woman farmer, linked to an NGO 2022

Women from this study linked to an NGO also shared that due to the regular training, they forged new friendships with other women and feel part of a community where they can share their problems, solutions and new ideas on various aspects of livestock, crops and other aspects of life in general.

Differences between organisation types

Results indicate that NGOs were the most engaged type of organisation, followed by Government and private organisations. They also show a lack of women field staff in general, but especially in private and research organisations that were part of this study. Supporting this engagement data is the qualitative data collected during the training interventions and semi-structured interviews from a household impact study. This data indicates that majority of the farmers working with NGOs and the private sector had implemented more on-farm practice changes compared to farmers who were linked with the government and research organisations. This related to the number of extension activities NGO/private organisations were already running. Hence, those farm advisors who already had established relationships or mandates working directly with farmers were able to apply new ideas about the WFEA more easily.

The data highlights that there are major differences between both the types of organisation as well as the individual organisations. Some of the more nuanced results, which vary across these range of contextual differences, can be seen in greater detail in Appendix 11.1.

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7.2 Objective 2 Results

7.2.1 Research question

This section draws on the key results for Objective 2 (see Methods 5.2 and Appendix 11.2) and addresses the corresponding research question from the project proposal;

> **RQ3:** *What are the predominant beef value chains and how can the families of smallholder livestock producers benefit from the increasing demand for beef?*

A review of the literature provided a comprehensive summary of each of the 21 reports/papers identified. Collectively these summaries contain sufficient information that could, if distilled, provide a good description of the current structure of the Pakistan beef industry and the constraints preventing its development in both the domestic and export markets.

From a project perspective, the review provided no insights as to extent of the engagement of individual livestock producers with their value chains, the issues associated with individual livestock producers engaging more effectively with their value chains, or the opportunities that may exist for livestock producers due to changes in consumer demand in domestic and export markets.

The capacity building activities of Objective 2 provided the Dairy-Beef team with the knowledge and skills necessary for them to identify and evaluate new potential market opportunities for smallholder producers. During their capacity building program the members of the Dairy-Beef team conducted three *walking the chain* activities which provided them with factual examples of how the consumer demand for beef was changing and the opportunities that these changes in demand provided for smallholder beef farmers. The reports described under Activities 2.3 & 2.4 concluded:

1. That consumer demand for beef meat was changing.
2. Meat processors were paying premiums for cattle that met their strict specifications in terms of age, sex, liveweight, health and soundness.
3. The sourcing of cattle that met these specifications was difficult and expensive.
4. Progressive livestock producers were changing their calf rearing strategies, including the establishment of feedlots, to meet this demand.
5. There were opportunities for smallholder livestock producers to engage in this superior value chain by dealing directly with traders, feedlot operators or meat processors.

The knowledge and skills of the Dairy-Beef team that were developed through the activities of Objective 2 enabled them to mentor and support the formation of the Farm Business Groups established under Objective 4.

7.2.2 Evaluation of value-chain capacity building

An evaluation of this capacity building process is provided in the draft paper that can be found in Section 11.7.2. The main conclusions drawn from this evaluation were that the capacity building process was partly effective but an inefficient use of resources due to:

1. The small number of participants in the activity
2. The different levels of motivation and commitment among the participants.
3. The participant's lack of knowledge and experience in downstream value chain activities.

Evidence of the process being partly effective is provided in the following quotation from one of the participants at the conclusion of the training activities.

> *At the start of this activity building program, I didn't have any idea about value chains and finding opportunities for farmers and linking them with profitable markets. I think the following activities played a critical role in developing my skills……..*
>
> *All these processes and activities enabled me to plan and execute "walking the chain activity" as my capacity was building at each step. But points (a)* (understanding the system)*, (c)* (frequent feedback) *and (d)* (conducting qualitative research) *need more to plan and execute this activity successfully.*

This need for more training/support was evident when the members of the Dairy-Beef team attempted to apply their knowledge and skills with smallholder farmers in the Objective 4 activities. The Dairy-Beef team produced three reports as a result from these training activities that are discussed in Activities 2.3 (Section 11.2.3) & 2.4 (Section 11.2.4).

7.3 Objective 3 Results

This section highlights the Results of two different research components that were part critical part of this objective and linked to other Objectives of the project. Details of the other studies and applied research that was carried out in this objective can be seen in Appendix 11.3, this includes the researchers and students involved disaggregated by gender. The Methods for these two components can also be seen in Section 5.3.

7.3.1 Assess trade-offs for rearing calves for beef

Based on the data from the buffalo calf rearing trail, the growth rates of different treatments were compared to assess the 'best practice' treatment for rearing buffalo on a smallholder farm in Pakistan (see Table 7.3-1). The results show that, feeding buffalo milk before weaning and combined with hay fodder after weaning can gain a higher growth rate of calves, which is 0.57 kg/d pre-weaning and 0.51 kg/d post-weaning.

Table 7.3-1: The growth rate of buffalo calves under different treatment.

Treatment pre-weaning	Average growth rate day 0 to day 56 (kg/d)
buffalo milk + concentrate	0.568 ± 0.107
cattle milk + concentrate	0.454 ± 0.067
Treatment post-weaning	**Average growth rate day 56 to day 98 (kg/d)**
BF (fresh fodder)	0.482 ± 0.138
BH (hay fodder)	0.506 ± 0.164
CF (fresh fodder)	0.396 ± 0.180
CH (hay fodder)	0.476 ± 0.035

Furthermore, by running a statistical analysis using a linear model of the buffalo growth rate, factors that were found to have a significant effect on the pre-weaning growth rate of buffalo were birth weight, milk consumed volume, milk type and concentrate feed quantity ($p<0.05$). The fodder type and fodder intake ($p<0.05$) are the two main factors that affect the post-weaning growth of buffalo. This analysis indicates that the BH feeding regime is significantly better than the other feeding regimens. Hence, the 'best practice' for rearing buffalo calves in this project for further investigations and analysis of farmer options will applied assuming the feeding regime, growth rates and associated cost of the BH treatment.

According to the research from Bhatti *et al.* (2011), the 'best practice' for rearing cattle and applied in this project can be summarised as milk and starter ration before weaning (day 84) and TMR-fed after weaning, which can obtain the growth rate of cattle 0.357 kg/d and 0.705 kg/d respectively.

Traditional feeding vs Recommended feeding treatment

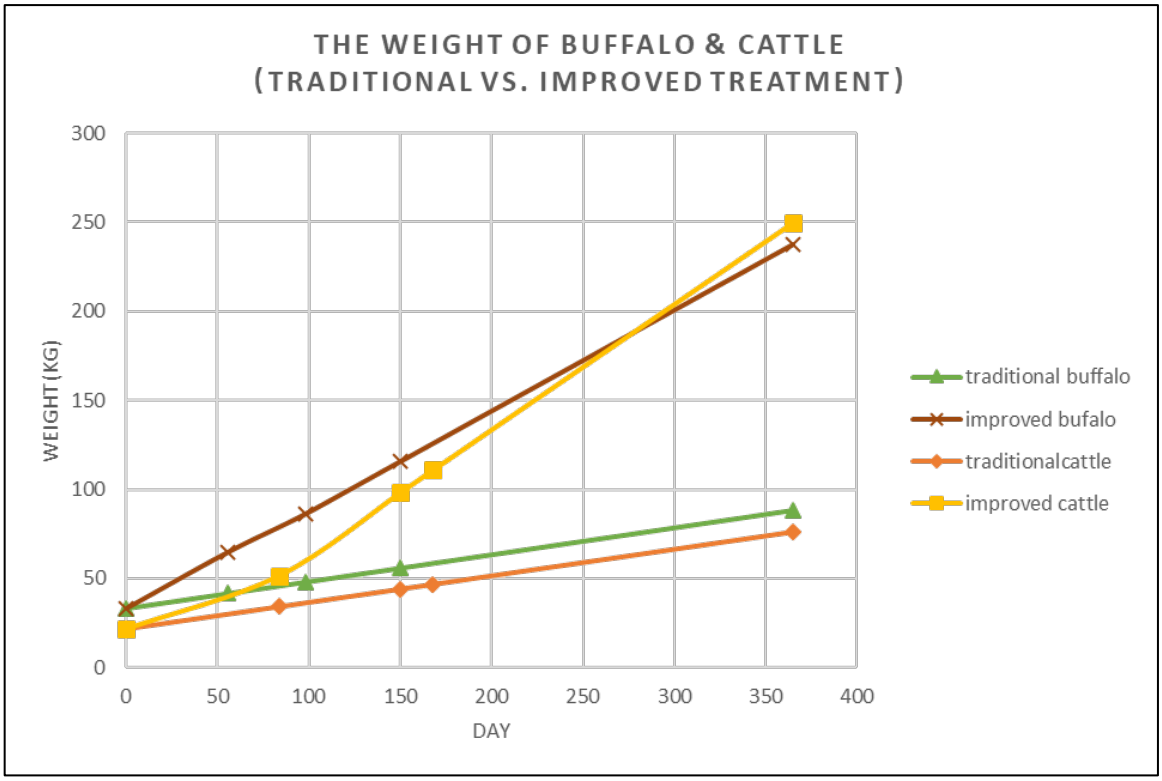

Figure 7.3-1 the weight of buffalo & cattle under traditional or 'best practices' treatment.

Based on the research from Aijaz et al. (2021), the growth rate of calves under traditional rearing treatment among smallholder farmers would apply 0.15kg/d for the whole period.

As can be seen in Figure 7.3-1, it is clearly seen that, over the rearing time, the weight of buffalo and cattle under ‘best practice’ treatment can gain more weight than the traditional one. This indicates higher beef production, but also includes higher input costs. The subsequent analysis investigates both these input costs and potential selling options for smallholder farmers.

Market options for smallholder

Based on the information gathered from Pakistan team (as part of a value-chain assessment), four market options were identified for smallholder farmers to sell their beef calves. These different options, their selling price and the animal specifications that need to be met are summarised in Table 7.3-2. Traditional selling options for smallholders are beoparis (i.e. a local middleman who purchase from the farmer doorstep), local butchers and livestock market (shown in Figure 11.2-1). Selling to larger farmers (or feedlot operators) that have the capacity and resources to rear cattle to a higher slaughter weight is another options for smallholders. The Eid market has a highly elevated price that farmers can achieve, but the specifications of liveweight, age and ‘animal beauty’ are more difficult to achieve. The Eid market is large but highly competitive, and asking high requirements for cattle sold. If the animal that meets the requirement for the festival, it will offer great opportunities for these smallholder farmers.

Table 7.3-2 The market options & specification for calves selling in Pakistan.

Market Option	Price (PKR/ kg LW*)	Specifications
Beopari/local butcher	Buffalo: 195- 210 Cattle: 230- 240	• The easiest and simplest way for smallholder farmers to sell the livestock • Farmers can sell animals at any age or weight
Direct to livestock market/local slaughterhouse	Buffalo: 235 Cattle: 265	• Male calf demand is more • Young and healthy animals • Round with no bony appearance.
To feedlot	Buffalo: 235 Cattle: 265	• Male calves • Healthy, disease free, large Dewlap, round rump • Age: 1.5-2 years • Purchase weight is 230-350 kg LW/animal
Eid-ul-Azha value chain	780-800	• Age: 2 years • Weight: good conformation (may need to achieve 320kg) • Beauty: uniform coat colour; absence of horns; absence of structural defects • Healthy: robust appearance

*LW: live weight.

From Table 7.3-2, it can be seen that the price per kg of buffalo is generally lower than the price of cattle. There are no special requirements for selling calves from options such as Beopari, local butcher. Selling direct to the livestock market or slaughterhouse is also an option, but the animal should be young and healthy, or it will be difficult to sell. While both feedlot and Eid-market have certain age and weight requirements for both cattle and buffalo.

Profit comparisons to selling age and different market options

Table 7.3-3 summarises the profit (PKR/kg LW) of buffalo and cattle when selling at different age based on different market options and ‘best practice treatment’ current. This table assumes rearing costs of milk, concentrate/starter ration, hay fodder/TMR, and fixed costs described in 5.3.2. In general, the profit per kg of both buffalo and cattle increases as the rearing time increases based on the ‘best practice’ treatment.

In addition, with the increase of rearing time, the weight and age would meet more market options for smallholder farmers. The Eid market is the most profitable options for the smallholder farmers if they have the buffalo or cattle that meet the specifications of the market (from Table 7.3-2).

Table 7.3-3 The profit (PKR/kg) for buffalo and cattle under 'best practice' management.

Sale options	Price (PKR/kg liveweight)	profit at day56	profit at day98	profit at day180	profit at day 450	profit at day 730
Buffalo						
Beopari/local butcher	210	36.30	57.30	54.91	79.62	83.40
Livestock market/ local slaughterhouse	235	61.30	82.30	79.91	104.62	108.40
Feedlot	235	NA	NA	NA	104.62	108.40
Eid-ul-Azha value chain	780	NA	NA	NA	NA	653.40
Cattle						
Beopari/local butcher	240	32.75	25.37	85.40	124.64	134.21
Livestock market/ local slaughterhouse	265	57.75	50.37	110.40	149.64	159.21
Feedlot	265	NA	NA	NA	149.64	159.21
Eid-ul-Azha value chain	780	NA	NA	NA	NA	674.21

Profit values are in PKR/kg sold. Hence, the larger animals provide a much greater margin.

NA: the selling age of animal does not meet the requirement in Table 7.3-2.

To see more analysis and results relating to this study, please see Section 11.3.2.

7.3.2 Research questions

This section draws on the key results from Objective 3, and market specification data from Objective 2 to address research question 4 from the project proposal.

