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Final report

project

Institutions to support intensification, integrated decision making and inclusiveness in agriculture in the East Gangetic Plain

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1 Acknowledgments

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Similarly, the participation of our in-country expert panels cannot be understated. The pressures placed on the policy-making communities at this time were intense, and yet many found time to participate in this research project.

Our Australian collaborators also showed considerable adaptability and their expertise was key to the project's accomplishments. Our thanks are given especially to colleagues at The University of Western Australia (UWA) and the related input from collaborators at Manchester University.

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Although it was not possible to assemble the large primary data set from farm households, we are indebted to the many hundreds of households who completed phone surveys and supported the piloting of the major survey instrument, thereby positioning this research for further useful inquiry.

2 Executive summary

The future prosperity of the massive population of the Eastern Gangetic Plain (EGP) is at a crossroads. Rural poverty is endemic across the region and food insecurity is common but Conservation Agriculture System Intensification (CASI) in the EGP has also been given a high priority by the governments of Bangladesh, India and Nepal, and significant investments have been directed at this goal.

Agricultural intensification can be consistent with successful integrated decision making, where knock-on effects are understood and accounted for in advance. However, this is not always the case and higher-order policies can have unanticipated consequences, especially if the policy is not aligned with the institutions given responsibility for delivery. Some institutions can also increase the opportunities for greater inclusiveness, especially if rules are crafted around the needs, preferences and wishes of specific groups, like women and tenant farmers.

A critical question is how institutions can simultaneously and successfully promote intensification, integration and inclusiveness (the 3 I's) in the EGP?

This project was established to answer this question and to simultaneously develop capacity within district, state and national agencies in the EGP, to promote institutions that foster the '3 I's'.

The project had planned to assemble sets of primary data that would both inform policy-making communities and engage them in a discourse about the current settings. These data would reveal policy/delivery institutional combinations that were most effective and also provide farmer insights into the perceived merits of different combinations.

The primary data collection of experts in the policy communities was completed and analysis consistently highlighted the important role of increased access to inputs as the preferred means of raising and stabilizing farm incomes across the region. In addition, there was strong support for the use of private sector institutions to deliver on this goal, rather than government. The comparison data from farm households could not be assembled due to COVID19 restrictions, making it difficult to compare end-users' support for this approach.

Analysis was undertaken of several secondary data sources to meet the other objectives of the project, along with a reduced primary survey focussed on specific topics. Overall, the findings from the numerous studies support the view that:

- Knowledge transfer to farmers, especially on new technologies, offers promise on multiple fronts. However, its benefits are not universally accessible because of the delivery apparatus, with women particularly disadvantaged but (ironically) having much to gain from better transfer mechanisms (like mobile phones);
- Water access in the region is intimately tied to energy and the incentives for using energy differently. Leveraging diverse preferences around pumping technologies offers promise for further developing groundwater markets and widening water access;
- Policies that are seemingly focussed on risk reduction are producing perverse impacts and require a re-think in terms of how they are rolled out. Additional international support around broadening better governance and financing systems can have important benefits in agriculture.

The project has made significant progress by shaping new thinking amongst the local policy communities about policy and delivery institutions. Leveraging this beyond virtual dialogue would deepen and widen this influence. In addition, the innovative primary data collection from

farm households is poised for deployment and, if ultimately sanctioned, will deliver important low-cost, high quality data to sharpen future dialogue.

3 Background

Almost every analysis of the EGP for the past two decades has concluded that one of the most feasible development paths for development is increased intensification of agriculture (e.g. Erenstein et al. 2008). This conclusion has been drawn against a background of:

- Growing population demands with accompanying high and rising population density.
- A large dependence on agriculture for livelihoods, albeit varying somewhat between the countries of Bangladesh, India (Bihar and West Bengal) and Nepal (e.g. 80% in Bihar compared to 55% in Bangladesh).
- Food insecurity and undernourishment for a non-trivial portion of the population (circa 16% in Bangladesh, 15% in India and 8% in Nepal).
- Marked inequalities with women, in particular, experiencing vulnerability to stresses.
- Small and fragmented farm landholdings usually operating at sub-optimal levels while using cultivation practices that jeopardize soil health.
- Challenges with managing floods and water shortages in the same year accompanied by declining water quality and depletion of groundwater.
- Generally poor physical infrastructure with significant limits to reliable and affordable energy and weak transport infrastructure that hinders market access and development.
- Mounting evidence that climatic stresses will increase.

Despite these challenges, the region has relatively abundant agricultural resources compared to some neighboring jurisdictions (e.g. Northern Mountains). The region has also benefited from significant research into testing options for agricultural intensification at field scale including low tillage grain systems, improved seed, labor saving mechanical seeding, and water efficient irrigation options.

Intensification involves increasing the output from a given set of inputs and much of the work in the region has centered on the principles of Conservation Agriculture System Intensification (CASI). The emphasis of CASI in the region has been on using soils more intensively, often in tandem with machines that reduce tillage and the call on other inputs, like labour and water. But despite its apparent financial promise, the uptake of CASI remains shy of expectations and up-scaling and out-scaling have not always occurred.

A review of CASI and related development work by Joshi et al. (2017) suggested that there were major opportunities to enhance adoption of alternative farming practices in the EGP through improved institutional settings.

Better institutions are usually defined by having lower transaction costs – they add certainty to the behavior of others and thus make the work of markets and government more effective. The lessons from New Institutional Economics also shows that alignment of high-level policies with appropriate delivery institutions can play a major part in achieving better outcomes. Reducing transaction costs in just a few areas can have a very large impact on agriculture in the EGP, with potential positive flow-on effects.

But questions remain about what are the ‘best’ policy/delivery combinations and can experts be engaged to critically review the extant approaches and look for better solutions? In addition, can the ‘best’ solutions from experts align with those most acceptable to farmers and thus generate win-win outcomes?

The purpose of this project was to tackle these questions head-on but to do so in a way that encouraged the policy communities to be directly engaged. This approach hinged on the interaction with policy communities to generate primary data that could then be transposed to compare the views of farm households.

To make the overall task manageable, the ambition was to build a set of insights from three related domains covering: (1) knowledge transfer to farmers (2); water rights (defined as access to the benefits of water) for farming households, and (3) risk management for farm households. These three strands of research were also overlapped with an interest in the impacts of institutional design on inclusion, especially for women and tenant farmers.

By dealing with this question the project would progressively build support from within key decision making communities to place greater emphasis on the ultimate outcomes of policy on farm households, who are amongst the most impoverished and food-insecure.

4 Objectives

The overall aim of this project was to develop capacity within district, state and national agencies in the EGP to identify and consistently promote institutions that foster the '3 I's' (intensification, integrated decision making and inclusion).

The project originally had four main objectives:

1. To create an understanding within agencies of the existing institutions that influence farm level choices across local and district scales against specific national objectives.
2. To empirically evaluate the performance of different institutional designs across three domains (knowledge transfer, water property rights and risk management), using economic efficiency, equity and environmental sustainability as yardsticks.
3. To foster collaboration with and within district, state and national authorities by developing an agreed evidence-based framework for shaping institutions that promotes the '3 I's'.
4. To create institutional 'field sites' where the benefits of institutional change can be showcased and monitored beyond the life of this project.

In 2020 it was agreed that COVID19 had made Objective 4 unviable and the remainder of this report focusses on proposed activities and outputs pertaining to the other objectives. For convenience, these are replicated for the project proposal below:

Objective 1 Activities:

- Map the overall institutions that influence farmers' incentives to change production in Bangladesh, India and Nepal, using expert local and regional knowledge.
- Create maps that reveal the institutional influence on particular segments of farmers, specifically, women farmers and tenant farmers.

Key outputs from these activities:

- An institutional map of jurisdictions reflecting the decision environment of 'average' farmers.
- An institutional map of jurisdictions reflecting the decision environment of women farmers and tenant farmers.

Objective 2 activities:

- Empirically measure the performance of institutions that aim to transfer new knowledge to farmers and detail the gender-sensitivity of different models of information transfer.
- Measure the impact of alternative institutions for water (e.g. landholders versus tenants; women farmers versus men) on the use of other inputs in agriculture and how limiting some rights can help sustainable management water at different scales.
- Empirically measure the performance of different institutional set-ups for helping farmers deal with risk with specific analysis of the effectiveness for different cohorts, including women farmers and tenant farmers.

Key *outputs* from these activities:

- A suit of statistical studies showing the relative performance of different institutional set ups (covering knowledge transfer, water property rights and risk management) from the perspective of the 'average' farmer, women farmers and tenant farmers.
- A synthesis of key findings that are (a) digestible to end-users (b) informative to media and other outlets.

Objective 3 activities:

- Use systematic qualitative approaches to develop guidelines for institutional design that effectively transmit information about farmer adaptation across both men and women and in different settings.
- Develop guidelines for institutions that strike a balance between private and public interest in the use of resources, like water.
- Develop guidelines for institutional design that fosters coping with climatic and market risks.

Key *outputs* from these activities:

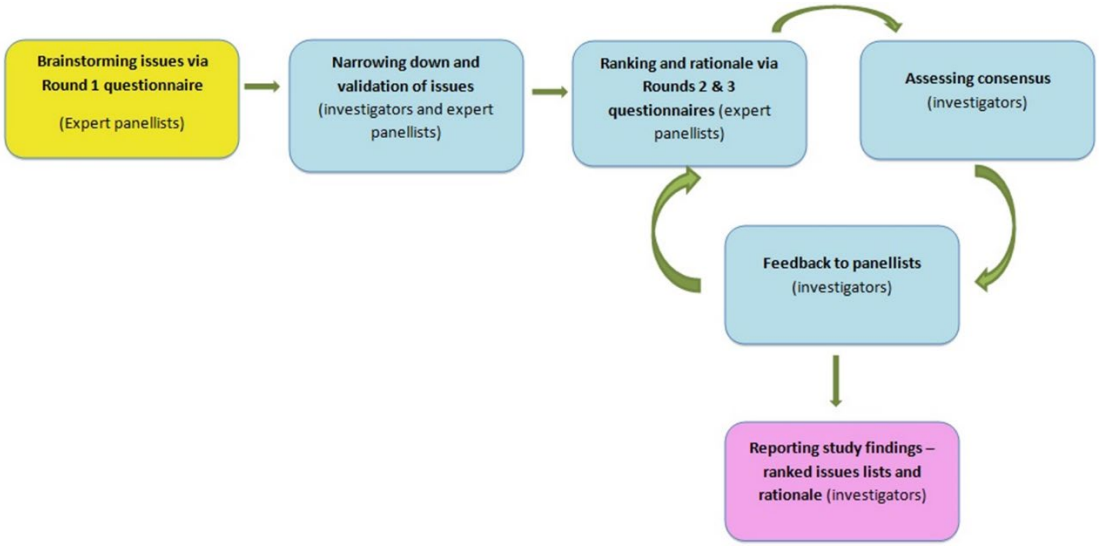
- A '3 I's' Framework based on consensus that guides the overall design of institutions across the EGP.

5 Methodology

The work was undertaken in the EGP and spanned the states of Bihar and northern West Bengal in India, Terai in Nepal and Northwest Bangladesh. The ambition was to mirror the regions covered by earlier Sustainable Development Investment Portfolio (SDIP) projects and thereby build a bank of evidence to assist in the analysis of CASI and other programs. However, given the policy breadth of the project input was also sought from national experts beyond these regions.

The methodology followed several phases. Given the objectives, the initial phase required an understanding of the institutional landscape. This was undertaken from an expert perspective. Using the initial steering group as a guide, experts were recruited to participate in a Delphi analysis. The process of recruitment is described in detail in Cooper et al. (forthcoming). Delphi is a structured means of engaging with experts to gather information and ultimately reach consensus. Delphi is usually conducted over several rounds with information provided by experts interrogated by investigators and then put back to experts for validation. The standard Delphi approach is described in Figure 1.

Figure 1: Steps in a Standard Delphi Analysis



Source: Ju and Jin (2013)

The Delphi was managed by CI Cooper at UniSA although input and recruitment was vested in partners in country. Since Delphi is relatively uncommon in a development context there was some adaptation of the technique anticipated. This centered primarily on the recruitment process.

Phase two of the project sought to harness the evidence from the Delphi and apply a more discriminating process to reveal what institutional set ups (i.e. combinations of policy and delivery) were most effective at raising and stabilizing farmers' incomes. The recruitment

process for this task would follow that of the Delphi and this was expected to provide additional engagement with the policy making communities on the topic of institutional reform. The discriminating technique adopted was the Best Worst Scaling (BWS) method.

BWS is a form of discrete choice experiment. Its origins are attributed to Louviere and Woodworth (1990) and Finn and Louviere (1992) who introduced the technique to deal with some of the limitations associated with other scaling approaches. One such limitation is that Likert Scale approaches (such as that used in the final Delphi round) allow people to rate all items the same, for example as ‘very important’ or ‘very unimportant’, with little or no discrimination between items.

In contrast, BWS forces respondents to discriminate between the items under consideration, and it allows researchers to investigate underlying preferences via the choice tasks. There are different ‘cases’ of BWS with ‘case one’ applying when the interest is the relative weight respondents allocate to items. The analysis can center on brands, products, or policy goals (Flynn and Marley 2014) and the choice tasks are generally considered less onerous on respondents than many other discrete choice experiments. This stems from the fact that BWS only requires the respondent to indicate their most and least preferred items from a given set rather than weighting choices comprised of multiple attributes. BWS is also particularly useful where a large number of items require ranking, as the experimental design generates a series of sub-sets of these items and systematically asks respondents to indicate their most preferred and least preferred from each reduced set.

In this instance, the BWS design would focus on all items identified by the Delphi as being relevant. However, a challenge emerged insomuch as all institutional elements were deemed important/relevant and these comprised both policy and delivery components. To cater for this, the BWS was redesigned such that it was divided into two tasks. The redesign was achieved with input sought from Prof Dan Rigby at Manchester University. Consequently, the first task asked experts to discriminate which policies would be most effective at raising and stabilizing farmers’ incomes. The BWS survey was dynamically programmed to capture these results and present the respondent with only their most preferred options. Respondents were then asked to rank the delivery apparatus that would best accompany the selected policy.

The design of the BWS instrument was a major undertaking. BWS experiments that are not thoughtfully designed and tested can yield very little information of use. Nomenclature was repeated developed and tested with in-country collaborators. Several pilots were also administered. The design process was shared across the research team with specific tasks assigned against expertise. CI Burton was responsible for the statistical design that sits behind the programmed survey. The item refinement and description (including graphics) were managed by UniSA however IFPRI and BAU input was critical. The loading of the instrument into *Sawtooth* software was undertaken by CI Burton and CI Cooper.

