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Final report

Small research and development activity

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1 List of acronyms

ACIAR – Australian Centre for International Agricultural Research

ACT – Australian Capital Territory

CIAD – Critical Institutional Analysis and Development

CSIRO – Commonwealth Scientific and Industrial Research Organisation

CSU – Charles Sturt University

IUCN – International Union for the Conservation of Nature

LWR – Land and Water Resources

MNSUAM – Muhammad Nawaz Sharif University of Agriculture, Multan

MUET – Mehran University of Engineering and Technology

NRM – Natural Resource Management

NRSP – National Rural Support Programme

NSW – New South Wales

SDIP – Sustainable Development Investment Portfolio

SIAGI – Promoting **s**ocially **i**nclusive and sustainable **ag**ricultural **i**ntensification in West Bengal and Bangladesh project

SOFT – Society of Facilitators and Trainers

SRA – Small Research and Development Activity

SWSIP – Sindh Water Sector Improvement Project

UC – University of Canberra

USPCAS-W – US-Pakistan Center for Advanced Studies in Water

WAC – Water and Climate

2 Acknowledgments

We are grateful to ACIAR for its ongoing support for collaborative design and long-term vision inherent in the scoping of the proposed salinity project of Pakistan. We particularly appreciate Drs Robyn Johnston and Kazmi Munawar for championing the project and its participatory design process, and for guiding us through the inevitable challenges that such a design process has provided. Dr Lashari and his team at MUET provided logistical and flexible support that was critical to the success of activities in both Pakistan and Australia. We also express our appreciation to Mr Mahmood Cheema and his team at IUCN-Pakistan for hosting the workshop in Karachi in July 2019.

3 Executive summary

This Small Research and Development Activity (SRA) is the second associated with the development of a proposed long-term ACIAR program for building adaptive capacity of communities living in salinity affected landscapes of Pakistan. The increasing extent and severity of salinisation across the Indus Basin greatly jeopardises the potential of those living there to escape the trap of poverty. Soil salinity problems are particularly serious in Sindh province where some 70 to 80% of the soil is classified as moderately or severely saline (Smedema, 2000). The southern districts of Lower Sindh, Thatta, Badin and Sujawal are particularly vulnerable to salinity due to waterlogging and seawater intrusion in coastal agricultural areas.

Given the scale and severity of the development issues the research project aims to address, this SRA sought to build greater engagement with potential partners in the southern end of the Indus Basin, create opportunities for key individuals from Pakistan who are championing the project to meet with and learn from those in Australia who have dealt with or are dealing with their salinity affected landscapes, and create activities to ensure the project proposal uses pathways to impact based on sound systems analysis.

Key activities were:

1. A workshop in Karachi on 10 July 2019 to consolidate the Impact Pathways Analysis for the project that had been undertaken at a prior workshop in 2018, with a particular focus on identifying a set of research activities that will deliver intended outputs and outcomes (see Section 5.1).
2. A field trip on 11 July 2019 to two accessible “bright spot” communities in the delta region of the Indus basin; i.e. communities nominated by project partners whose capacity to sustain and perhaps enhance their livelihoods through active adaptation could provide the project with learning and engagement opportunities (see Section 5.2).
3. A workshop at MUET in Jamshoro on 12 July 2019 to explore opportunities with representatives of local farming communities and supporting organisations for improved gender inclusion in project design, delivery and outcomes (see Section 5.3).
4. A visit to Australia from 11 to 24 August 2019 by selected representatives of the SRA’s Pakistan-based partners, involving meetings with the Murray-Darling Basin Authority, ACIAR, CSIRO, as well as several Landcare, regional NRM and irrigation management organisations (see Section 6.1).
5. A workshop on 20-21 August 2019 to develop a systems analysis foundation for the project proposal (see Section 6.2).
6. A workshop on 22-23 August 2019 to explore ways to assist transdisciplinary project development (see Section 6.3).

These activities have ensured those Pakistan partners who are championing the proposed project have a high level of ownership of, and contribution to, its design. Key individuals had the opportunity to engage with internationally renowned experts in complexity and transdisciplinary action, and to collaboratively consider best strategies to apply this experiential knowledge to project design. These experiences have affirmed the position reached through the first SRA (LWR/2017/028) that a new approach to salinity management is needed. Rather than pursuing larger scale strategies of salinity control and reclamation, expertise needs to be directed at building the capacity of affected communities to adapt productively to the salinity affected landscapes they live in. Such expertise includes taking a systems approach, building on the identification and development of adaptation options that are economically and socially viable, and an approach to planning that is adaptable while drawing on information from best available future scenario projections. This second SRA has thus built on the first, and laid the foundations for long term collaboration between Australia and Pakistan for improving the lives of some of the most impoverished communities in Pakistan (see Section 8).

4 Introduction

This Small Research and Development Activity (SRA) (WAC/2019/102) is the second associated with the development of a proposed long-term ACIAR program for building adaptive capacity of communities living in salinity affected landscapes of Pakistan.

The increasing extent and severity of salinisation across the Indus Basin greatly jeopardises the potential of those living there to escape the trap of poverty. Soil salinity problems are particularly serious in Sindh province where some 70 to 80% of the soil is classified as moderately or severely saline (Smedema, 2000). The southern districts of Lower Sindh, Thatta, Badin and Sujawal are particularly vulnerable to salinity due to waterlogging and seawater intrusion in coastal agricultural areas.

This SRA is a response to feedback from the June 2018 ACIAR In House Review of the LWR-2017-027 Phase 1 Proposal. We were excited by ACIAR's enthusiasm for how the proposed project could enable our Pakistan partners benefit from Australia's long experience of farming communities "living with salinity", and the suggestion that we reconsider the timescale of our intended activities from 4 to 10 years.

The objectives of the current SRA were to:

1. Re-engage potential project partners and engage other expert informants in a reconsideration of the existing "Living with Salinity in the Indus Basin" project approach as a series of projects to be conducted over a ten-year timeframe.
2. Use this re-engagement opportunity to model and document an approach to ten-year project proposal development for ACIAR that begins with a focus on intended outcomes, and then works backwards to outputs, activities and expertise needed.
3. Incorporate a strategy for gender inclusion into the projects being developed.
4. Submit a revised Phase 1 proposal with input from and endorsed by all project partners.

The key activities undertaken to meet the objectives are described in detail in Sections 5 to 8. These are summarised in Table 1.

Table 1: Summary of SRA activities

Activity	Date	Location	Report section
A workshop to consolidate the Project Impact Pathways Analysis	10 July 2019	Karachi	5.1
A field trip to two accessible "bright spot" communities	11 July 2019	Delta region of the Indus Basin	5.2
A workshop to explore opportunities improving gender inclusion in project design, delivery and outcomes	12 July 2019	MUET, Jamshoro	5.3
A field visit to Australia by selected representatives of the SRA's Pakistan-based partners	11-24 August 2019	ACT, NSW and Victoria, Australia	6.1
A workshop to develop a systems analysis foundation for the project proposal	20-21 August 2019	Albury, Australia	6.2
A workshop to explore ways to assist transdisciplinary project development	22-23 August 2019	CSU, Albury, Australia	6.3

Development of a portfolio of 'bright spots'	Ongoing	Pakistan/ Australia	7
Development of 10-year framing document	Ongoing	Australia/ Pakistan	8

Delivery of intended activities for the SRA resulted in all the objectives being met and the objective of re-engagement was surpassed.

