



Sharing the load

Labour-saving technologies, gender dynamics and food security in Timor Leste

TOMAK (*To'os ba Moris Dj'ak*) is a 10-year agricultural livelihoods program funded by the Australian Government in Timor-Leste. Its goal is to ensure rural households live more prosperous and sustainable lives. Developing and promoting technological solutions to achieve productive, profitable and resilient agricultural livelihoods is core to the work of TOMAK. Mechanised labour-saving technologies are promoted to reduce the time and work burden of women and men farmers whilst improving their productivity, income and food security. This learning brief summarises key findings from recent research conducted by TOMAK into the impact of agricultural technologies on gender dynamics and food security. It highlights the gendered barriers and enablers behind women and men's technology adoption and provides strategies and actions that can be implemented to overcome them.

Context

Agriculture is the predominant economic activity in Timor-Leste, with more than 80% of households engaging in agricultural work. Farming is predominantly at subsistence level, with maize, roots and tubers, rice, and beans taking up the largest share of household production. The majority of households also produce some fruit and vegetables.¹

Women in Timor-Leste play an important role as cultivators, laborers and family workers, with 66% of employed women self-employed as farmers, compared to 62% of men.² Within smallholder households, cultivating crops is often done by women and men together although they have distinct roles in agricultural production – men tend to take the lead in land preparation, the application of fertiliser and pesticides, while women are primarily involved in crop establishment, weeding, harvesting and post-harvest activities (processing, storage and seed selection).³

Recent assessments of the gender agricultural productivity gap in Timor-Leste, found that on average women farmers are 15% less productive than men farmers.⁴ This gap is almost entirely explained by gender differences in factors of production, the most important of which are women's limited access to extension information and services, hired labour and agricultural technologies, and their limited participation in cash crop production and collectives such as farmer's groups.

¹ UN Women and World Bank East Asia and Pacific Gender Innovation Lab. (2018). *Women Farmers in Timor-Leste: Bridging the Productivity Gap*. Washington D.C.; World Bank Group.

² Government of Timor Leste. (2018) *Census Analytical Report on Agriculture*. Dili, General Directorate of Statistics.

³ Akter, S., Erskine, W., Viana Branco, L., Ferreira Agostinho, O., Imron, J. and Spycyckelle, L., (2016). *Gender in crop production in Timor-Leste*. ACIAR *TimorAg Conference Papers*.

⁴ UN Women and World Bank East Asia and Pacific Gender Innovation Lab. (2018). *Women Farmers in Timor-Leste: Bridging the Productivity Gap*. Washington D.C.; World Bank Group.

New and improved agricultural technologies can transform lives, particularly the lives of smallholder households that are highly dependent on agriculture. Technologies can support smallholders – particularly small-scale, resource poor women farmers – produce more, add value, manage risk and use less energy, time and resources. These production and quality improvements can in turn have a broader impact on the food and nutrition security, prosperity and resilience of their families and communities.

However, many barriers exist to achieving gender equity in access to and adoption of agricultural technologies - social and gender norms permeate agriculture and food systems, where they shape who does what, under what conditions, using what means, and to what ends. Women and men often exhibit different knowledge, skill sets, challenges, needs and preferences related to agricultural technology - in other words, agricultural technology and innovation are seldom, if ever, gender neutral.⁵ Despite this, women are rarely consulted during technology development, meaning that their voices, needs and preferences are not reflected in the design, dissemination, and evaluation of agricultural technologies.

TOMAK promotes agricultural technologies (primarily mechanised labour-saving technologies) through program-established farmer field schools as a mechanism to increase agricultural production, improve food security and reduce the physical burden of women and men farmers. Promoted technologies include rice mowers, mini-power tillers, power threshers, hand sprayers and manual and motorised peanut shellers. Farmers are shown how to use and maintain equipment in order to reduce labour and time, maximise production, improve quality and increase income. Once farmers trial the technology and see tangible results, they can decide to invest in the technology through a 50% cost-share arrangement with the program.

TOMAK recently undertook research to better understand the direct and indirect impacts of promoted technologies and the gendered barriers and enablers behind women and men's adoption; and to identify strategies and actions that can be implemented to overcome them. Recognising that inclusive and effective agricultural technologies need to integrate gender along the technology development cycle, the research conducted gender analysis across four technology development phases: design; dissemination; adoption; and continued use.⁶

Research was conducted in Baucau and Bobonaro municipalities and focussed on three promoted technologies: mini-power tiller; rice mower and manual and motorised peanut shellers. Research was mixed-method and included household surveys; focus group discussions (FGDs) and a series of in-depth key informant interviews (KIs).⁷

Design

Gender analysis for 'design' focuses on whether the needs of both women and men farmers are considered when labour-saving technology priorities are being set. TOMAK selected promising 'already-on-the-shelf' technologies based on technical performance and financial feasibility for farmers.