An important output from the BWS that was applied to experts was that the ingredients for the overarching institutional mapping were now assembled. This allowed progression to the next phase of the method – the development of a survey instrument to be administered to farm households. The purpose of administering a similar survey to farm households was to explore synergies and differences between the views of farmers and those of experts. This was tackled by having an ‘institutional component’ embedded in a broader survey (see below). The institutional component of the survey would again present farmers with policy options (with examples) and ask them to indicate which they most favored (as opposed to experts who were asked which is most effective). As with the expert BWS survey, the second stage would then ask respondents to express a preference on delivery mechanisms using the dynamically revealed choices in the initial stage. Unlike the survey of experts, the information in this survey

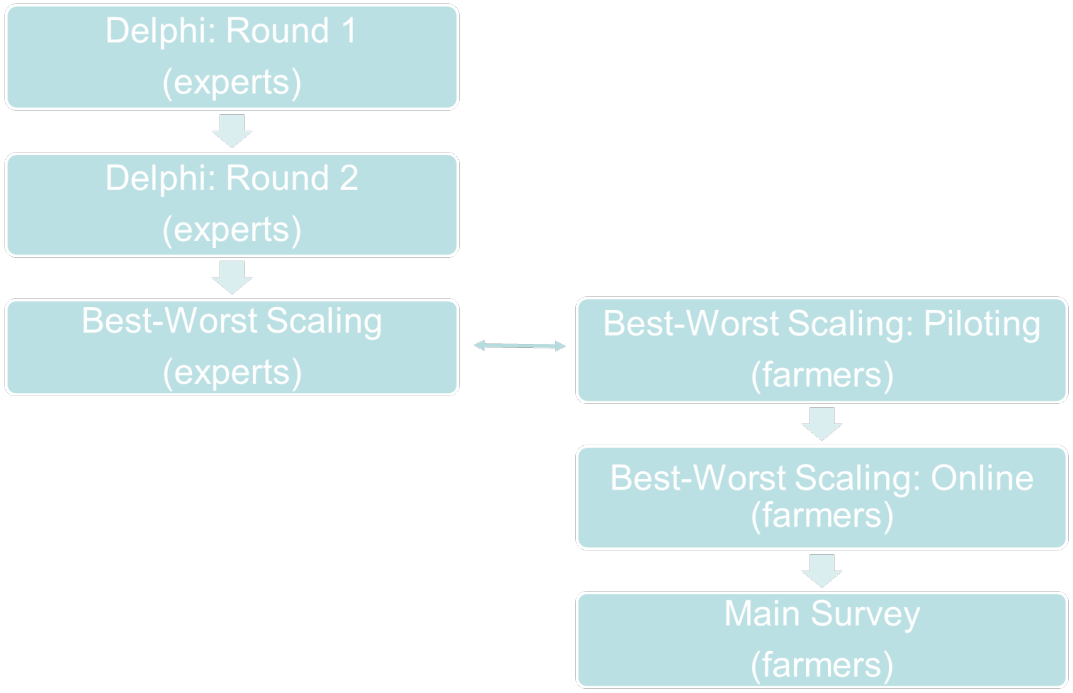
was translated into local languages with the intention of administering the instrument using trained enumerators and mobile tablet devices.

The data from this part of the survey would then allow analysis of policy/delivery combinations on two fronts. Specifically, it would reveal what combinations were most effective in the eyes of experts and what were most acceptable to farmers. Focusing effort on this subset was likely to yield better results and help progress the discussion with state and national officials on better targeting interventions.

The responsibility for the BWS component of this farmer survey was shared along similar lines to the expert BWS instrument. The instrument was programmed into *Qualtrics* to accommodate the other components of the survey. The piloting of the BWS survey with farmers was assigned to BAU.

The various phases of the methodology and their linkages are depicted in Figure 2.

Figure 2: Phases of Methodology



In addition to gaining general insights into institutional design, the project sought to explore institutional themes across specific domains – namely, knowledge transfer, water rights/access and risk management. Also, the project had sought to explore inclusiveness in detail across each of these domains while applying an inclusive lens against the broader institutional mapping exercise. Given the geographic spread of the work and the commitment to work across so many domains, a method was adopted to assign some elements of the main survey in full to only some of the geographic areas. This had the advantage of keeping the survey instrument

manageable while also collecting sufficient data from across each jurisdiction to explore issues with pooled data.

This design of the main survey of farmers is illustrated in Figure 3.

Figure 3: Design of Main Farmer Survey by Domain of Interest

	Best-Worst Scaling: Institutions preferences	Water rights: Pump preferences	Knowledge transfer		Risk management		Gender (Empowerment)
West Bengal							
Bihar							
Nepal							
Bangladesh							

The design in Figure 3 indicates that the BWS questions related to institutions would be administered in full across all jurisdictions.

In the context of water rights/access the decision was taken to focus on groundwater extraction. West Bengal offered opportunities to explore the relationship between changes to energy cost and pumping behaviors and there was also scope to delve into the increasing role of women and the interface with pumping technologies. This component of the survey was managed primarily by CI Cooper and CI Crase and formed the foundation of a higher degree research project.

The knowledge transfer section of the main survey focused on the part of public and private extension services. Here the interest was to empirically trace the potential on-ground impacts of different forms and degrees of knowledge transfer. This component was developed by BAU collaborators with the intention to deploy an extensive module in Bangladesh and a truncated version in other locations.

The risk management elements were managed by CI Connor at UniSA with support from CI Kishore at IFPRI. Again, the intention was to have a more extensive version applied in one jurisdiction (Nepal) and a more concise version elsewhere. The key dimension of this component sought information about self-assessed risks as well as risks related to adoption of specific technologies.

The inclusive module of the survey employed the women's empowerment in agriculture index along with other items drawn from the literature and related to institutional design. This module was developed by CI Cooper with support from other collaborators. Given its prominence in policy across the EGP, the extended version of this module was to be deployed in all locations.

Once modules were developed separately, they were then synthesized. This allowed for the removal of overlap and improved the 'flow' of the instrument. This was undertaken by CI Crase and CI Cooper with support from the team. The final instrument comprised five sections detailed in Table 1.

Table 1: Components and Focus of Main Survey to Farmers

Survey section	Topic	Key issues
A	Socio-economic details	• Gender, household makeup and relationships, employment • Use of ag inputs (current and historical) → child gender influence • Access to capital • Access to credit • Income
B	Preferences for policy/delivery institutions	• Introduce objects • BWS of objects • Follow-up
C	Farm decision making	• Leadership and community influence • Farm production and income decision making • Characteristics of the dwelling
D	Knowledge transfer	• Sources of information that shape the use of different technologies • Contact with ag extension
E	Risk behaviors	• Self-assessment of risk: – in general, farm management, finance, health • Risk in context of a specific technology

		– Seed adoption and use – Stubble retention

An initial sample target of 500 household was set for each jurisdiction. In some cases, purposeful sampling was anticipated (e.g. in the water access survey there was an interest in tenant and women famers, so the intention was to ensure there was adequate coverage of these groups). The survey was translated into the local languages and local enumerators were to be trained in the uploading and downloading processes to allow remote monitoring of data input. The advent of COVID19 halted the deployment of the main survey instrument beyond the piloting phase, although the survey itself is a major asset for further research.

The altered approach to the project caused by COVID19 is described in part 7 of this report.

6 Achievements against activities and outputs/milestones

Objective 1: To create an understanding within agencies of the existing institutions that influence farm-level choices across local and district scales against specific national objectives.

No.	Activity	Outputs/ Milestones	Completion date	Comments
1.1.1	Recruit sub-project steering committee members across 3 domains (knowledge transfer, water rights and risk management) with regional coverage.	Terms of reference established for each sub-project committee with representation for each jurisdiction including broad coverage of agricultural issues and policies and some sensitivity to needs of women and tenant farmers	Yr 1 m1	**Completed**. This was completed during the inception meeting in Nepal, October 2018.
1.1.2	Select project steering committee from sub-project committees	Terms of reference established and committee formalised with geographic representation and capacity to consider all 3 Is	Yr 1 m1	**Completed**. This was completed during the inception meeting in Nepal, October 2018.
1.1.3	Generate Delphi panel for developing the overall institutional mapping		Yr1 m3	**Completed**. This was partially completed during the inception meeting and finalised in the following months - December 2018. A snowballing approach meant that the panel grew organically throughout the course of the project.
1.1.4	Administer initial rounds of Delphi for generic institutional map	Institutional map of jurisdictions reflecting decision environment of 'average' farmer	Yr1 m4	**Completed**. First round took place in a group format in Bangladesh, June 2019 while face-to-face and an email approach was used in other countries. Recruitment in India proved problematic.

1.2	Administer later rounds for refining map to specific cohorts (women and tenant farmers)	Institutional map of jurisdictions reflecting decision environment of women farmers and tenant farmers	Yr1 m4	**Completed but not deliverable**. The second round of Delphi was successfully administered and key institutional items identified. It proved difficult to recruit a sufficiently large sample of women into the Delphi to draw inferences about expert opinions as they relate to gender. This was taken up in the BWS instrument that was subsequently used to force a more discriminating institutional map to emerge. Some specific insights relating to female experts are reported in Cooper et al (forthcoming).

PC = partner country, A = Australia – Note: all activities shared across PC and A

Objective 2: To empirically evaluate the performance of different institutional designs across three domains, using economic efficiency, equity and environmental sustainability as yardsticks.

No.	Activity	Outputs/ Milestones	Completion date	Comments
2.1.1	Review, establish and agree on performance metrics/ yardsticks	An agreed performance measure framework covering efficiency, equity and environmental sustainability	Y1 m1	**Completed**. This was completed during the inception meeting in Nepal, October 2018 and confirmed with later meetings and workshops. It was agreed that the focus should primarily lie on *increasing and stabilizing farmers' incomes* as an appropriate and relatable proxy.
2.1.2	Assemble coalitions with key state and local agencies to guide and participate in data gathering, where appropriate	A group of agencies operating at state and local levels committed to assisting in-field and building analytical capability	Y1 m3	**Completed**. Key relationships formed as part of Delphi phase 1. These were further developed by the roll-out of the BWS instrument to circa 100 experts across the region.

2.1.3	Extract institutional architecture(s) that relate to each of the following: • knowledge transfer (KT) • water rights (WR) • risk management (RM)	Detailed institutional map illustrating a variety of institutional designs for knowledge transfer across the EGP	Y 1 m6	**Partially completed**. Overarching institutional design principles were drawn from the analysis of the BWS expert data. The intention was to further explore these notions in each domain using the main farmer survey. While fully developed, the survey could not proceed as planned due to COVID19. **KT** – Some additional exploration using secondary data occurred. **WR** – A separate phone survey was developed using paired comparisons to deliver on this activity. Some additional exploration using secondary data also occurred. **RM** - Some additional exploration using secondary data occurred.
2.1.4	Develop conceptual models for testing effectiveness based on Theory of Planned Behaviour (TPB) for knowledge transfer, water rights and risk management.	A clear conceptual model suitable to the context of the research, offered for peer review in respected outlet	Y1 m4	**Completed** The final survey instrument to farmers used a number of frameworks to shape its design. TPB was one of these, although others were also used to structure the instrument.
2.1.5	Refine primary data gathering instrument for knowledge transfer, water rights and risk management as per TPB including preparation for field collection using tablets	Apps developed and survey loaded;	Y 1 m5	**Completed** The final survey instrument to farmers used a number of frameworks to shape its design. TPB was one of these, although others were also used to structure the instrument.
2.1.6	Recruit and train survey administrators including women	Field staff trained in understanding of DCE techniques generally and deployment of survey using mobile devices.	Y1 m6	**Partially complete.** Dr Alam has the Bangladesh team ready to be deployed. Dr Kishore commenced the contracting process for immediate deployment if/when the COVID19 situation eases. Enumerators were trained to administer the phone survey relating to water access and pumping technologies.

2.1.7	Collect field data on effectiveness of knowledge transfer and water rights across 4 jurisdictions (Bangladesh, India (Bihar and West Bengal) and Nepal) with a minimum of 500 surveys to support discrete choice analysis. Collect field data on effectiveness of risk management across the 4 jurisdictions with a minimum of 200 household surveys to fill gaps in extant data.	Data suitable for modelling the hypothetical relationships for different institutions involved in knowledge transfer.	Y 1 m11	**Partially complete.** Secondary data were accessed to progress the analysis relating to knowledge transfer and risk. A primary phone survey was administered in West Bengal relating to water access and the data iteratively modelled during collection to monitor its usefulness.
2.1.8	Cleanse data and develop empirical models using path analysis and structural equation modelling, as appropriate	A suit of statistical models showing the relative performance of different institutional models from the perspective of the 'average' farmer, women farmers and tenant farmers	Y1 m10	**Partially completed** Alternative modelling approaches were used given the modification to data collection required due to COVID19. Some secondary data have been analysed using Difference in Difference and other regression techniques. Simulation modelling of risk and adoption has occurred. The primary data from the water access survey was analysed using logit modelling to generate importance scores from the perspective of different farmer groups.
2.1.9	Extract and summarise empirical findings	Precis of findings that are (a) digestible to end-users (b) informative to media and other outlets	Y2 m1	**Partially completed.** Online panel discussions have been prepared to assist in progressing this activity. Policy notes and conversation pieces have been assembled and continue to be developed.

PC = partner country, A = Australia – Note: all activities shared across PC and A

Objective 3: To foster collaboration with and within state, district and national authorities by developing an agreed evidence-based framework for shaping institutions that promote the '3 I's'

No.	Activity	Outputs/ Milestones	Completion date	Comments
3.1.1	Maintain contact with initial panellists involved in Delphi in objective 1	Ongoing monthly ezine or similar to continue engagement	Y1 m 3 – Y2 m12	**Ongoing** – The in-country partners are still regularly in touch with the Delphi panellists, and the expanded group who participated in the BWS of experts.
3.1.2	Circulate precis of findings with a request for additional recruitment on: • knowledge transfer institutions • water rights • knowledge transfer institutions.	Extended panel of experts for administering objective 3 Delphi	Y2 m3	**Incomplete.** The intention was to feed the findings back to the policy communities involved in Delphi and BWS experiments. COVID19 has made this problematic.
3.1.3	Conduct new rounds of Delphi	Consensus on guidelines for knowledge transfer that is consistent with 3 Is	Y2 m7	**Incomplete.** Experts have expressed a keenness to know more of the results but it is not feasible at this point to further test the findings via the proposed approach. A capacity building activity on BWS has been arranged in May 2021 to retain interest amongst participants and their support staff.
3.2.1	Convene pre-symposium workshop in Australia for key meso-tier agencies	A draft agenda for international symposium and draft communique that captures key issues	Y2 m8	**Incomplete.** Due to COVID-19 a reduced virtual event has now been scheduled for May 2021.
3.2.2	Convene an international symposium to synthesise findings from across 3 domains and leverage for additional influence	Impactful social media and conventional media releases accompanied by policy related dialogues and invited presentations	Y2 m9	**Incomplete.** A more manageable online event with high profile policy makers has been scheduled for May 2021.

PC = partner country, A = Australia – Note: all activities shared across PC and A

7 Key results and discussion

Context to changed approach to assembling results

Figure 2 shows the staged methodology that was planned to underpin the project. In early 2020 the deployment of the main survey to farm households was poised to commence. The instrument had been through multiple iterations and design reconfiguration following feedback from numerous stakeholders. The team had also drawn simultaneously from the work with expert policy communities as it came to hand. The main farmer instrument was designed to provide data to explicitly explore some of the institutional lessons already emerging from the work with experts and how these might specifically apply in the three nominated domains of: (1) knowledge transfer (2) water rights and access (3) risk management. The survey had also been designed to capture a broad suite of information on inclusion, especially around women's empowerment in agriculture and the impacts of policy/delivery institutions on tenant farmers.