- The level of participation at the Karachi workshop on July 10, 2019, to consolidate work on the proposed project's Impact Pathways Analysis, was much greater than anticipated (see Section 5.1). It stretched into new areas of expertise and included a greater proportion of women than in all previous workshops associated with this project. These successes can be attributed to the work of the Pakistan partners on the project, and especially Dr Lashari's team at MUET who handled the logistics and made numerous telephone calls to encourage participation.
- The intended meetings to explore gender issues and inclusion turned into a half-day well-attended workshop organised by MUET (See Section 5.3). Participants included local farmers (women and men), staff from a range of government and non-government organisations, and academics. The discussions provided many practical suggestions for how project outcomes could be pursued with women, and how these activities could in turn empower women and girls, meeting objective 3.
- The visit to Australia by Pakistan-based partners actively involved in developing the proposal was highly successful. The team were able to meet with key decision makers and influencers such as at the Murray Darling Basin Authority, as well as with a range of Landcare organisations and individuals with a history of productively managing salt-affected land. The two-week visit culminated in a couple of workshops that contributed significantly to the participants' systems understanding of the issues the project aims to address (see Section 6).
- Our documentation of the process to develop a ten-year program proposal turned out differently from what we had expected. The project proposal being submitted will benefit from a new template developed by ACIAR as a 2.5-year project, with a separate document that 'frames' how this initial project can contribute to the momentum being built for a 10-year series of activities (see Section 8).

These activities have therefore enabled us to go beyond our intended SRA objectives. We have re-engaged potential project partners and other experts, and have extended the network. This extended network has contributed to the development of the project's impact pathways analysis, and the design of research activities to achieve intended project outcomes. This has included new activities and strategies that can support gender inclusion with the added potential of empowering women and girls. We also submitted a revised Phase 1 proposal, and the In House Review held at ACIAR in December approved its passage through to Phase 2.

5 Activities in Pakistan, July 2019

5.1 Second Impact Pathways Analysis Workshop

The workshop held in Karachi on 10 July 2019 was hosted by IUCN, organised by MUET, and involved activities facilitated by Drs Catherine Allan and Michael Mitchell (CSU). Of the 40 participants who attended, the majority (63%) were based in the southern Indus Basin (including Multan), and most were engaging with one of our workshops for the first time. We also had a significant increase in the proportion of women participants (20%, an increase from 5% at the last workshop).

The main aim was to consolidate the Impact Pathways Analysis partially developed at a workshop held in Faisalabad on 13 September 2018. Participants at the Faisalabad workshop had identified research outcomes and associated outputs, so the 2019 workshop sought to identify a set of research activities to deliver those outcomes. To maximise participant input, the outputs were organised into the following five themes for more focused small group discussions. Participants organised themselves into the themed small groups according to their expertise.

Theme 1: Understanding salinity affected landscapes context

Theme 2: Adaptation options

Theme 3: Farmer to farmer learning

Theme 4: Scaling out

Theme 5: Value chains

Each group was able to develop a logical set of research activities to deliver on each of the intended outputs, and these are listed in Appendix 1, pp. 2-6. A particularly remarkable outcome was that the approaches to the activities were highly consistent and complementary, even though the five themes drew on expertise split along disciplinary lines. When the participants reflected on the outcomes of the activity, “commonality” and “understanding” were key terms that emerged. This demonstrates the merit of having research outputs framed as part a set of impact pathways leading to intended end of project and longer-term outcomes. The more “concrete” project components were observed as having a common direction and flow.

The workshop was also used to initiate development of a portfolio of “bright spots” (see Section 7). IUCN presented one of the “bright spots”, and invited the Australian delegation to visit the coastal village involved. However, the travel time precluded a visit to this village. Instead, MUET arranged for the Australian delegation to visit villages that were also close to the coast in the delta region, and the outcomes of visit are summarised in Section 5.2 below.

5.2 Field Visit

MUET organised a field trip for 11 July 2019 involving a delegation from ACIAR (Robyn Johnston, Gerard McEvilley and Kazmi Munawar), CSU (Michael Mitchell, Catherine Allan and Jay Punthakey), Murdoch (Ed Barrett-Lennard) and SOFT (Iftikhar Hussain and Fozia Memon). The field trip included an introductory briefing at the Sujawal district office of the National Rural Support Programme (NRSP), followed by a visit to two villages receiving support from NRSP and MUET. These two villages are included among the “bright spot” nominations (see Section 7).

The first village, M. Juman Sanghar, is located near the end of the irrigation distributary. Due to shortage of canal irrigation water and groundwater intrusion of seawater, their soils have been severely affected by salinity. Seawater intrusion is mostly less than a metre

below the surface. At the time of our visit, the villagers estimated that only 20% of available land was being cultivated, and most of this land could only support one crop per year, mostly rice, and some sugar cane. Canal irrigation water is not available in the Rabi (dry/winter) season, so the villagers store water for domestic (non-drinking) and livestock needs. There are pockets of fresh groundwater 5-7 metres deep, and almost all households have access to water that has been improved for consumption. Nearby villagers have resorted to fish farming, but those we spoke to in this village were very much opposed to this practice as it can contribute to raising the water table.

While most adults in the village have never attended school, this village has two schools, with half the girls and almost two-thirds of the boys attending school. Almost all households have access to mobile phones and own livestock, while no households are landless in this village. We discussed possibilities for low cost changes to agronomic practices to bring economic improvement to the area, and the possibility of introducing alternative more salt tolerant crops and produce for kitchen gardens. The NRSP has an office in the village.

The second village, M. Ramzan Uplano, receives no irrigation water and the entire land of the village has not been farmed for at least 5 years. There is no school. No children attend school, and almost all adults have never attended school. Two-thirds of householders are landless, and most (71%) do not own livestock. Almost all households have access to a mobile phone, but the women explained that the men do not allow women to use the phone independently of them. To earn a living, men work on fishing trawlers, and are away from home for 15 to 20 days a time. The women work as labourers for nearby fish farms. The villagers are stuck in a poverty trap, having accrued debts that cannot be repaid.

As outsiders we found the situation in this village overwhelmingly desperate. Yet the villagers demonstrated pride of place, and a desire to stay. So, despite the emotional response to the dire situation we observed, this remains a “bright spot”, challenging us to think what alternatives are available to enable the villagers to adapt productively to their dire conditions. We discussed some options with the villagers at the time of our visit such as salt tolerant fodder for livestock, but the cost of buying livestock was prohibitive for the debt-affected villagers. Date palms is another option that came up later but that of course takes many years before income can be generated. If the salaries earned by men working on fishing trawlers continues to be the main source of family income, diversification opportunities could extend to identifying women-based enterprises that can provide a supplementary income in the short-term, while also enabling community transition towards more productive futures in the longer-term.

Maps and photos from the field visit are included as part of Appendix 1.