> **RQ4;** *How can smallholder farmers best utilise their dairy animals to supply beef markets and increase their farm profitability?*

Smallholder dairy farmers in Pakistan have the animal resources, feed and in many cases, access to beef markets to help increase their overall farm profit. Gross margin analysis comparing sale times and markets, indicated that farmers can make a profit when selling their buffalo and cattle calves to the local markets if they follow best-practice rearing and feeding practices. Furthermore, if they can meet the animal specifications and timing for the Eid-market, the profit per kilogram of liveweight can be increased five-fold, but this only works for older animals.

This research was supported by findings from on-farm trials, in particular calf-rearing competitions demonstrated that higher calf growth-rates are achievable for smallholders using their available resources. By following best-practices for rearing and feeding, 55% of participating smallholders in Punjab and Sindh achieved calf growth rates higher than those achieved during similar on-station trials. Collectively, the research trials indicate that a profitable beef enterprise from dairy animals is possible for smallholders in Pakistan. In contrast, smallholders are unlikely to make any profit when calves are reared following traditional rearing and feeding practices, regardless of the market they sell their animals to.

Smallholders can best utilise their animals if they rear their animals following 'best-practice' calf rearing feeding and management and target local markets/feedlots. These markets have easier specifications for farmers to meet and can be sold earlier if required. For those farmers in a position to hold onto animals for longer (ie greater than 12 months or two years) can make more profit per kilogram of meat they produce on their farm. The largest margins would come from selling into the Eid market, but farmers targeting this opportunity would ideally plan for this early on and plan, rear and feed the animal accordingly to ensure the animal(s) have good health and a profitable growth rate.

7.3.3 Digital extension tools to support farm advisors

For a brief summary of the Methodology linked to this study, please see Section 5.3.3. Greater detail can be found in Appendix 11.3.5.

This section provides a short summary and conclusions from the study; *Investigating the use of a novel digital extension tool in communicating ruminant nutrition recommendations to smallholders in Pakistan*.

The purpose of this study was to investigate the acceptance of a digital extension tool with farm advisors. This study has identified that farm advisors perceived the potential of the digital tool to communicate extension messages in an engaging way, which did not completely overcome the concerns expressed in relation to the usability of the app for particular target audiences but pointed to the value of digital tools within AIS.

In addition to uncovering advisors' attitudes towards the extension tool, the TAM framework allowed for the generation of direct feedback on the tool's features and their fit with the social, organisational, and technological context. That is, context for iterative development of a more usable, useful tool. The participatory approach used to develop RNG with advisors of varied experience and backgrounds that reflect the AIS and whole-family extension approach of the Dairy-Beef Project, may improve adoption of the tool with both farm advisors, and farmers and in turn support more participatory extension approaches. Further research should be undertaken to explore farmer acceptance of the digital extension tool, investigate which messages may be best suited to digital formats, and explore subsequent impacts on uptake of messages and management changes within smallholder systems in Pakistan.

It is clear that digital extension tools do not replace traditional face-to-face extension in this context, but rather, support engagement with extension material through novel and interactive formats. This provides another reason for involving advisors in tool development as they are key 'intermediaries' between farmers and digital tools, able to promote tool use as well as build the capacity of farmers to use agricultural ICTs more generally.

Ultimately, the Ruminant Nutrition Guide developed for communicating animal feeding management messages to smallholders in Pakistan is one form of agricultural ICT that farm advisors can use to support change in smallholder contexts by engaging farmers with extension material. Further studies should investigate the attitudes of other stakeholders, as well as the challenges that might be faced in scaling out the tool beyond the immediate innovation system to support farmers across the region in practice.

7.4 Objective 4 Results

More details of this section can be found in the Methods (5.4) and Appendix (11.4) of this report.

7.4.1 Village and individual participant selection

Throughout the project a total of 10 FBGs were formed in 3 villages in Punjab (45 GD, 77D, 96 D) and 2 villages in Sindh (Beero Lunjwani and Sidique Narejo) with a separate men's and women's FBG formed in each village. One village (45GD) in Punjab was used to pilot the approach to establishing an FBG and thus activities first occurred here and were then reviewed before implementing in the remaining four villages.

Village selection

Using the villages which had participated in the ASLP project as a base population for selection of villages for potential FBG participation enabled quick and effective shortlisting of villages. The project team were able to draw on their previous knowledge of the villages in a simple but structured way to form an opinion on their participation.

There were 15 villages which were shortlisted during the initial village selection process to proceed with FFGDs. In Punjab, 44 women and 97 men participated in FFGDs from 7 villages (Table 7.4-1), whilst in Sindh, 59 women and 51 men participated from 8 villages (Table 7.4-2).

Table 7.4-1; Farmer Focus Group Discussion participants and locations in Punjab

Village name	District	Female Participants	Male participants
77D	Pakpattan	5	11
40-3R	Okara	6	4
45GD	Okara	8	25
50-3R	Okara	4	11
83D	Pakpattan	6	12
96D	Pakpattan	10	16
Chak 34 (Mundeki)	Okara	5	18

Table 7.4-2 Farmer Focus Group Discussion participants and locations in Sindh

Village name	District	Female Participants	Male participants
Beero Lujwani	Badin	11	5
Haji Ahmad Somro	Sujawal	7	9
Khalifo Ahmad	Sujawal	6	3
Rehmatullah Jahejo & Tamachi Jahujo	Badin	6	8
Shaheed Ahmad Somro	Badin	8	6
Sidique Narejo	Sujawal	11	8
Sidique Soomro	Badin	3	6
Tando Gamo	Badin	7	6

The 15 villages where FFGDs were held were assessed according to their suitability for formation of an FBG based on the group responses to the interview questions. Filtering the answers into the framework for assessment aided in the discussion amongst the project team as to which villages were most suitable for participation in the project. Key points were then added to a comparison table, which included the opinions of the project team (Table 7.4-3). This table shows an example of the FFGD interview results for two villages, Village 1 was included in the following project activities, while Village 2 was not considered

appropriate for inclusion. A consensus was reached within the project team as to which were the most suitable villages aided by the comparison table. All villages which were selected had the necessary resources for calf fattening and were interested/motivated to fatten their calves. They were also cooperative, and women were involved in dairy-beef farming as outlined in the village comparison table (Table 7.4-3). Factors which suggested that a village may be unsuitable for formation of an FBG are shown in red.

The village, 45GD in Punjab was selected as the first village for the FBG formation process because farmers were already fattening male calves, were seeking opportunities to improve their calf fattening business and were highly cooperative. 45GD was used to pilot activities and thus activities were refined for subsequent establishment of FBGs in the additional villages. This allowed reflection and refinement of the support provided which was utilised when establishing FBGs in the other villages. In addition, three villages in Punjab and three villages in Sindh were selected for future FBGs. These villages were 96D, 77D and Chak 34 (Mundeki) in Punjab and Sidique Narejo, Beero Lunjwani, and Khalifo Ahmed in Sindh. However, after completion of the calf competitions the village selection was refined to include 5 villages (45GD, 77D, 96 D, Beero Lunjwani and Sidique Narejo) due to a low level of participation and interest from villages Chak 34 and Khalifo Ahmed. This indicates that the village selection process based on FFGD results may need to be more rigid in excluding villages that display traits considered not suitable for FBG formation in the future.

Overall, the villages in Punjab had greater access to resources, such as land and schools, whilst socially only one caste commonly lived within a village in Sindh (Appendix 11.4.11). Roles and responsibilities for raising cattle was similar between villages in Punjab and Sindh and were shared in similar ways amongst household members. However, decisions were perhaps made more equitably in Sindh, although women appeared to be more restricted in their mobility. Relationships within households and villages were largely viewed positively, however relationships with the next step of the value chain, such as middlemen and markets were variable in both Punjab and Sindh. This suggested that FBGs may be more successful in Punjab because of greater resources and mobility of women in the villages where FFGDs were held.

Table 7.4-3 Punjab village comparison for suitability to establish an FBG using output from Farmer Focus Group Discussions. Text in black indicates positive indications for the development of a Farm Business Group in that community, while red text indicates negative indications.

		Interest in fattening		Capacity to Fatten			
Village		Livestock relations	Goal setting	No. animals	Land area	Fodder production	Team's Opinion
Village 1	Male	Farmers think fattening could be profitable if middleman is good	Would like to start fattening, but don't know how	10.5 animals per household	average 5 acres	Producing enough fodder to feed animals	Top ranked village, let's start farmers are cooperative already selling quality animals within value chain high calf mortality - but we can work on this
		Do not think it is currently profitable due to marketing	Have contacted Riaz to start selling to him (one farmer has 24 male calves to sell to him)	Purchasing (21) and selling (15) calves	1.3 acres for fodder production	exchange fodder within village	
		Not fattening at the moment, raising with dairy animals - raising male calf for sale	Have made contact with a feedlot as well	33 calves born in village			
		6 male members (that are keen to work with us) have livestock away from house and work with them themselves, rest more traditional		20-30 male calves potentially for sale in 1 yr			
	Female	Females already think fattening is profitable	Want to increase fattening	8.4 animals per household	average 2.4 acres	Allocate more land for fodder production depending on herd size	Some farmers were cooperative, some weren't can consider because of their goals and interests. Some of the husbands are middlemen have purchased male calves to sell at time of need
		females are enthusiastic about fattening are confident in negotiating price		10 male calves born in village		Only 1 farmer purchases feed off other village members	
		Not fattening at the moment, just raising with dairy animals - raising male calf for sale		purchasing (9) and selling (2) calves			

Village 2	Male	Animals are burden in harsh weather	Can see that fattening could be profitable but are not interested, more interested in cash crops	Guessed 2-3 male calves per farm	2 acres average	Prefer cash crops	Have resources but are absolutely not interested in fattening Small number of farmers present
		Primary focus is on cash crops				Can produce enough for dairy animals	
		See more value in dairy animals (nutritional as well as financial)				Feed maize, millet, sorghum to animals	
		Interview was conducted with 3 teachers and a vet - farmers are not interested in fattening					
	Female	Livestock not burden	Can see that fattening could be profitable but are not interested, more interested in cash crops	10 male calves born in village	4-5 acres average	25% land is for fodder production	Hard to get women to engage, were not cooperative Not interested in fattening Education for children is more important than livestock rearing
		Only older females are involved in livestock rearing, younger females feel their role is within the household to support their children's education		Sale and purchase minimal		Can produce enough for dairy animals	
		women have less involvement in livestock since development of community farm					
		Some women are more interested in household, some didn't like going to community farm because the men were there as well					

Calf competitions

A total of 35 smallholder farming families from three villages in Punjab (n=19 families) and three villages in Sindh (n=16 families) participated in the competition to raise calves with the highest growth rates from birth to three months. There was positive engagement in 96D, 77D, Sidique Narejo and Beero Lunjwani, and thus subsequent activities to support the formation of FBGs in these villages occurred. However, in Chak 34 (Mundeki) and Khalifo Ahmed there was limited engagement in the calf competition and a loss of interest in fattening cattle. Thus, no further activities occurred to support the establishment of an FBG in these villages, given the evidence from the literature that individual motivation was a key success factor to FBG type groups. The village of Khalifo Ahmed was considerably smaller than other villages included in this activity. This contributed to the lack of engagement. In the future, the village population, and therefore, the likely number of individuals interested in fattening and the cattle population available for fattening and sale should be considered more heavily in the selection process. A calf competition did not occur in 45GD because other activities to develop a FBG had already been initiated.

The average calf growth rates in Punjab and Sindh were 689 and 492g/day/calf, respectively (Table 7.4-4). The average feeding cost in Punjab and Sindh was 311 and 257 PKR/day/calf. The highest cost of feeding calves was in Mundeeki, Kasur (426 PKR/day/calf), but this did not equate to the highest growth rate which occurred in 96D Pakpattan (890 g/day/calf) due to a variety of factors, including the quality of feed.

Table 7.4-4 Average daily calf growth rates (kg) in 3 villages in Punjab and 3 villages in Sindh

Village Name	No of calves registered	Average Birth weight (kg)	Average Days of competition	Average daily growth rate/calf (kg)
96-D Pakpattan	8	34.13	74	0.89
77-D Pakpattan	7	38.79	72	0.55
Mundeki, Kasur	4	34.75	79	0.63
Average daily growth rate/calf (Punjab)				0.69
Siddique Narejo	8	29.75	79	0.52
Beero Lunjwani	5	32.20	80	0.46
Khalifo Ahmed Sujawal	3	40.00	63	0.50
Average daily growth rate/calf (Sindh)				0.49

The calf competitions provided interactive engagement with farmers and helped to develop their interest in fattening cattle for sale. Gross margin calculations were used demonstrate that improving calf management practices had the potential to contribute to generating greater profits from male calves. Farmers who could not participate in the competition, due to not having new born calves to enter during the competition period, also showed keen interest to engage in project activities and calf fattening in the future.

Overall, farmers involved with the calf competition were very pleased with the results; they commented that their calves grew faster and were healthier. In 96D, Ahmad Yar told us that;

> *"I reared female buffalo calf for that competition and it was much healthier as compared to other calves of even more age. This was because I put more focus on nutrition and husbandry management. Unfortunately, I had to sell that calf due to emergency and received PKR 20,000 at age of 4 months which in*

other case would have been maximum PKR 7000-8000. So, this extra money was the reward I got apart from the prize money of competition".

Some farmers had continued with 'best practice calf rearing' practices developed during the calf competition. For example, also in 96D Allah Dad who was the judge of the competition told us,

"I learned a lot from that competition. I have 4 calves at my farm now and I implemented all the practices learned through that experience. My calves are more active than other calves on the village just because of small adjustment in their feeding and management".

However, some other farmers had reverted to 'traditional' practices requiring lower inputs due to time constraints and feed costs; a lack of reward for this increased input in the market may have also contributed to this regression, this further demonstrates the need to improve farmer capacity to interact effectively with the value chain.