The onset of COVID19 and the related uncertainty resulted in the main farmer survey instrument being paused. Initially, the in-country team provided weekly updates to establish the probability of a likely safe start date for survey deployment. This continued for several months, but ultimately a view was reached that the survey was not feasible in the current environment, regardless of the significant investment in its development. In addition, the project itself was part of a broader program supported by DFAT and a decision had been made to prioritise other programs. Thus, the prospect of an extension to the project timeline to account for the time foregone through COVID19 was not an option. Moreover, these collective events effectively reduced the time available to produce project outputs, consolidate them into digestible messages to achieve outcomes and provide the necessary reporting documentation to funding agencies.

The project team thus sort to develop an alternative methodology that would: (1) limit the COVID19 health risks of researchers (2) attempt to deliver on the objectives of the project as initially described (3) meet the truncated reporting timeline imposed by the changed circumstances facing agencies. The alternative method had three elements.

First, it was recognised that in some domains there were extant data sets that could potentially shed light on institutional gaps and issues related to that domain, albeit not at the level of granularity initially intended using the primary data. This was considered most applicable in the case of the knowledge transfer and risk management domains. There were national data sets that might be used in this context and some of the earlier CASI data was available to test some hypothesis on risk and adoption. To a lesser extent this approach was seen as partly satisfying the inclusion components of the project, with a review showing that the secondary data on inclusion was patchy in the region. Bangladesh had assembled some useful national data but the data in India and Nepal was incomplete or missing. Of itself, this review points to areas for future work for government agencies who seek to promote empowerment and inclusion.

Second, the prospect of collecting some primary data was also on offer. This particularly related to the work that had been undertaken on water access and a decision was made to progress this domain by simplifying the intended survey instrument that specifically related to water access and deploying it by phone in West Bengal. Concurrently, it was agreed that the online expert survey would remain open longer than initially intended to add to the primary data on hand.

Third, whilst the initial ambition had been to support and encourage officials at multiple tiers through a 'demonstration site' (objective 4), this was no longer achievable. It was also initially proposed to engage with policy communities to collectively finalise a generic framework using

the information from the project – again this was no longer achievable. Similarly, some of the planned support and development opportunities that would engage via face-to-face meetings to progress this ambition were no longer on offer. In this regard a changed approach involved targeting the development of online materials, webinars and documents directed at different audiences.

The remainder of this section thus reports on a combination of results drawn from the initial approach and the COVID19-modified approach adopted later in the project. Some of the information provided is drawn verbatim, but with an emphasis on synthesis. To simplify reporting this section is divided into sections comprising (1) overall institutional analysis (2) knowledge transfer (3) risk management (4) water rights and access (5) inclusion and empowerment. As intended in the initial plan, some elements of this research overlaps and readers are encouraged to source the individual outputs to understand their contribution. Manuscripts are available to support this overarching summary in this report. The polish of some manuscripts reflects the circumstances described above (e.g. working papers) while others are already under review with scholarly journal outlets. A full list of outputs is available on the project website.

Institutions

Key Findings

- Strong and consistent support from policy communities for improved access to inputs as a means of increasing and stabilizing farm incomes
- Expert communities advocate a greater role for the private sector to deliver better access to inputs
- Collectively, the research finding support the view that access to inputs is key to the success of agricultural development and increasing and stabilizing farmer incomes in the EGP

The generic findings that relate to institutional design and coherence between policy and delivery mechanisms are described in full in Cooper et al. (forthcoming). A recorded panel discussion is also available that explores the implications of these findings. These outputs relate specifically to objective 1 of the project and to some parts of objective 2. In terms of the methodology described earlier, the results in this section pertain to the first three phases on the left-hand side of Figure 2.

Cooper et al. (forthcoming) provide details of the Delphi study undertaken with experts across the EGP and the follow-up Best-Worst-Scaling instrument. In essence:

- Delphi Round 1 was used to identify key aspects/characteristics of policy and delivery that would lead to higher and more stable farm incomes;
- Delphi Round 2 refined these into a list of 16 items and generated and importance ranking of each using Likert scales;
- The Likert rankings indicated 10 of the 16 items were considered important/very important for 80 per cent of respondents;

The characteristics designated as significant and their relative importance using the Likert measures appears as Table 2 in Cooper et al. (forthcoming) and is repeated here for convenience.

Table 2: Characteristics Ratings from Delphi Round 2 (means and standard errors)

Item	All Jurisdictions	Nepal	Bangladesh	India
Deals with farm inputs in isolation	4.05 (1.16)	4.11 (1.21)	4.24 (1.12)	3.90 (1.16)
Deals only with farm outputs	4.27 (0.99)	4.02 (1.15)	4.56 (0.51)	4.31 (1.04)
Involves government actively on the inputs side	3.87 (0.89)	3.77 (0.84)	4.12 (0.88)	3.81 (0.94)
Involves government actively on the outputs side	4.34 (0.96)	4.31 (1.07)	4.48 (0.77)	4.28 (0.99)
Deals with both inputs and outputs	4.33 (0.97)	4.31 (1.21)	4.04 (0.97)	4.52 (0.71)
Encourages diversification away from agriculture	3.95 (1.11)	3.43 (1.39)	4.16 (0.74)	4.26 (0.85)
Encourages diversification within agriculture	4.57 (0.86)	4.20 (1.25)	4.68 (0.47)	4.83 (0.43)
Involves more leadership by the private sector	4.07 (0.84)	4.11 (0.72)	4.16 (0.80)	4.00 (0.96)
Requires more pro-active leadership by government	4.39 (0.89)	4.37 (0.97)	4.52 (0.65)	4.33 (0.95)
Involves a partnership between government and farmers	4.35 (0.85)	4.37 (0.68)	4.36 (1.18)	4.33 (0.75)
Is created from the bottom up by farmers themselves	4.37 (0.68)	4.28 (0.62)	4.04 (0.84)	4.64 (0.53)
Involves farmers having more access to locally developed technologies	4.29 (0.83)	4.00 (1.05)	4.48 (0.51)	4.42 (0.73)
Involves farmers having access to state-of-the-art technologies even if developed elsewhere	4.26 (0.79)	4.17 (0.89)	4.28 (0.61)	4.33 (0.81)
Relates to more effective transport for farm households	4.66 (0.69)	4.71 (0.89)	4.64 (0.48)	4.64 (0.61)
Has the trust of farmers	4.37 (0.85)	4.08 (1.06)	4.48 (0.71)	4.54 (0.67)
Is consistent with customs and social expectations related to local farming	3.56 (1.27)	3.26 (1.44)	3.64 (1.11)	3.78 (1.17)

A more discriminating approach was subsequently used to explore the relative importance of these characteristics. This led to the BWS design which had the following features:

- The 16 items were unpacked into policy options (which comprised two subgroups and 8 options) and delivery mechanisms (comprising 4 alternatives)
- The BWS experiment required experts to choose the most effective and least effective policy options that were presented as sets of 4. Respondents completed 8 choice tasks.
- The survey dynamically programmed the most preferred options selected by the respondent and subsequently asked respondents to nominate the preferred delivery mechanisms.

The policy and delivery items appear as Tables 3 and 4 respectively in Cooper et al. (forthcoming) and are repeated here for convenience

Table 3: 'Policy' Items and Sub-Groups for BWS Experiment

Group	Item description in BWS
Features related to farm inputs and outputs	Cheaper farm inputs (e.g. subsidized fertilizer, electricity)
	Easier access to farm inputs (e.g. quality seeds; in-time irrigation water, electricity; credit; good roads)
	Higher farm output prices (e.g. more competition among buyers; easier access to markets with more buyers)
	More stable farm output prices (e.g. public procurement of rice, or other produce, at minimum prices; market linkage development for higher prices)
Features related to diversification and technology	More income from non-farm sources (e.g. support such as subsidy or training for developing off-farm income such as small agribusiness enterprises, shops etc)
	Farmers adopting different types of crops (e.g. subsidies/credit/seed etc to grow different crops such as vegetables, oil, pulses etc.)
	Farmers increasing non-crop farming (e.g. credit/subsidies to support livestock/fishing or other non-crop farm activities)
	Easier access to modern technology (e.g. low-till seeders, tractors, threshers; hybrid seed varieties)

Table 4: 'Delivery' Responsibility Items

Action by the private sector (e.g. private sector, such as fertilizer and pesticide dealers, providing advice on crop-farming, access to equipment, or know-how on markets and new products)
Action by governments (e.g. government agriculture office (extension service) providing advice)
Partnership between farmers and government (e.g. farmer organizations, such as FFS, CIG, IPM Club etc., supported by the government)
Action by farmers themselves (e.g. producers and/or marketing cooperatives built around certain commodities)

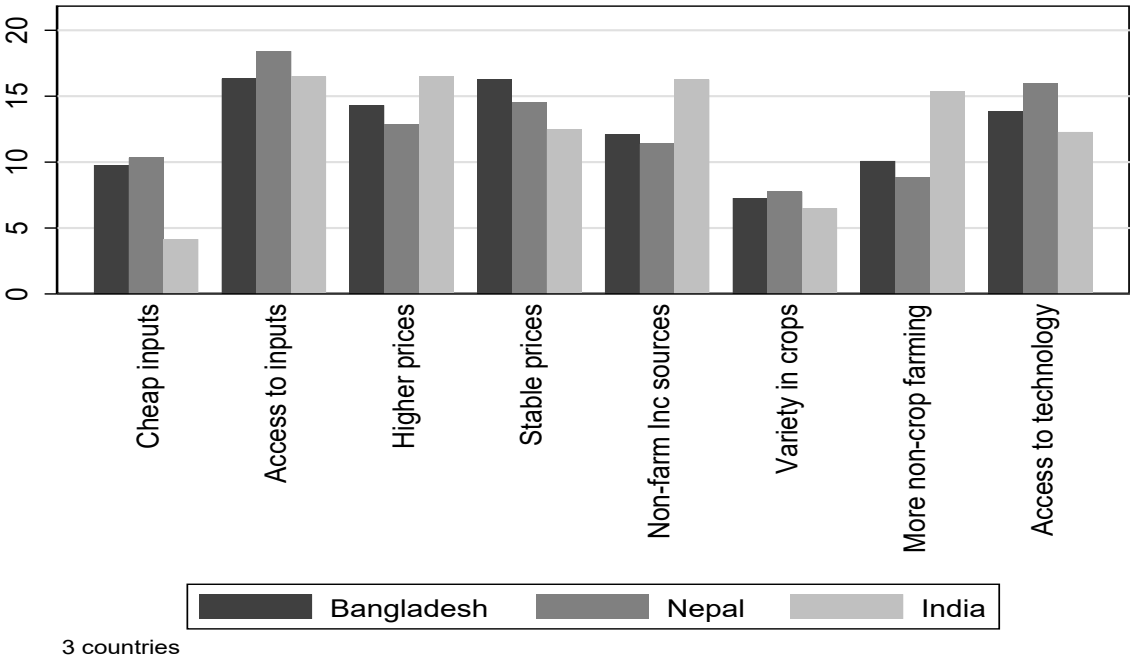
Sample choice tasks and the follow-up format that relates to delivery alternatives appear as Figures 4 and 5 respectively in Cooper et al. (forthcoming) and are again repeated here.

Figure 4: Sample Choice Task as Part of BWS Part of Survey

Figure 5: Example Ranking of Delivery Mechanisms against a Specific Policy Option

The data generated by the BWS were analysed and the differences across countries were significant, making it necessary to report results separately for each country. The ranking of each policy option by country are graphically depicted as Figure 6 in Cooper et al. (forthcoming) – reproduced below.

Figure 6: Probability Scores for Eight Items, by Country



A key finding from these data was that there is strong and consistent support from across the policy communities for improved access to inputs as a means of increasing and stabilizing farm incomes. Similar enthusiasm attends policies that provide access to modern technologies.

In terms of delivery mechanisms, there is again a consistent message across communities in the context of increased access to inputs. Namely, **the expert communities advocate a greater role for the private sector to deliver better access to inputs**. In contrast, the delivery mechanism favoured for a policy aimed at increased access to modern technology was less clear. That said, there was strong agreement that farmers were unable to achieve this on their own.

The potential influence of gender on experts' opinions was explored, albeit within the constraints of the small sample of women. A key finding here is that male experts are more inclined to advocate modern technology as a policy solution than women.

As noted earlier, the initial research plan had sought to then contrast these findings drawn from expert communities with the views of farmers. This would allow for the identification of policy/delivery options that are considered most effective and simultaneously agreeable to farmers. There is considerable potential useful impact on offer once it become possible to administer this survey instrument to farmers.

The importance of focussing on access to inputs is further confirmed by two additional studies using secondary data undertaken as part of this project.

Kumar et al. (forthcoming) considered the influence of the Kisan Credit Card (KCC) scheme in India. The KCC scheme was introduced in 1998 to provide a single-window system of credit to the agricultural sector and to ensure that farmers have access to timely, hassle-free credit (Diwas et al., 2012; Kumar et al., 2011). Although credit might not be considered an agricultural input, it provides an opportunity to undertake investments in other inputs while waiting to realize the benefits. Formal credit is on offer in many agricultural settings but often involves high transaction costs and this results in many relying on money-lenders for credit, but at much higher interest rates. Despite its apparent advantages Kumar et al. (forthcoming) notes that only about 43 per cent of farmers nationally hold a card and this proportion is even less in the poorer states to the east, where credit might be even more advantageous at reducing poverty. A question thus arises about what determines access of farmers to a card and does access impact access and use of other inputs.

Kumar et al. (forthcoming) use data from a primary survey conducted during 2018-19 in five eastern states of India; namely, Bihar, Jharkhand, Odisha, eastern Uttar Pradesh, and West Bengal. They use a Coarsened Exact Matching (CEM) approach to attempt to answer the two research questions and finds that access to the KCC scheme is strongly associated with the socioeconomic and demographic characteristic of farming households. For example, farmers with larger landholding and higher education are more likely to hold a card. They also found that access to KCC increases farmers' use of agricultural inputs and households and farm income especially for marginal and small farmers. Finally, access to KCC reduces farmer's dependency on moneylenders for borrowing by 25 per cent.

Rahman and Connor (forthcoming, a) also highlight the benefits of access to inputs. In this case, they considered farmers' access and use of High Yield Varieties (HYV) of rice in Bangladesh. They explore the causal relationship between HYV uptake for Aman (monsoon) season rice by Bangladesh farmers and rice productivity, farm income and household nutrition. A challenge with evaluating the impact of changes such as crop varieties on yield is that farmers who self-select into groups of adopters and non-adopters often also differ systematically in other unobserved attributes that can influence yield. To overcome this problem, they employ the Difference in Difference (DID) method.

They use data from the Bangladesh Integrated Household Survey-BIHS (2012 and 2015) administered by IFPRI and found that farms that switched from local to HYV, experienced around 35 per cent higher yield and after adopting HYV enjoyed more than 76 percent higher profit from Aman rice than non-adopting farms. More calorie intake, more protein and especially higher fruit and vegetable intake was also associated with the switch to HYV seed. They conclude that improved seed still has a high potential return on investment for regions where smallholder farming and malnutrition is common.

Collectively, these additional pieces of research support the view that access to inputs is key to the success of agricultural development and increasing and stabilizing farmer incomes in the EGP.

