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Small research and development activity

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1 Acknowledgments

'Roadmaps' was a provincial agricultural development project that, like it's mother-project Sustainable and Resilient Farming System Intensification in the Eastern Gangetic Plains (SRFSI), was at its heart was about partnership. We acknowledge and sincerely thank every individual and institution who has made any material, intellectual, or in-kind contribution to this project. In particular we thank partners from the Ministries of Agriculture, Land Management and Cooperatives (MoLMAC) from Province 1 and 2, NARC and various farmers and cooperatives who were willing to invest their time in this project and forge new relationships despite the short time frame of the project and direct limited financial incentive. Their buy-in to this project highlights there is strong potential for Nepal's agri-mechanisation success and reaching our collective vision for the Nepal Terai.

As project leader, would like to thank particularly Anjana Chaudhary, Manisha Shrestha and Rama Sharma for the extra miles they went to make this project a success. Their hard work, long days and various travel enabled our collective success. We also acknowledge the Australian taxpayers for their financial support through the DFAT Sustainable Development Investment Portfolio, and ACIAR for commissioning the project.

Dr. Brendan Brown (Project leader – CIMMYT Nepal)

2 Executive summary

The 'Building Provincial Capacity for Sustainable Agricultural Mechanisation in Nepal' ('Roadmaps') project was originally envisaged as an 18-month development-oriented project based in Provinces 1 and 2 of the Nepal Terai. It aimed to build solidarity and teamwork around the drive for agri-mechanisation in each of these two budding provincial governments. Unfortunately, the short time frame paired with intensive efforts to establish new relationships and then the onset of COVID-19 meant that there was limited scope to deeply develop these new relationship and fully build the envisaged roadmap process and plans.

Regardless of this, 'Roadmaps' has made some essential steps in improving provincial agri-mechanisation planning and implementation, including:

- Substantial capacity developed though placement of engineering experts within NARC, MoLMAC, various cooperatives and AKCs; and

- New and deepened relationships with and between key stakeholders, and particularly between NARC and provincial government, as well as with and between various cooperatives; and

- Development of the first quantification of the status of agri-mechanisation on the Nepal Terai – indicating that there is high potential for rapid mechanisation if some key constraints are addressed; and

- Publication of the learnings for a review of mechanisation in India and Bangladesh, and what that means for Nepal's agri-mechanisation planning; and

- Regional learnings and new collaborations with various stakeholders in Nepal and West Bengal; and

- A national symposium on Agri-mechanisation on the Nepal Terai, with a large number of supported individuals attending and learning from the national Agri-mechanisation Fair; and

- Development of a "roadmap" process that can be used more widely with additional further development; and

- Technical guidance and relationship building to improve the scaling of government supported custom hire centres in Province 1.

A Video summary of the Roadmaps project is available at https://youtu.be/Dr183kb6-5s

A video summary of Roadmaps capacity development initiatives is available at: https://youtu.be/i2Py6aZTYEU

3 Introduction

The activities within the Sustainable and Resilient Farming System Intensification in the Eastern Gangetic Plains (SRFSI) project have highlighted the potential for Conservation Agriculture based Sustainable Intensification (CASI) practices to improve the livelihoods of those in rural areas of the Eastern Gangetic Plains (EGP). This has led to the development of various recommendations to create enabling environments that facilitate the uptake of CASI in targeted farming communities. Yet there remains a gap in how to 'put into action' such recommendations, alongside significant researchable questions relating how to strategically plan for and implement transformational change at provincial level.

The 'Building Provincial Capacity for Sustainable Agricultural Mechanisation in Nepal' ('Roadmaps') project aimed to address this gap through the production of participatory roadmaps. Road mapping is a flexible planning technique to support strategic planning and programming. This process was developed and applied to two newly formed provinces in Nepal, where the SRFSI project has been working since 2012. It explored the pathways for increased CASI mechanisation through a series of activities that aims to improve linkages and capacity to create and maintain enabling environments. CASI mechanisation is integral to the wider sustainable intensification of the region, and there remains particular scope to engage with and develop provincial level institutions to increase effective policy, planning and programming related to CASI mechanisation. The gap that 'Roadmaps' attempted to address was the 'messy middle' identified in the project proposal document (and below in Figure 1).
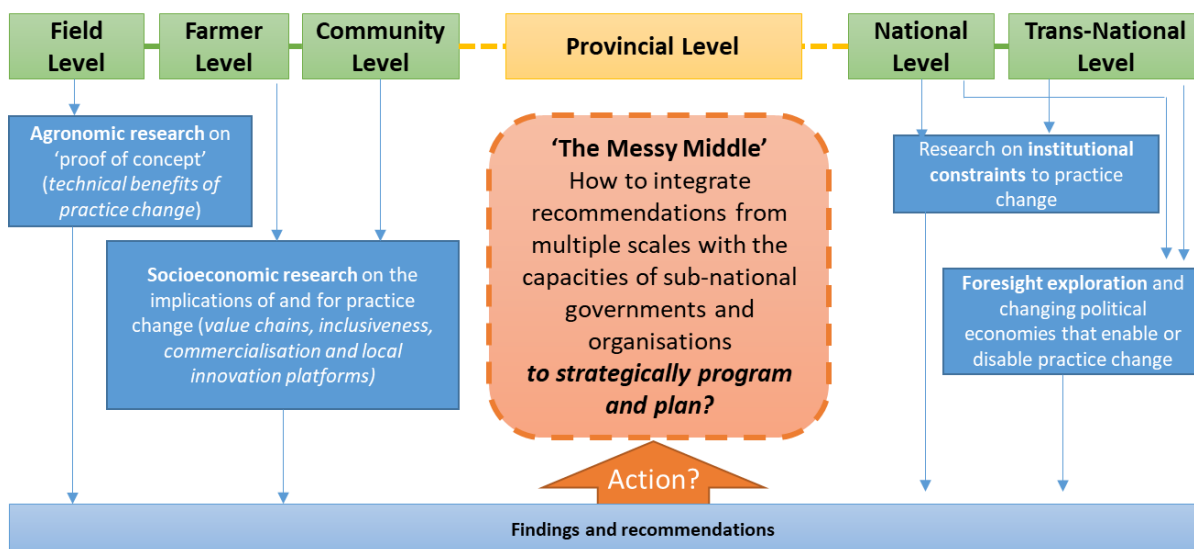

