

# ACIAR SDIP

Report on Diversification Workshop, December 2018



Australian Government  
Australian Centre for  
International Agricultural Research

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# **Diversification for sustainable food systems in South Asia**



**ACIAR SDIP Workshop**  
**10<sup>th</sup> – 11<sup>th</sup> December 2018**



## EXECUTIVE SUMMARY

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A workshop focused on *Diversification for Sustainable Food Systems in South Asia* was held at ACIAR House in Canberra on the 10<sup>th</sup> and 11<sup>th</sup> December. The workshop brought together 30 researchers representing 10 research organisations from Australia and the CGIAR, including ACIAR Research Program Managers (Water and Climate Change, Crops, Horticulture, Livestock and Farming Systems) and regional staff; partners from the SDIP portfolio; and other researchers working in the Eastern Gangetic Plains. The workshop was held to share experience and expertise in promoting diversification of farming systems in the Eastern Gangetic Plains (EGP) region across a range of disciplines, scales and approaches, to understand the synergies and trade-offs across the work already being undertaken by ACIAR.

Over two days, the meeting discussions showcased the ACIAR SDIP program and highlighted existing and previous ACIAR projects. In a short foresighting exercise, the future status of each of the three countries part of the EGP was considered to envisage what diversification for sustainable food systems look like in these areas. Using this as a guide, future research priorities that can contribute to the sustainable development of food systems in the EGP were considered. Given the broad range of experience, the identified knowledge gaps were broad and included production dynamics; resource use and impacts; risk; knowledge sharing and adoption; and market arrangements.

Key themes for future work included technical research on diversified options for production that includes crop-livestock systems; farming systems research; resource constraints and dynamics; markets; options to improve information and knowledge sharing, linked to improved adoption and implementation of research projects; and generating a better broader macroeconomic understanding of the region.

Importantly, potential links between current projects were also identified, and effort will be dedicated to following up on these to capitalise on existing knowledge.

Participants highlighted the benefits in coming together in person to better understand complementary work and identify links between projects. For the ACIAR SDIP program, this was a valuable opportunity to identify where there are links to existing work, and to consider priorities for future research priorities in the region.

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## Background

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ACIAR funds a range of projects in South Asia that focus on diversification and intensification of agricultural systems to improve farm and community level profitability, sustainability and productivity. The ACIAR Sustainable Development Investment Portfolio (ACIAR SDIP) program incorporates a range of activities on diversification in the context of sustainable intensification to improve food, energy and water security. Diversification can enhance resilience to biotic and abiotic stresses, promote more effective and efficient nutrient cycling, improve soil health, provide ecosystem services, and contribute to adaptation and mitigation of climate change (FAO, 2010), in particular as systems intensify. However, there are often trade-offs and interactions in resource consumption (e.g. water and energy) and productivity as a result of diversifying farming systems in time and space. For example, adding an additional dry season crop can increase water use where crops were previously not grown, or reduce water use if it replaces a higher water use crop. Impacts at the field level may be different at the landscape level, and second-generation impacts (e.g. pest, disease and weed dynamics) often emerge over time. The institutions that farmers rely on may also need to adapt to better support diversified systems, for example in terms of access to information, different inputs, resources and market options.

## Aim

The workshop was proposed to share experience and expertise in promoting diversification of farming systems in the Eastern Gangetic Plains (EGP) region across a range of disciplines, scales and approaches, in order to:

1. Present the SDIP program and individual projects to the group for co-learning and feedback.
2. Understand current approaches to diversification of farming systems in South Asia (including crops, livestock, horticulture, agribusiness, gender and socially inclusive strategies). What can SDIP learn from ongoing and previous ACIAR projects?
3. Identify trade-offs and interactions that arise as a result of diversification over time and scale.
4. Identify potential gaps in the existing ACIAR SDIP program and explore opportunities to develop collaborative research activities to improve the outcomes of diversification in the EGP.

The intended outcomes of this workshop were to identify areas of shared interest between ACIAR projects within and external to the SDIP program to ensure that projects are informed of the different approaches being tested, the common challenges and potential collaborative opportunities. In particular, the synergies, interactions and trade-offs that arise from diversification of farming systems in time and space within the EGP should be able to be better anticipated and managed in the future.

## Workshop Content

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### Ongoing ACIAR work

The first day of the workshop focused on ongoing and previous research being undertaken in the Eastern Gangetic Plains, including within the SDIP program. Some of the gaps and discussion related to the current SDIP program included the following:

- How are the interactions of labour and gender being considered, with relation to labour markets? This is particularly important in relation to diversification, because for example intercropping involves more female labour than male.
- It is important to study and understand the role of formal and informal institutions that support diversification.
- There is a lack of work on agrichemicals, particularly herbicides as a significant issue related to conservation agriculture adoption, and also pesticides when considering diversification. The overuse of pesticides in particular needs to be explored, but the researchable questions need to be identified. This includes defining the kinds of agrichemicals that are understood to be problematic: for example, pesticides as distinct from fungicides.
- Dis-adoption of technologies can be looked at as a learning opportunity.
- How does the SDIP program address or include nutrition? This is not done explicitly, but the Foresight work will consider nutrition as a driver of the food system.
- Is there any work on climate variability within the SDIP program? This is addressed at the farm level in terms of CA approaches as an option for improving climate resilience and reducing emissions (i.e. adaptation and mitigation). Climate variability is also built into the Foresight work as a major trend that will influence food systems in the EGP in the future.