Water Property Rights

Key findings

- Continued strengthening of governance at the state level in West Bengal should be a priority if private investment is to be stimulated.
- Delivery of irrigation as an input is of itself not a panacea and a range of accompanying factors need strengthening.
- Careful attention needs to be paid to the linkages between energy reforms and their impacts on groundwater markets as these can have perverse impacts for the poor.
- The differences in preferences of some farming groups are material and policies that favour the preferences of some better-off groups can reinforce inequalities or even make them worse.
- The work reinforces the important role of access to inputs and the capacity of the private sector to deliver better outcomes, provided governments take care to avoid establishing perverse incentives.

The more detailed analysis of water property rights was undertaken using a primary survey of over 500 farm households in West Bengal and this is reported in full in Lountain et al. (forthcoming, a). Lountain et al. (forthcoming, b) provides additional conceptual work that relates to this topic but is not specifically referenced here. The project analysis also includes the work detailed in Rahman and Connor (forthcoming, a), Kishore (forthcoming, a) and Kumar et al. (forthcoming, b). In line with the other components of the project, a short recorded panel conversation is also available. The purpose of this section is to provide an overview of the results from this body of work, along with a synthesis of key messages and their relationship to the aim of the project. The section draws directly from these contributions for convenience.

At the outset it is important to understand that the notion of 'property rights' has a specific meaning in disciplines like economics that can vary from the common view that equates the term to ownership, often of land. Property rights in this case refers to the capacity to access a stream of benefits from a resource. Such rights are not about ownership per se but relate to the surety with which it is possible to access the stream of benefits and any other conditions that might attenuate that access.

The EGP is a region characterised by relatively abundant water supplies, although perversely there are also periods of intense shortage. Public irrigation schemes operate across the region, but their importance as a source of irrigation has progressively declined in a relative sense with the rapid and substantial growth of groundwater pumping that accompanied improvements in pumping technology since the 1970s. Prima facie surface water systems that use gravity should enjoy an advantage over pumping technologies that require additional energy inputs and cost. And yet surface water (channel) systems have either stagnated or progressively declined across most of south Asia, and this has often been attributed to failed governance in collective and/or government managed irrigation programs.

There are at least two important concepts that sit behind the interest in irrigation and its relationship to the ambition to raise incomes and make them more stable. First, there is a body of research that points to the disproportionate increase in agricultural productivity that stems from investments in irrigation. Second, there is the disproportionate reduction in poverty that attends an increase in agricultural development. Collectively, these relationships have made a compelling case for focussing on irrigation as a source of development.

This is repeated and emphasised in the work of Kumar et al. (forthcoming, b) that forms part of this project. Using secondary data their study examined Indian state-level trends in the interlinkages between private investment in agriculture, irrigation governance, and agriculture productivity between 2001/2002 and 2015/2016. Data was sourced from the unit-level All-India Debt and Investment Survey of the 59th and 70th Rounds of the National Sample Survey; data on public expenditure on irrigation and other variables were also sourced from the Finance Accounts (India, Ministry of Statistics and Program Implementation, National Accounts Statistics) and from the Indian government's Agriculture Statistics at a Glance (India, Ministry of Agriculture and Farmers Welfare 2015).

A governance index was constructed by taking a set of public irrigation water and infrastructure variables that also capture key dimensions of governance; these included institutions and regulatory mechanisms, participation and accountability, and service delivery. The results obtained from the structural equation model and from the instrumental variable method indicated a positive impact of governance on private investment in agriculture; an increase in private investment can, in turn, augment agriculture productivity and net returns earned by farmers.

The findings validate the existing literature on the importance of governance in the agricultural sector and the need for improvements in irrigation governance. With the exception of Punjab and Haryana, the estimated governance index is very low and has been on a declining trend since 2001/2002. Among 20 selected states, high governance and high investment in irrigation by farm households are found only in Haryana, Gujarat, Andhra Pradesh, Maharashtra, Rajasthan, and Tamil Nadu. Low governance and low investment in irrigation, as are found in Assam, Odisha, West Bengal, Kerala, Bihar and Jharkhand, Uttar Pradesh and Uttarakhand, suggest the need for improvements in governance in these states. Notably, two of the foci of this project are West Bengal and Bihar.

Kumar et al. (forthcoming, b) conclude that to create incentives for farmers to undertake higher asset formation, states should make concerted efforts to more rapidly complete major to medium irrigation projects, maintain them adequately, and ensure timely delivery of water and infrastructure development. Importantly in the context of this project, their work again highlights the need for increased attention to governance, below the level of policy, to deliver better outcomes in the EGP states of West Bengal and Bihar.

Bangladesh has also witnessed a surge in the interest in irrigation to supplement crop demands and improve agricultural production. This has extended to irrigation even in the wet season, where field trails have shown some benefits from reduced crop stress. Rahman and Connor (forthcoming, b) sought to further test this relationship as part of the project's goal to undertake closer analysis of the links between policy and delivery in the context of water.

In the absence of the opportunity to use primary data, Rahman and Connor (forthcoming, b) extracted data from the Bangladesh Integrated Household Survey for 2012 and 2015. Their interest was to test the extent to which supplementary irrigation might universally raise monsoon season rice production – the dominant crop in Bangladesh. Their work uses a specific econometric technique referred to as Difference in Difference. The Difference in Difference technique uses panel data to replicate the conditions of a natural experiment – i.e. comparing a treatment versus control group. Importantly, the researchers sought to gain unbiased estimates by matching the control group and the treatment group based on observable characteristics from an estimated propensity score. This has the advantage of isolating only the variable of interest (use of supplementary irrigation) from other variables that irrigation adopters might share versus those in common across non-adopters.

The results of Rahman and Connor's (forthcoming, b) analysis is a timely reminder that the detail matter and universal panacea, like encouraging supplementary irrigation on its own, are rare. More specifically, they find no statistically significant gain in terms of yield among the farmers who converted from rainfed irrigation to supplementary irrigation. This raises important questions about government investment in further expansion of supplementary irrigation, at least in monsoon rice cultivation. The data available to this research were not able to distinguish if access had occurred through private sector of other mechanisms.

Access to water for many farmers in the Indian states of Bihar and West Bengal rests heavily on the private sector, even though the influence of government can be significant. The interaction between public sector policy settings and water access are key topics that sit behind the work of Lountain et al. (forthcoming, b) and Kishore (forthcoming, a) that were part of the secondary data analysis in this domain.

Lountain et al. (forthcoming, b) trace the development of groundwater markets in West Bengal and explores the scope for reining in such markets into more formal arrangements. They find that groundwater markets have emerged organically and play an important function in providing access to water, especially for poorer and tenant farmers. This arises because pumping assets are relatively expensive and unaffordable for many, even with a subsidy. The upshot is that richer farmers generally purchase pump sets and, in many cases, become water sellers in groundwater markets to less-well-off groups. This is driven by the desire to defray the up-front cost of the pump set. In many districts there are also active pump rental markets used by those unable to meet the initial fixed costs.

The review by Lountain et al. (forthcoming, b) also introduces the important link between the functioning of groundwater markets (that ultimately influence water access for the poor) and the costs related to energy use. More specifically, they draw on the history of government mandated changes to energy prices to explore the water-energy nexus. They conclude that attempts to bring organically formed water markets into some formal marketing framework would likely yield little, especially if the water-energy nexus was not given full consideration.

The nexus between energy pricing and water access is given further attention by Kishore (forthcoming, a), in this instance he undertakes a comparative analysis of water-energy issues in Bihar and West Bengal. In the absence of primary data, he uses data from representative samples of paddy and wheat growers of Bihar and West Bengal from 2000-01 to 2016-17 to see how the water markets and water application rates to two crops have changed with the increase in diesel prices in Bihar and rapid electrification of irrigation in West Bengal. He finds that a one rupee increase in diesel price is associated with a smaller increase in the average hourly pump rent in Bihar, which suggests low monopoly power of pump owners in the state. The situation is different in West Bengal where rapid electrification of pumps after 2011 led to a sharp reduction in the hourly cost of irrigation for pump owners, but not the water buyers, suggesting an increase in the monopoly power of pump owners with electrification. The increase in the monopoly power of pump owners despite deregulation and capital subsidies for new connections is surprising. Kishore (forthcoming, a) argues that understanding how the change in the source of energy for groundwater irrigation and the power tariff structure affect water markets is crucial further work. This is important not only for the agricultural development of West Bengal but also the neighbouring regions of Bihar and Bangladesh where rapid electrification of pump-sets is also underway.

Lountain et al. (forthcoming, a) take on this challenge by assembling primary data using a phone survey administered in West Bengal. The purpose of the survey was to shed light on the links between pumping technologies and likely use by specific farm households. It is worth noting that this work takes place against a background where national policies result in subsidise for specific pump sets (e.g. solar pumps) regardless of the preferences of individuals or groups of farmers, or other factors, like the current functioning of groundwater markets.

Lountain et al. (forthcoming, a) positions the analysis in the context of the sustainable livelihoods framework and seeks to explore how the uptake of new technology is influenced by a number of factors, including gender and land tenure. The work had initially been structured as part of the main farmer survey and was designed to rely on the BWS technique. The rationale for this approach was that other parts of the survey instrument would also use BWS and it was felt that respondents would become increasingly familiar with this style of question and thus reduce their cognitive burden.

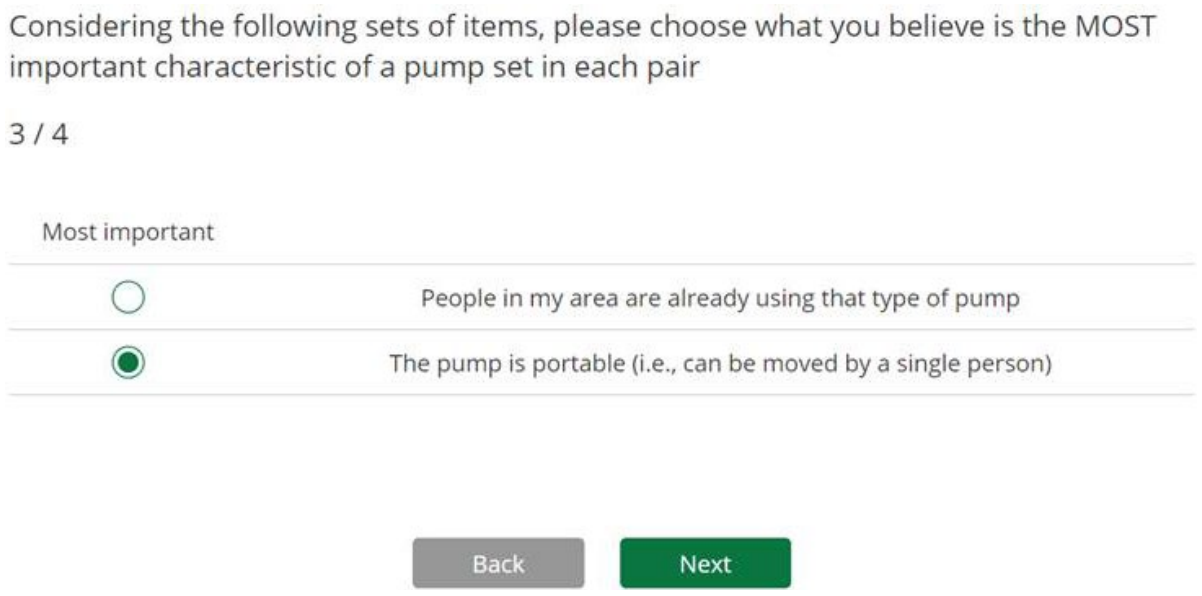
The data collection instrument for this research was a phone survey with a paired comparison experiment. We can trace paired comparison back to the seminal work of Louviere and Hensher (1982) and Louviere and Woodworth (1983). In paired comparison experiments, data is collected by presenting respondents with two choice options at a time and asking them to select one (Burton, 2003) – in this case, the option considered most important by the respondent. Paired comparison is a valuable technique because of the simplicity of the required judgements and the focus that this gives the experiment (Burton, 2003).

The development of the items for the experiment is described in full in Lountain et al. (forthcoming) as is the statistical design that sat behind the choice sets. The attributes and an example comparison set appear as Table 5 and Figure 7 in Lountain et al. (forthcoming, a) and are repeated here for convenience.

Table 5: Pump Paired Comparison Attributes

Attribute	Attribute details
1	The pump has affordable ongoing costs (i.e., I can pay the cost of running the pump)
2	The pump can access deep water sources
3	The pump can be connected to the electricity grid
4	People in my area are already using that type of pump
5	The pump is portable (i.e., can be moved by a single person)
6	The pump can be used at any time of the day or night
7	I can make money from the pump when I'm not using it
8	The pump has affordable upfront costs (i.e., I can pay the cost to purchase the pump)
9	The pump does not produce (too much) fumes and smoke
10	The pump can be maintained and repaired by myself or someone local

Figure 7: Example Paired Comparison Choice Set



In addition to presenting the statistical models, Lountain et al. (forthcoming, a) offer graphical illustrations of the results in Figures 8 -10 (repeated below).