Figure 1: Visualisation of the 'messy middle' – the research gap between implementation of field level and institutional research recommendations that 'Roadmaps' attempted to address (from project proposal document)

4 Delivery against Proposed Activities

4.1 Activity 1 - Understand

[A] Explore of the theories of change that have been applied for agri-mechanisation in South Asia (how changed occurred, which theory of change was used and explorations of social history)

Proposal:

This forms part of an academic exploration of 'what has worked where and why?'. It will explore specific examples of successful and unsuccessful interventions related to agricultural mechanisation in the region to understand the factors which enabled change, and the subsequent implications for agricultural mechanization in Provinces 1 and 2 of Nepal. The scope will depend on the number of examples that can be found and investigated.

Delivery:

This output has been comprehensively addressed by the development of two outputs:

[1] A **Review manuscript** was developed and submitted to the Journal of International Development, with positive reviewer comments and is currently being finalized for resubmission to the Journal of International Development (*Attachment 1*). The manuscript provides an evaluation of what Nepal can learn from the mechanisation processes and theories of change applied for agri-mechanisation in India and Bangladesh. The abstract of the manuscript is as below:

Nepal has the potential to expand and intensify its constrained agricultural productivity through agricultural mechanisation for small holder farmers among different regions within the country. Current and future climate uncertainties along with diverse topography and labour shortages highlight the need for scale-appropriate mechanisation to ensure food security and profitability. However, limitations in research and development systems, credit access and local manufacturing hinder access to and uptake of agricultural machinery. This review provides a timely reflection on the pathways in which mechanisation has occurred in the neighbouring countries of India and Bangladesh to inform the development of Nepal's future mechanisation policies.

Manuscript details (Attachment 1):
Karki, E., Sharma, A., Brown, B (2021) Farm Mechanisation in Nepal: Policy Context, Drivers and Options. Journal of International Development (Under revision – submitted May 2021, Resubmitted September 2021)
Video Abstract: https://youtu.be/h_MO49QcZt8

[2] Development of a **Policy Handout** based on the above manuscript. This is available in both Nepali (*Attachment 2*) and English (*Attachment 3*). This handout was distributed widely amongst key stakeholders and at the national agri-mechanisation fair In Nepal, 2019.

Summary of learnings:

Current policies and plans seeking to increase farm mechanisation in Nepal indicate the government's prioritization of developing the agricultural sector. However, systematic implementation and regular monitoring of activities planned are crucial for success. Limiting factors such as lack of trained technical experts to meet the diverse requirements of farmers in the newly formed federalized state hamper the ability to meet long-term goals. One of the critical learnings highlights the need for substantial investment in Research and Development, extension services, and capacity development of trained professionals to ensure scale-appropriate promotion. In addition, learnings from farmers need to be incorporated to ensure promoted technology addresses the needs of all categories of farmers. The focus must also be given to provide support to rural entrepreneurs to expand the use of machinery since ownership, despite existing subsidies, is still not economically viable for many farmers.

[B] Map the institutional environment for CASI mechanisation in Provinces 1 and 2 of Nepal (Baseline assessment).

Proposal:

Two baseline assessments will be undertaken to understand that status and key stakeholders that currently exist for CASI mechanisation in each province. This will also be the beginning of engagement with stakeholders as part of the development of multi-stakeholder platforms. This baseline will also assess key bottlenecks as the starting point for roadmap development. The mapping exercise will identify who the decision makers are within governments, as well as who are influential in value chains through private operators. The scope of analysis will be from innovation platforms to national level.

Delivery:

This output is addressed though the **Institutional Analysis Report** that provides an overview and analysis of the enabling environments for agri-mechanisation in Provinces 1 and 2 (attachment 4).

Report details (attachment 4):

Chaudhary, A., Shrestha, M., Sharma. R., Brown, B. (2021) Understanding Agricultural Institutional Structures in Province 1 and 2, Nepal. SRFSI Working paper. CIMMYT, Nepal

Summary of learnings:

After federalization, the provincial government is in a state to exercise power for strengthening agricultural development in provinces including agricultural mechanisation. In addition, policy related to agricultural mechanisation has been formulated at the provincial level, which allows subsidies on variety of agricultural machineries including ZT-MCP (75% subsidy). The provincial government has budget allocation for promoting mechanisation but are in dilemma regarding the implementation process. Furthermore, the provincial government seems keen on improving service delivery and envision working with a diversified group of stakeholders to achieve the goals of sustainable agricultural mechanisation. Therefore, this provides an opportunity for the Roadmaps project to build

the provincial government's capacity and implementing bodies to minimize the gaps and meet their objectives through road mapping and providing technical backstopping whenever required.

[C] Undertake a needs assessment with service providers

Proposal:

This sub-activity will provide a participatory analysis of perceptions from service providers on the enabling environments, they require to catalyse the CASI service provision industry. It will analyse the broad livelihood context of CASI service provision, with a focus on the impediments that are applied from beyond the community. This will form an integral input to understanding the required actions from the later formed multi-stakeholder platform, as well as providing a base for identification of service providers willing to participate in the multi-stakeholder platform.