Ongoing and previous ACIAR projects were also presented, and time given for discussion. There was an interesting mix of technical and biophysical work presented, but also importantly the different approaches used to engage with stakeholders, implement projects, scale results and understand adoption decisions by farmers.

### Diversification – what and how?

Following the presentations on what the different projects had been engaged in, time was given to consider the following points:

1. Types of diversification to promote based on experience
2. Key trade-offs in diversification and intensification
3. Major challenges in implementation

#### Types of diversification to promote based on experience

One group put forward a set of criteria for deciding which diversification option to promote in any given location. The options should be:

- Evidence based
- No regrets
- Low/no path dependency (i.e. if a farmer opts in, they can also opt out, and are not 100% committed to the new system)
- No crowding out of private incentives (e.g. west vs east India)
- Diversification options must include all livelihood strategies – not just agricultural ones

Following on from this, a range of specific diversification options were suggested:

- Agribusiness: Service providers/local service centres to act as machinery and information centres to allow/enable diversification. For example, service providers can act as change makers in diversifying income streams, and promoting access to information and machinery. Need to look at who are the key influencers for diversification.
- Marketing: Value addition, targeting and access to local markets, communal marketing to increase bargaining power
- Crops as diversification and also leading to other flow on effects e.g. maize for poultry feed, livestock feed, rice-fish systems
- Taking a stronger focus on nutrition
- Livestock: Poultry, growing fodder for livestock, rice-fish systems, maize based systems. Fish and shrimp farming in ponds and canals, although there can be issues relating to water governance.
- Focusing on diversification from a livelihoods approach, including a better understanding of who is influencing diversification
- Within household diversification strategies, the key is to diversify income and expenditure streams
- Relay cropping can be a good option in salt affected areas
- Intercropping of vegetables, with more benefits for women who are more involved in vegetable production and harvest
- Acidic soils – tailored recommendations required.

### Key trade-offs in diversification and intensification

- Use of technology – those who don't have it will lose out
- Pests, weeds and diseases need to be managed differently
- Labour – shortage, dynamics
- Scale is critical
  - For example, how to move from a pilot level vs scaled level, with implications for market and price.
  - Water use at the farm scale and how this impacts at wider e.g. basin scales.
- Water and energy use will change. For example, if farmers move away from rice as a winter crop, water use will be reduced at the farm scale, and hence energy use (for

pumping) if groundwater is the main resource. There are implications related to intensification compared to diversification.

- Food vs feed for livestock – the livestock balance
- Sustainability of resources
- Risk (investment risk)
- Rich getting richer – how to ensure inclusiveness?
- Information access as systems become more complex
- Creating an unintended work burden for women

### Major challenges in implementation

- Institutionalisation (slow acceptances)
- Time scales – funding cycles and expectations for impact
- Diversifying where there is resistance from local traditions and cultural acceptance?
- Diverse partners and populations (who to target for the most impact? Landless farmers? Women?)
- Managing inclusiveness (polarisation, sub-populations, alternative livelihoods).
- Ensuring fairness
- Scaling pathways – including the technical capacity of the extension system
- Demand generation – a critical mass for the private sector
- Functionality of information systems (government)
- Farmer cash constraints/cash flow
- Shallow value chains, and low/variable prices
- Understanding the triggers for decision making in complex and diverse systems (e.g. why and how do farmers make decisions about which crops to grow)
- Complex policy environments
  - o Often limited capacity for implementation
  - o Synergies and complementarity between different levels and different policies, for example subsidies that are conflicting.
  - o For example, MSP systems favour the cereal system at the expense of promoting diversification to other crops
  - o Look for effective ways to communicate our results and recommendations to governments e.g. we should place emphasis on avoiding distortions such as subsidies, such that diversification of farming systems is not crowded out by government policy.
  - o Influencing policies; scaling, push and pull mechanisms, designing policies for grassroots.
- Degradation of land already happening – Agroforestry as an option
- How to make farming profitable and attractive
- Labour dynamics



## Alternative options – integrated pathways for diversification

In this session on Day 2, non-crop options for diversification such as livestock and horticulture were presented by relevant RPMs, followed by open discussion.