The research found the **physical strength and labour intensity required to operate technologies poses a constraint for women farmers.** For example, whilst fewer men are available for land preparation due to out-migration to urban areas, men continue to dominate the use of the mini-power tiller. Women perceive the mini-power tiller to require a lot of strength to operate, and therefore believe that men, who women perceive to be stronger, should operate the machine. Men held similar views that women are unable to do 'heavy work' and therefore cannot operate the mini-power tiller. Similar constraints were found for the rice-mower which women perceive as requiring strength to operate and potentially dangerous if not operated correctly.

LABOUR-SAVING TECHNOLOGIES

Labour-saving technologies are defined as 'practices or techniques, tools or equipment, know-how and skills applicable across agricultural value chains or food systems, that are used to enhance productivity, reduce production and processing costs, and save on resources or inputs such as labour and energy.'

Technologies may include improved varieties of different commodities (crops, livestock, poultry, aquatic species and agroforestry); management practices (agronomic, aquaculture and animal husbandry); mechanisation; organic and inorganic fertilisers, pesticides, animal drugs and vaccines; irrigation; post-harvest and processing practices and equipment; and digital technologies, including information and communication technologies.

⁵ Tarjem, Ida Arff; Ragasa, Catherine; Polar, Vivian; Sylla, Almamy; Teeken, Béla; Nchanji, Eileen; Mujawamariya, Gaudiose; Mudege, Netsayi; Marimo, Priscilla. 2021. Tools and methods on gendered design, deployment and evaluation of agricultural technologies. CGIAR GENDER Platform Working Paper #003. Nairobi, Kenya: CGIAR GENDER Platform

⁶ Meinzen-Dick, R., Quisumbing, A., Behrman, J., Biermayr-Jenzano, P., Wilde, V., Noordeloos, M., Ragasa, C. and Beintema, N. 2011. Engendering agricultural research, development, and extension. Washington, DC: International Food Policy Research Institute (IFPRI). <http://dx.doi.org/10.2499/9780896291904>

⁷ TOMAK adapted its Gender Technology Assessment methodology from the IGENAES 'Assessing how Agricultural Technologies can change Gender Dynamics and Food Security Outcomes' toolkit which describes an analytical process to understand gender-related and nutritional impacts of specific agricultural technologies on women and men.

Women reported that although the manual peanut sheller can be operated by women, it requires at least two people given the strength required for the hand crank. For the motorised peanut sheller, although it requires less physical strength to operate, it is mainly operated by men due to the requirement to lift sacks to a much higher height for the funnel inlet.

Labour availability was identified as a constraint for women in the adoption of labour-saving technologies – in municipalities such as Bobonaro and Baucau male out-migration to urban areas adds to the constraints already facing women farmers, and while they may receive help from male relatives or be able to hire male labour (for the rice mower and mini-power tiller), this is usually only after the men have taken care of their own plots.

'Women are not ready to use this rice-mower. We are afraid and we are not strong enough, when the machine is shaking, I feel like the machine will pull me forward and I am afraid of the sharp disks. I would rather wait for a machine that is lighter and easier for women to use.' (Female – rice-mower household)

'Women cannot use the machine, it is shaking and it needs force, they get tired easily. When they are tired, they may lose control and destroy the corn and the peanut plants – it's better for men to use it.' (Male – mini-power-tiller household)

'The manual machine can be used by women, usually we use it with our husband or with another woman – it requires force to turn and after an hour you need to change with someone. The motor machine does not need force, but the men need to lift the heavy sacks very high to pour in the hole.' (Female – peanut sheller household)

Dissemination

Gender analysis for 'dissemination' focusses on who is reached and by whom and how – including how extension services reach, benefit and empower women and men farmers differently. Whilst the most visible gender differences between women and men appear in the adoption and hands-on-use of technologies, the research found gaps in women and men farmer's ability to learn about and access information on labour-saving technologies.

TOMAK disseminated information on labour-saving technologies through on-farm demonstrations led by program-supported extension workers.⁸ The research found **women and men farmers perceive the program as an important source of information, reporting they 'first heard' of technologies through on-farm demonstrations or extension workers (W:100%; M:80%). Men were found to have access to a wider range of information sources compared to women**, also citing input suppliers (11%), relatives and neighbours (9%) as sources of information. Notably for women, the program was their only source of information.