Figure 8: Comparing Preferences by Gender

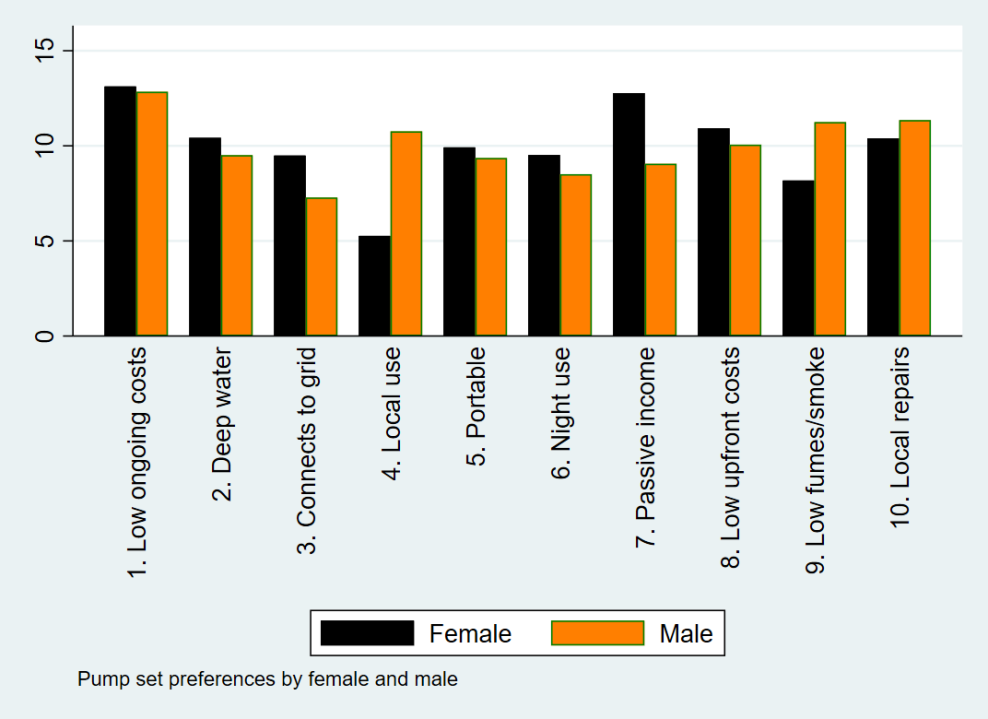


Figure 9: Comparing Preferences by Land Ownership

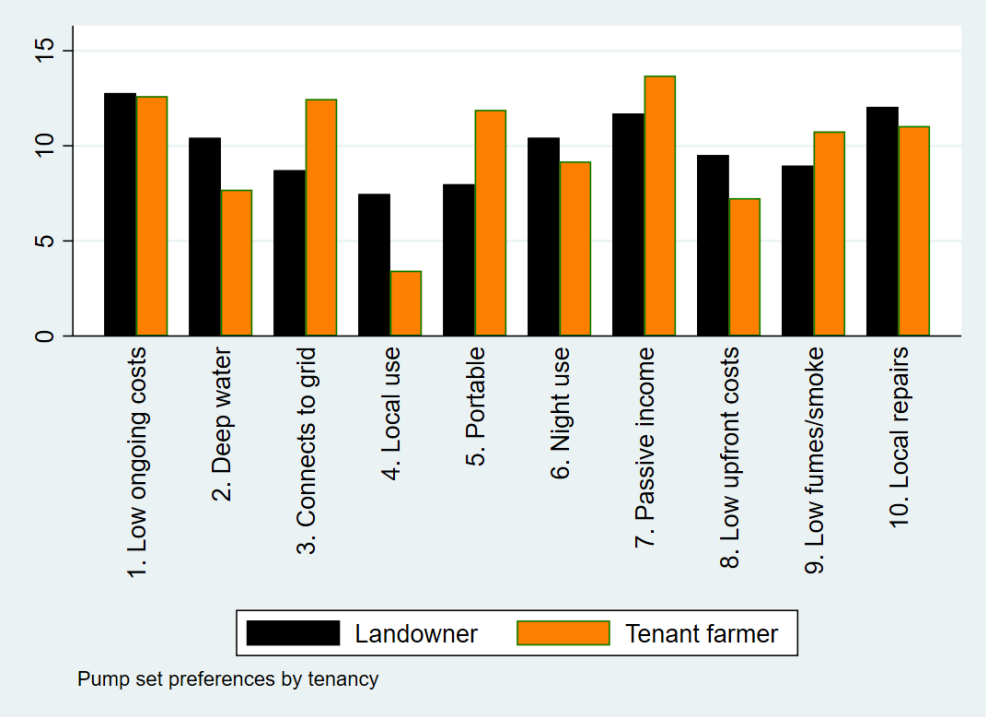
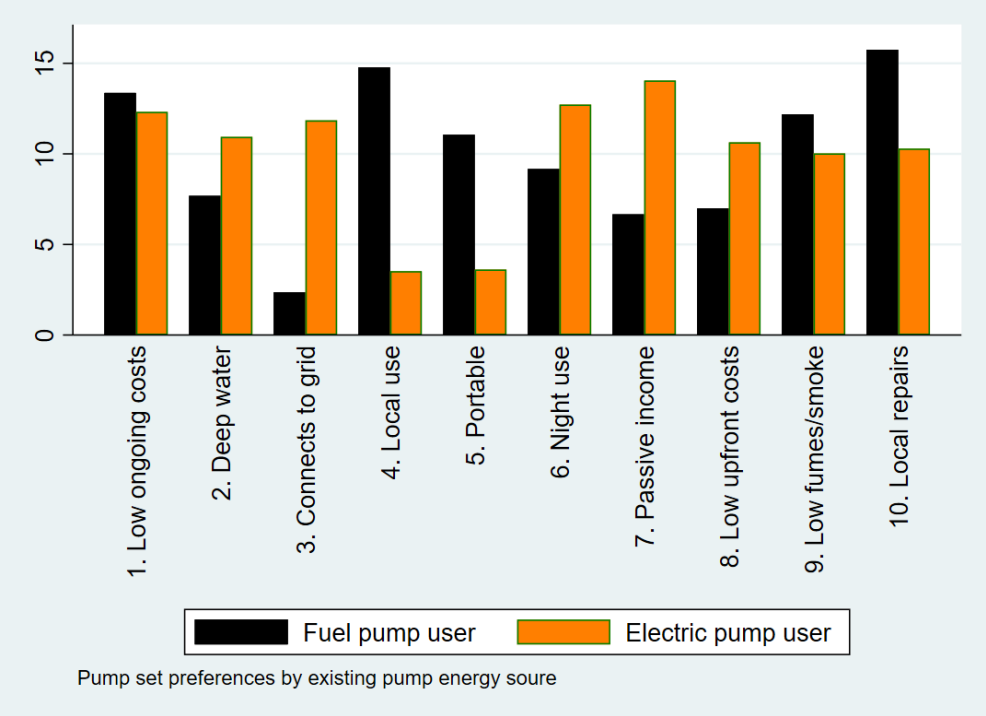


Figure 10: Comparing Preferences by Existing Pump Energy Source



It is important to note that, like BWS, these data are all scaled so that they are directly comparable (i.e. an importance score of 10 indicates that the attribute is twice as important/preferred than a score of 5). Whilst lower cost is commonly preferred across all groups, there are other key differences, especially taken with the work by Kishore (forthcoming, a) and others. Specifically, it is noted that the preference for earning income from the pump device, when not in use for their own agriculture, is significantly stronger amongst women and tenant farmers. This raises important questions about the flow on effect to the groundwater market if government incentives to own a pump set are skewed in favour of male farmers and those who own land (also usually men). Given Kishore's (forthcoming, a) concern about the scope for monopoly power to emerge in groundwater markets in West Bengal, the results also highlight the importance of understanding how access to inputs (like water) and its relationship to preferences for adopting specific technologies needs further consideration.

In sum, the body of work undertaken to consider the institutions that relate to water access adds significantly to the policy debate. First, **continued strengthening of governance at the state level in West Bengal should be a priority if private investment is to be stimulated**. Second, **delivery of irrigation as an input is of itself not a panacea and a range of accompanying factors need strengthening**. Third, **careful attention needs to be paid to the linkages between energy reforms and their impacts on groundwater markets as these can have perverse impacts for the poor**. Fourth, **the differences in preferences of some farming groups are material and policies that favour the preferences of some better-off groups can reinforce inequalities or even make them worse. Overall, the work reinforces the important role of access to inputs and the capacity of the private sector to deliver better outcomes, provided governments take care to avoid establishing perverse incentives.**

Knowledge Transfer

Key Findings

- Extension services materially improve the productivity and profitability of rice farming in Bangladesh and the related introduction of farmers to inputs is a key consideration.
- Exposure to extension increase the technology portfolio of farmers.
- Whilst adoption of a broader portfolio may be warranted and positive, there are also potential risks, and governments may have a role in better managing those risks or facilitating others to share them.
- There are less obvious spill-over effects through access to extension, borne out by the related increased in women's empowerment.

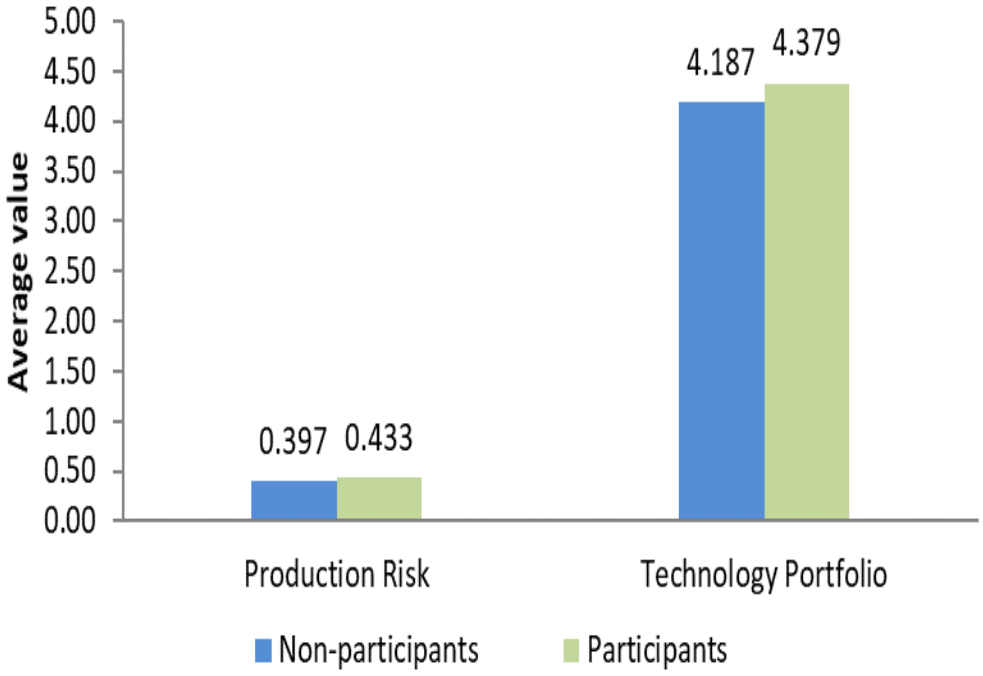
Under the initial (pre-COVID19) research plan the more detailed analysis of knowledge transfer institutions was intended to take place in Bangladesh. The revised research plan retained a focus on knowledge transfer in Bangladesh, primarily because of access to a more comprehensive data set in this country. This section summarizes and synthesizes several papers developed using the Bangladesh Integrated Household Survey. The analyses use sophisticated econometrics to control for a range of interrelated factors and thus attempt to derive policy recommendations on the basis of causal links. A more simplified description of findings is available via the recorded panel discussion that overlaps with some other work from the project.

The role of agricultural extension as a means of improving farmer productivity is generally accepted, although empirical evidence at a granular level is often missing. This is complicated by the fact that knowledge transfer to farmers can take a variety of forms. Alam et al. (forthcoming, a) summarises the range of extension service offering in Bangladesh, spanning from farmer field schools, farmer-to-farmer extension and the establishment of common interest groups. The main farmer survey initially planned for this project had taken account of these differences but the aggregate secondary data on hand does not. Accordingly, Alam et al. (forthcoming, a) use a dummy variable to capture any extension engagement in the last 12 months.

Using the DID approach to account for other variables in common with those accessing extension and those who did not, Alam et al. (forthcoming, a) find that rice farm productivity and profitability is significantly different for those exposed to extension services. More specifically, productivity is 18 per cent higher and profitability is 23 per cent higher for those exposed to extension versus than those not exposed to extension. Alam et al. (forthcoming a) also find that extension is related to a range of other positive outcomes.

Alam et al. (forthcoming, b) further investigate the relationships between extension services and some of these other outcomes. Using the same data set they manipulate a number of variables to produce scores on technological adoption and production risk. This is done by exploring only rice farmers in the Farmer to Farmer zones, including the EGP, using data within the broader national survey. Their analysis of the relationship between participation in extension and production risks and technology portfolio is summarised in Figure11 below.

Figure 11: Relationship between Extension Participation, Production Risk and Technology Portfolio



Technological adoption is consistently higher for participants, but production risk is also higher. This points to the usefulness of extension in encouraging great access to new inputs but also highlights the need to consider potential risk that attend adoption, a point explored in more detail by Connor et al. (forthcoming, a) below.

Alam et al. (forthcoming, c) take the analysis of Alam et al. (forthcoming, b) a step further by contemplating the interrelationships between rice productivity/profitability, extension services and women's empowerment. Comparisons between 2015 and 2018 show that households that participated in extension also witnessed a 16 per cent increase in women's empowerment over the three-year timeframe. Using a simultaneous econometric system, they find that agricultural extension service has significant positive effect ($p<0.05$) on total rice farm income and the

women's empowerment index in Bangladesh. This is taken further in Alam et al. (forthcoming, d) and reported in the inclusion section of this report.

Collectively, this body of work contains important policy implications. First, **extension services materially improve the productivity and profitability of rice farming in Bangladesh and the related introduction of farmers to inputs is a key consideration**. Second, **exposure to extension increases the technology portfolio of farmers.** Third, **whilst adoption of a broader portfolio may be warranted and positive, there are also potential risks, and governments may have a role in better managing those risks or facilitating others to share them.** Third **there are less obvious spillover effects through access to extension, borne out by the related increase in women's empowerment.**

Risk Management

Key findings

- Subsidies for inputs, like fertilizer, have limited impacts on production and incomes. They are also distortionary and unless well targeted will likely benefit larger, richer farmers disproportionately.
- Shifting to income transfers as a policy approach has some prima facie merits but the detail of delivery again matter. Unless comprehensive transfers systems are in place that cover all the community there is risk that more transfers will simply accrue to landholders. International funders of agricultural development research might consider broadening their focus to go beyond the farm to achieve better poverty-reducing outcomes.
- The adoption of new techniques might on average lead to higher farm incomes. Greater attention to the stability of those incomes and the risks of new production techniques is required.

Agriculture is inherently risky, especially in the EGP. Moreover, anticipated changes in climate add to that risk. Under the initial project plan, the intention was to use primary data from farmers to better understand the links between policy and delivery, particularly those that had been purportedly aimed at risk reduction. Some of these include national insurance schemes and a range of input subsidies. In the absence of the primary data, analysis of secondary data was undertaken, and the findings are synthesised using the work of Connor et al. (forthcoming, b). We also draw on the media release by Kishore and Crase (2021) and some preliminary modelling of CASI data by Connor et al. (forthcoming, a). Again, we encourage readers to access the recorded panel conversation on this topic.

Connor et al. (forthcoming, b) used secondary data from India's paddy production in the period 2000-2016. Their aim was to understand the impact of removing fertilizer subsidies on rural farming households. Fertilizer subsidies have been cited in some cases as generating a positive effect for farmers, particularly in the Sub-Saharan African region where they have been attributed to increased food security for small farm households, particularly during lean periods when food is less accessible (Wiredu et al., 2019). The study by Connor et al. (forthcoming, b) empirically estimates the input and output demand functions with respect to phosphate and potash prices. The aim was to examine the effect of subsidies on farm yield, profit, fertiliser demand, and factor substitution in paddy production. In addition, price elasticities and marginal values were calculated to scrutinise the effect of price subsidy removal in 2011.

Connor et al. (forthcoming, b) note that the impacts are not universally similar. In the context of demand and fertilizer application, the marginal impact of the subsidy removal from 2011 to 2012 is almost two times greater for the lowest capitalised quartile of farms as compared to the more capitalised quartile of farms. Put differently, smaller farmers reduced their use of fertilizer substantially more than the more capitalised farms (where there are likely complementary assets that would be underutilized with fertilizer).

Regardless of these differences in input demand, Connor et al. (forthcoming, b) also found that the subsidy prices had a very small impact on operating profit and yield. For instance, a 100 per cent increase in phosphate prices decreases yield by 7 per cent and profits by 9 per cent in the full sample. Further, there is no impact on yield and only a 9% decrease in profits in the top quartile of capitalised farms; but again less capitalized poorer farms were more impacted

witnessing a 10 per cent decrease in yield and a 8 per cent decrease in profits in the lowest quartile of capitalised farms. Collectively, their findings suggest that the removal of the fertilizer subsidies in 2011 did not significantly impact farmers, particularly the large farmers. Connor et al. (forthcoming, b) conclude that if a fertiliser subsidy is implemented, it should be targeted towards poorer farmers only. The policy delivery mechanisms really matter in this case. Alternatively, if a subsidy is applied across the whole farming population, it is an inefficient way to get productivity gains and may result in transferring of resources to farms that are already doing well.