Delivery:

This activity is addressed through two outputs:

[1] An in-depth Nepal Service Provider evaluation report (A*ttachment 5*). This explores why existing tractor owners do not provide CASI services for hire to farmers in Province 1 and 2;

Report details (Attachment 5):

Brown, B., Chaudhary, A., Sharma, R, Shrestha, M (2021) Considerations for the scaling of CASI service provision: Findings from a study of potential CASI service providers in Nepal.

[2] An academic manuscript that collaborates with SRFSI for a more regional analysis of service provision constraints and decision making on CASI.

Manuscript details (Attachment 6):
Sharma, A., Timsina, P., Chaudhary, A., Karki, E., Brown, B (2021) Expanding Zero Tillage Service Provision: perspectives from machinery owners in the Eastern Gangetic Plains (in finalisation for submission to the Journal of Food Security by 30 September 2021)

Summary of learnings:

Currently, smallholders across the Eastern Gangetic Plains are broadly unable to personally invest in agricultural machinery. Limited financial capacity to invest in the necessary Conservation Agriculture based Sustainable Intensification agricultural machinery themselves, coupled with small landholding, limited income and fewer investments in any agricultural technology means smallholders across the EGP require fee-for-service-provision models to enable them to adopt agricultural mechanisation technologies. The benefits of service provision in Nepal include increased financial and time savings that helps foster positive lifestyle changes for service providers, who were able to invest in better homes and their children's future. However, constrains for ZT service provision included technological issues along with a lack of reliable machine operator and lack of after sales services. Specifically in Nepal, farmers also linked large heavy machinery to difficulty in turning corners on small fields, an issue in Nepal linked to land fragmentation and small plots. As a way to further enhance expansion of services in the future, service providers in

Nepal highlighted the importance of government subsidies that encourage more farmers to try new technologies, particularly how they can aid in early demand generation.

[D] Develop multi-stakeholder platform and road mapping protocols

Proposal:

Through collaboration with SRFSI partners, and particularly CSIRO colleagues, a set of principles will be developed through which innovation platform theory may be 'scaled up' to the provincial level, such that it is relevant to provincial governments. This will build on SRFSI innovation platform work. There will also be a formalization of the road mapping process that can be applied for CASI mechanisation in the two provinces.

Delivery:

This activity was delivered though the 'Roadmaps protocols', available in both Nepali (*Attachment 7*) and English (*Attachment 8*). They were used as the basis of roadmaps building in each province.

Summary of learnings:

Establishing the roadmaps process with participants was difficult, as it was something completely new to partners. In hindsight much more time needed to be allocated to developing collaborative skills with each working group. However, establishing these principles was useful and the manual provides a process for wider use of those interested in participatory planning processes.

4.2   Activity 2 - Engage

[E] Mentor the establishment of government working groups in two provinces of Nepal

Proposal:

Independent yet interrelated working groups will be established in each province. The working groups will be populated by key individuals who have mandates to promote sustainable intensification (non-specific to mechanisation). This will include stakeholders at higher and lower levels of responsibility within governments. This working group will consist of both technical experts as well as bureaucrats, and with engagement with higher level decision makers.

CIMMYT's role will be that of mentoring, and there will be strong efforts to ensure that the working groups and subsequent platforms are not viewed as 'owned' by CIMMYT, but rather as mentored by CIMMYT to fill an articulated government need. As government officials, participation will not be remunerated monetarily, but costs of participation (e.g. travel, per-diems) will be covered, and other in-kind contributions will be made (e.g. merchandise).

Delivery:

Government leaders to head the working groups were established in each province. The lead in Province 1 was Dr. Rajendra Uprety, while in Province 2 was Lalan Kumar Singh, as representatives from each MoLMAC in the provinces. Each has a prominent position in their organizations. Around them a mixed group of government officials were selected to provide inputs based on their areas of expertise and divisions of work. Full details are given in the reports on wider provincial multi-stakeholder platforms. This is primarily reported in the travel reports to Janakpur (*Attachment 9*) and Biratnagar (*Attachment 10*), while the agreements formal sanctioning is shown in Attachment 13 for Province 2.

Summary of learnings:

Establishing new initiatives is very difficult in government systems without commensurate financial incentives in terms of project budgets. Given the short time frames and nil budget transferal to provinces directly, we relied on the initiative and goodwill of these individuals to enable project delivery. Our progress in particular would not be possible without Rajendra and Lalan, and we thank them for their initiative.

Figure 2: Dr. Brendan Brown (CIMMYT) and Dr. Rajendra Uprety (MoLMAC) on the ratification of the Province 1 working group commitment

[F] Mentor the formation of a wider provincial multi-stakeholder platform

Proposal:

Broadening from the primarily governmental working group, invitations will be made to the wider stakeholder community as part of mentoring the multi-stakeholder platform. As sub-national platforms, focus will be to engage those working from district levels to scale up their activities, as well as national partners to engage at scales at which they may not traditionally engage. This will strengthen linkages that should last beyond the project lifespan. Importantly, there will not be monetary incentives to participate in the platforms. It is envisaged that stakeholders will be motivated to remain engaged due to their input into joint objective and goal setting, and that contribution to activities will enable them to benefit through achievement of various co-objectives. This process will again be mentored by CIMMYT, but will be facilitated by the working groups to ensure ownership and sustainability. It is intended that each platform will be populated with 15 to 20 member organisations, from government as well as private sector actors in the value chain, service providers and farmers.

Delivery:

This activity was formalized through formal ratification of the working groups in a set of meetings. The agreement for Province 1 (Attachment 11) highlighted the initial members but subsequent members later joined. In Province 2, a declaration was agreed on and finalized but due to COVID was never formally signed (Attachment 12). A directory of working group members is given in Attachment 17 (Province 1) and Attachment 18 (Province 2).

