Evidences

Study #4042

Contributing Projects:

- P1815 - SRA Roadmaps - Building Provincial Capacity for Sustainable Agricultural Mechanisation in Nepal
- P823 - Cereal Systems Initiative for South Asia (CSISA) Mechanization and Irrigation
- P1389 - Mechanization of wheat based systems in Sub-Saharan Africa

Part I: Public communications

Type: OICR: Outcome Impact Case Report

Status: Completed

Year: 2020

Title: Cross-region/project learning from appropriate-scale mechanization projects: Rural labour dynamics, access and scaling approaches are key issues

Short outcome/impact statement:
MAIZE/WHEAT and partners developed, refined and sustained appropriate-scale mechanization solutions, linked to climate-smart practices (e.g. zero-till, rotation). R4D focused on mitigating labour shortages and building capacity for delivery and support systems. Research revealed a much higher demand for mechanization than previous studies had shown, indicating access is the problem, not demand or affordability. MAIZE/WHEAT projects in Africa, South Asia (on 2 million ha) and Latin America confirmed improved livelihoods and income (opportunity) effects. Constraints to scaling differ, but remain significant.

Outcome story for communications use:
Comparative analysis of appropriate-scale mechanization adaptive research and development interventions in several African and South Asian countries, as well as Mexico, shows that improved scaling approaches are needed, including policy change and enabling conditions. The Covid19 pandemic underscored the growing rural labour shortage challenge, which mechanization service providers could help to address.

In tropical and sub-tropical climates, delayed planting can result in high temperature plant stress, leading to significant yield losses. Delayed harvest can also have serious detrimental effects on yield--especially for cereal crops (e.g. mold infestations, wildlife predation). In addition, farmers increasingly struggle to meet the rising costs of hired labour at peak, time-sensitive moments in the production process; recently exacerbated by mobility restrictions due to SARS-COV2.

To stay competitive with large farmers, smallholder and medium-sized farmers in developing nations require efficient and user-friendly equipment that optimizes resource and energy use. But many lack the knowledge about available options and the means to acquire new tools. Poor infrastructure and supporting services inhibit the set-up, rollout and maintenance of sustainable mechanization delivery mechanisms. In eastern and southern Africa, MAIZE/WHEAT research revealed much higher farmer demand for mechanization than previously established by macroeconomic analyses, pointing to a problem of access. African farming households may be far more dependent on labor markets than commonly assumed, and more inclined to hire mechanization services. Similar findings apply to Egyptian farmers and raised-bed mechanization (2017).

A comprehensive response requires building farmer know-how and sustained efforts to minimize barriers to adoption. Farmer communities need to be enabled to promote and sustain local enterprises providing mechanization services. An integrative approach is needed: Identifying best-bet technological solutions in terms of cost-efficiency, incentives, infrastructure and policies to increase sustained uptake of these solutions. Ways to go about this include training programs for small businesses, fostering women and youth employment opportunities and continued participatory research on improved and adapted farming practices.

MAIZE/WHEAT and partner researchers produced publications about cross-regional learning experiences, performed in-depth research on improved farm management using climate-smart machinery and deepened our understanding of rural labour dynamics in relation to appropriate mechanization solutions. CIMMYT and core consortium partners (the governments of Mexico and Zimbabwe, and International Development Enterprises (iDE) in Bangladesh) actively brokered collaboration among different actors that support scaling. CIMMYT played a key role in linking governmental projects and NGOs aiming to strengthen local access and adoption of farm machinery.

Links to any communications materials relating to this outcome:

- https://mel.cgiar.org/reporting/download/hash/4AlnfGvI
- https://tinyurl.com/ygxyuv9t
- https://doi.org/10.1016/j.agsy.2020.102792
- https://www.cimmyt.org/news/farm-mechanization-under-covid-19/
- https://www.cimmyt.org/tag/mechanization/

Part II: CGIAR system level reporting

Link to Common Results Reporting Indicator of Policies : No

Stage of maturity of change reported: Stage 2

Links to the Strategic Results Framework:
Sub-IDOs:
- Reduced smallholders production risk
- Agricultural systems diversified and intensified in ways that protect soils and water