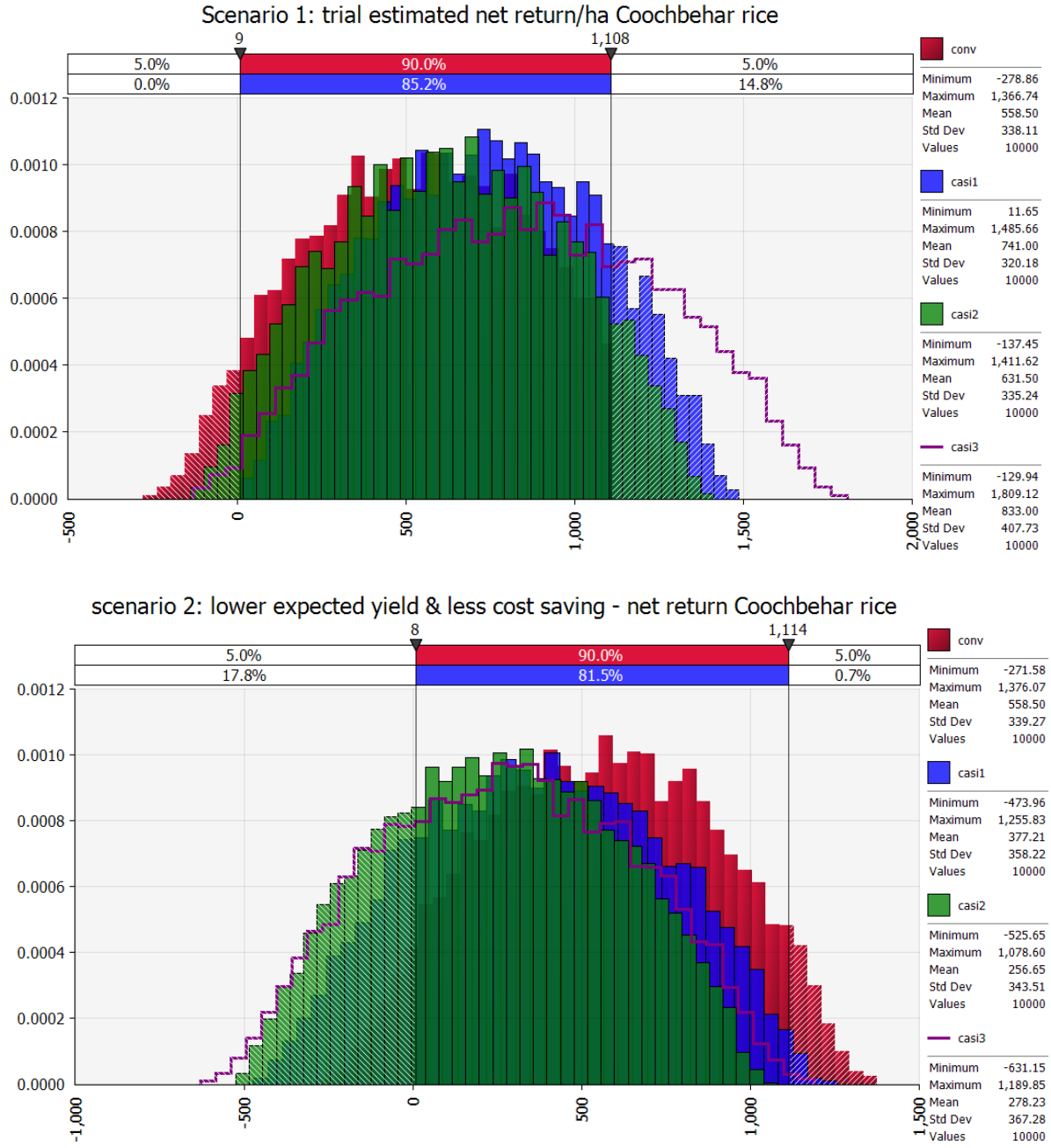
The removal of fertilizer subsidies was also examined in Kishore and Crase (2021). In an op-ed piece provided to the *Conversation* they note that like other governments in the region, the Indian Government has been progressively moving towards direct cash transfer of fertilizer subsidies, rather than manipulating prices. On the face of it, most economists would see this as a sensible approach because the current price distortions caused by the subsidy leads to imbalanced applications of fertilizers and diversion of subsidized fertilizers into non-agricultural uses. However, a big challenge in switching to non-distortionary cash transfers is: How to measure and track payments to farmers who do not own land?

The challenges of policy delivery were also highlighted in their observation about the Indian crop insurance scheme. The Indian crop insurance scheme is worth over USD 2 billion and offers subsidies equal to at least 95% of the premium, but this completely excludes tenant farmers who bear most of the production risks. Kishore and Crase (2021) advocate for agricultural research sponsored by donors to go beyond the traditional spheres of crop and animal production/marketing and also help guide the development of other civil infrastructure to support the delivery of better policies.

Notwithstanding that a shift in donor sentiment may occur over time, the Australian government has invested significant monies in an effort to promote intensification of agriculture in the EGP by focussing on improved technologies and different farming systems. A large body of published work has been generated by these efforts and new work in this field continues to focus on the scaling out of conservation agriculture practices. Gathala et al. (2021) produce a large amount of data relating to the impacts of conservation agriculture in the EGP and show substantial increases in profits, along with reduced input uses and improved efficiency thanks to conservation agricultural adoption. Whilst these field trials continue to show promise others report only modest uptake.

Against that background, Connor et al. (forthcoming, a) used simulation modelling to further investigate how risks might inhibit adoption. Put simply, evidence from adoption literature shows that farmers expect learning costs resulting in less yield and higher costs when they first adopt a new technology that typically means less return than in demonstration trial and more risk on the downside. Connor et al. (forthcoming, a) develop their simulation models directly from the data available in Gathala et al. (2021) and ran scenarios where alternative assumptions are applied around the cost of labour, the cost of other inputs and less yield. The results of combining all those scenarios appear in Figure 12.

Figure 12: Returns to Rice in a Rice-Wheat Rotation in Cooch Behar – Top Panel Simulation of Gathala et al. (2021) Assumption, Bottom Panel Simulation of Lower Yield and Higher Costs Expected in Scaling out Early Adoption



In the top panel, the different CASI and conventional practice are modelled using a simulation program that represents the range of outcomes. The horizontal axis shows the net return and the vertical axis represents the frequency of that level of return. The red curve shows the distribution of profits for conventional agriculture and the other lines represent distributions related to alternative forms of conservation agriculture. It shows that in Cooch Behar for rice in rice-wheat rotations all CASI practice outperforms conventional tillage in terms of both the

average return and also that there was less probability of low returns and higher probability of high returns on the CASI plots in the trial.

The bottom panel shows the returns to different cropping systems for a scenario that could be representative of expectation for a farms implementing CASI practices who would expect to be able to implement it less optimally than in trials and face higher cost given high costs of informal lending. Noticeably, the distribution for conventional tillage is narrowed – indicating less variation in outcomes. The conventional practice would be judged more profitable and involve less risk of loss under these assumptions. This is not to say that adoption of CASI is flawed. Rather, the work by Connor et al. (forthcoming, a) shows the value of this technique in understanding the delivery of a policy of intensified agriculture via CASI techniques is likely to be more challenging than simply showing more profitable outcomes in field sites. In addition, this analysis shows that if governments are keen to promote CASI they must also find delivery approaches that reduce the downside risk for adopters who face learning costs for new technology and may face high cost for more purchased inputs.

Collectively, the research on risk and policy/delivery institutions shows the following: **(1) Subsidies for inputs, like fertilizer, have limited impacts on production and incomes. They are also distortionary and unless well targeted will likely benefit larger richer farmers disproportionately. (2) Shifting to income transfers as a policy approach has some prima facie merits but the detail of delivery again matter. Unless comprehensive transfers systems are in place that cover all the community there is risk that more transfers will simply accrue to landholders. International funders of agricultural development research might consider broadening their focus to go beyond the farm to achieve better poverty-reducing outcomes. (3) The adoption of new techniques might on average lead to higher farm incomes. Greater attention to the stability of those incomes and the risks of new production techniques is required to support delivery of conservation agriculture.**

Inclusion

Key findings

- Technology can increase incomes and make them more stable. Focussing on how technologies can specifically address the needs of less advantaged groups can lead to even greater welfare gains than simply looking to increase universal access.
- Policy communities have made substantial progress in recognising the benefits of greater empowerment of women, but this needs to be matched by efforts to measure and monitor change in the status of women over time.
- Care also needs to be taken when reviewing data on empowerment – there may be some instances where aggregate improvements in empowerment disguise the welfare impacts on some women.

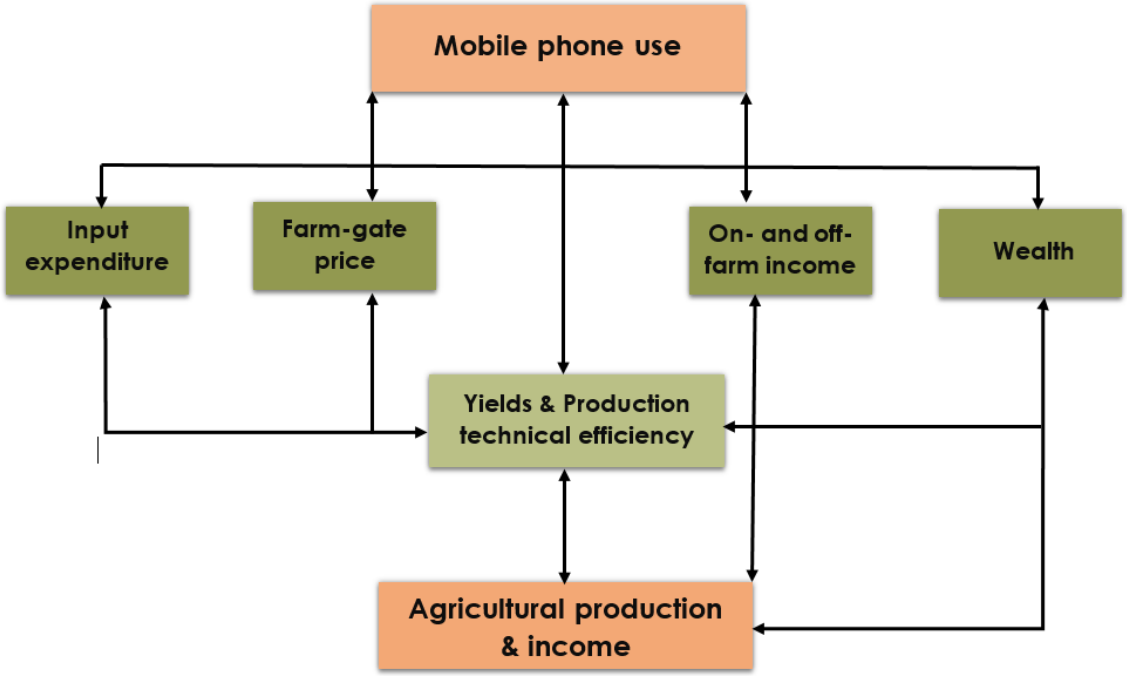
Figure 3 in the Methodology section of this report details the initial methodology that sat behind the main farmer survey. Inclusion, particularly in the form of women's empowerment and the status of tenant farmers, was a topic that spanned all domains and locations. Moreover, the modified method post COVID19 retained a focus on inclusion wherever feasible. For example, the analysis of water rights was specifically targeted to capture data on women and tenant

farmers in West Bengal and the link between knowledge transfer via extension services and women's empowerment was also examined. Within the broader institutional analysis of experts provided by Cooper et al. (forthcoming) the opinions of women were also considered against those of men.

This section details additional analyses of inclusion that were undertaken as part of the project and, as with other themes, a short panel recording is also available.

Kandulu et al. (forthcoming) used the Bangladesh panel data employed by Alam and others. Recall, that Alam et al. (forthcoming, c) initially found a significant and positive relationship between extension service access and women's empowerment in agriculture, at least in the case of Bangladesh. Kandulu et al. (forthcoming) also had an interest in knowledge transfer and were particularly motivated by the role of mobile telephones. The conceptual model used to buttress their empirical work appears as Figure 13.

Figure 13: Heuristic of Possible Impact Pathways through which Mobile Phone Use Can Influence Various Agricultural Production Indicators



In addition to the panel dataset on households in Bangladesh, they combine a spatial climate dataset from Bangladesh. Household fixed effects and control function modelling approaches are used to evaluate the causal influence of mobile phone use on rural households' agricultural production and income. Kandulu et al. (forthcoming) results show that mobile phone technology can significantly improve yields, production technical efficiency, and agricultural net revenues.

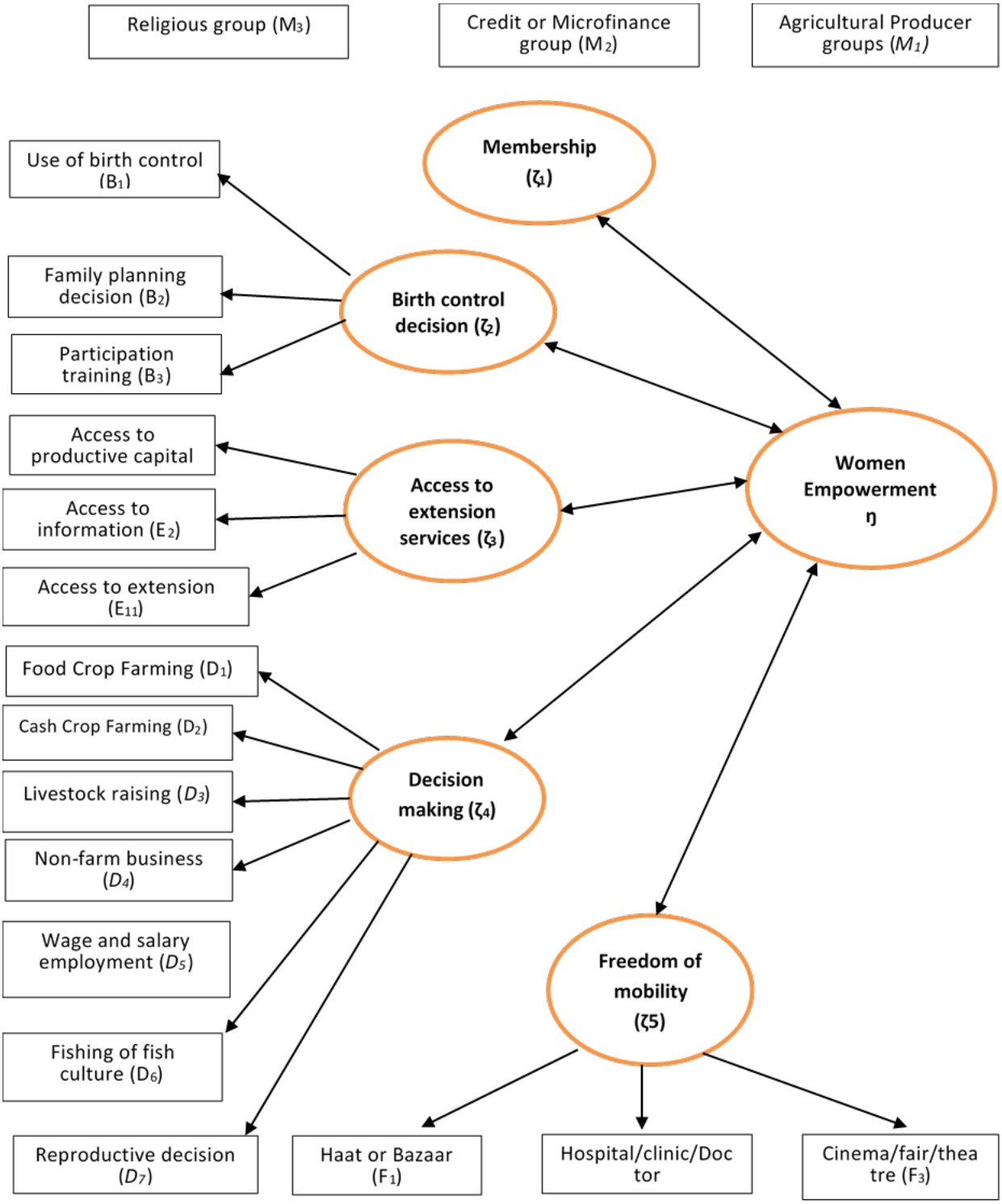
Importantly, they find that policies targeted at addressing gender disparities in mobile phone use can yield the highest benefit. Thus, employing mobile phone technology in agricultural extension

services and prioritizing regions with poor access to off-farm employment can yield the highest benefits.