Self-selection of individuals

Farmer needs assessments

The key issues which were identified in Punjab were animal nutrition, health, and marketing, whilst in Sindh similar issues were identified with the addition of water quality (Table 7.4-5). Both women and men predominantly identified similar issues within a village. However, overall women appeared to identify animal health more frequently as an issue, whilst men identified marketing or finances more frequently as compared to women. This was also reflected in the roles and responsibilities predominately performed by men and women as described from the FFGDs in Appendix 11.4.11.

Table 7.4-5 Key issues identified by farmer needs assessment in 3 villages in Punjab (45 GD, 77D, 96D) and 2 villages in Sindh (Sidique Narejo, Beero Lujwani)

Village	Group	Participants	Issue 1	Issue 2	Issue 3
45 GD	Women	8	health	Husbandry	Nutrition
	Men	17	marketing	Nutrition	animal selection for fattening
77D	Women	8	health	poor weight gain	Marketing
	Men	14	finance to purchase inputs and animals	no beef breeds	lack of awareness
96D	Women	8	poor weight gain	Health	Nutrition
	Men	9	nutrition	Marketing	lack of awareness
Sidique Narejo	Women	8	water quality/ access to water	fodder shortage	Health
	Men	27	water quality	Health	Finances
Beero Lujwani	Women	8	water quality	lack of awareness	Nutrition
	Men	15	finances	fodder shortage	water quality

Needs based extension visits

Allowing participants to identify priorities for extension was effective in creating a sense of ownership over the direction of the group. It also allowed the project team to reinforce the role of working together as a group; the group had identified the issues and were now working together to solve them under the facilitated guidance of the project team. Wherever the opportunity was presented, the benefits of working collectively to solve an issue or improve a situation was reinforced, therefore, although not all topics identified by the villages were directly related to the formation of an FBG or marketing, these themes were carried through. Extension topics, such as animal health and calf raising, which had been previously covered under the ASLP Dairy project and provided a weaker link to marketing and collective action were covered first, followed by nutrition topics, which flowed into gross margins and marketing. It was essential that the extension topics were covered in a logical order to maintain engagement within the group. All extension topics were delivered via interactive sessions, which allowed the participants to immerse themselves in the learning experience. Each visit to the village was concluded with a reflection session on what was learned during that session's activities, each consecutive session begun with a reflection session on what was learned in the previous session; this allowed the project team to monitor the engagement and understanding of farmers. Farmers showed a thorough understanding of the topics explored and excitement to adopt these on farm in these sessions. One of the most important extension visit topics was on gross margin calculations. Predominantly, the examples used identified that current practices of raising and fattening calves would result in a financial loss at the time of sale (except when sold for Eid). For example, in 45GD, farmers calculated the cost of production as 49,700Rs for a 2 year old male calf in the village. The sale price for this animal would be 35,000Rs, thus resulting in a loss of 14,700Rs. This was a key realisation and motivation for farmers to make changes to their current fattening and marketing practices. One farmer, Safdar, shared that

> *"I knew during the activity that we will be in loss and this thing is confirm now. Because our cost of production is more and sale price is also less which results in loss".*

Another farmer, Ahmad, shared that;

> *"if this farmer had given concentrates to this animal, then body weight would be more than present and it would get a higher sale price; thus reducing the loss".*

This shows that the farmers understood the gross margin activity, the second farmer was also reflecting on lessons learned from the nutrition extension activities. Strategies to turn this loss into a profit were discussed including reducing input costs by weaning earlier and supplementing with concentrates, and improved bargaining due to increased knowledge or collective action at the time of sale.

Value chain activities

Animal market/ farm visit

Farmers were effectively exposed to value chain opportunities outside of their normal markets. Farmers reflected on the additional risks incurred by selling directly to the market or transporting animals to markets outside of their village, such as potential injury during transport, and recognised this was a risk local middleman faced. However, they identified that there was potential to receive higher prices when selling directly to the market, but this required astute negotiation. Two key factors were identified to increase their bargaining power with any potential buyers; these were, sell cattle together to increase their economy of scale, and to know accurately the weight of each animal.

Ghulam Nabi (male farmer from 45GD) commented,

> *"we always sell the animals on estimated carcass weight and have to agree with the weight which middlemen tell us. They take this advantage and sell on carcass weight basis in mandi. Although there was no scale in mandi but the bigger middleman was purchasing on estimated carcass weight and this is where middlemen make profit due to our wrong estimation of carcass weight".* He mentioned that *"I remember the activity during first nutrition extension visit conducted by project where we weighed a young cattle calf and everyone estimated weight before weighing. We all were 10-20 kg wrong when that calf was weighed. If we are so much inaccurate at that level, then surely we will be 40 kg short when selling the animals and middlemen take this profit in mandi which we deserve".*

Aqsa (female farmer from 45GD) commented,

> *"before this visit we always thought we should buy heavy weight animal for fattening and we spent more money on buying expensive animal. Today, we learned that we should buy young animal with less price and low weight and rear it for fattening".*

This activity required the farmers to leave the village, invest more of their time and get out of their comfort zone. This applied effective selection pressure to the individuals who had been involved in the extension activities and reduced the groups to those more progressive farmers, who were committed to the goals of strategically marketing their animals, rather than selling them at a time of need. This activity was only completed for the pilot village as the project team wanted to test if the same outcomes could be achieved through skipping straight to the "walk the chain" activity. In reflection, this activity provided good background and experience for farmers before delving into the larger "walk the chain" activities. Where time and resources permit, this activity should be included as part of the FBG development process as it better prepares farmers for the essential "walk the chain" activities.

Walking the chain

The "walk the chain" activity was effective in exposing the farmers to other value chain opportunities. This highlighted to the farmers that there are plenty of opportunities to make money from beef fattening in Pakistan, however, to achieve this, farmers need to be strategic and meet the market demands. A key realisation for farmers was the need to participate collectively as an FBG to benefit from these value chain enhancement opportunities. Whilst the greatest financial benefit was likely to occur if farmers sold directly to a feedlot or processor there were other benefits to working collectively which were identified. These included collective purchase of feed or rearing of animals to market specifications, or simply consulting the group regarding the selling strategy and price for their animals to utilise the collective knowledge of the group. Farmers who participated in the "walk the chain" activity also had a clear idea of the effort and strategy required to successfully sell beef animals to more profitable markets. The process of engaging farmers in basic extension activities then increasingly demonstrating the need to work together to sell animals and letting them form this opinion themselves, rather than entering the village and communicating the intention to form an FBG, was highly effective. This was a critical factor in ensuring that the farmers engaged at this point in the process had the right intentions and motivations when going forward to form an FBG.

The 'walking the chain' activity also facilitated the farmers to reflect on their current practices for raising beef cattle and to identify changes which could be made to increase profits. For example, in 45GD farmers made the following pertinent comments:

> *"Main reason of our loss is wrong animal weight estimation and high cost of production. We are just rearing animals and never observed how much animal feeds, how much it costs and how much is weight gain. We have to reduce our*

cost of production and improve weight estimation of beef animals to prepare desired animals."

"We cannot deliver 12-15 animals individually and will have to work as a group. We will buy animals of same weight, age and will rear for 4 months. In this way, we can produce animals according to required specifications with uniform supply".

7.4.2 Initiation and evaluation of value-chain enhancement opportunities

Evaluation of value-chain enhancement opportunities

A detailed assessment of the opportunities which were identified through value chain actors who were interviewed was facilitated by the project team (Appendix 11.4.12). In Punjab and Sindh, the markets identified to have potential for smallholder farmers to directly engage with were feedlots (Oasis, Ever Fresh, Asif Khanzada) and, to a lesser extent, processors (KATCO International, Fauji Meat). Farmers were encouraged to consider each of the opportunities and identify which opportunity would be the most appropriate for them to pursue. In all villages, the value chain actors identified during the 'walk the chain' were deemed by farmers to be too far away due to transportation risks and costs. Thus, farmers initiated an investigation of opportunities with local value chain actors.

The need for cooperative action was highlighted by both the project team and the farmers during these evaluations. It was at this point that the project team formally introduced the idea of an FBG and asked the group if they would like to form an FBG. Given that the activities had clearly highlighted the need for farmers to work together the engage in the market opportunities, farmers were enthusiastic about the FBG idea. Generally, male participants were more enthusiastic about formalising the FBG than women participants. Female farmers noted that it is difficult for them to be involved in the negotiation of animal sales due to social norms, such as not being able to visit markets. Therefore, they chose not to formalise their FBGs, instead choosing to engage in more extension activities and support their male counterparts. This is something that would need to be addressed in future research and alternatives ways for women to participate in more profitable value chains explored.

Formalising the FBG through rules and regulations

Rules and regulations were set in 4 villages [45GD, 96D, Beero Lunjwani, Sidique Narejo (men only)]. In each of the men's FBGs a group leader, general secretary and finance secretary were appointed based on mutual agreement between the farmers. Each FBG also determined their own membership criteria, responsibilities of the group leader, standard operating procedures (SOPs) for the purchase and sale of livestock, and Standard Operating Procedures for conflict and financial management. The general criteria and procedures which were relatively consistent amongst the FBGs.

Although the farmers did not recognise the importance of establishing these rules and regulations initially, the approach of the team to ask a series of "what if" questions highlighted the importance of this to the FBGs. For example, farmers were asked questions like "what would you do if another farmer wanted to join the group?", "what would you do if one of the group members did not raise their animals correctly and the group was not able to deliver the consignment". These types of questions highlighted what sort of rules were needed by the group but allowed the FBGs to retain ownership of the rules set for the group.

The women's FBGs did not formulate rules and regulations for their groups, however they identified how they would contribute to the household cattle fattening business, with an

emphasis on their roles in managing cattle nutrition and health, and the importance of this to deliver a consistent consignment of cattle from the FBG. Additionally, they undertook to keep records and calculate gross margins to support marketing decisions made by the men's group. Older women within the group had greater ability to visit other houses within the village and suggested that they would make visits to ensure cattle intended for group marketing were of uniform quality.

FBG marketing strategy

45GD marketing strategy

Initially, a market opportunity was identified by the FBG with a feedlot farm (Ahsan). Specifications and an indicative gross margin analysis suggested that this was a viable option, with a return of approximately 15% based on estimated variable costs (Appendix 11.4.10). However, when confirming this opportunity with the feedlot there was no longer interest from the feedlot operator who had instead prioritised their dairy business. An alternative market opportunity with a slaughterhouse (Tazij) which had also been identified during the 'walking the chain' activity was then pursued by the FBG. The risks were lower regarding injury during transport and there was greater flexibility regarding animal sex and species. However, farmers were concerned about the risk and cost of taking their cattle long distances, and prices were similar to what they received when selling cattle within the village. They are now pursuing local market opportunities, which they analyse to ensure they are profitable, and the Eid market. The project team provided the 45GD FBG with specifications commonly demanded by customers in the EID market to facilitate their ability to rear appropriate beef cattle.

Marketing strategies in the other FBGs

The FBGs in 77D, 96D, Sidique Narejo and Beero Lunjwani expressed a greater interest in pursuing opportunities in the Eid market, rather than those identified during the "walk the chain" activity. This may have been influenced by the timing of the "walk the chain" activities in these villages, which were conducted in the lead up to Eid, and because famers already targeted Eid markets. Marketing strategies were discussed and the project team were able to help the farmers identify more detailed market specifications. These included requirements for cattle to have no deformity, no injury or disease, age 2-2.5 years or more, and to be well fattened. It also included breed preferences and a preference for humped animals. The FBGs were then able to analyse the Eid opportunity and develop a sales strategy for this market. For example, in 77D after gaining an understanding of Eid market specifications, farmers met with buyers to negotiate future sales. This led to buyers now coming directly to 77D to purchase cattle reared to meet specifications.

7.4.3 Engagement and subsequent impact

There was a total of 15 men and 15 women surveyed at the conclusion of the project led FBG activities. In Punjab there were 18 members interviewed using survey questions, and in Sindh 12 members were surveyed.

Survey results from 30 FBG members indicated that the average age of FBG members was 34 years (18-50) and 45 years (32-60), Punjab and Sindh, respectively. Most members in Punjab either had no education (6/18;33%) or were educated to a tertiary level (7/18; 39%). Whilst in Sindh, most members either had no education (4/12; 33%) or were education to a primary level (4/12; 33%). In both Punjab and Sindh within a village all FBG members belonged to the same caste, except for one man in 77D. Households owned an average of 4 acres before and after the formation of the FBGs, similarly the average number of cattle owned by a household has stayed relatively constant (around 11; Table 7.4-6).

Table 7.4-6 Land and cattle ownership before the FBGs and after the FBGs were formed according to region

Indicators of wealth					
	Punjab			Sindh	
	Before	After		Before	After
Land owned (acres)	4.5	4.6		3.3	3.3
Number of cattle owned	12.2	11.8		8.5	8.6

Most members had other household members who were also a part of either the men's or women's FBG in the village (15/18; 83%, 12/12; 100%) in Punjab and Sindh, respectively. Overall, members had participated for 42 months and participated in 79% of the activities offered to their specific FBG within their village. These averages were slightly higher in Sindh, as compared to Punjab (Table 7.4-7).

Table 7.4-7 FBG membership duration and participation according to region

	Punjab	Sindh
Membership duration (average months)	41.2	43.3
Participation in FBG activities (average proportion of total FBG activities)	73.3	87.8

Most FBG members changed their practices used for fattening and selling cattle after participation in the FBG. All members changed their feeding practices, whilst most now believe they meet consumer preferences and have changed the person or market where they sell their cattle (Table 7.4-8). Whilst none of the FBGs sold their cattle collectively, they are now able to calculate gross margins and a fair sale price for their animals, they do this regularly and discuss this as a group before proceeding to negotiation with a customer.