Is this OICR linked to some SRF 2022/2030 target?: Yes

SRF 2022/2030 targets:
- # of more farm households have adopted improved varieties, breeds or trees
- Increase in water and nutrient (inorganic, biological) use efficiency in agro-ecosystems, including through recycling and reuse

Comment: <Not Defined>

Geographic scope:
- Global
- Regional

Region(s):
- Central America
- Sub-Saharan Africa
- Southern Asia

Comments: <Not Defined>

Key Contributors:
Contributing CRPs/Platforms:
- Wheat - Wheat
- Maize - Maize

Contributing Flagships:
- FP4: Sustainable intensification of wheat-based farming systems

Contributing Regional programs: <Not Defined>
Contributing external partners:
- Government of Zimbabwe
- DAE - Department of Agriculture Extension (Bangladesh)
- SADER - Secretaria de Agricultura y Desarrollo Rural (México)
- ICAR - Indian Council of Agricultural Research

CGIAR innovation(s) or findings that have resulted in this outcome or impact:
appropriate/small-scale mechanization solutions, e.g. 2-wheel tractor, direct seeding, maize shelling, etc.

Innovations: <Not Defined>

Elaboration of Outcome/Impact Statement:
A 2020 paper with case studies from sub-Saharan Africa (11), South Asia, and Latin America" (1) summarizes appropriate-scale mechanization solution impacts. All projects monitored service providers, including use of machines, number of hectares under machinery practices and effects on agronomic performance to measure implementation progress, or assess the impact pathway trajectory of the interventions for farmers and service providers (5, 6, 7).

In southern Bangladesh, scientists monitored the increase in number of two-wheeled tractors with attachable seed and fertilizer drills (A and B), multi-crop reaper-harvesters (C and D) and axial flow irrigation pumps (E and F) used by mechanization service providers in 2013–14, compared to 2017–18 (4). Overall in Bangladesh, researchers monitored sales of machines to service providers without project involvement (e.g. by facilitated third-party private sector partners). The CSISA-MI project succeeded in leveraging close to US$6 million of private sector investment in appropriate machinery, with over 308,000 farmers purchasing machine services from just over 3,400 service providers (3, 12), supported by enabling policy (finance, subsidies).

In Mexico (2012-2020), the relevant projects produced these outputs: 53 prototypes developed with full construction plans for easy replication and commercialization, 27 operation manuals and 4,101 farmer field days with scale-appropriate machines. In terms of first user outcomes, mechanization services covered 17,590 ha, delivered by a network of 34 machine manufacturers, who had constructed and serviced climate-smart machinery.

The SRFSI – CASI projects (conservation agriculture based sustainable Intensification in the Eastern Gangetic Plains) in India and Nepal (2013-2020) reached 300,000 farmers with 110,000 ha. More specifically for India during 2020, ca. 11,000 Happy Seeder (HS) were in use in north-west India by that year, of which over 80% in Punjab (source: personal communication with machine manufacturers). 18 manufacturers currently produce the HS. (8, 9). 3,000 service providers were trained on zero tillage/happy seeders. 15,000 HS for direct drilling of wheat into rice residues covered 0.5 million ha. Service providers and some farmers deployed 10,000 multi-crop direct seeding planters (2020) to directly seed rice on 1 million hectare. With regard to economic benefits, zero-tillage (ZT) & mechanized direct seeding reduced crop establishment costs by 1539 INR ha−1 (45.9 %), compared to conventional practice, fully costed (e.g. machinery, labor for soil tillage and sowing- and direct seeding costs using a hired ZT drill (2).

7,000 Super Straw management systems for combine harvesters were employed on 0.4 million ha in 2020.