### Livestock

Dr Anna Okello highlighted the significant role of livestock in human health and nutrition. Livestock played a critical role in human development throughout the millennia; physically, socially and immunologically. According to FAOSTAT 2016, livestock contributes 14% of the total calories and 33% protein demand. In addition, it is an important source of Vitamins like A, B12 and Riboflavin, Calcium, Zinc and Iron. Livestock plays a significant role in food security, especially where there is grain scarcity, with eggs and milk supplements and provide diversity to staple foods. However, the flipside of livestock intensification is the occurrence of Zoonotic/Foodborne diseases.

Several multiplier effects of livestock were identified. They provide a source of additional income to the system contributing through diversification, insurance and food security. The traditional methods of livestock raising is important for animal traction and manure to boost crop productivity. They are also a source of additional financial instruments and social status. However, there are several social and cultural issues related which includes access to services. Livestock often give more income source options for women.

Livestock systems are varied, and not all are created equal. In extensive grazing systems, animals get more than 90% of their feed from pastures. In the case of mixed farming (crop-livestock), animals get at least 10% of their feed from crops and crop residues produced on their own farms. In the case of industrial/commercial systems animals get less than 10 percent of their feed from the own farm. Most of the future demand for livestock products will have to meet through sustainable intensification with increased productivity of both land and livestock. The potential of grazing areas (range and grasslands) is limited due to expansion of cultivated land and urbanization. The potential for increasing arable areas for mixed farm expansion is also limited. On the other hand, in the case of commercial/industrial production several other concerns arise like waste, welfare, diseases (antimicrobial resistance); and the public perception has to be taken into account. Part of the consideration for any new project is deciding which systems to intervene in.

According to the Dairy in South Asia study by the FAO (2013), South Asia produces ~12% global milk production (India is about 75% of the region). 28% of dairy cattle are raised in mixed systems as opposed to 10% in Western Europe and 4% in North America. Dairy cattle in South Asia produce about 23% of global livestock GHG emissions. The emissions intensity is almost double in mixed dairy systems in South Asia ~ 5.5 kg CO<sub>2</sub>-eq/kg milk as opposed to the global average of 2.7 CO<sub>2</sub>-eq/kg milk. Poor feed quality (60% crop residues) is the key limiting factor and leads to low productivity (low milk yields, slow growth rates, older calving ages and longer inter-calving intervals) contributing to breeding overhead. Particularly in South Asia, it is also necessary to look at the holistic view of livestock systems including cultural and religious aspects.

The following interventions can be useful in the context of South Asia;

- Improved feed quality with improved digestibility through feed processing or addition of locally available improved forages for reduced methane.

- Health and husbandry improvements with reduced ICI, faster growth rates, improved fertility and earlier calving age.
- India - potential reduction of male calf cohorts through AI sexing.
- Improvements in feed quality, animal health and husbandry could reduce emissions by 38% of baseline GHG emissions (120 million tonnes CO<sub>2</sub>-eq)

There are lessons from CA that can also apply to livestock production: for example, efforts to promote both CA and livestock need to be tailored to suit local conditions. The potential of CA is site-specific and depends on local bio-physical and socio-economic environments. Limited availability of crop residues is a key constraint to CA adoption in many mixed systems: trade-offs between crop residues as feed and mulch is well known. Another important consideration is land-use rights for post-harvest free grazing, which often rely on often complex communal land use practices and traditional grazing patterns.

Suggested considerations when diversifying with livestock are:

- Do people currently keep livestock? Which species, and in which system(s)?
- Are they 'livestock producers'? i.e. do they receive money from trading/processing animal-source foods?
- What is their interest and capacity in intensification/diversification (moving from low-input low-output systems)?
- What inputs are available, including feed/health/environmental/labour?
- What are the current market opportunities?
- Gender/power/social implications/land use?
- Risks, including economic, health, environmental, welfare-'do no harm'

Discussion centred around considerations of the viable models for mixed crop-livestock systems, and the opportunity to learn from places like Vietnam and Cambodia. Integrated farming systems that include household dairy production and poultry are good examples for ways to improve productivity for small scale farmers. The opportunity for genetic improvement of livestock is something that is being pursued by bigger donors (for example, BMGF), but ACIAR's priority currently is to improve what is available in the region (i.e. local breeds), improve the efficiency of the system or adapt the systems which have worked well in similar environments. Biogas digestors are already used in some parts of the EGP as an alternate source of energy.

### Horticulture

Dr Irene Kernot presented some successful case studies and experiences in horticulture research and development. Currently the world is producing only 1/3rd of the global requirement of fruit and vegetables. Added to this are the challenges of the logistics associated with horticulture and food production more broadly. There are currently no ACIAR horticulture projects in the SDIP region (EGP), although there have been thoughts on role of Horticulture on diversification in South Asian countries and therefore, redesigning some of the programs can be considered. 80% of the current ACIAR horticulture research investments are in the Pacific, Philippines and PNG. The projects are mainly focused on mango and banana. There are also projects in Cambodia, Lao PDR and Pakistan on vegetables, and tree fruits (mango, banana, citrus, papaya, cocoa, coconut, coffee).