Figure 3: Province 1 Working group on signing of ToR for each collaborator.

Summary of learnings:

Broadening the working group by introducing other private stakeholders in the region was challenging during the initial stage. Therefore, inputs from the provincial government were crucial for identifying the potential stakeholders keen to join hands in working towards agricultural mechanisation in the provinces. Terms of reference (ToRs) for the working group in Province 1 was much more diversified compared to Province 2. Keeping the working group engaged and their involvement in drafting the vision and planning activities increased their feeling of ownership. It is possible to foster relationship and engage private stakeholders without directly funding them if they are able to understand the importance and benefits received from involvement in the working group.

[G] Undertake a series of field trips to understand processes for success

Proposal:

To facilitate learnings and new linkages, a series of field trip will be organised, most likely to India, to explore contextual success-enabling factors and transferrable learnings for participants once they return to Nepal. It is estimated that 30 participants will be involved in this field trip for approximately one week. It will coincide with the pre-harvest period, so as to see various achievements in the area and the status of crops planted with CASI equipment. There will be formalised activities on lessons learned and what changes can be implemented in Nepal.

Delivery:

This deliverable was hampered by COVID-19 and the associated cross border closures (meaning international exchange with SSCOP was not possible) and then localised movement restrictions (e.g. between Kathmandu and each province and between provinces). While we continued localised COVID-safe trainings as appropriate, we also transitioned from broader capacity development to targeted individualised support for organisations mobilizing the available local resources.

The core activities included:

- Exposure visit for Province 1

  - A group of 11 participants from Province 1 representing the working group members visited Satmile Satish Club 'o' Pathaghar (SSCoP), West-Bengal for exchanging learnings related to agricultural mechanisation using CASI machinery. This was a 3-day visit which enabled the working group members to identify new concepts and ideas which could be replicated back in Province 1. The participants showed their keen interest to learn about ongoing activities related to agriculture mechanisation in West-Bengal including various business models for establishing and sustaining CHCs. However, due to COVID-19 similar visit could not be planned for Province 2.

- 4th National Agricultural Mechanisation Fair

    - Supported 4th National Agricultural mechanisation fair held in Chitwan from 22-25 Nov, 2019 where more than 100,000 individuals participated including the working group members from both the provinces. CIMMYT also had a booth for displaying various IEC materials to promote agricultural mechanisation in Nepal. Audio-visuals relevant to CASI machineries were played grabbing attention from the visitors and other leaflets and manuals were distributed to the interested visitors thus increasing awareness of farmers.

- Corresponding national symposium of mechanisation on the Nepal terai.

    - Approximately 40 participants attended the national symposium which was organized on the last day of the National Agricultural mechanisation fair. Learnings from CSISA and SRFSI for agricultural Mechanisation in Nepal was presented along with some learnings and updates from each of the province.

- Other trainings :

    - The Roadmaps project in collaboration with provincial governments of Province 1 and 2, PMAMP and Agriculture Machinery Testing and Research Center (AMTRC) successfully conducted a four-day training between the 1st – 4th December 2020, focusing on capacity development of operators for improved technical ability to operate agricultural machines like Laser Land Leveller, Zero Till Seed Drill and Happy Seeder at AMTRC, Nawalpur in Province 2. A total of 19 participants attended, from Provinces 1, 2 and 3. Additional trainings were conducted in collaboration with private organisations such as Kuber & Sons and Nepal Krishi Company on various small machineries, repair and maintenance.

Summary of learnings:

Identifying key gaps was difficult, patricianly in larger and broader topic areas. Mostly the requests for capacity development were extremely specific, hampering efforts for initiatives like gender mainstreaming. Overall, we adapted under COVID-restrictions to ensure that capacity was built, though not as originally envisaged. Because of delays in the development of actual roadmaps, it was also hard to integrate this activity with roadmaps development.

4.3   Activity 3 – Plan

[H] Joint analysis of activity 1 and 2 output to establish mode of progression

Proposal:

Each platform will be mentored through the analysis of the baseline assessment from activity 1 and learnings from activity 2. This will be discussed in the context of core skills and capacities required of stakeholders. It will explore critical success factors from the field trip as well as gaps that will need to be addresses for success. As this will occur in groups, it is the first step in formalising the roadmap process to stimulate discussion before developing joint goals and activities. The scope will include stakeholder, policy and institutional capacity mapping, including required capacity developments.

Delivery:

Integrated and reporting on in activity [J – Roadmap development]

Summary of learnings:

Due to time constraints and COVID induced practicalities, this activity was merged into the road mapping process. Ideally it would have been better to have had time to move more slowly and purposively though this stage, but this was not possible so was adapted for practicalities.

[I] Address capacity gaps through capacity building activities

Proposal:

As part of the ongoing capacity development activities of platform members, a series of workshops are envisaged which will increase skills in participatory programming and planning, further encouraging ongoing engagement. Projected workshops include (but are not limited to): CSIRO smallholder ADOPT workshops; CIMMYT Scaling Scan workshops; considerations of inclusiveness in programming (especially gender sensitive strategy development for CASI mechanisation); and other generic capacity building activities to encourage dialogue and inter-governmental communication (e.g. community consultation and facilitation, principles of action learning and research).

Delivery:

Due to the implications of COVID-19, focus transferred from development of working groups higher level skills to practical implementation of institutional support, and as such Roadmaps was able to contract the following for specific capacity development initiatives:

- Technical expertise for building capacity for sustainable intensification in Province 1, Nepal

    o Prasanna Shrestha, agriculture engineer was assigned as a consultant by CIMMYT for providing technical support to MoLMAC and cooperatives in Province 1. He acted as a liaison officer thus maintaining coordination with the working group members and provided technical support as requested

by the working group. The tasks ranged from contribution in the working group members discussion to orientation on CASI machineries during 4th National Agriculture Mechanisation Fair. Providing technical support when planning and conducting demonstrations on ZT as well as responding to working group members queries were some of the major roles served.