References cited:

1. https://doi.org/10.1016/j.agsy.2020.102792 2. https://doi.org/10.1007/s12571-015-0492-3 3. https://csisa.org/wp-content/uploads/sites/2/2019/07/190430-CSISA-MI-Semiannual-Progress-Report-Y6.pdf, see p.12 4. Jahan, M.A.H.S.; Sen, R.; Ishtiaque, S.; Choudhury, A.K.; Akhter, S.; Ahmed, F.; Biswas, J.C.; Manirruzaman, M.; Miah, M.M.; Rahman, M.M.; et al. Optimizing sowing window for wheat cultivation in Bangladesh using CERES-wheat crop simulation model. Agric. Ecosyst. Environ. 2018, 258, 23–29. https://doi.org/10.1016/j.agee.2018.02.008 5. Alakonya, A. E., Monda, E. O., and Ajanga, S. 2008a. Effect of delayed harvesting on maize ear rot in western Kenya. Am. Eurasian J. Agric. Environ. Sci. 4:372-380. http://ir-library.ku.ac.ke/handle/123456789/8642 6. Baudron, F., Misiko, M., Getnet, B. et al. A farm-level assessment of labor and mechanization in Eastern and Southern Africa. Agron. Sustain. Dev. 39, 17 (2019). https://doi.org/10.1007/s13593-019-0563-5 7. Diao, X., Agandin, J., Fang, P., Justice, S.E., Kufoalor, D., Takeshima, H., 2018. Agricultural Mechanization in Ghana. Insights from a Recent Field Study. IFPRI Discussion Paper 01729. In: International Food Policy Research Institute (IFPRI), Washington DC. Agricultural Mechanization in Ghana. Insights from a Recent Field Study. IFPRI Discussion Paper 01729.
https://www.ifpri.org/publication/agricultural-mechanization-ghana-insights-recent-field-study 8. Frontline – India's national Magazine. High costs hurt farmers in lockdown year.
https://frontline.thehindu.com/cover-story/poor-earnings-income-for-farmers-peasants-during-covid19-lockdown-2020-low-prices-high-costs-agricultural-output/article33314151.ece (January 01, 2021) 9. https://doi.org/10.1080/14735903.2020.1834277 10. Clarke, L.J., 2000. Strategies for agricultural mechanization development. The Roles of the Private Sector and the Government. CIGR E-Journal 2. http://www.fao.org/fileadmin/user_upload/ags/publications/agr_mech_strat.pdf 11. Sims, B., Kienzle, J., 2016. Making mechanization accessible to smallholder farmers in Sub-Saharan Africa. Environments 3. https://doi.org/10.3390/environments3020011. 12. Sims, B., Kahan, D.G., Mpagalile, J., Hilmi, M., Santos Valle, S., 2018. Hire services as a business enterprise. A Training Manual for Small-Scale Mechanization Service Providers. Food and Agricultural Organization of the United Nations & International Maize and Wheat Improvement Center. http://www.fao.org/3/I9207EN/i9207en.pdf

Quantification:

Type of quantification: a) Actual counts or estimates from a particular study (please provide reference)
Number: 500000.00
Unit: hectare
Comments: In 2020, Happy seeders for direct drilling of wheat into rice residues: # seeders - 15,000 deployed on 0.5 million hectares in Eatern IGP, India.
https://doi.org/10.1007/s12571-015-0492-3

Type of quantification: a) Actual counts or estimates from a particular study (please provide reference)
Number: 308000.00
Unit: farmers
Comments: 308,000 farmers purchased machine services from just over 3400 service providers in project year 6 (2018-19).
https://csisa.org/wp-content/uploads/sites/2/2019/07/190430-CSISA-MI-Semiannual-Progress-Report-Y6.pdf, see p.12

Gender, Youth, Capacity Development and Climate Change:
Gender relevance: 1 - Significant
Main achievements with specific **Gender** relevance: adaptation of technologies, access to technologies, gendered business models
Gender, Youth – Employment opportunities as service providers and drudgery relief for women during field operations
Capacity Development – Training manuals and curricula developed
Climate Change – Climate Smart technologies
https://doi.org/10.1016/j.techsoc.2020.101250
Youth relevance: 1 - Significant
Main achievements with specific **Youth** relevance: service provider business models targeted at youth
CapDev relevance: 1 - Significant
Main achievements with specific **CapDev** relevance: train-the-trainer approaches
Climate Change relevance: 1 - Significant
Describe main achievements with specific **Climate Change** relevance: indirect positive impact on ag-based GHG reductions (e.g. mechanized zero-tillage).

Other cross-cutting dimensions: Yes

Other cross-cutting dimensions description: Integrated agri-food systems
Scaling of CGIAR R4D

Outcome Impact Case Report link: Study #4042

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