5.3 Gender Inclusion Workshop

MUET organised a half-day workshop on 12 July 2019 for the delegation listed in section 5.2, to learn from a range of local farmers and organisations about the conditions for women in communities affected by salinity, and to discuss strategies that the proposed project could pursue to enhance gender inclusion. A full report from this workshop is included as part of Appendix 1. To maximise participant engagement, the workshop included a breakout session with three smaller groups.

The group involving farmers highlighted the conditions faced by women because of the adverse link between low quality water and their/ their family’s health. Despite the burden on women, such as from having to carry water over long distances, the women farmers emphasised their entrepreneurial potential, backed by awareness training programs related to health and nutrition. The main conclusion was that women’s entrepreneurial potential should be supported through access to good loans, appropriate marketing facilities, improved access to transport and family support.

The group involving professionals spent a considerable time discussing power differentials embedded in cultural norms and how to move beyond them. The discussion included strategies focused on men involved in project activities so that they will allow and encourage women to become actively engaged in activities. While everyone in the room acknowledged the value and importance of having women's input, they recognised they were pursuing this within social contexts where women's inputs are rarely enabled. The recurrent themes were therefore about building women's capacities, improving their health and enabling access to improved livelihood opportunities; themes that are similar to that raised by the group involving farmers.

The group involving academics offered some practical research ideas, such as exploring salinity adaptation options with women using kitchen gardens (e.g. mulching, trialling and establishing nurseries for salt tolerant vegetables). A key concern for this group was how to maximise engagement of women researchers, including students, in such activities, requirement reconsideration of how university courses and field research are managed.

6 Activities in Australia, August 2019

6.1 Field Trip

From 11 to 24 August, a delegation from the three Pakistan partners involved in this SRA visited Australia. This delegation comprised the following:

From Mehran University of Engineering and Technology (MUET):

1. Dr Bakhshal Lashari, Professor and Director, US-Pakistan Centre for Advanced Studies in Water (USPCAS-W), MUET, Pakistan
2. Dr Abdul Latif Qureshi, Professor and Sectional Head in Hydraulics, Irrigation and Drainage, USPCAS-W, MUET, Pakistan
3. Dr Altaf Ali Siyal, Professor, USPCAS-W, MUET, Pakistan

From Muhammad Nawaz Shareef University of Agriculture Multan (MNSUAM):

1. Dr Irfan Ahmad Baig, Professor and Acting Dean, Faculty of Social Sciences and Humanities, MNSUAM, Pakistan
2. Dr Tanveer ul Haq, Associate Professor and Chairman, Department of Soil and Environmental Sciences, MNSUAM, Pakistan

From Society of Facilitators and Trainers (SOFT):

1. Dr Iftikhar Hussain, Chairman, SOFT, Pakistan
2. Ms Fozia Memon, Project Officer, SOFT, Pakistan

The visit to Australia included participation in several Canberra-based meetings and the Crawford Conference followed by a five-day tour through the Murray-Darling Basin. For this part of the tour, Drs Mitchell and Allan joined the group of seven. A report of this field tour is attached as Appendix 2.

On the last day of the field tour component, the team reflected on their key learnings from this trip, facilitated by Drs Catherine Allan (CSU) and Greg Walkerden (Macquarie University). The group developed a comprehensive list of key considerations for the project, in no particular order, building on what they had learned on the field trip. This list was revisited the next day within a larger group context, and all people present were asked to vote for what they thought were the two most important considerations. The prioritised list is presented below, with the votes cast by the nine field trip participants shown first, followed by the votes from the six other non participant experts.

- Scientists and other institutions involved in the project should be connected with communities so that communities drive the research: farmers contribute; they are key players (received 7 field trip participant votes + 1 non participant vote = 8)

- Patience and persistence is required; adaptive planning needs to continue for the long term (5 + 3 votes = 8)
- Local solutions can and should be shared to enable neighbours to learn good practice from each other (2 participant votes)
- Start with the resources and opportunities on site (2 participant votes)
- Welcome women and youth (1 + 1 votes = 2)
- Consider vegetative solutions but adapt to Pakistan enterprises (1 + 1 votes = 2)
- Remain realistic with accountability (1 + 1 votes = 2)
- Learn about and build on existing institutional conditions (2 non participant votes)
- Meaningful networks need to be built with the right people (2 non participant votes)
- The right questions and approach can tap into existing enthusiasm
- Use appropriate communication to build shared understanding
- Industry partners are needed for scaling out equipment
- Use ideas not necessarily specifics
- Be opportunistic and flexible
- Use existing knowledge and seek new knowledge
- Understand connectivity

All the considerations listed above were deemed important by the field trip participants. However, it is clear from the two given highest priority that field trip participants had been profoundly impacted by the opportunity to meet with farmers and members of Landcare organisations who had been involved in salinity management 20-30 years prior. This experience emphasised the merit of taking a longer-term perspective. The organisations and activities that field trip participants were observing and interacting with in 2019 had evolved over decades of adaptive management/ trial and error/ collaboration, communication and varying government support. This reminded us all that to effect change can take a long time, especially where the change being sought involves institutions that are slow to change.

6.2 Systems Analysis Workshop

One of the key outcomes of a set of discussions held at ACIAR on involving the Australian-based team was the value of basing research proposal development on sound systems analysis of the context that researchers are seeking to influence. This confirmed the need for us to undertake a systems analysis that would inform the development of the project proposal and its associated impact pathways analysis.

A report of the systems analysis workshop is attached as Appendix 3. The aims of the workshop were to:

1. Describe and gain a shared understanding of the system within which the 10-year program and 4-year project will be implemented, examined from each of biophysical, social, agricultural livelihood, and institutional/ governance perspectives.
2. Map the network of relevant priority stakeholders and key decision-making actors
3. Test and refine the mapped draft impact pathway, and describe the pathways to change.

The bulk of the workshop time was devoted to Objective 1. The pursuit of this objective in turn helped deliver on the other two objectives.

The process began with descriptions of the biophysical, social, agricultural livelihood and institutional sub-systems recorded on video with dot point summaries forming the basis of the workshop documentation. This process involved all participants listening to those from the group who had relevant sub-system expertise answer a set of questions that had been prepared beforehand. Participants sought further clarifications from these experts with the

aim of reaching a shared understanding of all key aspects of the system that the project is seeking to influence.

The next part of the process occurred on the second day. Workshop participants examined the descriptions of each of the sub-systems to identify the scope for change, that is, to determine what the proposed four-year project can influence: What can the project change? How much can be changed? What can the project do to contribute to these changes? The session was again recorded on video, and the dot-point summary of the discussion resembled a set of outputs and outcomes that could then be matched against the outputs and outcomes that had emerged from the impact pathways analysis.

As these discussions unfolded, there was a clear appreciation among the group that changes identified within each sub-system are likely to have strong association with changes identified in other sub-systems. When system changes identified were matched with outputs and outcomes emerging from the impact pathways analysis, there was again substantial coherence. As with the workshop in Karachi, this demonstrates the merit of having a single set of end of project outcomes that can serve to provide a common direction and flow to projects that necessarily require integration across multiple areas of academic expertise, as well as integration between academic expertise and the expertise of others in society.