Some examples of horticulture based sustainable development were presented:

1. Banana – focus on integrated management. Banana is globally grown as monoculture with 95% of bananas traded being Cavendish bananas with good shipping quality. It provides good return on investments. Bananas contribute to food and nutrition security. India is one of the biggest producers of Cavendish but exports none. Banana systems are inherently unsustainable in terms of disease risk due to the tropical race of Fusarium (Panama Disease, particularly tropical race 4). The solution to this is to diversify cropping systems and manage soil organic matter to break the host and pathogen relations. There has been value adding opportunity for Banana like banana flour, cosmetic products etc.
2. Vegetable protected cropping systems can ensure food safety in the Pacific, both increasing returns and quality. These are low cost systems for mitigating environmental impacts.
3. Tree crops are long term systems. Examples of research include tropical tree fruit systems looking at high density mango systems with improved water use efficiency, fertilizer use efficiency, cyclone resilience and light interception. These are amenable to mechanization. There has been a long term project for changing the vigour by genetic improvement.
4. Coconut germplasm improvement program. Coconut is an important crop across the Pacific. There are several value-added products available.

In summary,

- Monoculture systems are not sustainable.
- Horticulture consistently provides higher returns.
- Provides added benefits for nutrition.
- Easily flexible system, including for landless farmers and women.
- Opportunities for value addition-business/market development
- Need to find the research questions, since horticulture is often the domain of the private sector.
- Think about how to “pick winners” (almost impossible), or more importantly, rule out the losers
- Aim to reduce the risk associated with horticulture (weather, pest and disease, markets)

Discussion revolved around integrating horticulture into smallholder farming systems and the kinds of crops that would focus on, as well as how to have a commercial focus for horticultural crops in these systems. Processing is one option that should be considered to value add to existing products.

## Outputs

### The future of food systems in the EGP: what will agriculture look like in 2030, and what is the research needed now to get there?

A short foresighting exercise was conducted to sketch out the future status of agriculture in the EGP for Bangladesh, India and Nepal. **Figure 1** illustrates the case for India in 2030, including elements such as the different roles of small and large farmers; changing crop priorities (away from rice); an increased alternative agricultural support industry; and a reliance on new forms of technical support. Similar considerations were made for Bangladesh and Nepal. These discussions were used as the basis for identifying key knowledge gaps (**Table 1**) and research priorities (**Table 2**) that need to be undertaken to contribute to these sustainable food systems. Key themes for future work include technical research on diversified options for production that includes crop-livestock systems; farming systems research; resource constraints and dynamics; markets; options to improve information and knowledge sharing, linked to improved adoption and implementation of research projects; and generating a better broader macroeconomic understanding of the region.