Table 7.4-8 The proportion of member households that changed their practices related to either fattening cattle or sale of cattle after participation in the Farm Business Group according to region

	Region	
	Punjab	Sindh
Practices related to fattening cattle		
cattle bought for fattening	11/16 (69%)	5/11 (45%)
feeding cattle	16/16 (100%)	11/11 (100%)
meeting customer preferences	16/16 (100%)	7/11 (63%)
other changes	15/16 (94%)	7/11(63%)
Practices related to selling cattle		
discussion with FBG prior to sale	13/16 (81%)	7/11 (64%)
sale to different market/ person	12/16 (75%)	9/11(82%)
confidence in negotiating sale	12/16 (75%)	5/11 (45%)
calculating gross margins	14/16 (88%)	8/11 (73%)
other changes	9/16 (56%)	5/11 (45%)

The changes made to their beef businesses (practices related to fattening or sale) reduced the work burden for most men involved in the FBGs (12/15; 80%). However, the work burden was reduced for less than half of the women (6/15; 40%). The other women

either reported an increased work burden (7/15; 47%) or no change to their work burden (2/15; 13%). Reasons for increased work burden included additional time required for cattle husbandry, such as colostrum and concentrate feeding, as well as shed cleaning. Three women who reported increased work burdens also reported that they were not concerned about their increased work burden because of increased profits gained, whilst the remaining four women did not specify if they were concerned about their work burden.

The profitability of beef businesses of FBG members increased after their involvement, and in Punjab the number of cattle sold also increased (Table 7.4-9). By discussing sale prices as a group and collectively demanding better prices for their animals, the farmers participating in the FBGs are receiving a greater return for their animals and are more confident participating in the beef value chain.

Table 7.4-9 Average profit data for the beef cattle businesses of member households before and after participation in the Farm Business Groups according to region

	Profit/Loss					
	Punjab				Sindh	
	Before [a]	After [b]			Before [c]	After [d]
Number of cattle sold after fattening	2	4			2	2
Price received (PKR/ animal)	62667	268130			55000	73000
Cost of production (PKR/animal)	21000	153700			50000	46625
Profit (PKR/animal)	41667	114430			5000	26375

[a] Based on complete data provided by 3 member households, b Based on complete data provided by 10 member households, c Based on complete data provided by 1 member households, [d] Based on complete data provided by 4 member households

Knowledge, attitude and practice changes to the way that FBG members now work with value chain actors were identified during project visits. Significant changes which have occurred include: 1) identifying more profitable cattle purchases, 2) improved bargaining power through group negotiation, and 3) raising cattle to meet market demands. Key changes which have been made by each village are included below. As expected, the greatest progress and changes appear to have been made in 45GD. This is likely to be the result of more support from the project team over a longer period of time, but may also reflect greater resources and higher education levels within this village. The other villages have also benefited from the FBG activities, with some unexpected benefits such as the women of Beero Lunjwani seeking investment in their beef businesses.

45GD

Members of the 45GD FBG have demonstrated changes in their resources and agency. They are proactive in the rearing and selling of their calves either for Eid or for the Lahore market (mandi). This proactive approach incorporates many value chain management principles such as creating value for customers, adopting ‘best practices’ to deliver in full, on time and quality (DIFOT-Q), accurate physical and financial records, sharing information and communicating regularly. They have developed strategies that enable them to be adequately rewarded for the customer value they create. They can apply accurate gross margin analysis and accurate weight measurement using scales they purchased with project support, this mean they can now apply the “wish-want-walk” principles based on market conditions. They now calculate the cost of production and determine their preferred sale price according to body weight. They are receiving on average PKR 5000 more per animal as compared to before the FBG activities. This is aided by the collective action of the group, whilst the group are not pooling animals and selling together, they are working together to determine a fair price for the animals that they sell individually. Thus, they are able to negotiate a better price with the local middleman because they have additional knowledge, but also because they are all doing this.

Female farmers are supporting their households to rear beef animals according to customer demand. This includes investment in concentrate feeding, improving calf nutrition and management, vaccination and deworming. Whilst, male farmers are planning to jointly sell their cattle at an equitable price to a specific customer to get higher rewards for their product. To identify a specific customer, FBG members are now able to explore local beef market opportunities using the value chains approach. Farmers also adopted digital marketing practices in response to COVID-19 restrictions. They have a Facebook page where they upload pictures of their animals and promote their FBG, resulting in an increased interest in their animals. However, they did not sell to buyers who contacted them via Facebook because the prices offered were low.

"We decided to work together to sell our beef calves to profitable markets. Dairy-Beef Project strengthened our skills to raise and fatten our calves according to market requirement and engaged us to interact with beef value chain actors. We are more confident now to negotiate the sale price of our animals".

M. Ahmad, Member farm business group, 45GD, Okara.

96D

The FBG in 96D are using the learnings about the Eid value chain to rear animals that meet the specifications for this market and are now selling their animals at higher prices. Two main factors have influenced this: 1) understanding and meeting market specifications, and 2) discussion amongst the FBG regarding rearing, such as feeding strategies, and prior to sale. For example, one family involved in the FBG recently sold an animal meeting the desired specifications of the Eid market at their desired price based on current local market prices (300 000 PKR) to the middleman. Two of the FBG members are middleman who have improved their negotiation skills, and this is likely to also benefit other FBG members in receiving appropriate prices for their cattle based on weight and meeting specifications of the market. Farmers now weigh their cattle if they are unsure of the weight, or to confirm the weight when their estimate differs from that made by a middleman.

Farmers have identified two feedlot farms nearby to them and they are planning to meet with the feedlot farmers to collect information regarding product specifications and financials. They have been able to do this because of the evaluation of market opportunities that the project team supported. Farmers considered that the transportation costs were too high to engage with value chain actors identified during the 'walk the chain' activity. Thus, they have initiated an exploration of market opportunities nearby to them and are evaluating these two feedlots based on profit margins and risks involved.

Farmers prioritised gaining further knowledge about cattle nutrition and health above developing a marketing strategy and setting rules and regulations of the group. Farmers were concerned about the cost of production and growth rates of their cattle and buffalo. They wanted to address these concerns prior to formalising the group. After these extension visits were carried out farmers started feeding concentrates and vaccinating their animals. Farmers are now progressing with market opportunities for Eid and with local feedlots as outlined above.

"Before the walking the chain, every farmer was selling the animal at the individual level. Whereas after group exposure visits, farmers consult each other and are mutually negotiating with middlemen for making the good price of their animals".

Allah Dad, male farmer from 96D, Pakpattan.

77D

The farmers in 77D are experienced in marketing cattle for the Eid market and therefore prioritised learning more about this market to increase their sale prices. The FBG members are using the learnings about the Eid value chain and are now receiving higher sale prices as compared to before their engagement with the project. Farmers met with buyers to negotiate future sales which led to buyers now coming directly to 77D to purchase cattle reared to meet specifications. For example, one farmer involved in the FBG recently sold an animal meeting the desired specifications of the Eid market at their desired price based on local market prices (900 000 PKR). His profit was 400 000 PKR, and his animal was 100 kg heavier, as compared to the animal sold the previous year when his profit was 250 000 PKR. This was the result of improved negotiation skills and producing an animal meeting the specifications of the market. Five FBG members have also sold their animals together on two occasions to increase their bargaining power with value chain actors in the Karachi and Lahore Eid markets. FBG members checked local market prices and weights, then invited a middleman from Karachi to see their animals. After viewing the cattle, the middleman offered the farmers prices which they were happy to accept.

Farmers also decided to explore nearby market opportunities to get a better understanding of the product specifications and market requirements. Farmers are currently using the skills developed during the “walk the chain” activities to analyse local market opportunities. They then intend to decide on the group rules and regulations after a market opportunity is identified.

Sidique Narejo

The farmers of Sidique Narejo are fattening their animals to meet Eid market specifications based on information shared by the project team. Farmers have also developed linkages with other beef value chain actors, but the distance of feedlot farms from the village and the low number of animals fattened per farm has made such options less viable. An unresolved conflict over land between the male farmers has prevented formalisation of the FBG and development of a marketing strategy. At this point in time, it is unclear, other than an improved understanding of market specifications, if the FBG members in this village have received any benefits from participation.

However, female farmers are still interested in improving their animal husbandry and marketing strategies. They have developed new skills and knowledge which they intend to put into practice on their farms. For example, Hakeema (female farmer from Sidique Narejo) shared that

> *“through participation in “walk the chain” activities she understood the demand of male calf meat and the specification of the customer so she will try to rear the animal according to the market demand or requirement”.*

Whilst another female farmer, Husna, shared,

> *“we learnt about the animal nutrition for fattening purposes of young calves so that they can gain weight to fetch better prices at the time of selling in the market”.*

Husna was also pleased to learn farm business management skills. She said,

> *“This practice has allowed us to know how much money we spend on our animals and how much we get in return. The skill of calculating cost of production helps us to evaluate our farm business returns (profit/loss)”.*

Beero Lunjwani

Ten female farmers of Beero Lunjwani have initiated a beef fattening business plan. They have purchased 10 animals after getting a loan from the National Rural Support Program

(NRSP) and Sindh Rural Support Organisation (SRSO; both are NGOs, which provide loans to female farmers to purchase livestock assets). They now intend to fatten these cattle to meet requirements of their customers and then sell these cattle. To facilitate this initiative they intend to make rules and regulations for their FBG.

During the feedlot farm visit, female farmers learnt that animal prices are lowest after Eid Ul Azha, presenting a good time to purchase animals for fattening. The female farmers intend to take advantage of the low purchase prices and rear the animals using feeding practices learnt from the project team. They aim to meet market specifications at a low cost, and thus increase their potential profit margins.

> *"We learned what kind of animals should buy for fattening. Before this visit, we had always assumed that buying a heavy-weight animal for fattening would save our money. We bought the expensive animal and spent more input cost to rear them. We learned from this exposure visit that we should buy a young animal with a low price and a low weight (high growth potential) and fatten it."*
>
> Amina (female farmer from Beero Lanjwani)

Both male and female groups identified a feedlot farm as an opportunity to sell their animals and are building up their relationship with the farm owner (Asif from Organik feedlot farm, Kotri). They have also been targeting the Eid market utilising market specification information and gross margin analysis to evaluate and negotiate sales. They often get market information about the animal specifications and prices from various external sources. They now compare prices for feedlots with nearby markets (mandies) and use gross margins to assess where to sell their animals. This demonstrates that the participants are able to use the skills learnt during their engagement with the project to make more informed decisions.

7.4.4 Discussion

This objective aimed to determine the impact of supporting the formation of FGBs as a way of improving small-holder dairy-beef farmer engagement in beef supply chains in Pakistan. We hypothesised that encouraging farmers to sell collectively would increase their economy of scale and enable them to engage in more profitable value chain opportunities. Whilst farmer groups were established effectively, farmers did not sell collectively and thus they did not form true FBGs. A key purpose of smallholder farmers' keeping cattle is their ability to act as a bank, thus, dedicating specific numbers of cattle for sale within set timeframes did not appear to be an opportunity that smallholders could take up. However, they did engage in more profitable value chain opportunities as indicated by the changes to their practices in fattening and selling cattle, and the profits they have received. Farmers have a greater understanding of the value chain and market specifications and are in a better position to understand the value of their cattle and negotiate to be rewarded for producing better quality cattle.

Research questions

This section draws on the key results from Objective 4 to address research questions 5 and 6 from the project proposal. See detailed responses below.

> **RQ5;** *What are the critical success factors that underpin smallholder dairy-beef producers engaging in more profitable value chain opportunities?*

Critical success factors identified in the literature and factors identified during implementation of this objective were relatively consistent, but there was a notable difference. The literature suggests that increasing the economy of scale of smallholder producers via collective action is critical to smallholders engaging in more profitable value chain opportunities. Thus, collective action was encouraged during FBG formation, but despite this, farmers did not sell collectively. However, they did engage in more profitable

value chain opportunities as indicated by the changes to their practices in fattening and selling cattle, and the profits they have received. This suggests that whilst collective action may greatly enhance the ability of smallholders to engage with more profitable opportunities, it is not the only factor influencing engagement. Improved animal marketing also contributed to dairy-beef smallholders engaging in more profitable opportunities. In particular, the ability to negotiate to be rewarded for producing better quality animals was a critical success factor we observed. This was possible for FBG members because of their greater understanding of the value chain, market specifications, and the value of their cattle. The farmers participating in the FBGs are selling to alternative value chain actors and receiving a greater return on investment for their cattle.

Key success factors for group formation were also identified in the literature, including resources, agency, culture, and motivation. The successful formation of FBGs influences the likelihood of cooperation and collaboration amongst the group. As discussed above, this is one, but not the only factor influencing the likelihood of engaging in more profitable value chain opportunities. Success factors for group formation from the literature were incorporated into the selection process for establishing FBGs and from our results, still appear to be critical. For example, we found that practice change was greater in Punjab than in Sindh. In Sindh, resources such as access to land and schools, and agency for women as indicated by social norms for their mobility, were both lower compared to Punjab. We also observed when a husband and wife were in the respective FBG groups more practice change occurred, potentially due to a culture that was more conducive to change and support. Finally, group members were allowed to self-select, with multiple "selection pressures" applied prior to group formation to ensure members were motivated to join the group with a genuine interest in improving their fattening business, not just seeing an opportunity for a quick or easy win.