The Impact Pathways Analysis was on display throughout the workshop, helping us to regularly reconsider, revise and/or reconfirm the phrasing used for intended project outputs and outcomes. There was, in general, overall consensus about the impact pathways, despite its analysis having been developed over the three workshops (in September 2018, July 2019, and August 2019). The main contribution made at this August 2019 workshop was to add in a set of four-year end of project outcomes, which were:

1. Leading individuals and groups (women, men, girls and boys) are continually improving management of their salinity affected landscapes
2. Cumulative bases and networks for sharing knowledge are enabling collaboration on planning and other activities between relevant experts, government agencies, NGOs and salinity affected communities
3. Key partners, government agencies and other policy influencers own and acknowledge the importance of supporting actions for continual improved management of salinity affected landscapes into the future

The final stage of this part of the process relates to Workshop Objective 3: to describe the pathways to change. Many potential pathways to change were discussed during the workshop. However, workshop participants broke into small groups to explore and articulate a set of more specific pathways of change related to the three end of four-year project outcomes. The logic that participants had to describe involved a set of causal links: i.e., **if we** do this, **then** the result will be this, which can then feed into the next action step, which would in turn have a result that contributes to the end of project outcome.

So, for example:

> **If we:** use FILM to support farmer learning associated with the introduction of new technologies, crop varieties and other adaptations for living with salinity
>
> **Then:** farming communities will adopt and adapt these new approaches to farming which will improve soil and water management
>
> **And finally:** people will adapt to living with salinity and there will be improved livelihoods and social conditions
>
> **Contributing to this intended end of four-year project outcome:** Leading individuals and groups are continually improving management of their salinity affected landscapes

And:

If we: establish or build on a key partnership by having the partners collaborate on an activity that is meaningful for both the project and the partners involved

Then: the partners will work on that activity driven by their own motivation

And finally: it becomes their activity

Contributing to this intended end of four-year project outcome: Key partners, own and acknowledge the importance of supporting actions for continual improved management of salinity affected landscapes into the future

6.3 Transdisciplinary Framing Workshop

A report from this workshop is being prepared and will be published separately. While the workshop focused on giving ILWS members an opportunity to improve its approaches to delivering transdisciplinary research, its timing took advantage of the presence of the team from Pakistan so that they too could improve the framing of the proposed project.

A transdisciplinary approach to research is where a common research objective is pursued through partnerships that enable collaboration between researchers from a range of academic disciplines and other actors in society (Tress et al., 2005, Mitchell et al., 2017, Christen et al., 2019). A research objective to enhance capacity for living well with salinity benefits from the adoption of a transdisciplinary framing. For communities in salinity affected landscapes to adapt productively to their landscape conditions requires technical knowledge and innovations, but it also requires ability to exchange and co-create understanding across technical and non-technical languages; between scientists, communities, and other actors in society.

The workshop explored five different ways in which transdisciplinary projects could be framed:

1. As systemic co-inquiry (Foster et al., 2019).
2. In terms of the United Nation's 17 Sustainable Development Goals (Nilsson et al., 2016; Stafford-Smith et al., 2017).
3. As a set of co-evolving social-ecological interactions (Schlüter et al., 2012; Mitchell et al., 2016).
4. In terms of supporting, provisioning, regulating and cultural services provided by nature for human benefit (Millennium Ecosystem Assessment, 2003; Gordon et al., 2010).
5. Through a critical institutional interrogation of how sets of rules and resources interact in a particular social situation (Cleaver & de Koning, 2015; Whaley, 2018).

The presenter for each framing listed above was asked to conduct a hands-on activity that would illustrate how the framing could be applied to real-world contexts. For the delegation from Pakistan, they used contexts associated with the salinity project except for the first activity which involved a conversation mapping exercise to explore challenges and opportunities of doing transdisciplinary research. In each case, the time constraints in place (less than an hour for each activity) limited the potential for useful results emerging from the activity. However, the activities provided a sufficient glimpse of how useful the results could be if undertaken over a longer time frame (the time required would vary according to the intended outputs and outcomes of the activity).

For the development of the salinity project proposal in particular, two activities stood out as particularly relevant. First, the use of social-ecological conceptual mapping to identify scenarios (Mitchell et al., 2016) could be a useful means for a participatory approach to the creation of a range of future scenarios based on a systemic understanding of local contexts. The process could evolve over a series of workshops that purposefully integrate a range of knowledges from science and practical experience.

Second, the interrogation of local social situations using Whaley's (2018) critical institutional analysis and development (CIAD) framework was appreciated by the participants as being a potentially highly effective means to articulate and explain the tacit rules and norms that create power imbalances through the workings of local governance arrangements. The need to reveal the complex embeddedness of such governance dynamics is crucial to fully appreciating local social situations, especially because these dynamics can undermine efforts to engender change if they are not fully considered.

So, for example, by exploring the range of social and ecological drivers of change on communities in salinity affected landscapes, one of the two small groups involved identified the extent of community engagement and the effectiveness of public policy as the future's greatest unknowns. Many of the other most significant drivers of change have more predictable trajectories or outcomes that could be more easily anticipated, such as water availability as determined by climate change and a range of other social and policy drivers.

Both small groups involved with the Pakistan salinity project uncovered many useful elements of the local social context using the CIAD framework. Caste as a social attribute was highlighted by both groups, including in terms of its influence on behavioural norms related to gender dynamics. And in terms of discourse, there are significant differences between men and women in knowledge and the way knowledge is exchanged. These differences actually strengthened the case for engaging women in community change processes. Their means of indirect influence on decision-making was seen as likely to be initially more effective than engaging with men directly to effect change. The groups also identified a range of power imbalances prevalent in the political economic contexts, including due to location (especially along the length of canals and distributaries), size of landholdings, which are in turn linked with the quality and extent of biophysical resources available and the state of laissez-faire water management decision-making resulting from water management policies that are ineffective or non-existent.

7 Portfolio of "Bright Spots"

The term "bright spots" was adopted as part of Living with Salinity project development to describe communities in salinity affected landscapes that are managing to sustain and perhaps enhance their livelihoods through active community-driven adaptation (cf. Noble et al., 2006). The purpose of identifying these communities is that the project team would like to learn with and from these communities, so that other communities can also benefit from their adaptation actions.

A list of some bright spots has been nominated by SRA project partners, and a summary of these is provided in Table 2. Full details are included in Appendix 4.

The intention is that nominations for bright spots will continue. These bright spots do not necessarily need to be communities in the southern Indus Basin. We are also interested in other types of bright spot activities that will have relevance to the proposed project's development.