The level of detail in Kandulu et al. (forthcoming) explaining mechanisms between technology and women's empowerment make a welcome contribution, especially against the background of Cooper and Kishore's (2021) policy note. Here, they observe that data on women and empowerment is sadly lacking in many cases or patchy at best. The Bangladesh data used by Kandulu et al. (forthcoming) represents an outlier. They argue that more attention needs to be paid to systematically measuring the plight of women if policy ambitions are to live up to expectations.

Using the Bangladesh data, Alam et al. (forthcoming d) unpack the relationships they revealed between extension services and women's empowerment in their earlier work. They use structural equation modelling, which allows for multiple path dependencies which can be critical in complex environments, like those related to increased empowerment. The conceptual model that underpins their analysis and the structural equation models is repeated below as Figure 14.

Figure 14: Conceptual Model of Women's Empowerment Drivers



The study reveals that five latent factors, namely decision making, freedom of mobility, membership, birth control, and extension services were positively associated with the women's empowerment in agriculture index. Women's membership (M=0.425), decision making

(D=1.822), freedom of mobility (F=0.055), decision to birth control (B=-0.252) and extension services (E=0.976) all have have a significant effect on WEAI (P<0.01). Accordingly, they find that agricultural extension services enhance all measures of women's empowerment and increased the overall empowerment index and recommend that extension services be considered as a pathway to enhance empowerment in agricultural domains.

The need for more comprehensive data on empowerment of women in agriculture is further emphasised by some of the results reported by Lountain et al. (forthcoming, a) in their analysis of pumping technologies in West Bengal. Recall that Lountain et al. (forthcoming, a) found significant differences in preferences around pumping technologies between men and women, as evidenced in Figure 8 above. In addition to collecting these data, Lountain et al. (forthcoming a) also asked questions about decision making in the context of: (1) productive resources related to farming, (2) spending of farm income and (3) spending household income. A major discrepancy was evident between male and female respondents around the notion of joint decision making. Across the sample of women in the phone survey each of these three decisions are purportedly made jointly in 43, 48 and 67 per cent of households, respectively. In contrast, men indicated joint decision on the same items in 23, 20 and 39 per cent of households, respectively. Clearly, data that does not capture these differences could disguise the true status of women's empowerment in agriculture.

Similar important disparities were also found in the institutional mapping that involved the opinions of experts. There Cooper et al. (forthcoming) found that men consistently weighted the benefits of modern technology more highly than female experts. Being cognisant of these differences is important when choosing policies and delivery approaches that relate to increasing and stabilising the incomes of men and women.

Avey and Cooper (forthcoming) take the contradiction between policy ambitions around women and lack of detailed measurement further by reviewing the extant literature on empowerment and mapping this against the policies in countries that cover the EGP. They undertake this work by (a) providing a precise of the policy frameworks for women in India, Nepal and Bangladesh (b) reviewing the scholarly literature on women's empowerment (c) contemplating instances where empowerment can and cannot increase life satisfaction for women. In line with the overall theme of this project they find that the detail of policy delivery matter, and there are some circumstances where claimed empowerment enhancing activities directed at women can lead to increased disadvantage.

Combined with the other studies that have embedded empowerment this body of work offers several key messages. First, **technology can increase incomes and make them more stable. Focussing on how technologies can specifically address the needs of less advantaged groups can lead to even greater welfare gains than simply looking to increase universal access.** Second, **policy communities have made substantial progress in recognising the benefits of greater empowerment of women, but this needs to be matched by efforts to measure and monitor change in the status of women.** Third, **care also needs to be taken when reviewing data on empowerment – there may be some instances where aggregate improvements in empowerment disguise the welfare impacts on some women.**

8 Impacts

This project had set out to primarily impact officials in government who were well placed to advocate for improved institutional alignment between policy and delivery approaches. Objective 4 in the initial research plan specifically involved the creation of a demonstration that would add further weight to the calls for greater attention to this issue.

COVID19 resulted in excising objective 4 from this project and much of the face-to-face engagement that was planned to accelerate impact. Nonetheless, there are non-trivial impacts to report to date and more can be expected in coming years.

8.1 Scientific impacts – now and in 5 years

A substantive body of scientific knowledge has been generated from this project. The primary data collected from expert communities and the novel application of the Delphi and BWS techniques to generate the institutional mapping are particularly valuable. This represents a substantive contribution to the New Institutional Economics literature and development analysis. This part of the research involved extensive collaboration from each country and the manuscript detailing the method and outcomes is currently under review in a Q1 ranked journal (*Journal of Economic Development*). The data from this component has also been assigned a Digital Object Identifier to enhance future impact.

The primary data collected as part of the water rights analysis by Lountain et al. (forthcoming, a) is similarly valuable and has been assigned a DOI. This part of the project is also under review in the Q1 ranked *Agricultural Water Management*. Similarly, the work by Rahman and Connor (forthcoming, b) detailing supplementary irrigation is under review for publication in *Agricultural Water Management*.

To the knowledge of the project team, the simulation method used to better articulate potential risks of adopting conservation agriculture has never previously been employed. This manuscript is undergoing further refinement for submission to *World Development* (Q1). Similarly, the manuscript developed by Kandulu et al. (forthcoming) focused on mobile phones and empowerment is currently under review with *World Development*.

At the time of preparing this report at least 15 papers were either submitted or in the process of refinement for submission to peer reviewed outlets, all of high academic standing.

The survey instrument prepared for administration to farmers is poised to make an additional important scientific and policy impact. The data that can be yielded from this survey will provide a further lens on policy/delivery institutions and shed light on the most effective and acceptable combinations for improving livelihoods in the EGP.

8.2 Capacity impacts – now and in 5 years

The project was aimed squarely at enhancing the skills of institutional actors/leaders and the policy making communities, via the evidence generated on institutional mapping. The analytical techniques used to produce this evidence and the processes by which empirics can inform a wider discourse was also an important part of this development. The enthusiasm of members of the policy communities to better understand some of the analytical techniques resulted in CI Burton developing and recording a series of instruction sessions on the use and interpretation of BWS experiments.

Considerable capacity was also developed within the research team. Delphi and Discrete Choice (i.e. the BWS approach) are rapidly changing research approaches and training sessions were arranged for the research team. This included sessions presented by Professor Darryl Maybery (Monash University) and Professor Dan Rigby (Manchester University) on Delphi and DCE, respectively. CI Cooper also worked closely with colleagues at BAU, honing their skills in Delphi and publication, ultimately co-authoring a paper with a BAU PhD candidate submitted to the *Journal of Business Process Management*.

Three Higher Degree Research students were also directly supported as a result of this project; 2 submitting theses at the time of reporting. A HDR scholarship was provided by UniSA to support Sophie Lountain. Some of her earlier work has already been published and she won support from the Crawford Fund to expand her work in south Asia.

Mahbubur Rahman was also supported by this project through his scholarship at UniSA. As a result of his continued work on Bangladesh agriculture he secured a promotion to a new post in the Bangladesh government. John Kandulu's work also helped him leverage a role in the private sector where he now provides advice to multiple government agencies.

A team of researchers at BAU were appointed through this project and given opportunities to develop expertise in discrete choice methods, mobile data collection and related analysis and problems solving. Exposure opportunities in *Qualtrics* and *Sawtooth* software also attended the project. Supporting appointments at IFRPI were also made and given scope to develop new projects and finalise existing work.

8.3 Community impacts – now and in 5 years

The project focused on expert communities with the aim of bringing changes that would impact across the EGP. The opportunity to engage directly via the farmer survey and the establishment of demonstration sites was halted due to COVID 19.

8.3.1 Economic impacts

In addition to engaging directly with policy communities as part of the institutional mapping, the formal and grey published material from this project provides clear guidance on how to better structure and align policies and delivery apparatus. The national budget allocation to agriculture across the EGP is substantive and small improvements in allocation can yield substantial flow-on effects to the wider economy. The fertilizer subsidy in India is alone valued at $US 11 billion per year and research undertaken by this project clearly shows that this has little useful impact. Moreover, policies and delivery institutions that focus on access to inputs rather than the price of inputs stands to significantly improve agricultural incomes. The World Bank (2016) also notes that much of the commendable growth in Bangladesh agriculture since 2000 is directly attributed to enhanced policy settings accompanied by strong institutions.

In the case of conservation agriculture specifically, Gathala et al. (2018) estimated that CASI had the potential to positively impact 1.5 million farmers in the EGP by 2020/21 and this included at least 35% women farmers. The research undertaken as part of this project provides clear guidance on how some of the policy and delivery options might be adjusted to realise those changes.

In the context of current events, it is not feasible to accurately estimate the economic impacts in the EGP however leveraging from the existing resources created by this project can be expected to produce substantial positive economic achievements within 5 years.

Image 1: Farmer discussion around crop diversification and productivity changes through irrigation access due to electrification, West Bengal

8.3.2 Social impacts

The project purposefully sought to shed light on the plight of women and tenant farmers and how policy/delivery options might be adjusted to better meet their needs. This was achieved across all domains considered by the project. The examination of water rights revealed opportunities to better engage women in groundwater markets and also provided guidance on shaping energy policies that do not produce detrimental impacts on groundwater buyers (usually poorer and tenant farmers). Specific opportunities were also identified for women through expanded extension service and increased access to mobile phones.

Advice on expanded data collection to better monitor changes in the status of women also stands to have significant social impacts however calibrating those changes in the current context is problematic. Again, we would expect these to materialise in 5 years, particularly if an opportunity arises to deploy the main farmer survey as this will add more weight to the case for change.

Image 2: Qualitative field sessions to discuss roles and relationships with tenant farmers and women farmers, West Bengal

8.3.3 Environmental impacts

Judicious use of natural resources is a key feature that underpinned several aspects of this project. For example, the analysis of knowledge transfer covered a range of issues that relate to better management of soils, capital and water. The empirical insights into the energy-water nexus in groundwater markets also has significant environmental consequences through less carbon-polluting pumping technologies.

Climate change is predicted to have a major impact in the EGP and several elements of this project help deal with those challenges. The analysis of risk management, for instance, can significantly inform better ways to deal with the environmental consequences of a changing climate and the policies to encourage adoption by farmers.

8.4 Communication and dissemination activities

Given the objectives of the project, the communication and dissemination activities have focussed on the key audience – policy making communities that impact the EGP. Two face-to-face workshops were undertaken in Nepal prior to the disruption caused by COVID19. These included a range of interactive sessions designed to both inform the institutional mapping exercise and gain buy-in from key informants. In round 1 of the Delphi, 70 experts in the region engaged with the open-ended format to share their views on institutions that matter. Round 2 had participation of over 100 experts who refined concepts and provide a preliminary ranking that later helped shape the BWS.

Image 3: Delegates at the project inception meeting, October 2018, Nepal

Image 4: Meeting with senior officials (Planning Commission, Ministry of Planning and Ministry of Water Resources, Bangladesh) during the Project Inception meeting

Image 5: Delphi workshop delegates, Bangladesh

Image 6: In-person Delphi interviews

The BWS received voluntary engagement from 96 experts and an additional 30 participated in the completion of a pilot phase. The training sessions arranged on BWS were in response to demands for participants keen to learn more of the approach. These are schedule to be undertaken after the completion of this report.

Although farming communities could not be engaged as planned, qualitative phases of some of the survey work and pre-testing provided opportunities to communicate with farmers and farmer organisations. The pilot of the main survey instrument using tablet-based technologies has been scheduled to take place in Bangladesh in May 2021. Farmers were engaged in West Bengal through a phone survey. This reached 534 farm households across multiple districts.

Image 7: Portable pumps used in West Bengal, 2021

Image 8: Hand pump and electrical shallow pump in West Bengal, 2021

Preliminary findings from some of the quantitative analysis were presented at international conferences. This included sessions at the Australian Agricultural and Resource Economics Society in 2019, 2020 and 2021. For example, Dr Cooper chaired a mini-symposium titled *Social inclusion in a development context: Cases from ACIAR projects*, at the virtual AARES conference in 2021. The Bangladesh team also presented their work virtually at the Agricultural & Applied Economics Association (AAEA) meeting held at Kansas City, MO, USA in 2020

Image 9: Professor Alam presents preliminary findings and Ms Sophie Lountain presents at AARES Conference 2020