> **RQ6;** *What impact does effectively engaging farmers in whole of market chain activities have on household income from beef production?*

Farmers have increased profits from their beef businesses after their involvement in the FBGs. On average, prices received by farmers for their cattle in Punjab are now 4.3 times greater and in Sindh are 1.3 times greater. The cost of production also increased in Punjab, potentially as a result of farmers investing more in fattening their cattle but decreased in Sindh (small sample size). Ultimately, profits reported by FBG members are now 2.7 times greater in Punjab, and 5.3[11] times greater in Sindh, compared to before the FBGs. This is likely to have been influenced by the practice changes those farmers made in response to whole of market chain activities. All FBGs reported improved understanding of the value chain and market specifications, improved negotiation and price determination skills, and improved sale prices for their cattle. Farmers now weigh their cattle, calculate gross margins and determine a fair sale price. They do this regularly and discuss as a group before proceeding to negotiation with a customer. By discussing sale prices as a group and collectively demanding better prices for their animals, the farmers participating in the FBGs are receiving a greater return on investment for their cattle. Additionally, in Punjab farmers are now selling an average of four cattle per year after fattening, as compared to two prior to their participation in the FBGs. Thus, further adding to the income generated from their beef businesses.

[11] *Note small sample size used for this calculation from Table 7.4-9*

7.5 Objective 5 Results

The major results presented here are the outcomes of the 'Science into Action' workshops that were part of Activity 5.1 from the project proposal (for further detail on these, please see Methodology Section 5.5.1). These results presented in this section are drawn from the outputs of these workshops and form the basis of the policy paper (Activity 5.2) that has been drafted. Further details of this paper can be seen here; *The current role of livestock extension and future opportunities for improving outcomes for smallholder farmers in Pakistan.*

Further details of these Activities can also be seen in the Methodology (see Section 5.5), 'Achievements against Outputs/Milestones' (see Section 6.1.5), Results (see Section 7.5) and Appendix (see 11.5) of this report.

7.5.1 Policy paper; livestock extension & future opportunities

This paper addresses the issue: How can a holistic training intervention (that is, the whole family extension approach, WFEA) build on the fundamentals of quality extension programs in a smallholder farming context in the existing extension systems of Pakistan?

This paper describes the main components of the national level workshop including the identification of on-going extension challenges in Pakistan and concludes by linking some of these problems with recommendations and potential solutions and how we can better support improvements in the sector in the future.

Methods: see Section 5.5.1.

Information shared: As part of the 'Science into Practice' workshops, pre-reading information was provided to participants to help support understanding of the project, evidence and lessons prior to the day starting. Documentation that was shared with them included the following;

1. Key lessons from the project which included results, evidence and experiences from a validated extension program in the Pakistan context.
    a. See list and links to 'Key lessons' in the Methodology of this report (5.5.3).
2. An overview of a review of extension policy across both national and provincial livestock extension organisations.

Participants were requested to read the information prior to arriving at the workshop to assist in initiating discussion during the day.

As part of the process to understand the current situation and support needed in the Pakistan extension system, the project team carried out a review of national and provincial policies related to smallholders, livestock and extension policy in Pakistan.

What does the policy review tell us?

It emphasises that policies are actually well articulated and clear at both the national level and across provinces.

- Each have a core goal to improve smallholder farmer profitability and improve farm production
- Each have a strong support to carry out farmer training or capacity building.

What is missing from these policies is documentation which describes how these goals will be reached. This is understandable as it is complex and is up to the management of each organization to implement themselves, but highlights the need for this kind of information to support quality extension.

Results: During the first Science into Action workshop the majority of the participants (20/24) mentioned that whole family extension approach has great importance in the farming system of Pakistan. Few of the participants (4/24) responded that they are not familiar with WFEA and now they learned and will implement this approach in their ongoing projects. The majority of the participants (17/24) shared that capacity development of farm advisors is critical in farm advisory services and also shared their experience of engaging farming families. The key extension recommendations during ASLP-I & II phase of the project were shared with the participants (see 'Key Lessons' box).

Based on workshops, the following are the key challenges that organisations heads shared regarding implementation of their extension programs (ref: Sci2Action Workshop, August 2021). This extent of this list highlights that although the policy documents are clear, there are still many difficulties in implementing extension in the field.

- Organisation level challenges:
  - Less skilled human resource
  - Geographical placement of farmers where organisation reach is a challenge
  - Lack of communication channels with smallholder farmers (male and female)
- Farm advisors level challenges:
  - Farmers advisors are lacking in communication and technical skills to motivate farmers for improving farm practice change, many of them practicing the treatment of animals (on-payment based services to farmers), less aware about the needs based extension services.
  - Some participants shared that it was challenging for them to include farm advisory services as a job target for themselves.
- Farmers level challenges:
  - Some participants shared that the farmers are reluctant to implement improved farm practice because they have to face language barriers when farm advisors communicating any extension advice to them.
  - Farmers have countless expectations from the concerned organisations and farm advisors.
  - Farmers took time to adopt any new idea of marketing dairy and beef production.
  - Lack of awareness of farmers related improved health management practices and ignore the timely treatment of animals.

In the second workshop, the participants discussed the lessons related to these challenges and which ones were most applicable to be incorporated in a policy paper and shared with interested participants and future project. The participants classified these key messages according to the timeframe in which they could be achieved, resulting in the following short, medium and long-term messages.

Table 7.5-1: Priorities to be addressed to improve livestock extension services in Pakistan.

Short-term	Medium-term	Long-term
- Working towards more profit - Developing extension material - Enhancing the WFEA	- Collaboration with other organisations - Engaging with smallholder farmers	- Capacity building of farm advisors

Note; Time constraints resulted in some of the listed messages not being classified.

Discussion: It was observed that being part of the 'Science into Action' workshops and the associated discussions the participants were really engaged and working with the material and ideas that were provided. This helped the group to better understand the different lessons that the Dairy-Beef team presented, and most importantly if/where they apply within their organisations.

8 Impacts

8.1 Monitoring, Evaluation, Reporting and Learning (MERL)

The tables below are based on the project's Monitoring, Evaluation, Reporting and Learning (MERL) plan developed in conjunction with Ted Rowley, Jo Roberts and the Dairy-Beef project team. This MERL plan was created at the AVCCR program meeting (July 2017). The tables report the results based on indicators against the project's intermediate outcomes (which relate to each objective), as a way of building to the project's long-term outcomes.

8.2 Objective 1

"To investigate the support necessary to integrate the whole-family extension approach within the current dairy-beef value chain and evaluate the impacts on smallholder farming families". The end of project outcome relating to Objective 1 is for *"Some smallholders have adopted improved farm practices (leading to higher profit/livelihoods/nutrition)"*.

Intermediate outcomes	Indicators	Results
Organisations practice and support the WFEA	Experiences and changes observed by organisation management on the WFEA, before/during/after implementation	*The evidence being collected to address these indicators is based on qualitative data collected from field follow-up (December 2021 to February 2022) meetings and the CoP workshops conducted with the heads of organisations and extension managers and reflection sessions conducted during farm advisors' training workshops.* During the reflection sessions with farm advisors of the collaborating organisations, the project team found that the majority of the NGOs (09/10) and some private sector organisations (03/07) are progressively implementing the WFEA interventions in the field. The majority of farm advisors from NGOs shared ideas with each other regarding how the WFEA project interventions helped improve their technical, social and communication skills which subsequently helped to achieve both their routine job targets and organisational goals. The evidence collected during the semi-structured interview with the extension heads of two partner organisations has shown large-scale support for the implementation of WFEA field activities above the commitments already made with the Dairy-Beef project.

		Both the extension managers from SLD and NSRP have shown interest and action in providing financial support and human resources to train more staff to expand their own field activities. This has led to training supported by these organisations and run by the project team. From these opportunities, 30 SLD VO/VAs have been trained (January 2020) from the district of Tando Allahyar and 30 farmers in Sargodha (September 2019), and 24 community resource persons and social mobilisers in Islamabad (October 2019) from NRSP. The organisation head of NGO's observed the significant importance and impacts of WFEA to achieve organisational goals. For instance, LPP has integrated the WFEA in many of their ongoing projects such as the honey bee project, WASH project, etc and RDF started engaging young girls in their value chain projects and started their training programs. Similarly, one of the farm advisors from L&DD Punjab shared that he is being involved in the prime minister's initiatives (PMI) to save the calves and calf fattening. He gained the upgraded role for PMI projects after engaging with farm advisors workshops because his management saw a significant change in training delivery and technical knowledge when he was conducting a training session on calf rearing (8th Farm advisors training workshop, 2022). Semi-structured interviews of each extension manager from partner organisations are conducted once a year during COP. Extension managers shared that farm advisors' technical and communication skills improved and subsequently helped to achieve the goals of their organisation. The majority of the farm advisors (17/22) have shared with the project team that the WFEA project interventions helped to save the resources of their organisations. For example, one farm advisor from the private sector reflected that previously, their company had to hire technical experts to run farmer training to meet the needs of the farmers. Now, the farm advisor is part of the WFEA network, he is confidently running those training workshops and the company is saving time and funds because they do not need to hire more veterinary/animal technical experts (December 2019). Qualitative data was collected in February 2020 where a second CoP was held with the extension management from collaborating organisation. Majority of the NGOs and private sector participants shared that after learning about the WFEA, their

		organisations have started various initiatives to support the implementation of the WFEA including school programs (involving youth in the extension process), incentives for farmers (provision of loans to build the animal sheds, water troughs, purchase animals), strategies to support practice change (on-farm demonstrations, participatory learning approaches, provision of one-one extension services) and involving female staff within their farm advisory service team to better engage women in communities. For example, the CEO of one NGO shared during the CoP (February 2020) that WFEA has now been implemented across all ongoing projects within their organisation including health, education, agriculture, and livestock. Another example is from the Government livestock department Sindh where the extension manager mentioned that previously their focus was always on the treatment of animals. Six of their farm advisors have been trained in the WFEA and following this have initiated regular extension activities by implementing WFEA to educate farming communities (in at least one community each) regarding the best farming practices. These actions highlight that the WFEA interventions are enhancing the scope of mandatory work of their organisations. Similarly, qualitative data collected from extension heads in the fourth COP held in March 2022, showed that farm advisors did not have sufficient knowledge to address the on-farm challenges. Whilst the WFEA program remained significantly beneficial for farm advisors to build technical knowledge, and confidence and are secure for spreading authentic information in farming communities. They can act as master trainers within their respective organisations. CEO from RDF stated that "*the training program for farm advisors is very critical to get on-farm practice change. We have 268 community livestock extension workers in our organization who will be provided training on WFEA, community engagement, and disseminating extension messages to whole families for desirable results across all projects within the organisation*".
	Many farmers (male/ female/youth) engaged in the WFEA (for each farm advisor, for each organisation). Method of delivery	*The evidence being collected to address these indicators is qualitative data collected from farm advisors at facilitated discussion at the farm advisor training workshops, and farm advisors' follow-up meetings by project team members.* The evidence collected during the facilitated discussion and field follow-up visits indicated that majority of the farm advisors are engaging 10-15 households, once/twice per month in each village and implementing the WFEA. The project team found that majority of the NGOs and private sector organisations visited the farmer communities

	and frequency of occurrence	more frequently as compared to other (e.g two to three times/month). Some organisations including LPP, RDF, CABI, NRSP have a larger number (25-30) of households engaged as part of their improved farm advisory services (LPP has engaged 2 new villages containing 30-35 households each and implementing WFEA in it to achieve their organisational targets). However, organisations including research and government organisations tend to be providing farm advisory services at a slightly lower frequency (~once a month) to their farming communities on need-based veterinary services. One farm advisor from L&DD shared that "*After getting last training (November 2021), he has trained 20 extension officers in my area who, in return, trained 50-70 farmers of their respective areas* (8th Farm advisors training workshop, 2022). The evidence collected during the field follow-up visits by the project team found that majority of the NGOs are not focused on livestock, and instead are working in a number of other areas like agriculture, poverty alleviation, health, education, and horticulture. By being part of this program, some of these NGOs have successfully integrated livestock extension using the WFEA within their own extension programs. For example, one of the farm advisor from NGO shared that she is from a purely agriculture background without any expertise in livestock production in the past. As a result of being a part of the WFEA network and training, she is now delivering various training on livestock farming with great confidence. This illustrates that the WFEA interventions are enhancing the scope of her mandatory work and her organisation (Dec 2019). Male farm advisor from government department stated that he has attended all eight training workshops organised by the Dairy-Beef project and implemented his learning in various villages while performing his job roles. So, he disseminated every innovative technique such as colostrum feeding, free access to feed and water, and better nutritional practices. In Pakistan, there are 70% smallholder farmers and they have little to no awareness of these practices. So, he is disseminating all the approaches to the farmers of his area using the whole family extension approach and other innovative farmer engagement approaches. (8th Farm advisors training workshop, 2022) One of the male farm advisors from private sector has improved his communication skills and community engagement techniques from WFEA training workshops. He started to implement the WFEA within his organisation by conducting training sessions on livestock farming to school children in his working areas. He delivered extension messages of colostrum feeding and calf rearing to school-going children. Moreover, he