Table 2: Summary details of "bright spots" identified by September 2019

	Location	Description	Nearest town centre	District	Main intervention	Extent of prior interaction	Challenges	Nominator
1	Dabla Tappan	A village	Keti Bunder	Thatta	Mangrove plantations	Current IUCN project; longstanding engagement	Loss of agricultural livelihood due to seawater intrusion in the Indus Delta	IUCN Pakistan
2	M. Juman Sanghar	A village	Chuhar Jamali	Sujawal	Fish farming	More than five years interaction with MUET	Saline soils due to shortage of irrigation water and seawater intrusion	MUET
3	M. Ramzan Oplano	A village	Sujawal	Sujawal	Fish farming	More than five years interaction with MUET	Saline soils due to shortage of irrigation water and seawater intrusion	MUET
4	Community group Akremwah	A Water Course Association (WCA)	Hoosri	Hyderabad	Vertical farming of vegetable crops – role of women is critical	Via Sindh Water Sector Improvement Project (SWSIP)	Water shortages during rabi season	SIDA
5	Horticultural farmers near MNSUAM university farm	A community of practice	Jalalpur Pirwala,	Multan	Horticulture: pomegranate, dates, mangos	MNSUAM are providing support	Limited canal water, poor quality groundwater	MNSUAM
6	Farmers located near Taunsa-Panjnad (TP) Link Canal	A community of practice	Muzaffargarh	Multan	Fish farming	MNSUAM are providing support	Seepage from link canal causing waterlogging	MNSUAM
7	Malwa Distributary	Villages along a distributary	Qazi Ahmad	Shaheed Benazirabad (Nawabshah)	GW and salinity monitoring	Part of LWR/2015/036 project; stakeholder forum established	Tail end of distributary water shortages	MUET
8	Chiho Minor Distributary	Villages along a distributary	Pad Idan	Naushero Feroze	GW and salinity monitoring	Part of LWR/2015/036 project; stakeholder forum established	Tail end of distributary water shortages	MUET

8 10-year program framing document

A key objective of this SRA was to imagine how the "Living with Salinity in the Indus Basin" project we had originally proposed could be refashioned as a series of projects to be conducted over a ten-year timeframe. The preceding sections describe activities that have contributed to meet this objective. A focus on intended research outcomes remained a focus for these activities. The resulting vision for a ten-year program of activities has laid a solid foundation for long-term collaboration between Australian and Pakistan-based researchers to improve livelihoods for those living in salinity affected landscapes.

The vision builds on existing ACIAR work undertaken in Pakistan related to understanding and improving surface water and groundwater management (through SDIP and ACIAR's LWR/2015/036 project), strategies that enhance farmer-based collaborative learning (through ACIAR's LWR/2014/074 project), value chain analysis (through a number of projects under the umbrella of ACIAR's Aik Saath program), and adaptation options for salinity affected landscapes through a number of ACIAR projects in Pakistan that date back to 1993, including the widely used handbook for saline agriculture by Qureshi and Barrett-Lennard (1998). It also imagines how the program could serve as a focus for building integration across all of ACIAR's program and sub-program areas, enabling collaboration for ACIAR activities in Pakistan in areas of cropping, horticulture, forestry, fisheries, soil and land management, farming systems analysis, climate change, among others. The other key component of the vision is the intended development of multiple projects with multiple partners and donor agencies with focused interests but working collaboratively for mutual value added benefits.

The ten-year vision is detailed in the document (attached as Appendix 5) that frames how a ten-year program of research for development projects could evolve. We assert that this document is an important outcome of this SRA, especially for ACIAR. In particular, it articulates an idea that first emerged during discussions between Drs Evan Christen and Robyn Johnston, the two mid-term project reviewers of ACIAR's salinity-related projects in Bangladesh (LWR/2014/072 SIAGI and LWR/2014/073 projects), and Drs Michael Mitchell and Ed Barrett-Lennard, among others.

Because many of ACIAR's projects deal with complex issues, our SRA recommends that ACIAR enables researchers to envision how projects could develop over a longer term timeframe. Our recommendation is that such a longer term strategy be envisaged as evolving through three stages: formative research, participatory research, and action research (with thanks to Jana and Carter (2018) from ACIAR's SIAGI project for the idea).

Many of ACIAR's projects are already designed to be participatory, or to take a partnership or transdisciplinary approach. Such approaches are recognised by many involved with ACIAR as critical in order to deal with the complex situations being faced (Christen et al., 2019). The contribution of the framing document is to situate this participatory research agenda as part of a broader research program with adequate formative research to ensure effective partnerships and participation of research users and intended beneficiaries, and an action research stage where research users take over to direct the agenda of the research together with the intended research beneficiaries.

Drawing on the typology of research shown in Figure 1, participatory research can be perceived as a continuum of approaches, with many ACIAR projects increasingly adopting strategies that enable their research participants (both intended research users and intended research beneficiaries) to take on roles as collaborators and/or partners.

Participatory action research is an approach first described in the 1970s (Chambers, 1974; Hall, 2005; Fals Borda, 2006, Woodward & Hetley, 2007), but links back to 1940s descriptions of action research (Lewin, 1946). The participants in such approaches are usually perceived as being communities of place, but participatory action research can also be undertaken by researchers collaborating with government and non-government

organisations, or through building collaboration between communities of place and organisations.

Mode of participation	Cooption	Cooperation	Consultation	Collaboration	Co-learning	Collective action
Role of community	Subjects	Employees, subordinates	Clients	Collaborators	Partners	Directors
Type of participation	Tokenism: representatives are chosen but have no real input or power	Tasks are assigned with incentives, outsiders decide agenda & direct the process	Options asked: outsiders analyse information and decide on a course of action	Local community work together with outsiders to determine priorities; outsiders have responsibility for directing the process	Local community & outsiders share their knowledge to create new understanding & work together to form new action plans; outsiders facilitate	Local community set & implement their own agenda

Figure 1: A typology of participatory research as a continuum of approaches. (Mitchell (2008) based on Race & Buchy's (1999) adaptation of Cornwall's (1995) typology)

The latter description also aligns this participatory approach with transdisciplinarity. Bellotti (2017) describes how the ACIAR LWR/2010/082 (2012-2017) project to improve livelihoods of impoverished and marginalised communities in the East India Plateau evolved to become transdisciplinary in character. Bellotti's description of the stages of this evolution matches the formative–participatory–action staging strategy recommended here.

Phase 1 of the project involved "collaborative problem framing and building a collaborative research team" (Bellotti, 2017, p. 227). Interestingly, he observes that if, at the time, this stage had been explicitly appreciated as involving the collaborative design of a transdisciplinary research project, there would have been a broader shared understanding of the project's intent to undertake research, and deliver research outcomes. Apparently, a key national agricultural research organisation withdrew its association with the project at that embryonic stage because they saw the project as being too development focused. That left PRADAN, a local non-government organisation, as the key partner in the project.

Phases 2 and 3 of ACIAR's East India Plateau project are described by Bellotti (2017) as involving "creation of new actionable knowledge through collaborative research" (p. 228) and "integration and application of new knowledge in ways useful for development and science practice" (p. 229). These are apt descriptions for the intended outcomes of research activities we have described as involving a participatory research stage, followed by an action research stage. Our descriptors focus on the process to be used. Bellotti's (2017) explanations based on his engagement with the East India Plateau project provide a pleasing parallel to emphasise how such a formative–participatory–action staging strategy delivers a set of research activities with research outcomes.

A key learning from the experiences of the current SRA project is the need for investing substantial time and effort at the formative stage. To collaboratively frame a research agenda and build a collaborative research team requires a formative research process to create a shared and emergent understanding of the complex situation that the research activities are intended to influence. Developing a shared understanding of a research agenda across disciplines is challenging in itself. To develop a shared understanding of that agenda with intended research users and beneficiaries as partners in the project requires substantial time to enable co-learning about the situations all parties are seeking to influence through the research activities. In our case, this has already involved two SRAs and an engagement period of over two years, and we are proposing that this continue for another 1-2 years before we can effectively embark on the participatory stage of research.