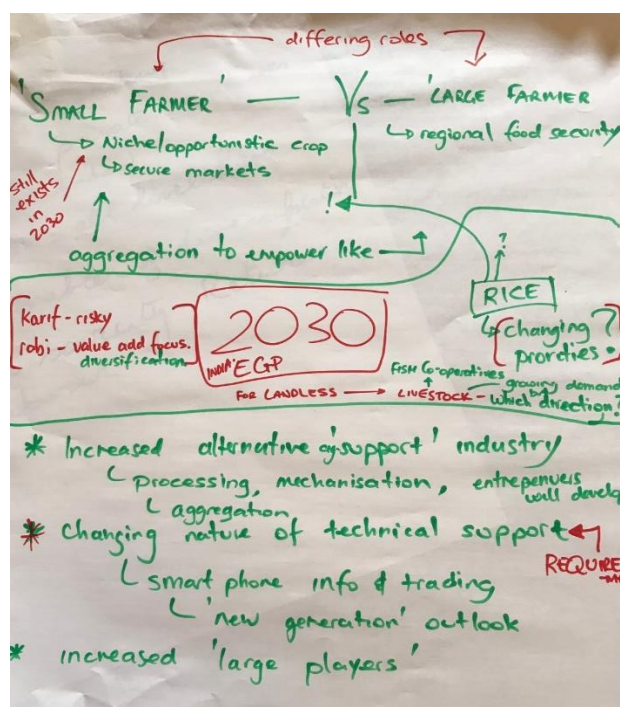


Figure 1 Imagining agriculture in the Indian EGP in 2030

**Table 1 Key knowledge gaps for diversification in the Eastern Gangetic Plains**

Focus area	Knowledge gap
Risk	<ul style="list-style-type: none"> <li>○ What does risk mean to a farmer?</li> <li>○ Map risk for crop diversification</li> </ul>
Resource use and impacts	<ul style="list-style-type: none"> <li>○ Resource use for food, water, soil, energy security</li> <li>○ Energy use to improve productivity and diversify</li> <li>○ Testing assumptions on diversification – what communities want, what is the follow-on impact</li> <li>○ Sustainable yields of groundwater aquifer</li> <li>○ Water use of diversified farming systems</li> <li>○ Address soil limitation constraints such as acidification</li> <li>○ How to maintain soil productivity and health?</li> <li>○ Economic, environmental and social impact of alternative crop combinations</li> <li>○ Pilot CA as a FEW solution in the basin in Nepal. Link SDIP Nepal.</li> <li>○ Farming systems research, integration across disciplines</li> </ul>
Production dynamics, including integrated crop-livestock systems	<ul style="list-style-type: none"> <li>○ Weed control and new diseases linked with CA adoption</li> <li>○ What is the current extent of pesticide misuse by farmers, and what impact does this have on food safety, personal and environmental health</li> <li>○ Potential productivities for alternative crops</li> <li>○ Interface between crops and fisheries as aquaculture develops</li> <li>○ Improved livestock production in intensified smallholder production</li> </ul>
Knowledge sharing, adoption and implementation options	<ul style="list-style-type: none"> <li>○ Link research on improving farming systems with research on adoption</li> <li>○ Land consolidation models/pilots. Case studies where it has already occurred, institutional arrangements and land use change, and economic benefits</li> <li>○ Knowledge on SDIP role on big picture in the region</li> <li>○ Incentives to make things happen – implementation gap</li> <li>○ Changing nature of technical support for farmers, role of public and private sector in adoption pathways</li> <li>○ Social history of maize diversification and intensification – why and how has it happened, and implications for other areas</li> <li>○ Effective sharing of knowledge between researchers and back to farmers</li> <li>○ Scaling impacts on natural resources, economics and markets</li> <li>○ Sustainable growth path for smallholder farmers</li> <li>○ Farmer behaviour – what are their motivations</li> <li>○ How to build capacity as women as farm managers in light of increasing migration</li> <li>○ Is livelihood addition or substitution more attractive or beneficial for farmers in the EGP</li> <li>○ Social and cultural norms and values around diversification</li> <li>○ Downscale climate information – how can farmers use what is known</li> </ul>

<b>Markets</b>	<ul style="list-style-type: none"> <li>○ Value adding and marketing of value-added products</li> <li>○ Role of PPP in smallholder agriculture</li> <li>○ Characteristics of successful local agribusiness entrepreneur models</li> </ul>
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**Table 2 Research priorities for sustainably diversified farming systems in the EGP**

<b>Focus area</b>	<b>Research priority</b>
<b>Technical production, including integrated crop-livestock systems</b>	<ul style="list-style-type: none"> <li>○ Feasibility of changing the timing and variety of rice for water saving in south Bangladesh (i.e. Braus rice)</li> <li>○ Improving productivity of long period rice in the Bangladesh delta</li> <li>○ Horticulture production as intercrop or home gardens</li> <li>○ Improved animal forage options for intensification in southern Bangladesh</li> <li>○ Increasing the use efficiency of nitrogen and water</li> <li>○ Climate smart CA in Bangladesh <ul style="list-style-type: none"> <li>– Varieties for CA including Aus/late Boro in the coastal areas</li> <li>– Water balance at landscape scale</li> <li>– Weed management</li> <li>– Second generation machinery – planters and harvesters</li> <li>– Cropping systems</li> <li>– Effective options for outscaling</li> </ul> </li> <li>○ Crop livestock. Effective use of residue, control free grazing, dry season fodder crops</li> <li>○ Limits to Braus rice cultivation – heat tolerance</li> <li>○ Agri chemicals <ul style="list-style-type: none"> <li>– Agro chemical management in diversified and integrated systems – priority intervention points</li> <li>– Safer IPM options for food security especially in CA based systems</li> <li>– Strategic, safe and profitable use of ICM in intensive cropping systems (herbicides) - research and capacity building</li> <li>– How can we best design and develop safe systems of crop protection in the EGP that minimises adverse effects on the environment and human health that are adopted by all stakeholders along the value chain</li> </ul> </li> <li>○ GM Canola for fish feed, the GM oil-enriched grasses for higher fodder nutritive value</li> </ul>
<b>Farming systems research</b>	<ul style="list-style-type: none"> <li>○ What is the role of CA displacing livestock in the EGP, particularly for women and marginal farmers</li> <li>○ Nutrition sensitive agriculture. How can intensification and diversification lead to improved nutritional outcomes</li> <li>○ Systems approaches; production systems, markets, livelihoods, futures (the arrows)</li> <li>○ Project bringing integrated view of forest production, soil and water management</li> </ul>
<b>Information and knowledge sharing</b>	<ul style="list-style-type: none"> <li>○ What local institutions are needed to strengthen farmers ability to access information on markets, inputs and advisory services</li> <li>○ Practical mechanisms to share knowledge effectively</li> <li>○ What is the value add to smallholders of short, medium and long term climate forecasts</li> </ul>