		has a recorded voice message on calf rearing and shared it with colleagues working in 8 zones within his organisation. He doesn't have a female colleague to interact with female farmers. Therefore, he conducted a session on gender inclusion and school children training with support of Dairy-Beef project female staff to demonstrate the WFEA model to his organisation and farming community. During the training session, Nauman and Sanam (brother and sister, primary school students) shared that "he *trained us on surf test which we are practicing after every 15 days at their farm. We were both amused when our mother asked about the test result".*
Farm advisors' communication and social mobilisation skills are improved including sharing knowledge/experiences and with smallholder households participating in the whole-family extension approach they are implementing	Observed and perceived benefits (from both males/females/youth) in terms of animal production, profit, animal welfare, human health/nutrition, other livelihood parameters and individual skills/practice change of lead farmers	*The evidence being collected to address these indicators are based on qualitative data collected from the facilitated discussion during the farm advisor training workshop, during farm advisor follow-up by project team members.* The farm advisors from government department tend to be providing farm advisory services at a slightly lower frequency (~once a month) to their farming communities and they visit the farming communities for veterinary services on need based. The majority of farm advisors from NGOs (7/8), private sector (5/7), research (3/5) and government (2/2) organisations shared ideas with each other at various facilitated discussions regarding how the WFEA project interventions helped improve their technical, social, and communication skills which subsequently helped to achieve both their routine job targets and organisational goals. For example, one farm advisor from private sector shared that smallholder farmers started implementing improved farm practice changes and increased milk production after participation in farm level extension activities delivered by this advisor who had been trained in the WFEA. This then contributed to the farmer reaching his routine milk volume targets with greater ease, benefiting both the individual and the company. He mentioned that these improvements have led to an increase in contribution of smallholder farmers (50% of total milk procurement) at his centre which was 30-35% before becoming the part of WFEA training (March 2021). The evidence collected during the fourth field follow-up meetings (February 2022) with the extension heads of two private organisations have shown that they are keen to replicate the lessons from Dairy-Beef project training workshops within various on-going projects and working areas of their organisations. Both extension managers shared that the lessons from Dairy-Beef project training workshops were helpful to achieve high

		adoption rate of improved on-farm practices of their farmers. It was further supported when team conducted interviews as part of the case study with this organisation (female farm advisor from LPP) who mentioned that *"She achieved her high job targets of building more than (24) farm fences in less than 1 year however, her professional senior manager could hardly be able to convince (8) farmers during last 10 years within same working villages* (March 2021). Based on the interactions with farmers, observations at the farm level, and conversations with farm advisors the project team has collected a number of stories and examples of farm-level practice change and anecdotal household impacts. Some examples from most engaged organisations are shared here; Male farm advisor from NGO shared he conducted regular training for the farming families of his area after every workshop. He mentioned that he plans his training after doing a need assessment of the farmers. So, he mentioned that he has started witnessing practice change at the farm. He also shared the story of one of his farmers, Arshad who had 16 cows and 4 buffaloes and was able to enhance one litter of milk production of his dairy animals by providing free access to water to his animals. Moreover, he also observed that these practices have saved time for the farmers and they utilise this time in cleaning the shed. He mentioned that *"Production has been increased a bit by following innovative practices and it has also saved some time for the farmers".* (6th field follow up visit, 2022). Male Farm Advisor from research organisation stated that after participation in WFEA training workshops, he started engaging farmers in the extension programs. Before this, the farmers in his area believed in myths regarding colostrum feeding to calves and retention of the placenta. After attending a training workshop of the Dairy-beef project he had been continuously advising farmers about calf care and colostrum feeding to calves immediately after birth. Now, the farmers are improving their calf management and nutrition practices which resulted in to better calf health and get higher weight gains. (7th Farm advisors training workshop, 2022). Another interesting story of male farm advisor from NGO mentioned that in Tharparkar, camel milk is easily available and quite cheap as compared to buffalo and cow milk. However, residents of Tharparkar farmer community do not prefer camel milk consumption so it is usually wasted. After getting the training on the milk value addition

		they shared these technical knowledge with their farming communities and engage female farmers to make dry milk powder out of this milk and making profit ((8th Farm advisors training workshop, 2022). One female farm advisor has facilitated male farmers to link with improved market channels for selling the milk at better price. She has implemented the milk marketing learning in various villages (about in four villages) and farming communities. As a result, the farmers are successfully selling the milk in nearby town and big cities. Before this practice change, they were selling milk in village at 60Rs/L and now they are receiving 90Rs/L by selling milk to a big retail shop in shop (8th Farm advisors training workshop, 2022).
	Farm advisors (male & female) skills, knowledge, confidence and practices observed before/during/after WFEA implementation.	*The evidence being collected to address these indicators are based on qualitative data collected from the facilitated discussion during the farm advisor training workshop, during farm advisor follow-up by project team members.* Qualitative data was collected in June 2021 when a third online CoP was held with the extension management from collaborating organisations. Extension managers observed that their farm advisors are now able to be master trainers in their organisations because they have not only improved their technical and communication skills but also built their confidence. They are taking farmers to the next level by providing them authentic information and tips to improve farm production and making their farming activity economically viable. The L&DD Punjab has observed significant improvement in the male farm advisors and made the decision to involve the female farm advisor in this program. Another example, extension manager from NGO mentioned that the farm advisors were facing difficulty in achieving their assigned targets. There was a significant improvement in the performance of farm advisors after receiving training from the Dairy-Beef project and were able to achieve their job target in most effective way. He has been shifted to another private organisation and started to implement WFEA lessons learned within this organisation as well as providing the training to males, females and children in the same way which he did with NGO (previous organisation). Based on the qualitative data captured during the facilitated discussion majority of farm advisors from the NGOs, private sector, research and government organisations shared ideas with each other at various facilitated discussions in the WFEA training workshops

		on how regular self-reflection and feedback from their management staff helped to achieve both their routine job targets and organisational goals. For example, Male farm advisor, from private sector, mentioned that he didn't have a veterinary background and learned technical information about livestock farming. The training program also helped to improve his communication skills to interact with organisations management and farming communities. He delivered the learning from training workshops to the farmers. The whole family extension approach was an innovative learning lesson for him and he engaged school-going children to implement this extension approach. His organisation has developed a WhatsApp group titled "extension workers" to guide their farming communities regarding issues about livestock farming. The group is going well and they will continue it after the end of the project. Majority of farm advisors from collaborating organisations shared that the WFEA project interventions helped to improve their capacity in terms of their communication skills and building trust with farming households. For example, a male farm Advisor from the government department being a technical person who knew the extension massage on livestock management has learned two most effective things from previous workshops; consistency and adoptable key messages for farmers, and social mobilisation skills to engage the farming communities. Another example male farm advisor, from NGO, mentioned that he was promoted from farm assistant to farm coordinator due to having improved technical knowledge of livestock farming and communication skills. During the workshop with NRSP, the participants highlighted and understood the importance of regular farm advisors training workshops to update their technical knowledge, and build their communication and social mobilisation skills. Farm advisors must be equipped with updated extension tools to address the farmer's queries and challenges. Abdul Rehman from NRSP mentioned: "*Feedback is one of the essential steps that we usually miss out on. As it is very necessary to analyze the impact of any intervention*".
	Frequency of extension workers meeting with each other and a	*The evidence being collected to address these indicators are based on qualitative data collected from the facilitated discussion during the 6th farm advisor training workshop*

	description of how these networks have evolved	*(March 2021), online interviews of farm advisors (case studies), CoP and household data collection by project team members.* The project organised farm advisor training workshops every six months, providing a platform to all farm advisors to meet with each other and share field experiences and lessons at least twice a year. Farm advisors who are working at locations nearby to each other interact more frequently as compared work other, and assist each other in executing field extension activities. For example, the farm advisor from Shakarganj Foods and Mukhtar Feeds are working in same areas. So, they support each other to address the farming issues. One female farm advisor from REEDS mentioned that she has supported one of the male farm advisors from Matra Asia (Fodder seed company) to deliver training (and engage female farm the farming households) on fodder agronomy and to help her farmers source high quality fodder seed. The WFEA interventions helped farm advisor to establish good working relationship with each other to achieve the common goals of extension. Majority of the farm advisors mentioned during the field-follow up visits that they are also connected with each other through a WhatsApp group where they share their learning, field activities and experiences/field stories with each other. Another male farm advisor from government department mentioned that his professional network has been increased after being part of WFEA training. He established good professional linkages with the farm advisors from various NGOs and organisations including Saddique NRSP, Babar PODA, RDF CABI and Ali Hassan Jamali which was working in Sindh but never got any chance to interact with him before. He meet with all of them at WFEA platform and professional linkages were developed. He further explained that quite frequently utilised these linkages to solve many field issues and helping each other. For example, Ali Hassan Jamali was looking for a quality concentrate feed company. He linked him with the K.B feeds, Sindh. The K.B feed is still providing animal feed to his farming community Moreover, the project team has created the farm advisors' group on WhatsApp where they share their learning and challenges with each to seek guidance and support. The

		WhatsApp group has proved to be a successful engagement tool where farm advisors share their experiences, success stories and challenges of working in field. It has also helped to engage those farm advisors who are shy to speak in front of audience during face-to-face training workshops and they update other group members about their field stories.

8.3 Applied research from Objective 3

Objective 3 of the project proposal is *"To evaluate alternative enterprise combinations which have the potential to improve on-farm efficiency and profitability"*. The end of project outcome relating to Objective 3 is for: *"Key academics to be leading participatory action research addressing on-farm and value-chain challenges".*

Details of how what has been done to achieve these outcome are outlined in the Table 2.4 below.

Intermediate outcomes	Indicators	Results achieved from April 2017 to June 2022
Academics including both men/women and early career researchers, are actively engaged in identifying and implementing research opportunities (on-site and on-farm)	Experiences and changes observed and practiced by lead researchers in identifying and running on-farm applied research	The evidence for evaluating the success of this component will be reflection and feedback from researchers from academia, private industry and farmers engaged in research discussions and assessment (using mixed methods) of the nature of research implemented on-ground. After discussion with the Research Focus Group (RFG, established in 2018), the project has engaged two master students from UAF under the supervision of Dr Masooma on local seed production of Rhodes grass to enable the smallholder farmers to produce their seed instead of purchasing from the market. They have achieved satisfactory results in Rhodes grass seed production so far. The data (forage & seed yield) was collected and analysed in December 2020. Findings have been shared with interested farmers and industry persons to cultivate seed production after its successful completion. Smallholder farmers are producing 3 times cheaper seeds at their own farms as compared to purchasing from the local markets. A factsheet is prepared in Urdu for easy understanding and basic information for farmers that how to produce seed at the farm level. Based on these workshops conducted in 2019, the project team worked in collaboration with UVAS and SAU to address the on-farm challenges of smallholder farmers, particularly regarding calf rearing and fodder production. The team gave an opportunity to young researchers (2 male MPhil students) from both universities to learn and implement modern and applied research skills. They are actively engaged in data capturing and monitoring the research parameters. The project team provided continuous support and mentorship to them for the research study through phone calls, zoom sessions and visiting the research station.

		Dr Naeem from SAU has submitted proposals and further engaged one student (Imran) to determine the worked with the “effect of water treatment and sources on performance, health and economics of post weaned buffalo calves”. The trial was initiated in October 2021 and completed in March 2022. They monitored the effect of three different water sources (ground, canal and chlorinated) on calf health and weight gains. In addition to this, they are also considering the economic parameters. The research showed that the calves fed on canal water had better performance, gained comparatively high weight (0.687 kg/day/calf) and are cost effective in terms of net profit. The economic analysis is based on estimated values of calves’ sale prices. The research findings have been shared with the various researchers and stakeholders. Furthermore, the research findings have been shared with veterinary officers, research officers, directors and additional directors of the Sindh livestock and fisheries department during the science into practice workshop. The Project team organised various workshops on scientific research writing with various researchers and students in SAU and UAF. One of Dr Naeem's students, Azam mentioned that during the capacity building workshop on four novelty moves of research, built his understanding of scientific writing and this workshop learning helped him to write a proposal for his M.Phil. study. The project team incorporated the outcomes of these experiments (and potential solutions to the original farmer challenge) within the extension modules of the overarching extension programme within the WFEA (Objective 1). The module is in the process of printing.
Researchers are skilful, confident and share knowledge with other researchers about participatory action research leading to	List of completed research trials, including researchers involved and practice change, key outcomes & number of published/presented papers/articles	*The evidence for assessing the success of this outcome will be reflection and feedback from academics engaged in research workshops/meetings and their attitudes to being involved in this type of research as well as sharing with the wider research community.* Several applied research efforts are now being run and at different stages of implementation (reported in Table 3.3). Trials being completed: • Dr Ashfaq (UAF, Aik Saath groundwater project collaborator) and his PhD student Mehreen have completed the research trial to assess the risks of poor groundwater quality on livestock production. The project team has worked with Mehreen to build her capacity in conducting participatory rural appraisal from July 2019 to March 2021 as a critical step in understanding the local context before engaging in any wider level of

impact at the farmer-level		research to collect/analyse the data qualitative and quantitative data. This has been a meaningful activity for the quality of her research by saving time and resources as compared to what was initially proposed by her (using a broad-scale survey methodology). Data has been collected from respondents and analysed. The main findings of these results so far are; (1) groundwater quality is good at tail reaches of 11-L distributary (2) two heavy metals, Arsenic and Cadmium, were found in the sampling area and (3) based on the PRA findings, animal milk yield is lower (~1kg/animal/day) in those areas where the water quality is poor. • Quality fodder seed production is a challenge for farmers. Local seed production of Rhodes grass is one option to enable the smallholder farmers to produce their seed instead of purchasing from the market. Hence research findings are shared with farmers and they are growing their own seed at a comparable price to the market, resulting in quality fodder availability to animals. • The research trial on the "effect of water treatment and sources on performance, health and economics of post weaned buffalo calves" has been conducted in SAU Tando Jam. The post weaned buffalo calves were reared for seventy-five days on three different water sources. Overall, the research shows that canal water is the most suitable water source for buffalo calves to obtain good weight gains and better performance. The research findings are shared with various stakeholders. This research-based extension message/information is shared with smallholder farming communities and farm advisors. • Sindh livestock department showed keen interest to learn from project research studies. Therefore, in addition to the current calf research findings, the project team shared all the previous project research studies on calves, fodder and seed production, with the Sindh livestock department officials during the science in practise workshop. The sharing of information and research knowledge would enable the Sindh livestock and fisheries team to address the on-farm challenges of smallholder farmers in Sindh and also get new ideas to design the research studies. Team also shared with them the extension material regarding the best agronomy practices, basics of fodder and seed production and fodder calendar in the Sindhi language.