The need for investing more time and effort in the initial stages of formulating large-scale transdisciplinary research projects is a consistent recommendation based on experiences

and evaluations of such projects (Tress et al., 2007; Lang et al., 2012; Lefroy et al., 2012; Allen et al., 2014; Mitchell et al., 2015, 2017). Christen et al. (2019) recommend the process of participatory impact pathways analysis as one means to offer focus to these research design activities (i.e. as a boundary object – see Bellotti's (2017) reference to Clark et al., 2011). To this we would also add the benefit of a participatory process to systems analysis (see Section 6.2, Mitchell et al., 2014, 2016 and Allan et al. in press).

9 Conclusions and recommendations

This SRA culminates over two years of scoping activities undertaken with an emphasis on participation and building an engaged network of relevant experts. The activities of this SRA have cemented the engagement of key Pakistan partners who have been championing the proposed LWR/2017/027 project from the outset with a high level of ownership. Key to that level of ownership is that the Pakistan partners have directly contributed to the proposed project design. While the Australian researchers have helped to frame the design steps and document outcome, most of its design has been undertaken by our Pakistan partners through their engagement in workshops in Pakistan and Australia.

Key recommendations:

1. Invest time and money to improve project design: Enabling collaborative design of a research for development project with intended users and beneficiaries requires their direct engagement, using participatory methods, as well as the time to co-learn a shared understanding of the complex situation the research activities are intending to influence.
2. Be outcomes-oriented: The collaborative design of a research for development project benefits from participatory impact pathways analysis to ensure focus begins with research outcomes, and then proceeds backwards to outputs, activities and the range of expertise and other resources that will be needed.
3. Appreciate complexity: The co-learning to be developed among researchers, research users and intended research beneficiaries as part of collaboratively designing a project can benefit from an increasingly accessible range of participatory, systems-based approaches to understanding complex contexts, such as social-ecological systems mapping and critical institutional analysis and development.
4. Engage and enhance the capacity of intended beneficiaries: For the proposed project relating to salinity in Pakistan, focus should shift away from salinity control and reclamation of land towards approaches that engage and enhance the capacity of affected communities to adapt productively to the salinity affected landscapes they live in. Identifying and engaging with "bright spot" communities in project design and delivery can help to ensure activities that enable those involved learn from and engage with lived experiences.
5. Take action to ensure women are engaged: Women have entrepreneurial skills and knowledge that add value to any project, and can influence change within communities in profoundly different ways to men. Consideration therefore needs to be given to how to understand and respond to constraints undermining women's participation in project design and delivery, including taking positive actions to maximise engagement of women researchers and students in field-level, community-based aspects of research design and delivery.

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11 Appendices

11.1 Appendix 1: July 2019 Sindh-based Workshops and Field Trip Report

Available from the authors upon request.

11.2 Appendix 2: August 2019 Murray-Darling Basin Field Trip Report for Pakistan Partners

Available from the authors upon request.

11.3 Appendix 3: 20-21 August 2019 Systems Analysis Workshop Report

Available from the authors upon request.

11.4 Appendix 4: Portfolio of “Bright Spots”

Available from the authors upon request.

11.5 Appendix 5: Proposal Supplement: Framing a 10-year program

Attached.

Australian Government

Australian Centre for International Agricultural Research

Proposal Supplement: Framing a 10-year program

ACIAR Program(s) area	Water and Climate
Project Title	Adapting to salinity in the southern Indus Basin
Project Number	LWR/2017/027
prepared by	Dr Michael Mitchell
ACIAR Research Program Manager	Dr Robyn Johnston

Abbreviations and acronyms used in this document:

ACIAR	Australian Centre for International Agricultural Research
AVCCR	Agricultural Value Chain Collaborative Research
CSIRO	Commonwealth Scientific and Industrial Research Organisation
GCF	Green Climate Fund
GW	Groundwater
FAO	Food and Agricultural Organisation
FILM	Farmer Integrated Learning Model
ICBA	International Center for Biosaline Agriculture
IHR	In House Review
LWR	Land and Water Resources
Min of CC	Ministry of Climate Change
Min of Water Res	Ministry of Water Resources
NARC	National Agricultural Research Centre
OFWM	On Farm Water Management
PCRWR	Pakistan Council
RPM	Research Program Manager
SDIP	Sustainable Development Investment Portfolio
SIAGI	Promoting **s**ocially **i**nclusive and sustainable **ag**ricultural **i**ntensification in West Bengal and Bangladesh project
SID	Sindh Irrigation Department
SIDA	Sindh Irrigation Drainage Authority
SOFT	Society of Facilitators and Trainers
SRA	Small Research and Development Activity
WB	World Bank

1. Introduction

This document explains how the LWR/2017/027 ACIAR project commencing in 2020 fits as part of a longer-term program of research for development activities.

Laying out a longer-term research strategy is needed for the complex issues being addressed by ACIAR's research on salinity in Pakistan. This document explores the strategy as unfolding over three stages: formative research, participatory research, and action research (with thanks to Jana and Carter (2018) from ACIAR's SIAGI project for the idea).

Many ACIAR projects are adopting participatory action research as their mode of operation. Such an approach was first described in the 1970s (Chambers, 1974; Hall, 2005; Fals Borda, 2006, Woodward & Hetley, 2007), but links back to 1940s descriptions of action research (Lewin, 1946). The participants in such approaches are usually perceived as being communities of place, but participatory action research can also be undertaken by researchers collaborating with organisations, or through building collaboration between communities of place and organisations, as is intended to be the case with the proposed LWR/2017/027 project.

The formative–participatory–action staging is intended to explain how a longer-term research approach can be built that gradually facilitates increasing participation and eventual ownership of the research by the intended users and beneficiaries of the research (as modelled through the typology shown in Figure 1).

Mode of participation	Cooption	Cooperation	Consultation	Collaboration	Co-learning	Collective action
Role of community	Subjects	Employees, subordinates	Clients	Collaborators	Partners	Directors
Type of participation	Tokenism: representatives are chosen but have no real input or power	Tasks are assigned with incentives, outsiders decide agenda & direct the process	Options asked: outsiders analyse information and decide on a course of action	Local community work together with outsiders to determine priorities; outsiders have responsibility for directing the process	Local community & outsiders share their knowledge to create new understanding & work together to form new action plans; outsiders facilitate	Local community set & implement their own agenda

Figure 1: A typology of participatory research as a continuum of approaches. (Mitchell (2008) based on Race & Buchy's (1999) adaptation of Cornwall's (1995) typology)

The ideal of shifting the roles of research users and beneficiaries from clients to collaborators to partners, and eventually those who own and direct the research requires a solid foundation, and this is rarely achievable within a four-year research timetable. Proponents of this approach to research working through ACIAR often pursue such a shift over a series of consecutive four-year projects. This framing document instead intends to make a difference by elaborating how such a formative–participatory–action staging strategy can be conceived from the outset. Its significant contribution is to place greater appreciation on the length of time needed at the formative stage of such a longer-term program of activities in order to improve contextual understanding, network building and joint formulation of research purpose, design and intended outcomes.