Women overwhelmingly identified limited access to training and extension services as a constraint to building the knowledge and skills needed for adoption. This is despite TOMAK's intentional approach of ensuring the equal participation of women in training – monitoring data shows that TOMAK achieved a 34% participation rate in technology training for women. The research highlights a number of common challenges facing women in accessing the training required for technology adoption. **Women reported they lack access to the transport and funds required for participation in extension training** - they lack cash to pay for fares and men are more likely to own intermediate means of transportation such a motorbike, than women. Furthermore, rural transport services are often infrequent and expensive, and at times, harassment and safety are a concern for women traveling alone. Gendered division of labour in the home presents another challenge to participation, with women shouldering the bulk of household and childcare responsibilities in addition to their agricultural production responsibilities. **Such unpaid domestic tasks limit women's time, preventing them from participating in training and improving their agricultural skills and knowledge.**

Women farmers' limited access to extension services is compounded by a perception bias that 'women aren't farmers.' Women reported that extension workers prefer to work with household decision-makers, which in husband-wife households are almost always perceived to be the male. Women reported that only men within the household are invited to training on new technologies, and there is an assumption that if extension is given to one member of the family, the knowledge will pass to other members of the household. Given information may be tailored to men's priorities the information is not always beneficial to women.

'The young women want to be invited to the training – they maybe have the power to operate the machine and also, they are curious to learn these things – but they are not invited to the training and instead the young men use it. The young women just observe but do not learn.' (Female – mini-power tiller household)

⁸ These included Ministry of Agriculture and Fisheries (MAF) extension workers and community-based private service providers known as Community Development Agents (CDAs).

'We as women have difficulties attending training because we are alone in taking care of the household – we raise children, we raise chickens, we must manage the vegetable garden and prepare food – so if there is any training the men will go and the women will stay back and look after the house. They say women know more about what is happening in the house – that is women's work.' (Female - peanut sheller household)

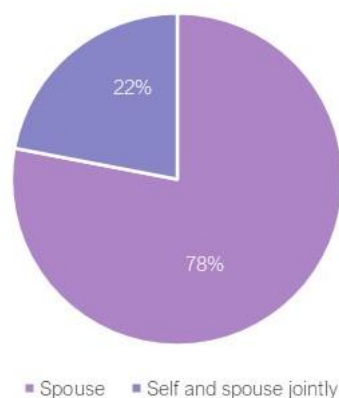
'Transport is difficult for us because we are living far away from the main road. We need to walk or pay for a lift on a motorbike – so we cannot attend training.' (Female – rice-mower household)

Adoption

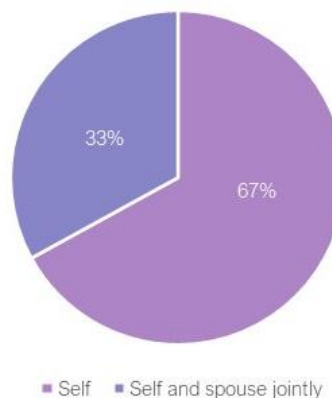
Gender analysis for 'adoption' focusses on the way in which previous technology development phases combined with gender norms and dynamics, affect who can and will adopt labour-saving technologies.

The research found men hold the decision-making power for both selection and purchase of labour-saving technologies. Across all three technologies, men were much more likely to state that they made selection and purchasing decisions alone (67%) compared to women (0%) who indicated that either their husband makes decisions alone (78%) or they make them jointly (22%). When asked why they did not have input into selection and purchasing decisions, women responded they did not have the knowledge or skills to make such decisions (100%). This highlights women's lack of confidence and capacity as a consequence of their limited access to information, training and extension services during dissemination and the constraint that subsequently places on equitable decision-making.

Women: decision-making power over technology purchase



Men: decision-making power over technology purchase



'Decision-making about technology is in men's hands – men are strong enough to use it, men know how to use it, men know how to fix it – even if he does not know he will ask a friend or call the supplier – women cannot do these things. We don't have confidence – so how would we know to make the right decision? If we make the wrong decision there will be trouble' (Female - mini-power tiller household)

The research also demonstrates how gender differences in earning capacity and contribution to household income can determine women and men's influence over selection and purchasing decisions. Continued labour division across gender-stereotyped roles, has led to lower earning potential for women, and limited bargaining power and control over household expenditure, particularly for larger purchases such as technologies.