8.4 Value chain research; Objectives 2 and 4

The activities in objective 2 involve critical capacity building of the project team to understand the 'value-chain approach' which is fundamental to the activities in objective 4. Due to this, their end of project outcome is connected; which is *"Smallholder farmers have worked with beef value chain actors to enhance/increased their product value"*.

Objective 2: *"To analyse the current beef industry structure in Punjab and Sindh with a focus on identifying market opportunities for smallholder farming families".*

Objective 4: *"To support smallholder dairy-beef farmers to engage in more profitable value chain opportunities".*

Details of what has been done to achieve these outcomes are outlined in Table 3.2 below.

Intermediate outcomes	Indicators	Results achieved from April 2017 to June 2022
Researchers are knowledgeable and capable and working with other researchers/farmers regarding the value-chain approach (VCA)	Experiences and changes observed and practised by the project team in running research using the value-chain approach	*The evidence for evaluating the success of this component will be an assessment of the outputs of the project team members and reflective feedback from the Australian research team involved in the training workshops.* The Dairy-Beef project team has engaged in a series of capacity-building workshops on beef value chain analysis (VCA) from 2016 to the present including face-to-face and online training sessions run by Dr Tony Dunne. These capacity building sessions enabled the team to analyse the current beef industry structure in Punjab and Sindh with a focus on identifying market opportunities and linking smallholder farming families with the profitable beef value chain. The capacity building activities involved in Objective 2 (Activities 2.2, 2.3 and 2.4) have been completed in previous years while the team is closely working with Dr Tony Dunne to finish activity 2.5 this year. Dr Tony Dunne has conducted several mentoring sessions with the Dairy-Beef project team (June 2020 to February 2021) to develop the marketing strategy for the 45GD farmers (objective 2, activity 2.5) to successfully capture the identified market opportunity for smallholder farmers. The document written on market strategy is helpful for farmers to confirm the opportunities from the buyers and by each group member. This also includes SOPs for group members, logistic providers, and a communication plan for themselves and with the buyer. The project

		team went through this document with farmers to provide a better understanding of how to negotiate for a reward for their efforts and get an acceptable price and develop an evaluation process if the opportunity is profitable & sustainable for them. Team gained knowledge and skills to facilitate the smallholder farmers to develop linkages of farmers with the identified profitable beef market opportunities. Based on team acquired knowledge and skills from the capacity building workshops, the project team conducted a 2-day training session for the thirty-five farm advisors of the Livestock and Dairy Development Board (LDDB). The workshop participants were able to understand the beef value chain actors and a general understanding of the FBG development process. Moreover, project collaborative organisations asked to develop the capacity building of their staff regarding the beef value chain analysis approach and FBG development process which will enable them to implement this within their organisations. The project team has conducted various discussion sessions with Dr Tony Dunne to develop a comprehensive training program (three-day workshops following six-month mentorship) for the interested collaborating organisations in June 2021. As a start up the project team has conducted a three-day introductory training workshop in August 2021 on value chain analysis; identifying opportunities & supporting farmers. Twenty-eight participants (18 male and 10 female) from twelve different organisations participated in the training sessions. These organisations include the livestock government department, private sector and NGOs (local and National) from Punjab and Sindh. Afterward, six-month mentorship training program has successfully ran with thirteen farm advisors four interested and committed organisations (LPP, WWF, SAFWCO and Haq feedlot farm). The six-month mentorship training program aimed to build the understanding of farm advisors on the beef value chain approach and its implementation within their ongoing projects. Based on the four training workshops, farm advisors have better understanding on the basic concept of value chain, value chain analysis, walking the chain and evaluate the identified market opportunity as compared to their previous knowledge. The training workshops enabled farm advisors to have broad understanding of the value chain concept and the basic skills to assess a profitable market opportunity and link the smallholder farming community.

		Dr Adnan (Director Agriculture and Climate Change, PODA) said that "*this training workshop was very helpful for us to understand the concept of beef value chain approach particularly women engagement in beef value chain activities*". Sunbal Sarfraz (area advisor small ruminants project) stated that *"The concept of the value chain will help me to conduct the activities for my project objective on small ruminant's value chain"* Asif (social mobiliser from LPP) stated that *"it was our first experience to interact with beef chain actors and understand their role and value creation".* A participant mentioned that "*It is good that farmers should learn the skills of gross margin and critical risk assessment for taking market decisions by themselves. Otherwise, they will expect farm advisors for direction and decisions which can lead to failure or unsustainability"* (Three-day value chain training workshop, Aug, 2021) Farm advisors from WWF shared that *"they never thought that there can be market options for farmers other than the Mandi, local butcher and beopari. They never visited any exporter and commercial feedlot farm. The workshop was good opportunity for them to explore the market options. They are now at better position to advise and facilitate their farming communities".* Iqra and Gurnique shared, "*it was an exciting experience to interview beef chain actors (feedlot farm and its customer) because it was their first time to engage in such activity*". Nadeem (farm manager, Haq feedlot) stated that *"I learned that we should not force/lead farmers to sell their animal in any market channels. We should provide exposure to the farmer with walking the chain activity and similar analytical process and mentor them to decide and choose the profitable market options for themselves".* *"I understood through the whole workshop process that If the farmer has more market information, then they can have more bargaining power",* Alina from WWF Said (Six-month mentorship training program, 2021-2022)

Smallholder farmers have increased access to information regarding the value-chains they are a part of and the skills/confidence to engage with value chain actors	FBG members' understanding, perceived benefits and confidence of engaging with value chain actors	*The evidence collected to address these indicators will be case studies of FBGs and the farmers within them; capturing changes in knowledge, attitudes and practices relating to working with value chain actors.* The team led exposure visits to beef chain actors (retailer, meat processor and feedlot (Mar2021) with 5 villages of Punjab and Sindh. The visits aimed to give farmers exposure to beef markets outside their villages, understand perspectives of value chain actors and consider beef farming as a business opportunity, including for women. During the discussions with the FBG farmers after the exposure visits, the farmers shared that before these visits, they only knew about local market (mandi) or middlemen as a market option for them, but knowing the specification of different chain actors provides a view of the bigger picture. They indicated that they understood the market demand and would now be able to produce animals according to the market specifications. This, combined with gross margin calculation and opportunity analysis skills gained through project activities gave them the knowledge and confidence to negotiate with beef chain actors. They found that major differences between traditional and improved beef value chains are the price of animals and their specifications (age, weight and beauty). Farmers shared that they will rear their animals according to customer demand and earn more profit. Female farmers will support the rearing of the animals according to product specifications of identified market opportunities. Knowledge, attitude and practice changes to the way that FBG members now work with value chain actors includes: 1) identifying more profitable cattle purchases, 2) improved bargaining power through group negotiation, and 3) raising cattle to meet market demands as outlined below 1) Amina (a female farmer from Beero Lanjwani, Sindh) shared "*We learned that what kind of animals should buy for fattening. Before this visit, we had always assumed that buying a heavy-weight animal for fattening would save our money. We bought the expensive animal and spent more input cost to rear them. We learned from this exposure visit that we should buy a young animal with a low price and a low weight (high growth potential) and fatten it*."

		2) Mukhtar Ahmed (male farmers from 96D, Pakpattan) shared that *"after experiencing the walking the chain, they understood that they need to work together for accessing the profitable markets and get a good price"*. The exposure visits of a group of farmers helped farmers to build good linkages with each other. Allah Dad (male farmer form 96 D, Pakpattan) mentioned *"before the walking the chain, every farmer was selling the animal at the individual level. Whereas after group exposure visits, farmers consult each other and are mutually negotiating with middlemen for making the good price of their animals".* 3) Hakeema (female farmer Siddique Narejo) shared that "*through participation in walking the chain activities she understood the demand of male calf meat and the specification of the customer so she will try to rear the animal according to the market demand or requirement".*
	Number of farm business groups established and a description of their functionality (particularly note differences between M/F groups)	*The evidence that will be collected to address these indicators will be case studies of FBGs and the farmers within them; capturing changes in resources (material, social, human), agency (understood and applied as decision) and values/perceptions (job/pride/aspirations).* 10 FBGs have been established and are at different stages of the formation and value-chain engagement process. Farmers from 45GD were exposed to different beef market opportunities such as visiting retailers, processors and feedlot farms through the "walking the chain" activity which was followed by opportunity analysis, risk assessments, gross margins, FBG formation and marketing strategy. These capacity building and facilitation sessions encouraged the FBG in 45GD to work together and adopt the principles of value chain management in the rearing and sale of their animals. Members of the 45 GD FBG have demonstrated changes in their resources, agency and values/ perceptions. They are proactive in the rearing and selling of their calves either for Eid or for the Lahore mandi. This proactive approach incorporates many value chain management principles such as creating value for customers, adopting 'best practices' to deliver DIFOT-Q, accurate physical and financial records, sharing

		information and communicating regularly. Moreover, they have developed strategies that enable them to be adequately rewarded for the customer value they create. They are able to apply“ wish-want-walk” principles based on market conditions, accurate gross margin analysis and accurate weight measurement using scales they purchased with project support (50/50). Male farmers of 45GD reflected that they have learned about working together for joint selling, sharing information and adopting ‘best practice’ to deliver customer value can reward them. While female farmers built an understanding of various beef chain actors and beef market channels other than the traditional market options (middleman or local mandi). Female farmers are supporting their male households to rear beef animals according to customer demand. Farmers are planning for joint selling at an equitable price to a specific customer to get high rewards for their product (animal). Furthermore, FBG members are exploring more beef market opportunities around them using the learned value chain approach and making appropriate decisions for selling their animals. *“We decided to work together to sell our beef calves to profitable markets. Dairy-Beef Project strengthened our skills to raise and fatten our calves according to market requirement and engaged us to interact with beef value chain actors. We are more confident now to negotiate the sale price of our animals”* M. Ahmad, Member farm business group, 45GD, Okara Project team has replicated the learning of the first FBG into other 9 FBGs (4 male and 5 female) of Punjab and Sindh. Team has provided the need based extension training and walk in the chain activities in all of these villages which helped them to improve the farming practices and identify profitable market opportunities for them. Farmers interacted with chain actors and explore more beef market opportunities near their villages to minimize the transportation cost and increase their profit margins. Team is mentoring farmers to work in group except 45GD, as this has already been completed,, for setting up rules and regulations and marketing plan to link them with the profitable market channels.

8.5 Objective 5

"To support the integration of critical lessons from Dairy-beef extension and value-chain research into policy level discussions (at both National & Provincial Government) to ensure the sustainability of the whole-system extension model. Details of what has been done to achieve these outcomes are outlined in the table below.

The evidence being collected to address these indicators is based on qualitative data collected during breakout sessions and facilitated discussions with participants from "Science into action" and "Science into practice" workshops.

Questions	Indicators	Results achieved from April 2017 to June 2022
What are the targets which could be achieved through the effective extension system in Pakistan?	**Whole family extension approach (WFEA)**	*The evidence being collected to address these indicators is based on qualitative data collected during breakout sessions and facilitated discussions with participants from two "Science into action" and three "Science into practice" workshops.* Most of the participants discussed that the WFEA is very important to be incorporated in the extension development projects to increase farm productivity. Head of research organisation shared that community engagement should be enhanced with the implementation of the WFEA (extension program) without disturbing the research and academic work". Similarly, participants from government organisations said, "Engaging all family members through WFEA will enhance the capacity of farm advisors but also farmers will adopt more improved farming practices, (first science into action workshop, August 2021).
	Capacity building of farm advisors/farmers	Participants from government organisations said that extension staff as a front-line force needs practical training to improve their communication and technical skills to support farmers. Further, social mobilisation skills are needed to manage and engage a group of 15-20 farmers in a meeting (first

	and need based advisory services	science into action workshop, August 2021). *"Regular training and refresher courses of farm advisors should be arranged in each organisation for mutual learning and implementation of new/improved practice with farmers",* Participant (government department) said. The Head of the research organisation said, *"Technology support for the implementation of any extension program and linkages with research organisations are comprehensive to knowledge delivery".* Similarly, a participant (government department) said, *"IT based solutions would work best in the current situation. Technology, no doubt will reach at a fast pace within the villages or remote areas"." Hand-on training for using digital extension tools is required for them",* further they added. Participants discussed that theoretical knowledge is delivered in the institutes while hands-on training is missing. However, new graduates should be provided practical assignments of real-time case studies (examples of small farm businesses) about the profit loss. "T*here is a lack of specific training modules for capacity building of farm advisors. Government should take a step in this regard and provide infrastructure or device a regular training program to solve farmer issues", (Participant from the national organisation in science into practice workshop, November 2021).* All of the members agreed that there is a need to address farmers' complex needs with more comprehensive extension information applicable to their farming system.
	Feedback and reflection mechanism	Participants discussed that the feedback mechanism is very important between farmers, farm advisors and to the heads of the organisations. It helps to redesign/restructure the program in a better way for smallholder farmers. So, they can fully take benefit from it.

		Farm advisors' training on getting feedback from the farmers for the assessment of their services is a complete mechanism. Previously, they were not taking follow-up and feedback from the farmers and farm advisors". Participants also agreed that there should be a strong two-way feedback mechanism at every stage of the extension program among organisation heads, farm advisors, and farmers. A male participant from NRSP mentioned that: "*feedback is one of the essential steps that we usually miss out on. As it is very necessary to analyse the impact of any intervention*".
	Collaboration	A facilitated discussion was carried out between and within public, private and non-governmental stakeholders on the positive collaboration, as participants heard many examples from the Dairy-Beef project. Participant (government department) said, *"All the departments are working in isolation. They should work together and share the findings with each other for the betterment of farming communities". "Today they got to know a lot of innovative extension strategies which could help in the implementation of their project"*.
What are the key challenges to establishing an effective extension system within your organisations?	**WFEA and gender role (gender mainstreaming)**	The evidence being collected to address these indicators is based on qualitative data collected during breakout sessions and facilitated discussions with participants from "Science into action" and "Science into practice" workshops. Very few people talk about gender mainstreaming, whereas they have discussed the challenges for women's mobility during each breakout sessions. However, private sector organisations shared that the company should enhance the gender mainstreaming for extension programs and encourage hiring the of female staff for the implementation of WFEA.