- Technical expertise for building capacity for sustainable intensification in Province 2, Nepal

  o Arbind Jha, an agricultural engineer was contracted for providing support to AMTRC, Nawalpur and Agriculture Development Directorate (ADD) in Province 2. He was assigned to support ADD, Naktajhij in drafting the protocols and developing specifics of the implements required for establishing CHCs. ADD has now finalized the protocols and started the bidding process for the same. He also worked in close collaboration with AMTRC and supported to conduct demonstrations on various crops using CASI machinery in P-2 and coordinate with the working group members thus minimizing the communication gap between ADD, AKCs and farmers. He served as one of the team members at AMTRC and supported to conduct rate analysis for non-conventional irrigation system, godown (warehouse), and estimates of various implements along with designs.

  o Omkar Singh (Engineer) and Suneel Kumar Singh (Technician), a team of two having expertise in establishing testing centers in India was consulted for providing support to AMTRC, NARC, Nawalpur in building their capacity to test different machineries and develop protocols for running the testing center smoothly. Testing regulation and evaluation protocols were developed in close collaboration with AMTRC team. The testing procedure was demonstrated and practiced with the AMTRC on various power tiller and tractor attachments along with harvesting machines thus building the capacity of AMTRC team to undertake the process from start to writing evaluation reports. The technical experts also supported in developing 10 year strategical plan with budgets incorporating key points required for sustainability of the testing center.

Their Deliverables are attached as Attachment 15.

Summary of learnings:

Capacity gaps are very difficult to fill at local levels given various constraints in hiring new positions. CIMMYT was able to provide flexibility and budget to be responsive to the technical gaps identified by working groups.

[J] Mentor platforms to jointly develop roadmaps

Proposal:

Roadmaps will be developed based on the above engagement activities. The focus will be on first establishing common objectives, then setting goals, and finally on activities to achieve those goals. Each stakeholder will engage as they see fit and if a partner is not engaged, they are free to leave the platform. The roadmap process, as outlined in Section 4 will be applied, led by the working group and mentored by CIMMYT. Noting the short period of implementation, a prioritization process will also be undertaken, with focus given to that which is achievable within the project period and that which needs to be planned for over a longer time period. A focus will be made to mainstream gender considerations and perspectives, as per capacity development learnings.

Delivery:

COVID-19 was a momentum stopping event in the production of roadmaps, given the focus on participatory development and the inability to conduct workshops. Our activities in Province 1 were more developed when COVID hit, with a preliminary roadmap developed (Attachment 14) but due to the shorter and less personal virtual format we were unable to progress this meaningfully into a full roadmaps. In Province 2, we were not able to develop a formal participatory roadmap and hence out work focused more on the technical assistance outlines in activity [I].

Summary of learnings:

Participatory roadmap developed with new partners and with limited internet connectivity was neigh on impossible to do virtually – this needs to be an in-person exercise. Because it took an extended time to be signed off officially, particularly in Province 2, there was essentially only 1 month to build the roadmaps before COVID-19 stopped all travel and in person meetings, so full development was not possible.

In terms of process learning, it took considerable time to create understanding of what a road mapping process was, and particularly around concept of participatory planning. Considerable time was spent in answering questions such as "what does the project want us to do?" reflecting the normal way of programming. Eventually, the concepts on participatory programming became understood, particularly with Province 1 where we had more existing partnerships through SRFSI than Province 2. In Province 2, we had a deepening connection with NARC and hence built a stronger relationship around linking NARC with various other stakeholders. However, it should be noted for future similar initiatives that the lag time in establishment is substantial and short time frames should not be provided for ambitious participatory projects such as Roadmaps.

4.4　Activity 4 - Implement

[I] Mentor the implementation of roadmaps through continual revision and alliance-brokering

Proposal:

Monitoring and mentoring will continue over the course of one year, with bi-monthly meetings scheduled to ensure continued stakeholder engagement and progress, as well as revision of the roadmaps. This will also occur over a dedicated social media platform, which is likely to include both private WhatsApp groups and public Facebook groups. There will also be opportunities for interaction between each of the platforms to encourage cross-regional linkages. New members may be invited as roadmaps are implemented and new capacity gaps emerge. This forms part of the 'action learning' of the road mapping activity.

Delivery:

Pre-COVID, we held monthly meetings in Janakpur and Biratnagar for each province, as well as coordinating a joint Provincial meeting at the National Agri-mechanisation Fair in Chitwan. Post-COVID, we moved to virtual online meetings. These meetings are listed below:

P1 Roadmap meetings:

1. 1st Exposure Visit (Aug 12-14, 2019)
2. 2nd Workshop at MoLMAC (27th Sep 2019)
3. 3RD Workshop at Chitwan Fair (24th Nov 2019)
4. 4th Workshop at MoLMAC (Feb 11- 12, 2020)
5. 5th Workshop virtual (21st May 2020)
6. 6th Workshop Virtual (12 Nov. 2020)
7. 7th Workshop Virtual (4th March 2021)

P2 Roadmap meetings:

1. 1st Workshop at Chitwan (23rd Nov, 2019)
2. 2nd Workshop at Janakpur (Feb 18-20, 2020)
3. 3rd Workshop Virtual (29th April, 2020)
4. 4th Workshop Virtual (4th May, 2020)
5. 5th Workshop Virtual (9th Nov 2020)
6. 6th Virtual Meeting with SSCOP on CHC (3rd Feb. 2021)

In relation to the implementation or roadmaps, a more practical approach of brokering between those within each location was taken, given that movement across provincial and even local government areas was restricted greatly at crucial times. This approach enabled more localised collaboration (e.g. between cooperatives that was not the primary objective of Roadmaps but provided some pathway to Roadmaps impact.