'The husband and wife can decide together on small purchases – however to buy something big or expensive like farm equipment, then I make the decision because men work harder to earn that much money, women cannot earn that much money so they cannot make that decision' (Male – rice-mower household)

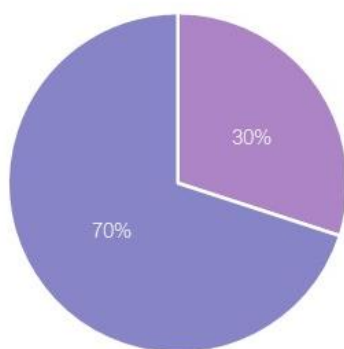
'My husband made the decision about buying it because he went to the training – so he knows how it works and he uses it – so it's his decision to make. He discusses it with me because I keep the money – but he is the one who decides to spend the money – I cannot disagree because I don't earn the money. How much you earn is how much you decide.' (Female - mini-power tiller household)

The research found the price of all three labour-saving technologies, even accounting for the program cost-share option, are beyond the financial capacity of women, making affordability a constraint to adoption. While women have access to credit through community-led savings groups, these are typically insufficient for large capital investments, and women are

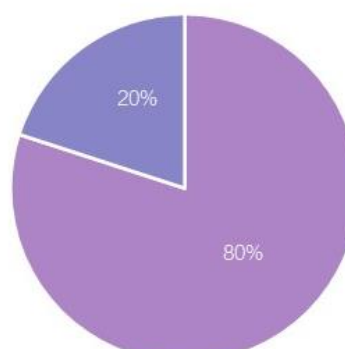
more likely to be risk-averse to borrowing larger sums given their lower income and asset-base.⁹ When households were asked if they had access to enough savings or credit to purchase additional equipment or to purchase a different technology, clear gender differences emerged, with 80% of men answering yes and 70% of women answering no.

Women: access to savings/credit to purchase technology

Men: access to savings/credit to purchase technology



■ Yes ■ No



■ Yes ■ No

'Men have easy access to money compared to women. Men can always find someone to borrow from or he can decide to go away and work somewhere to earn money in a job. It's not easy for women to do those things – women must stay home and are busy with their domestic work – there is no time to find work.' (Female – rice-mower household)

'I could borrow money from friends, but my husband would blame me and make me pay back on my own. I do not dare do this, because I can't earn enough money alone to pay back. It would create problems between me and my husband. Men – they are confident to pay back alone – they have experience and can find work to pay back the money.' (Female - mini-power tiller household)

The breakdown of labour-saving technologies, and an inability to repair them, increases the risk of women returning to traditional and burdensome means of performing agricultural activities. The research found **ongoing operation costs and limited knowledge and skills on maintenance/repairs is a constraint to women adopting technology**. When asked who makes decisions about operational costs such as fuel/repairs, women and men were more likely to make decisions jointly in peanut sheller households (100%), compared to mini-power tiller and rice mower households where men were much more likely to make decisions alone (60% and 66% respectively). When asked whether they felt confident in their knowledge and skills to repair and fix technologies, the majority of men felt they could (Yes: 83%; No: 17%) whilst women were much less likely to feel confident (No: 87%; Yes: 13%), with no differences across the technologies.

The research found **men perceive women as being less familiar and knowledgeable about mechanical systems, and therefore unable to repair a piston or engine (a common repair for the mini-power tiller) and that women do not have the physical strength required to do mechanical 'heavy work'**. Women held a different view, stating that although they are interested in mechanics and potential employment opportunities, they have not been invited to attend the training. Women also noted that they are unable to take responsibility for repairs because mechanics typically require farmers to pay for transport of broken machinery to their service centre in addition to paying for service and parts – **women's lower income and limited transportation affects direct access to mechanic services**.

'Women cannot repair the machine – they can bring coffee and food to the men who are working – that is women's work – they cannot do the heavy work like men can – men are faster to learn and go ahead.' (Male – peanut sheller household).

'We are not well informed about the maintenance of the machine – if the chains are broken, we don't know where to buy the replacement chain from, and if we do buy a chain, we don't know how to fix it anyway. We have no information on this but my husband is in Dili for work so what shall I do? I shall do by hand.' (Female – rice mower household).