		Most of the participants from SLD, LDDB and NRSP mentioned that it is challenging to approach the rural women in a households and provide extension services because organisations don't have female farm advisor. While women farmers are taking part in animal rearing activities at the household level, as it is essential to provide updated information on improved farming practices. One of the participants from LDDB shared that "*females play a vital role in the rearing of animals under a traditional farming system of Pakistan. We need to devise some strategies to approach them and guide about improved farming practices so that overall, on-farm production could be enhanced*". Female participant from NRSP mentioned that "*NRSP has provided assets to the female farmers but due to lack of the capacity building on value chain approach, they are unable to identify a profitable market for them to get a good return. So, we are keen to learn effective value chain analysis approaches which can be disseminated to these female farmers to enhance their farm profit*". She also emphasized that the strategies should be devised to engage women in dairy and beef value addition activities and link them to profitable markets. The participants agreed that evidence from the project's implementation of WFEA indicated a stronger impact on smallholder farmers' productivity and profitability.
	Trust building with farmers	The participants discussed that evidence from the project's experience of implementing WFEA showed a greater impact on the productivity and profitability of smallholder farmers. The majority of them said that the main extension function in this approach is trust building with farmers. Participants (government department) shared that "*farm advisors, should provide a evidence based information when needed to farmers which will*

		improve trust and create a working relationship in which they can get better result for on-farm practice change". *"long term association of farm advisors with farmer achieved through trust building with them".* Participant (government department) mentioned that building excellent relationships with farmers is a key for farm advisors to achieve their job targets. Another participant shared, "*whenever, we go for conducting any field activity with the farmers, we used to directly start from conveying our message and never interacted with farmers before or after that activity. Resultantly, we were unable to achieve our targets of production and the adoption rate was also quite low. After the session, I realised the importance of social mobilisation and trust-building with the farmers, which can help us reach our target quickly".* Female participant from NRSP said: "*We are working with farmers for years and we have realised that repo building is extremely essential to plan any intervention at farmer level. I have observed that it can be developed within a day or it may take years to develop trust. If you are planning any program and miss out this step, then your whole program can be a failure in the end".* "WFEA *is a useful tool for engaging rural women to improve farm production, hence WFEA helps to build farmers' trust and relation that talked farm advisors*" (Science into practice workshop, November 2021).
	Development of extension material	The majority of the participants took a keen interest in the research-based extension material of the Dairy-Beef project as they were not well aware of it and had never developed/used extension material to engage their target beneficiaries. They found that the extension material (both printed and digital) can be used to engage farmers and build the capacity of their staff. The team also shared their research findings regarding the use of different types of extension tools. After having a detailed discussion, participants (government department) said, *"extension material should be highly relevant to the farmers' situation so that they can get a solution to their problems. It should be updated every six months focusing on the emerging issues in the*

		farming communities. Unfortunately, the government is still relying on the outdated extension material which was developed years ago" Participants agreed that video messages usually retain longer as compared to printed messages. However, participants also took interest in story booklets of children to provide them with awareness and knowledge about livestock activities. Female participant from NRSP mentioned that "*extension material should be designed keeping in mind that majority of the farmers are illiterate, hence they would not be able to understand the complex concepts*".

9 Conclusions and recommendations

For the main conclusions relating to the research questions (from the project proposal) please see the corresponding Results section (or for a short version, please see the Summary section of each objective).

In this section of the report we have focussed on major lessons and recommendations from the different component of the project.

9.1 Social research into the extension system from Objective 1

More details regarding the UVAS team's lessons and the evidence from this project to support those lessons can be found in Appendix 11.7.

Based on these, and the research outcomes from this project component, the main recommendations regarding the extension system are outlined below and are further broken down with respect to the 'level' within the system;

At the organisation level;

- Plan for and invest in the participation and professional development of women farm advisors as a key means of improving innovation capabilities both within extension-advisory organisations and the farm scale.
- Extension and advisory services organisations to provide financial support for duplicating and sharing the materials and training package from the WFEA intervention (as has already occurred in several of the participating organisations).
- Working with extension management and their field teams in unison was the most effective way to support learning and change within organisations.
- Sharing 'success' at the organisation level was an effective way for different groups/managers to understand the possibilities of improving/working with their field teams. The 'community of practice' with organisation management was effective to share the stories of success, or solutions to various field challenges and provide opportunity to work collaboratively.

At the project team and higher collaboration level:

- Maintain networking opportunities and forums for agricultural extension and advisory services provision to sustain the impacts of collaboration between organisations.
- Develop a process for certifying the WFEA training program for farm advisors as part of their professional development.
- Develop an online workbook or facilitation guide for the WFEA program with practical tools and design suggestions for organisations to implement the WFEA program that could include: workshop plans; facilitation notes; budget templates; links to other resources; certification documents (building on the point above)
- Supporting partners to be more gender sensitive/considered is a slow process. It is recommended that organisations take every opportunity continue to support both women and men in roles providing farm advisory services to farming communities.

At the farm advisor level:

- Establishing a feedback mechanism and reflections between farm advisors and their management enhances the efficiency of the extension program and the organisation. Those farm advisors who had this established or built it through this project were often better supported in the field and had better impact. Well connected, knowledgeable and skilled farm advisors can also be effective without this support of their organisation, but the breadth/scope of their impact can be broadened with the additional support.
- The WFEA training can enhance working scope of non-technical farm advisors within their organisations. In many organisations working with this project, the farm advisors were from a non-technical background. This training was well developed and placed to support them to learn the basics of livestock management, feeding and farming which gave them enough capacity, knowledge, and confidence for them to support farm learning on these topics. This was synergistic with organisations that already had developed relationships with farmers, such as NGOs who have a community development focus.
- The ‘community of practice’ at the farm advisor level was critical to the project, and evidence from this project supports the idea that this networking helped promote collaborative work between farm advisors from different organisations and general support/information sharing with each other (eg What’s App group).

Regarding the household level;

- Based on the empirical evidence from this study we recommend that organisations working with smallholder farmers, recruit female farm advisors, preferably from the local areas. This is highlighted by the improved results seen in organisations with women employed in these roles who had much higher engagement of both men and women farmers compared with those with just men employed.
- Considering the education levels of farmers (less than 30% literacy on average among women and men in study sites), it is essential that all information be provided orally in the local language of the village, in addition to written material and incorporate farm visits, demonstration plots, hands-on skills training.
- Impacts at the household level tended to be greater for those communities linked to NGOs/private organisations. This was related to the number of extension activities NGO/private organisations were already running. Hence, those farm advisors who already had established relationships or mandates working directly with farmers were able to apply new ideas about the WFEA more easily.
- Support smallholder farmers to develop common interest groups where you can demonstrate income generating opportunities from improved production and markets access. The capacity of most smallholder farmers in terms of business and marketing skills is usually underdeveloped. Hence, training and time is required to help support them to understand the value-chains they are linked to so they can participate in the process of identifying potential market opportunities that are available for their products.

9.2 Regarding value-chain training in Objective 2

Lesson 1; The timeframe of capacity building process needs to be shortened. Ideally the process should have been completed within the first 6 months of the project. This would have required multiple visits to Pakistan by the consultant or the consultant spending an extended period in-country. The early completion of the capacity building program would have allowed the Objective 4 activities to commence sooner which, in turn, would have allowed the members of the Dairy-Beef team to apply and develop their skills in the value chain approach over an extended time period.

Lesson 2; The lack of knowledge and commercial experience of technically trained extension agents in down-stream value chain activities limits their ability to mentor smallholder livestock producers to engage effectively with wholesalers and processors. This lack of knowledge and experience is one of the main reasons that all the value chain activities have not progressed further than 'awareness' focused *walking the chain* activities and the focus has reverted back to on-farm productivity and efficiency gains. Again, this shortcoming illustrates the time that it takes for members of the Dairy-Beef team to develop their skills and confidence in applying the value chain approach.

Lesson 3; In-country mentorship and support in the value chain approach presents an on-going problem as neither the universities nor government agencies have this expertise despite claims to the contrary. Both the ASLP and the Aik Saath projects have successfully trained individuals in the value chain approach at the conclusion of these projects the individuals disperse, and this expertise is lost. One solution to this problem is the establishment of a value chain centre as part of an Extension Department in one of the major universities.

Lesson 4; The lack of interest in the value chain approach by organizations who participated in Objective 1 activities indicates that they have not yet appreciated the changing nature of the beef market in Pakistan nor their role in assisting smallholder livestock producers develop better linkages to emerging market opportunities. While this is a problem that is not unique to the beef industry, it is complicated, in this case, by the fact that the emerging beef sector is considered secondary to that of the dairy sector. In other industries, such as the vegetable sector, provincial Departments of Agriculture Extension are showing interest in capacity building programs for their extension agents.

9.3 Lessons from applied research in Objective 3

Lesson 1: It was difficult to engage researchers and universities in research activities that directly impacted smallholders. This is due to the on-going challenge to have acknowledgement in academia for applied research and the publications that it yields. This is not unique to Pakistan, but is something that future projects will need to consider. Some strategies to address this;

- Focus on students who have time to commit to working on an applied project.
- The timing needs to be extremely well coordinated to tie in student semesters, researcher support and working with farmers between seasons.
- Clear processes for data collection. Digital data collection can help with this, but dos not solve all field data issues, training is still critical.

Lesson 2: From this research it is clear that digital extension tools do not replace traditional face-to-face extension in this context, but rather, support engagement with extension material through novel and interactive formats.

Lesson 3: The on-farm calf competitions helped to motivate the farming community to achieve better calf growth rates using their available resources. These competitions also provided a platform to recruit interested farmers to participate in other research activities.

9.4 Conclusions from Farm Business Group development in Objective 4

We expected that FBGs would sell collectively to market opportunities identified in the value chain analyses, such as selling directly to feedlots. However, this did not occur. A key purpose of smallholder farmers keeping cattle is their ability to act as a bank, thus, dedicating specific numbers of cattle for sale within set timeframes did not appear to be an opportunity that smallholders could take up. Therefore, building the capacity of smallholder farmers to identify value chain opportunities that are within their capability is critical, as farmers are then able to identify opportunities as they arise within their networks.

The FBGs were very successful in supporting members to make profitable practice changes to their beef cattle businesses, despite not selling collectively. Important changes were made by most FBG members to the way in which they raise and sell cattle, such as understanding and meeting customer preferences, and negotiation of sale after calculating and discussing the value of their cattle with the FBG. It is not clear whether specific changes had a greater influence than others, or most likely, whether it was the effect of making multiple practices changes that had the greatest effect. However, it was apparent from our results that selling collectively is not the only factor which supports farmers to improve their income from beef cattle. Furthermore, FBG members acting as individuals, rather than as a group may prove to be more sustainable and reduce the risks associated with group decisions in the future. Whilst this direct comparison cannot be made with the farmers who participated, it would be useful to monitor whether they continue with the changes already made, and whether there are long term effects on their beef businesses.

Women were generally less interested in formalising their FBG with rules and regulations, and selling their cattle collectively, as compared to men who participated. A joint group between men and women was initially proposed in 45GD, but there was a preference by participants for separate men's and women's groups. Most women reported that it was difficult for them to be involved in the negotiation of animal sales due to social norms, such as not being able to visit markets. Instead, they focused on managing cattle nutrition and health, record keeping and calculating gross margins. Thus, indicating that alternatives ways for women to participate in more profitable value chains needs to be explored in future research. Understanding the factors enabling one women's FBG to purchase 10 cattle with the intent to fatten and sell these cattle may provide valuable insight into how to support women in other villages to undertake similar collective action and increase their engagement with the value chains.

Recommendation;

The necessary capacity to support farmers in establishing FBGs is a lengthy and resource intensive process requiring ongoing support from farm advisors. We recommend future projects have appropriately trained and supported farm advisors with the time and resources to enable forming and maintaining these kinds of groups. We also suggest that there may be a more efficient means to supporting farmers to increase income from their beef businesses. Rather than forming FBGs, producer groups could be formed to support farmers to develop their beef business skills as occurred in this project. However, in contrast, group sale would not be required, eliminating the need for a group marketing strategy and formal rules and regulations, making establishing the groups faster with less capacity development of farm advisors required. Instead, support for farmers to identify value chain opportunities as they arise within their networks could be prioritised.

9.5 Lessons learned from policy engagement in Objective 5

Lesson 1; The ‘Science into Action’ workshops and the associated discussions enabled the participants to engage and work with the material and ideas that were provided. This helped the livestock policy discussion group to better understand the different lessons that the Dairy-Beef team presented, and most importantly if/where they were applicable within their organisations.

Lesson 2: The co-designing process with critical organisations in the ‘Science into Practice’ workshops was a time-consuming but worthwhile step. The different agendas that came out of this process highlighted the differences in projects and capacity across partners.

Lesson 3: The brief policy review carried out in this objective emphasises that in Pakistan, policies relating to livestock and agriculture are well articulated and clear at both the national level and across provinces. From these workshops and discussions with senior livestock specialists, what was missing from the documentation was how these policies could be achieved/reached on-ground. This is understandable as it is complex and up to the management of each organisation to implement themselves, but highlights the need for clear and effective implementation plans to support effective field work.

10 References

10.1 References cited in report

Currently cited in each Objective's section.

10.2 List of publications produced by project

This is currently provided in an excel spreadsheet using ACIAR's annual reporting template. It can be added here as a list as well.