	<ul style="list-style-type: none"> <li>○ Scenario based planning of resilient agriculture production systems – link Pakistan and Bangladesh</li> </ul>
<b>Resource constraints</b>	<ul style="list-style-type: none"> <li>○ Address soil limitation constraints such as acidification</li> <li>○ Farmers to gain understanding of their soil resources</li> <li>○ Potential of soil microbiome to mediate soil fertility and plant diseases</li> <li>○ What will be the regional effects on the water balance of increased CO<sub>2</sub>, temperature, evapotranspiration</li> <li>○ What is the impact of diversification and intensification on water and soil resources and the local economy</li> <li>○ Watershed management and agriculture intensification in south east Bangladesh</li> <li>○ Optimise resource requirements and increase water use efficiency of existing crops</li> <li>○ Integration between farm scale to catchment scale</li> </ul>
<b>Markets</b>	<ul style="list-style-type: none"> <li>○ Understanding models of aggregation and consolidating farmer produce to respond to market requirements</li> <li>○ Linking farmers to markets – how do we do that?</li> <li>○ Understanding market related risk profiles for different enterprises, crop, horticulture and livestock</li> <li>○ Value chain analysis of key crops including pulses</li> <li>○ Improving women’s contribution via horticulture and marketing</li> <li>○ How to create incentives for investment in CASI machinery but at value chain intervention level. Viable business models.</li> </ul>
<b>Adoption and implementation</b>	<ul style="list-style-type: none"> <li>○ Improving adoption of technologies</li> <li>○ How best can we design entrepreneur models for locally based farmer input and advisory (outreach) services that are accessible by all smallholder farmers, particularly women</li> <li>○ How to institutionalise results. Process research on institutionalising capacity development. How to engage with governments with long term impact – a model for future projects!</li> <li>○ How do we link research learnings to government and other agency programs to improve adoption</li> <li>○ How to increase adoption of technologies/farm innovation/farm management/research outcomes developed by ACIAR projects</li> <li>○ Extension mechanism – new methodologies. How to effectively diffuse information – real participatory feedback mechanisms</li> <li>○ Understanding decision process in adoption of new technologies/cropping systems management</li> <li>○ Research the limits of price, ecological, path dependency of all diversified options</li> <li>○ Case studies on gender – how to aggregate to allow value addition and vegetable market access</li> <li>○ Farmers to engage in intensification and diversification (should they wish to) – helping to step up or step out? Formal institutions in production, water and markets to build agency of marginal farmers</li> <li>○ Will a diversified livelihood system (on or off farm) benefit women farmers?</li> <li>○ How can women’s participation in decision making and their share of benefits be increased?</li> </ul>
<b>Macroeconomic understanding of the EGP region</b>	<ul style="list-style-type: none"> <li>○ Do national goals of food security need to be at the expense of high value agriculture</li> <li>○ What are the macro economic effects of migration, land zoning (urbanisation) and land fragmentation and does this lead to better/worse livelihood options?</li> <li>○ Will young farmers who are technologically savvy change the way agriculture is done in the EGP?</li> </ul>

## Building links between projects

In addition to identifying some of the major knowledge gaps and future research priorities, there were several existing links between the different projects that can be followed up on. These include:

- Nutrient budgets, understanding the consequences of soil acidity – link Nutrient Management in (NUMAN) with the UQ Soil Constraints project – **[Murdoch; UQ]**
- Soil and plant nutrition application – Richard Bell (Murdoch University) with Neil Menzies (University of Queensland) and Dave Penton (CSIRO) **[Murdoch; UQ; CSIRO]**
- Link the DSI4MTF (Eric Schmidt) project with institutions (Lin), Gender and Farmer behaviour (Fay), soil (UQ), value chains (Jay Cummins, Richard Bell), social (Fay, Lucy Carter), horticulture (Irene) **[USQ; UniSA; UWA; Adelaide; UQ; Murdoch; CSIRO/ANU]**
- Link the SIAGI project with **[CSIRO/ANU; UniSA; UWA; IFPRI]**
  - Lin Crase’s work on institutions for local water governance; and
  - Fay Rola-Rubzen’s cognitive aspects of HH decision making; with
  - Foresight for food for community of practice and exploration of unintended consequences
- CSIRO SDIP **[CSIRO; SRFSI]**
  - Link Kamala Basin planning initiative with regional farm scale projects in Nepal
  - Phase 3 CSIRO SDIP Nepal Kamala Basin – links with local level knowledge and extension from SRFSI, and basin policy to inform and improve the effectiveness of the basin planning work.



## Summary and way forward

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The workshop was an excellent opportunity to identify key knowledge gaps and future research priorities in the EGP. It also allowed links to be identified between existing projects and provided an opportunity for project members to discuss common issues and approaches.

Participants highlighted the benefits in coming together in person to better understand complementary work and identify links between projects. For the ACIAR SDIP program, this was a valuable opportunity to identify where there are links to existing work, and to consider priorities for future research priorities in the region.