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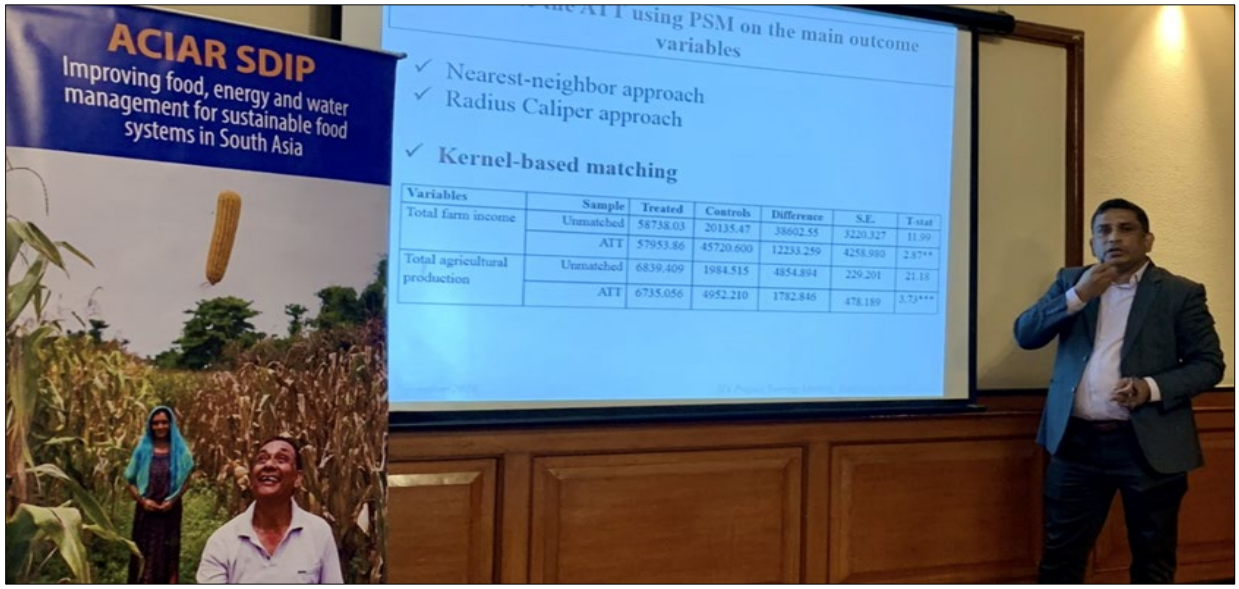
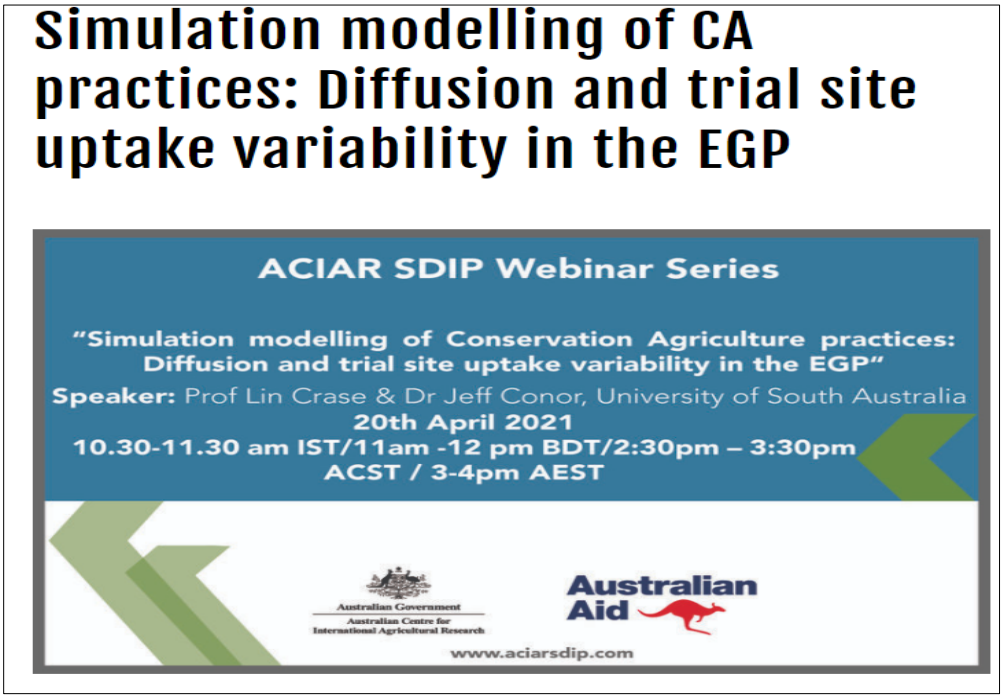


In addition to the extensive publishable material, op-ed pieces were produced for media outlets. As results became available towards the end of the project the team also disseminated finding through webinars and seminars.

Image 10: SDIP Webinar series, 20th April 2021



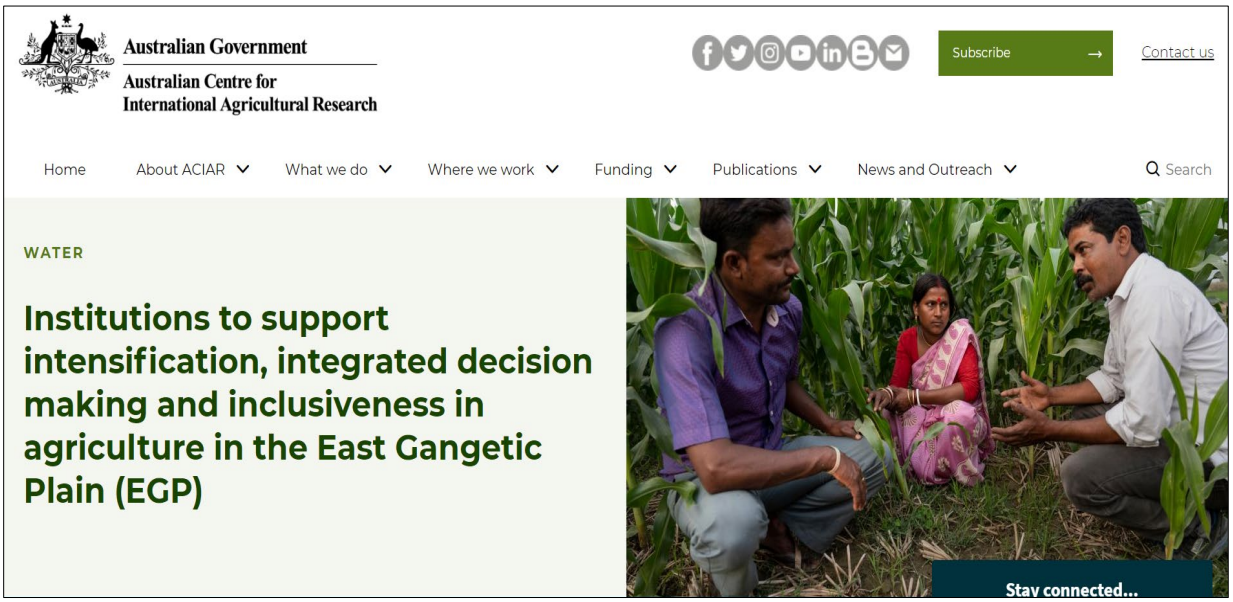
Findings and progress were regularly shared across the other research teams engaged with SDIP projects including program meetings in Nepal.

Image 11: Project meeting and SDIP field trip, November 2019, Nepal

A writing workshop was planned to be undertaken in Australia to accelerate the research and to also provide an opportunity to present findings to others working on development in Australia. These were rescheduled to an online format in June 2020.

Online Zoom panel discussions were arranged around the key themes that structured the results. A summary of each panel appears Appendix A

An International Webinar has been scheduled for 24th May 2021 to further engage with the policy communities and stimulate discussion. The webinar will be led by the Hon. Christopher Pyne and followed by contributions from members of government advisory bodies in south Asia, like the Planning Commission in Bangladesh. The webinar title is *Aligning low level institutions with high level policies for effective outcomes*.



9 Conclusions and recommendations

9.1 Conclusions

Collectively, the project has managed to assemble several important conclusions about the current alignment of policies and delivery mechanisms in the region along with specific conclusions relating to water, knowledge transfer, risk and inclusion.

In the context of *general institutional design* it was concluded that:

- Across the expert communities that span the EGP, policies focussed on increasing access to inputs are seen as having the greatest prospect of increasing and stabilising farmer incomes.
- These policies are best supported by actions that involve greater use of the private sector.
- There is some support for policies that increase access to modern technologies but the delivery mechanisms for these policies is not clear-cut.

In the context of *water* it was concluded that:

- Continued strengthening of governance at the state level in West Bengal should be a priority if private investment is to be stimulated.
- Delivery of irrigation as an input is of itself not a panacea and a range of accompanying factors need strengthening.
- Careful attention needs to be paid to the linkages between energy reforms and their impacts on groundwater markets as these can have perverse impacts for the poor.
- The differences in preferences of some farming groups are material and policies that favour the preferences of some better-off groups can reinforce inequalities or even make them worse.
- Overall, the work reinforces the important role of access to inputs and the capacity of the private sector to deliver better outcomes, provided governments take care to avoid establishing perverse incentives.

In the context of *knowledge transfer* it was concluded that:

- Extension services materially improve the productivity and profitability of rice farming in Bangladesh and the related introduction of farmers to inputs is a key consideration.
- Exposure to extension increases the technology portfolio of farmers.
- Whilst adoption of a broader portfolio may be warranted and positive, there are also potential risks, and governments may have a role in better managing those risks or facilitating others to share them.
- There are less obvious spillover effects through access to extension, borne out by the related increase in women's empowerment.

In the context of *risk management* it was concluded that:

- Subsidies for inputs like fertilizer have limited impacts on production and incomes. They are also distortionary and unless well targeted in delivery will likely benefit larger richer farmers disproportionately.
- Shifting to income transfers as a policy approach has some prima facie merits but the detail of delivery again matter. Unless comprehensive transfers systems are in place that cover all the community there is risk that more transfers will simply accrue to landholders. International funders of agricultural development research might consider broadening their focus to go beyond the farm to achieve better poverty-reducing outcomes.
- The adoption of new techniques might on average lead to higher farm incomes. Greater attention to the stability of those incomes and the risks of new production techniques is required.

In the context of *inclusion* it was concluded that:

- Technology can increase incomes and make them more stable. Focussing on how technologies can specifically address the needs of less advantaged groups can lead to even greater welfare gains than simply looking to increase universal access.
- Policy communities have made substantial progress in recognising the benefits of greater empowerment of women, but this needs to be matched by efforts to measure and monitor changes in the status of women.
- Care also needs to be taken when reviewing data on empowerment – there may be some instances where aggregate improvements in empowerment disguise the welfare impacts on some women.

9.2 Recommendations

It is recommended that ACIAR:

- Continue to support the dissemination of the findings from this project as it is poised to make a significant impact post-Covid19.
- Give serious consideration to supporting the deployment of the main farmer survey once ground conditions improve in the EGP. The instrument is fully developed and this is a significant resource. The assembled data will provide a platform for going beyond the views of the expert communities and identify solutions that are both effective and acceptable to farming communities.
- Consider partnering across government more broadly to leverage Australian expertise in the region. This includes providing support and advice on efficient income transfer mechanisms to remote communities.

10 References

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10.2 List of publications produced by project and cited in this report

Alam et al., (forthcoming, a) Impact of agricultural extension services on farm productivity and profitability in Bangladesh.

Alam, et al., (forthcoming, b) Agricultural technology adoption, agricultural extension services and production risk nexus: Evidence from Bangladesh.

Alam et al., (forthcoming, c) Nexus among agricultural extension services, women empowerment in agriculture and farm income: A stochastic modelling approach.

Alam et al., (forthcoming, d) Measurement of women's empowerment through the improvement of multidimensional capacity using the structural equation modelling approach.

Avey, S., Cooper, B. (forthcoming) Women's empowerment and the feminisation of agriculture in Bangladesh: Insights from a systematic review.

Connor, J., Gathala, M., Brown, B., Crase, L. (forthcoming, a) Simulation modelling of conservation agricultural adoption: Why real world adoption might fall short of expectations in the East Gangetic Plain.

Connor, J., Banerjee, R., Kishore, A., Gupta, K. (forthcoming, b) Fertilizer subsidy removal and agricultural production risk: A natural experiment from India.

Cooper, B., Crase., Burton, M., Rigby, D., Jahangir, M., Kishore, A. (forthcoming) Institutions and polices for enhancing farm household livelihoods: An analysis of the coherence of expert opinion in the East Gangetic Plain.

Cooper, B., Kishore, A., Lountain, S. (forthcoming) Is it possible to consistently scrutinize empowerment of women in south Asia.

Kandulu, J., Wheeler, S., Zuo, A., Connor, J. (forthcoming) Improving rural agricultural production and income in developing countries using mobile phones.

Kishore, A. (forthcoming) The changing energy-irrigation Nexus in West Bengal and Bihar: Implications for Equity in Access to Groundwater.

Kumar et al., (forthcoming, a) Assessing the impact of lending through Kisan Credit Cards in rural India: Evidence from Eastern India.

Kumar, A. Bathla, S., Elumalai, K., Saroj.S. (forthcoming, b) Irrigation Governance, Private Investment, and Agricultural Productivity in India.

Kishore, A., Crase, L (forthcoming) Solutions in agricultural development and poverty require governments to look beyond land.

Lountain, S., Cooper, B., Crase, L., Burton, M. (forthcoming, a) Technology, gender and sustainable livelihoods: Insights into preferences for irrigation pumps in West Bengal.

Lountain, S., Crase, L., Cooper, B. (forthcoming, b) When the genie is out of the bottle: The case of dynamic groundwater markets in West Bengal, India, and the market readiness assessment framework.

Rahman, M., Connor, J. (forthcoming, a) The effect of high yielding variety on rice yield, farm income and household nutrition: Evidence from rural Bangladesh.

Rahman, M, Connor, J. (forthcoming, b) Does supplemental irrigation enhance smallholder agricultural productivity? Evidence from monsoon season rice cultivation in Bangladesh.

11 Appendixes

Appendix A: Panel discussions, webinars and video training session links

Panel sessions

A series of panel discussions designed to summarise and the research that was completed were recorded with relevant research team members. The panel discussions covered: Institutions, Inclusiveness and each of the three domains (Water Property Rights, Knowledge Transfer and Risk Management).

We provide a brief explanation about each panel discussion and a link to the associated recording below.

Institutions

This panel discussion walks you through the paper 'Institutions and policies for enhancing farm household livelihoods: An analysis of the coherence of expert opinion in the East Gangetic Plain' with the authors elaborating on aspects related to their contributions.

Panel members: Professor Crase (Chair), Professor Alam, Associate Professor Burton and Dr Cooper.

Inclusiveness

Discussing access to resources, a case study about pump preferences in West Bengal and the inclusiveness aspect of agricultural extension services, agricultural productivity and the Women's Empowerment in Agriculture Index nexus.

Panel members: Dr Cooper (Chair), Professor Alam, Professor Crase, Dr Kishore, Miss Lountain

Water property rights

Drawing on observations made in the Conversation 'Solutions in agriculture require governments to look beyond land' and other research findings, Professor Crase leads the discussion about water property rights in the study areas (Bangladesh, India and Nepal).

Panel members: Professor Crase (Chair), Dr Cooper, Dr Kishore, Miss Lountain

Knowledge transfer

The panel discuss research from three papers:

1. Impacts of Agricultural Extension on Farm Productivity and Profitability in Bangladesh
2. Nexus among Agricultural Extension Services, Women Empowerment in Agriculture and Farm Income: A Stochastic Modelling Approach

3. Improving rural agricultural production and income in developing countries using mobile phones

Panel members: Dr Kishore (Chair), Professor Alam, Professor Connor, Dr Cooper, Professor Crase, Mr Kandulu

Risk management

Along with discussing elements of obtaining insurance in the Indian context the panel discuss research from three papers:

1. Does supplemental irrigation enhance smallholder agricultural productivity? Evidence from monsoon season rice cultivation in Bangladesh

2. Agricultural Technology Adoption, Agricultural Extension Services and Production Risk Nexus: Evidence from Bangladesh

3. Simulating risk to better understand low adoption of conservation agriculture in the east Gangetic Plain.

Panel members: Professor Crase (chair), Professor Alam, Professor Connor

International Webinar

24th May 2021, titled: Aligning low level institutions with high level policies for effective outcomes.

Panel members: Led by Hon. Christopher Pyne and followed by contributions from members of government advisory bodies in south Asia, like the Planning Commission in Bangladesh.

Online Training Session on Best-Worst Scaling Technique

18th May 2021

Instructors/Convenors: University of Western Australia and University of South Australia

Participants: Experts in agricultural development across India, Bangladesh and Nepal