Summary of learnings:

This type of work is not suited to virtual, because it needs to be a discussion and collaboration. Time is also a consideration as virtual meetings take longer to enable

collaboration and provide all members the opportunity to discuss and contribute. Particularly in south Asian culture this can be difficult. This project was already ambitious enough without adding in the complexity of COVID-induced virtual meetings!

4.5   Activity 5 – Learn

[J] Undertake an end line assessment of policy, mapping and institutional capacity context to understand the impact of the project and suggestions for continued road-mapping

Proposal:

In closing of the project, an end line mapping assessment will be undertaken. This will be compared with the baseline mapping exercise undertaken in Activity E. This exercise will then review changes in linkages, as well as changes in policies and institutions that relate to CASI mechanisation. Noting the project's brevity and single year of road-mapping, efforts will also be made in planning for the next stages of roadmap implementation.

Delivery:

Given the time it took to establish this project with each province and then the onset of COVID-19, an end line assessment was neither possible nor overly useful. Only limited changes were able to be enacted (summarized in section 5 of this final report– Impacts).

To compensate for non-delivery of this component, additional efforts were undertaken in quantifying the nuanced status of agri-mechanisation on the Nepal Terai. This was a collaboration with the CSISA project (who work in the Western Terai) and SRFSI/Roadmaps who work in the eastern Terai of Nepal. This work, published in Agricultural Systems, provides the first nuanced estimate of the status of agri-mechanisation on the Nepal Terai and hence also provides the building blocks for future agri-mechanisation evaluations and initiatives.

Manuscript details (Attachment 16):

Brown, B., Prasad, G., Krupnik, K. (2021) Visualising adoption processes through a stepwise framework: A case study of mechanisation on the Nepal Terai (Agricultural Systems (In Press) https://doi.org/10.1016/j.agsy.2021.103200

Abstract

CONTEXT The desire for agricultural mechanisation is mainstreaming across the Global South, yet there are limited tools through which to monitor and estimate progress made in pursuit of this. Despite Nepal enacting an agricultural development agenda focused on mechanisation to address issues of productivity, labour scarcity, inclusive economic growth and sustainability, it remains one of the few places in South Asia that is yet to see substantial agricultural mechanisation rates. We use this scenario as a case study to propose and investigate adoption processes.

OBJECTIVE This research aims to provide a baseline to understand progress made towards Agri-mechanisation on the Nepal Terai. Despite decades of promotional efforts, there are only limited comprehensive analyses of the status of agricultural mechanisation in Nepal that cover diverse machinery and go beyond binary adoption estimates, nor a framework to understand different types of (non-)adopters.

METHODS The applied non-binary 'Stepwise Process of Mechanisation' framework provides a systematic process for investigation of the status of agricultural mechanisation on the Nepal Terai. This framework is applied to representative survey data from 14 districts across 1,569 households from Nepal's Plains (Terai) region.

RESULTS AND CONCLUSIONS Results suggest that decades of activity have not yet led to the substantial closure of exposure gaps, nor sufficient ownership of machines that enables accessible fee-for-hire service provision. Exposure gaps were substantial in all machines, meaning current demonstration programs may not be achieving their targeted outcomes. Across nearly all machinery, a primary reason for limited progression to sustained adoption was a lack of service providers, a manifestation of limited machinery ownership, meaning current broad subsidy programs aimed at procurement may not be achieving intended outcomes. However, substantial pools of potential adopters and concentration of supply-side constraints highlight that with targeted intervention, rapid rural mechanisation is possible in the near future on the Nepal Terai.

SIGNIFICANCE This research provides a foundation on which to understand the progress made towards small holder agricultural mechanisation. For the first time in South Asia, a systematic analysis through a novel stepwise framework has clarified and updated the status of agricultural mechanisation on the Nepal Terai. This work also lays the foundation for future work to explore the drivers, implications and inclusiveness of agri-mechanisation, utilising the identified typologies, both in Nepal and more broadly where increased nuance in understanding the status of agricultural mechanisation is warranted.

Learnings:

Nepal's Terai is not yet mechanized to any great extent, though there is the foundation build for rapid mechanisation. A 'Video Abstract' explaining these findings is available at: https://www.youtube.com/watch?v=XCSLE2OC478

[L] Develop a manual relating to successful roadmap development

Proposal:

The learnings of this action research will be synthesised into a short manual outlining protocols for successful roadmap development in South Asia. It is envisaged that this manual will be approximately 20 to 30 pages and include instructions on how to develop working groups, platforms and roadmaps, as well as requirements for ongoing sustainability. It will also be translated and published in local languages to ensure it is useful to local contexts in various provinces of Nepal.

Delivery:

Due to implications in delivery of the project due to COVID-19, there was not sufficient time or depth to ensure that reflections made on the road mapping process were accurate. This is because most of the road-mapping process was done virtually and many of the envisaged interactions and capacity development activities were not able to be nurtured and implemented. Hence, in place of this output we hope that this final report will suffice, alongside the road mapping manual discussed in activity D. We also will attempt to build these protocols into the new ACIAR food systems project (WAC/2020/148) and this will enable enough time to properly evaluate, learn and document the proposed process.

New changes were made as part of the update from Activity D to better structure the road mapping process with those who are not familiar with the press of participatory planning. A 'road mapping bridge' concept was developed, whereby actives should focus around four key interrelated pieces , as highlighted in Figure 4. The concept is that the bridge will not stay u (i.e. there is no pathway from current status to desired vision) if one piece is removed. In this way, there should be activities cooperatively planned around each piece for successful transition from current status to desired vision.