2. Developing a formative–participatory–action research program

The impetus behind developing a longer term (ten-year) research program on the theme of 'Living with Salinity in the Indus Basin of Pakistan' resulted from ACIAR's In House Review (IHR) of the LWR/2017/027 preliminary project proposal submitted in June 2018. That proposal was seen as an ambitious and appropriate response to a priority issue for ACIAR's future engagement in Pakistan. Given Australia's deep skills and long experience with salinity management, the theme of 'Living with Salinity' represented an admirable focus for how Australian researchers could collaborate with their Pakistan partners to respond to a complex issue shared by both countries. The IHR required that the proposal be re-fashioned as a series of projects that evolve in an integrating way over ten years. Such a long-term integrative and transdisciplinary approach was recommended given the complexity and dimensions of the challenges to be addressed (also see Christen et al., 2019).

The IHR also noted the 'Salinity Network', developed from the Small Research and Development Activity (SRA) that preceded the submission of the June 2018 proposal, as an important resource. That recognition highlights that the formative stage of the long-term project had begun, and had already achieved a significant initial outcome. A range of additional formative research activities were proposed, including as part of a second SRA.

From this iterative process the team realised that the first project in the ten-year research program should aim to consolidate research activities and outcomes related to the formative stage. It should also aim to have commenced, and made the case for further investment in, participatory research activities. To make best use of available funds, and in recognition of the significant achievements already made, the team has decided that this first project should cover an intense period of activity from contract signing in mid 2020 until the end of 2022 (i.e. about 2.5 years). A key intended outcome by the end of this period would be a set of newly funded, or ready to be funded, project proposals to enable participatory 'scaling out' research activities across a wider range of salinity affected landscapes across Pakistan, and with a wider range of donors and partners. Such a vision is depicted in Figure 2.

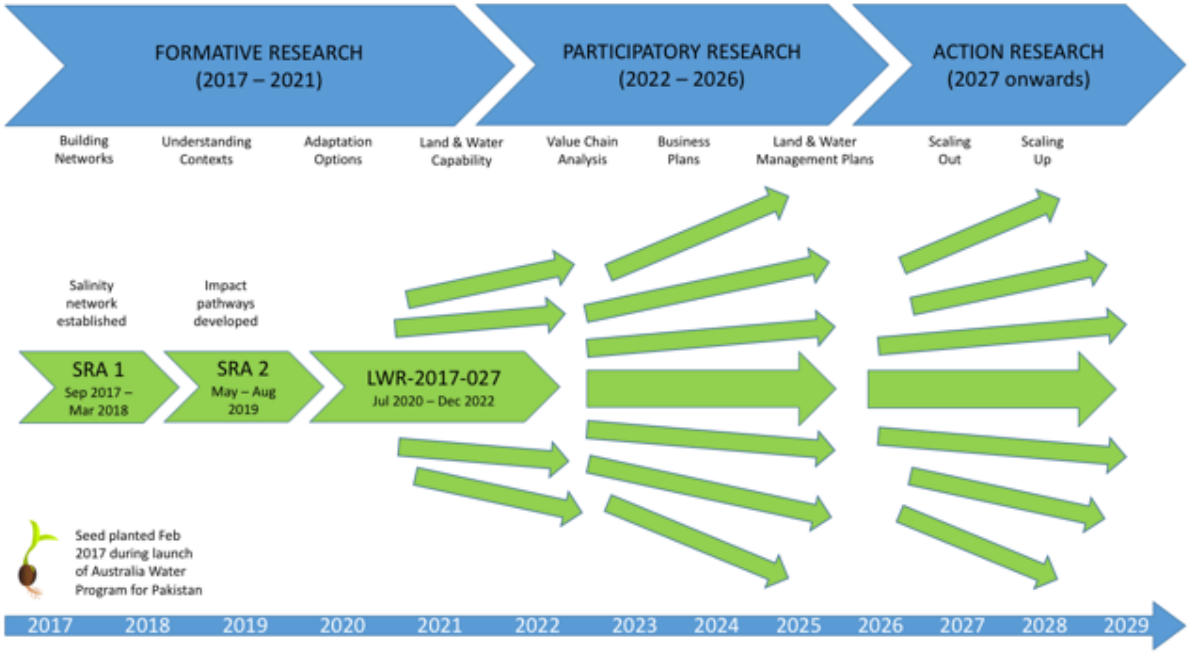

Figure 2: Envisioning a long-term program of formative–participatory–action research

The depiction describes some of the research activities that could evolve with research users and beneficiaries over time, as well as key formative research outcomes already in place (network established; impact pathways described). Additional research projects could commence during the proposed period of the LWR/2017/027 project (as represented by the green arrows commencing in 2021-2022); other projects could succeed it, including two central and integrating projects that oversee the participatory and action research activities (as represented by the larger green arrows).

The complementary depiction in Figure 3 indicates the type of research activities that could evolve, based on outcomes of a workshop in Karachi on July 10, 2019, where an initial set of research activities were described, and influenced by the field trip by representatives from key Pakistan partners through the Murray-Darling Basin. On the field trip Pakistan partners heard representatives of Landcare and other organisations reflect on the early successes of the Land and Water Management plans in building collaboration across farming communities for improved salinity management (among other things).

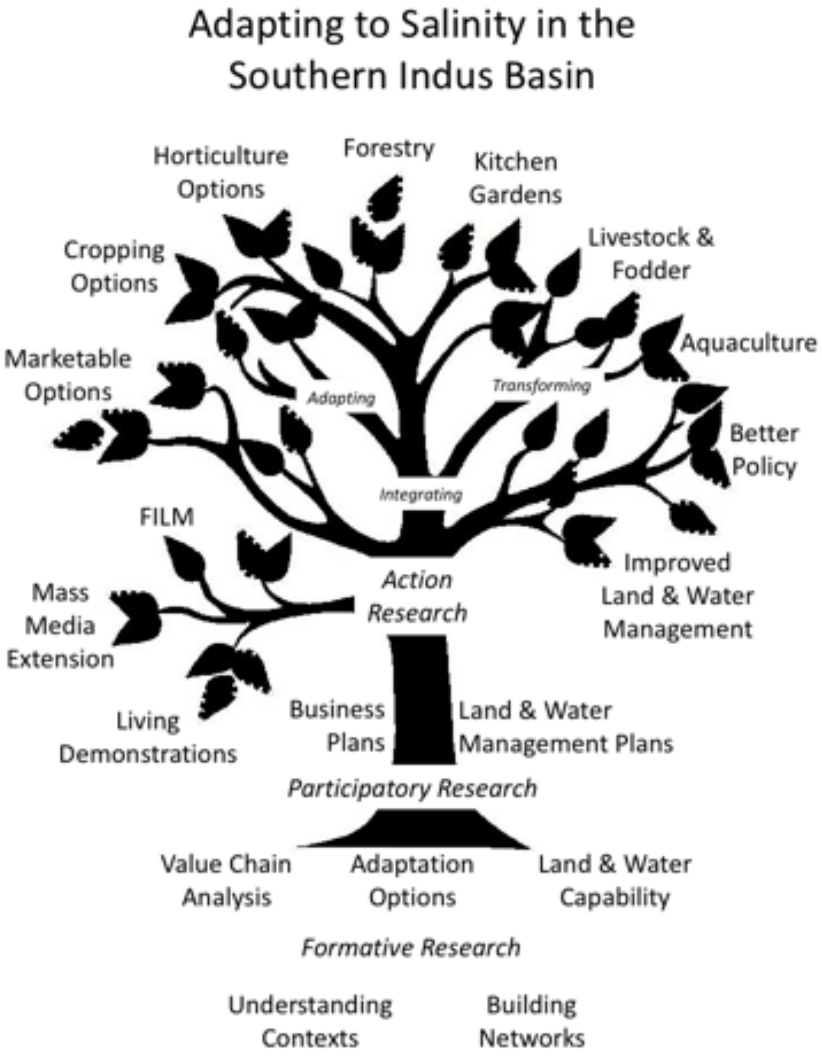

Figure 3: Fruits from a long-term process of formative–participatory–action research