Follow up actions include:

- Ensure that the gaps in the SDIP program highlighted on Day 1 are considered in both communication of the current program and new projects going forward.
- Ensure that potential project links identified can be pursued if seen as relevant by the project team members.
- Use the research priorities identified in the workshop as a basis from which to consider strategies for future work, including gauging relevance with our in-country partners.

## Appendix 1: Agenda

Monday 10 <sup>th</sup> December: Setting the scene with current and past projects			
Time	Session	Presentation topic	Presenter
9.30 – 10.30	Welcome	Welcome remarks	ACIAR
Facilitator: Eric Huttner		Introduction and overview	Robyn Johnston
Scribe: Kuhu Chatterjee		Outline of ACIAR strategy in South Asia	Pratibha Singh
		ACIAR SDIP Program Overview	Tamara Jackson
10.30 – 11.00 Morning Tea			
11.00 – 12.30	<b>ACIAR SDIP Program</b>		
Facilitator: Tamara Jackson	The following topics will be presented individually (5 minutes) and with time for discussion and questions. The brief presentations will focus on how the project supports or promotes sustainable intensification of farming and food systems, including the following elements:		
Scribe: Chetali Chhabra	<ol style="list-style-type: none"> <li>1. Project objectives</li> <li>2. The processes used to engage with relevant stakeholders</li> <li>3. Key achievements</li> </ol> <ul style="list-style-type: none"> <li>• SRFSI – Phase 1 results (Brendan Brown)</li> <li>• SRFSI – Scaling (Brendan Brown)</li> <li>• Foresight for food systems (Kuhu Chatterjee)</li> <li>• Institutions to support intensification, integrated decision making and inclusiveness in agriculture in the EGP (Lin Crase)</li> <li>• Building institutional capacity for Sustainable Agricultural Mechanisation (Brendan Brown)</li> <li>• Value chain and policy recommendations for ZT/HS adoption (Jay Cummins)</li> <li>• Commercialisation of smallholder CA-based mechanisation in Bangladesh (Richard Bell)</li> <li>• Soil constraints in the EGP (Ram Dalal)</li> <li>• Modelling yield gaps (Robyn Johnston)</li> <li>• Managed Aquifer Recharge in southern Bihar (Kuhu Chatterjee)</li> <li>• The political economy of the food trade in South Asia (Tamara Jackson)</li> <li>• The role of women in agriculture in the EGP (Kuhu Chatterjee)</li> </ul>		
12.30 – 1.30 Lunch			

<p>1.30 – 3.00</p> <p>Facilitator: Kuhu Chatterjee</p> <p>Scribe: Tamara Jackson</p>	<p><b>Diversification in the EGP: Past and current ACIAR work</b></p> <p>The following topics will be presented individually (5 minutes) and with time for discussion and questions<sup>1</sup>. The focus of the project descriptions should be:</p> <ul style="list-style-type: none"> <li>• What kinds of diversification did the project test and promote (i.e. specific crops, management practices, farming system changes)?</li> <li>• What were the processes involved in engaging with relevant stakeholders?</li> <li>• What are the top 3 outcomes from the project that could be promoted in the future?</li> </ul> <ol style="list-style-type: none"> <li>1. Pulses in diversified cropping systems (Willy Erskine)</li> <li>2. Nutrient management in Bangladesh (Richard Bell)</li> <li>3. Intensification in salt-affected areas of Bangladesh (Mainuddin)</li> <li>4. Improving water use in the EGP (Erik Schmidt)</li> <li>5. Farm household decision making (Fay Rola-Rubzen)</li> <li>6. Socially inclusive sustainable intensification (Wendy Merritt)</li> </ol>
<p>3.00 – 3.30 Afternoon tea</p>	
<p>3.30 – 5.00</p> <p>Facilitator: Robyn Johnston</p> <p>Scribe: Kuhu Chatterjee</p>	<p><b>Building on past experiences</b></p> <p>Given current and past experience in working in the EGP, work in small groups to answer the following key questions:</p> <ul style="list-style-type: none"> <li>• Prioritise the top 5 for each category: <ul style="list-style-type: none"> <li>○ What kinds of diversification can we promote based on past experience?</li> <li>○ What are the key trade-offs in diversifying and intensifying farming systems?</li> <li>○ What are the major challenges in implementing diversified farming systems?</li> </ul> </li> <li>• Identify opportunities for shared work between the projects</li> </ul>

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<sup>1</sup> If participants have existing material such as posters, fact sheets or pamphlets they can bring as background for talking points. It does not matter if these documents are not complete, they are to promote discussion only.