Figure 4: A road mapping 'Bridge used to formalise discussion on participatory roadmapping.

Due to COVID, we were not able to fully implement this process, though some limited attempts were made for specific seasons (example presented from out Province 1 virtual meeting on 20th May 2020 in Figure 5).

Figure 5: Example targeted roadmap developed virtually with Province 1 working group on 20th may for Kharif 2020.

[M] Produce a scientific report on participatory road mapping development, implementation and impact

Proposal:

As the final output of this research, all work will be synthesised into a scientific article focused on requirements necessary to increase CASI mechanisation in Nepal. It will provide a synthesis of the literature as per Activity A, and then explore the experience and learning

of the roadmap development process, concluding with a qualitative analysis with stakeholders on the pathways forward. The proposed journal is the Journal of Agricultural Education and Extension.

Delivery:

Unfortunately, due to COVID and even with the additional time provided, we were not able to deliver this output. The reasons for this are two-fold. Firstly, there was not an adequate time period to explore the road mapping implications and learnings, given that roadmaps were only truly active in moderated form for a few weeks before COVID-19 interrupted project momentum and subsequently limited working groups to virtual meetings. This still enabled some interaction but did not facilitate interaction to a level that would warrant scientific exploration. Secondly, evaluating in a meaningful qualitative way would not be possible in the current circumstances, given travel restrictions. It is hoped that the principles will be carried forward into the new ACIAR food systems project (WAC/2020/148), and this will enable a longer time period to evaluate and learn, and potentially publish, on this topic.

5 Impacts

As a development project removed from the normal research focus of ACIAR projects, COVID-19 was always going to have an impact on delivery. At the time of writing Nepal is still in the midst of a second wave of COVID, with restricted movements from Kathmandu to the provincial capitals. This catalysed a change in approach that moved this project more into the theoretical realm and away from the original development-oriented objectives. The other factor that was influential in reduced impacts was the time taken to establish new relationships, particularly for Province 2. For example, the project started in earnest in April 2019, while our first large event was the National mechanisation Fair in November 2019 and formal agreement with the government of Province 2 in January 2020. Of course, then COVI-19 hit in early 2020.

None the less, the section below summarises the impacts that have arisen from the Roadmaps project.

5.1 Academic

Academic outputs were not the focus of this development project. None the less, with the implications of COVID necessitating a change in direction for the project, three manuscripts were developed:

Published: Brown, B., Prasad, G., Krupnik, K. (2021) Visualising adoption processes through a stepwise framework: A case study of mechanisation on the Nepal Terai (Agricultural Systems - In Press) https://doi.org/10.1016/j.agsy.2021.103200

Revisions submitted: Karki, E; Sharma, A; Brown, B (2021) Farm Mechanization in Nepal: Policy Context, Drivers and Options. Journal of International development *(Submitted May 2021)*

Pre-Submission: Sharma, A; Timsina, P; Chaudhary, A; Karki, E; Brown, B (2021) Expanding Zero Tillage Service Provision: perspectives from machinery owners in the Eastern Gangetic Plains (Journal of Food Security)

While impact from these publications is not yet possible, it should be noted that all three are framed in terms of useable outputs from the research to inform the scaling of agri-mechanisation in Nepal. They have been purposively framed for non-academic audiences, and in each case a policy brief or other accessible content has been created to ensure that the learnings are as accessible as possible. This includes Video Abstracts:

Paper	Video Abstract
Brown et al., (2021)	https://youtu.be/XCSLE2OC478
Karki et al., (2021)	https://youtu.be/h_MO49QcZt8
Sharma et al., (2021)	https://youtu.be/txnFtip0FME

A policy note was developed from Karki et al (2021) as per attachment 2 and 3.

The methodology used in the Brown et al., (agricultural systems) paper has already been applied in further SRFSI, CSISA and CSISA MEA work, highlighting academic impact from the initial Roadmaps supported work.

5.2   Capacity development

Given COVID impacts, implementing capacity development activities was problematic, though the project was still able to conduct COVID-safe trainings in certain points between COVID waves. These are highlighted in Table 1.

Table 1: Summary of formal trainings conducted by the project. More training was undertaken in the four project consultancies, but not formally recorded.

Topic	Where	When	Trained
Agriculture Mechanization Exposure Visit- Province 1	Satish Satmile Club, Coochbehar, West Bengal, India	August 2019	10 (Six provincial government officials and five private sector partners)
Fourth National Agriculture Exhibition	Bharatpur Expo Centre, Nepal	November 2019	38 (Provincial government officials, private sector partners and farmers)
Repair & maintenance of Dasmesh seed drill	Morang, P-1	December 2019	10 (Facilitated by Nepal Krishi Company)
Small machinery training	Morang, P-1	December 2019	22 (Facilitated by Kuber & Son's)
Mechanical Rice Transplanter training with paddy seedling production	Dangihat, Morang, P-1	June 2020	17 (Facilitated by Nepal Krishi Company, five government officials and cooperatives technical person)
Operators Training on Laser Land Leveller, Seed drill & Happy Seeder	Agriculture Machinery Testing and Research Center (AMTRC), Nawalpur, Sarlahi, P-2	December 2020	19 (Eight Provincial government officials and eleven from cooperatives from P1, P-2 & P-3)
Discussion on Custom Hiring Center- P 2	Satish Satmile Club, Coochbehar, West Bengal, India (Virtual meeting)	February 2021	6 (Provincial government officials from P-2)
Total			122

Institutional training took an increased focus based on the COVID context. In this, four consultancies were actioned with the specific focus of building capacity of agri-mechanisation. These consultancies increased technical capacity in terms of machinery subsidy development, testing protocols and successful demonstration implementation. In most cases while salaries were paid by the project, operational and travel funds were provided by the partner with the explicit aim of co-ownership established through the road mapping process. This increased capacity is likely to have future impacts on Nepal's agri-mechanisations process, particularly within the NARC, AMTRC, MoLMAC of Province 1 and 2, partner co-operatives and agricultural knowledge centres who will all play key roles in this agri-mechanisation process.