The metaphor of the 'research project as a tree' has entailments of growth – substrates, inputs, and potential form. Figures 4 and 5 use the same metaphor, with Figure 4 aiming to show the long-term program of research, started with the LWR/2017/027 project under the Water and Climate theme within ACIAR, could eventually serve as a means for integrating all of ACIAR's programmatic themes in this important work in Pakistan. Because of this, a special central role is given to ACIAR's integrating program theme of 'Farming Systems Analysis'.

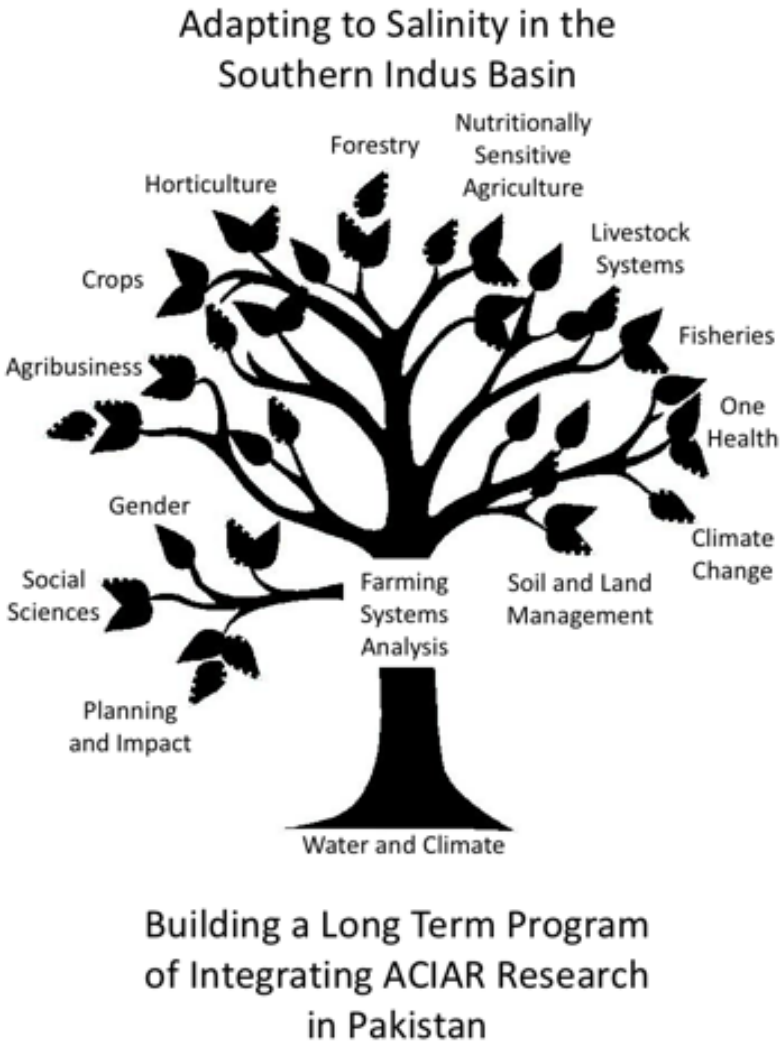

Figure 4: Building a long-term program of integrating ACIAR research in Pakistan

Figure 5 aims to show the result of the long-term research program as a set of research for development projects that partners in Pakistan have developed with a range of donors, or undertaken by themselves. It also aims to show how this long-term program built on existing projects ACIAR has been involved with, notably the LWR/2015/036 Groundwater Project and the LWR/2014/074 Farmer Learning Project, as well as more generally ACIAR's Aik Saath Agricultural Value Chain Collaborative Research (AVCCR) program in Pakistan and the Sustainable Development Investment Portfolio (SDIP) project led by CSIRO involving the development of an integrated river system model for Pakistan.

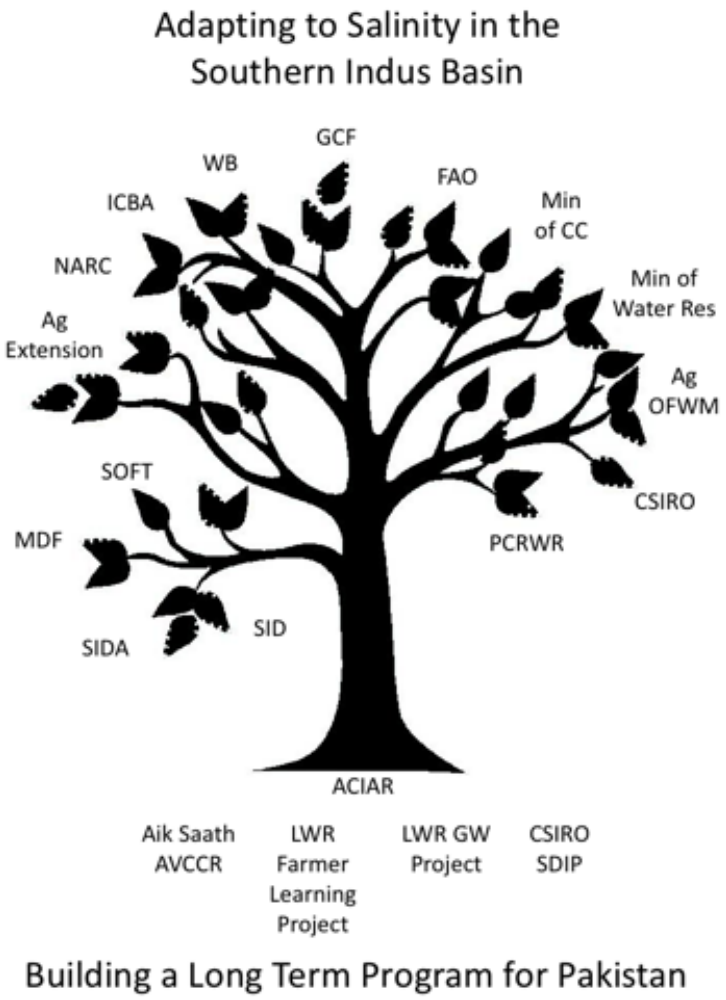

Figure 5: Building a long-term diversely funded research program building on initial Australian government investment

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