Tuesday 11 <sup>th</sup> December: Identifying future pathways for diversification			
Time	Session	Presentation topic	Presenter
9.00 – 9.15	Welcome	Recap of Day 1, introduce focus of Day 2	Robyn Johnston
9.15 – 10.30	<p><b>Integrated pathways for diversification</b></p> <p>Exploring non-crop options for diversification with relevant RPMs through presentation and open discussion.</p> <p>Facilitator: Tamara Jackson</p> <p>Scribe: Pratibha Singh</p> <ol style="list-style-type: none"> <li>1. Horticulture (Irene Kernot)</li> <li>2. Livestock (Anna Okello)</li> </ol>		
10.30 – 11.00 Morning Tea			
11.00 – 12.30	<p><b>Integrated pathways for diversification (continued)</b></p> <p>After presentations and discussion for each commodity, spend time thinking about how previous/existing project work could be enhanced by these additional options.</p> <p>Facilitator: Kuhu Chatterjee</p> <p>Scribe: Chetali Chhabra</p>		
12.30 – 1.30 Lunch			
1.30 – 2.30	<p><b>Identifying gaps and future priorities</b></p> <p>Based on ACIAR’s current and previous work, what are the gaps and opportunities for diversification in the EGP?</p> <ol style="list-style-type: none"> <li>1. How can this work benefit from taking a food-energy-nexus approach?</li> <li>2. What are the emerging priorities?</li> </ol> <p>Facilitator: Eric Huttner</p> <p>Scribe: Pratibha Singh</p>		
2.30 – 3.30	<p><b>Planning for a potential SDIP Phase 3</b></p> <p>Based on experiences and discussions throughout the workshop, identify some key elements that would be priorities for future work in the EGP.</p> <ol style="list-style-type: none"> <li>1. What are the major themes and emerging trends in the region?</li> <li>2. What would be key elements of a program to support diversification as a pathway to sustainable intensification?</li> <li>3. What support systems would need to be in place?</li> </ol> <p>Facilitator: Robyn Johnston</p> <p>Scribe: Chetali Chhabra</p>		
3.30 – 4.00	Wrap up and close (Robyn Johnston)		

## Appendix 2: Participants List

No.	Name	Project	Organisation
1	Andrew Campbell	CEO	ACIAR
2	Dan Walker	Chief Scientist	ACIAR
3	Robyn Johnston	RPM	ACIAR
4	Eric Huttner	RPM	ACIAR
5	Tamara Jackson	SDIP	ACIAR SDIP
6	Kuhu Chatterjee	SDIP	ACIAR SDIP
7	Brendan Brown	<i>CSE/2011/077 Sustainable and resilient farming systems intensification in the Eastern Gangetic Plains</i>	CIMMYT
8	Lin Crase	<i>LWR/2018/104 Institutions to support intensification, integrated decision making and inclusiveness in agriculture in the East Gangetic Plain</i>  <i>ADP/2014/045 Efficient participatory irrigation institutions to support productive and sustainable agriculture in south Asia</i>	UniSA
9	Peter Brown	<i>CSE/2011/077 Sustainable and resilient farming systems intensification in the Eastern Gangetic Plains</i>  <i>LWR/2010/033 Developing capacity in cropping systems modelling to promote food security and the sustainable use of water resources in South Asia</i>	CSIRO
10	Jay Cummins	<i>CSE/2017/101 Value chain and policy interventions to accelerate adoption of Happy Seeder zero tillage in rice-wheat farming systems across the Gangetic Plains</i>	University of Adelaide
11	Fay Rola-Rubzen	Understanding Farm-Household Management Decision making for Increased Productivity in the Eastern Gangetic Plains	University of Western Australia
12	Richard Bell	<i>LWR/2016/136 Nutrient management for diversified cropping in Bangladesh</i>	Murdoch University

		LWR/2010/080 <i>Overcoming agronomic and mechanisation constraints to development and adoption of conservation agriculture in diversified rice-based cropping in Bangladesh</i>	
13	Wendy Merritt	LWR/2014/072 <i>Promoting socially inclusive and sustainable agricultural intensification in West Bengal and Bangladesh (SIAGI)</i>	ANU
14	Erik Schmidt	LWR/2012/079 <i>Improving water use for dry-season agriculture by marginal and tenant farmers in the Eastern Gangetic Plains</i>	University of Southern Queensland
15	Willy Erskine	CIM/2014 / 076 <i>Incorporating salt-tolerant wheat and pulses into smallholder farming systems in southern Bangladesh</i>  CIM/2009/038 <i>Introduction of short duration pulses into rice-based cropping systems in western Bangladesh</i>	University of Western Australia
16	Ram Dalal	CROP/2018/210 <i>Identifying EGP soil constraints</i>	University of Queensland
17	Wahid Shahriar	CSIRO SDIP	CSIRO SDIP Kamala Basin
18	Dave Penton		
19	Auro Almeida		
20	Pratibha Singh	ACIAR South Asia Regional Manager	ACIAR
21	Chetali Chhabra	ACIAR South Asia Assistant Regional Manager	ACIAR
22	Anna Okello	ACIAR RPM Livestock	ACIAR
23	Irene Kernot	ACIAR RPM Horticulture	ACIAR
24	Sarina MacFadyen	ACIAR Associate RPM Farming Systems	ACIAR