A video summary of our capacity development efforts is available at https://youtu.be/i2Py6aZTYEU

5.3 Relationships and connectivity

The ultimate objective of Roadmaps was to build multi-level collaborations and a joint vision for sustainable agri-mechanisation in Provinces 1 and 2 of Nepal. The development of working groups that bring together cooperatives and lead farmers with local, provincial and federal government bodies alongside CIMMYT was successful in starting this process. We can see now that cooperatives who did not communicate with each other previously have formed lasting collaborations and are better connected to governmental bodies. The positioning of NARC in Province 2 has been improved and greater interaction is occurring particularly with MoLMAC of Province 2 since the establishment of Roadmaps. Essentially, people and organisations are now working together more. These relationships, now strengthened by Roadmaps, have the potential for enabling lasting impact for farmers across the two provinces.

6 Conclusions and recommendations

6.1 Conclusions

Roadmaps was an ambitious development project that aimed to bring together various stakeholders in the agri-mechanisation process to collaboratively agree on and make possible a vision for sustainable agricultural mechanisation. This process was made more complicated by the short timeframes coupled with new relationships to be brokered and COVID-19 implications.

Despite this, substantial capacity was developed in important organisations that will ultimately lead the agri-mechanisation process in Nepal, namely the NARC AMTRC, MoLMACs and their sub-organisations such as targeted Agricultural Knowledge Centres of each province, and key co-operatives working in agriculture.

Furthermore, the project enabled a stronger focus on Nepal's context, with three manuscripts developed that highlight next steps. Finally, the project was able to develop a process that is more widely applicable, and will hopefully form a part of the food systems diversification project to be funded by Nepal in the region.

This project was not a traditional research-focused investment from ACIAR, and was enabled through a broader development focus of the ACIAR-SDIP and with a need to bridge an identified void though the SRFSI project. Given the limited budget, short time frame and COVID context, the project was able to set the foundations for future agri-mechanisation in Nepal to occur more rapidly though new collaborations, processes and capacity.

6.2 Recommendations

[1] Development oriented initiatives such as 'Roadmaps' that focus on participatory collaborations are important to increasing research impact. However, they cannot be effective in the time periods such as were provided with the project (originally 18 months). Intensive effort is required in travel, relation building and synthesis of various objectives, activities and plans. If such projects are commissioned again, a realistic time frame should be provided.

[2] The road mapping process developed in this project should be further developed and applied in future projects, such as the Food Systems project, a to take advantage of the already built platform for effective implementation and to motivate the working group to maintain coordination and engagement. It was not possible to fully develop the working group, but it provides a basis for further improvement.

[3] Future agri-mechanisation efforts in Nepal need to focus on information systems. This is the largest constraint to sustainable agri-mechanisation in Nepal. Some of the findings from projects such as SRFSI and the Farmer Behavioural Economics project could be

integrated into an action research project that can help close information gaps and improve technological sensitisation efforts, without which Nepal has a slow transition to agri-mechanisation.

[4] If future project have a similar scope in participatory planning, the initiative is likely to be more impactful if areas of convergence with existing government programs are identified early and leveraged. This enables quicker integration, ownership and sustainability. If such programs do not exist, additional years will be required to enable such outcomes.

[5] Whilst SRFSI has comprehensively proven CASI as beneficial to farmers, the best pathways to inclusive mechanisation for smallholder farmers and the viability of various business models across the Eastern Gangetic Plain remains under-researched. There are various researchable questions on the most suitable business models that bring about the best outcomes for farmers that should form a focus of future initiatives in the region.

7 References

7.1 List of publications produced by project

1. Karki, E., Sharma, A., Brown, B (2021) Farm Mechanisation in Nepal: Policy Context, Drivers and Options. Journal of International Development (Under review – submitted May 2021)
2. Chaudhary, A., Shrestha, M., Sharma. R., Brown, B. (2021) Understanding Agricultural Institutional Structures in Province 1 and 2, Nepal. SRFSI Working paper. CIMMYT, Nepal
3. Sharma, A., Timsina, P., Chaudhary, A., Karki, E., Brown, B (2021) Expanding Zero Tillage Service Provision: perspectives from machinery owners in the Eastern Gangetic Plains (in development for submission to the Journal of Food Security)

8 Appendixes

Available at

or on request (b.brown@ccgiar.org)

- [9] Province 2 - Trip Reports
- [10] Province 1 - Trip Reports
- [15] Consultancy Deliverables
- [0] WAC 2018 220 Final report - Roadmaps (Revised)
- [1] Karki et al (Revisions Submitted) - Farm Mechanization in Nepal
- [2] Mechanisation Policy Brief - Nepali
- [3] Mechanisation Policy Brief   - English
- [4] Institutional Arrangement Analysis Report
- [5] Service Provider Decision Making Assessment - Report
- [6] Sharma Et al (Pre-submission) - Service Provision in the EGP
- [7] Road Mapping Manual Nepali (CIMMYT 2019)
- [8] Road Mapping Manual English (CIMMYT 2019)
- [11] Province 1 Working Group Commitment
- [12] Province 2 Declaration English and Nepali (original)
- [13] Province 2 Approval letter of MolMac-CIMMYT
- [14] Preliminary Province 1 Roadmap
- [16] Brown et al (2021) Mechanisation Status of the Nepal Terai (AGSY)
- [17] Province 1 Working Group members
- [18] Province 2 working group members