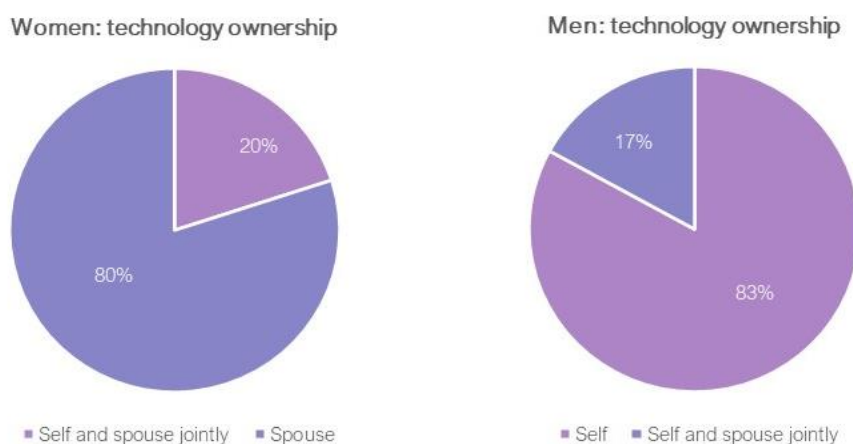
⁹ FAO and IFPRI. (2014) Gender-Specific Approaches, Rural Institutions and Technological Innovations. Rome, Italy.

Use

Gender analysis for 'use' focusses on how the costs and returns during continued use of labour-saving technologies are delineated along gender lines.

The research found men were overwhelmingly the primary user of labour-saving technologies, with the majority of both women and men stating men are the sole users of the technology (W:89% M: 92%).

Gender norms dictate that men are also the owners of larger household assets including labour-saving technologies. When asked who within the household had ownership of the technologies, both women and men agreed the male household head was the technology owner (W: 80%; M: 83%). Women identified asset ownership as a major constraint to the adoption and use of technologies, with extension services tending to target or prioritise the 'asset owner' meaning that women's training and information needs and preferences were not taken into consideration.



'Extension workers do not invite women to participate in the training because they say they need only men who can operate the machine – so my husband is the one who was invited because it belongs to him.' (Female – rice-mower household)

'It should be collective ownership of the tiller because it is our collective money for buying it – it should be family property because it is bought from our collective sweat - but Timorese men can do what they like – so he owns it and he makes decisions about it. I cannot say different.' (Female – mini-power tiller household)

All women and men agreed that the three labour-saving technologies had reduced time and labour associated with tasks such as shelling, paddy cutting/threshing and land preparation compared to traditional methods. Women and men also agreed technologies had made those same tasks less labour-intensive and easier to perform (W: 100%; M: 100%).

The research found shifts in the distribution of tasks between men and women as a result of adopting labour-saving technologies. For example, in both manual and motorised peanut sheller households, 100% of men reported that prior to the adoption of the sheller, their wives were solely responsible for hand shelling. Following adoption of the sheller, 75% of men reported they are now solely responsible for shelling or that they work together with their spouse. Women agreed that this shift has taken place, with 43% indicating men are solely responsible for shelling and 57% indicating they are now jointly responsible. Similar trends were found for mini-power tiller households and rice mower-households:

'Before women used to open the peanuts by hand – it was very slow – they could not finish one sack in one day - but now with the machine we (men) can finish one sack in one hour.' (Male – peanut sheller household)

'Before we used to use the hoe and women and men worked together – one hectare would take us two weeks and we would need to pay people to work with us. With the use of the tractor (mini-power tiller) it is much faster – we (men) can finish one hectare in two days.' (Male – mini-power tiller household)

'I see that there has been a change, before the women used to work in a big group cutting the paddy with the sickle most of the time, now after using the machine men are more involved in paddy cutting, women are now just responsible for the bundling and drying.' (Male – rice-mower household)

However, qualitative data reveals a much more complex picture for women in relation to labour distribution/reduction and time saved. For example, for the mini-power tiller, women reported that although land preparation is quicker compared to

preparation using a hoe, their workload has not decreased because households have simply expanded the area of land under production to meet market demand, and in some cases, their workload has actually increased:

'Using the tractor (power-tiller) is positive because family income has increased, but it has given more burden to women, because the husband decides to expand our production more. Before the tractor we only planted maize and some peanuts, but after the tractor we plant even more maize, even more peanuts and many different vegetables like tomatoes and peppers – these are for selling. Before the maize was just for eating. The work is faster but it is not less - women have more work planting, weeding, harvesting. But we must accept that because it brings income for a better family life.' (Female – mini-power tiller household).

Similar trends were observed for peanut-sheller, where households have rapidly expanded the area of land under production to meet market-demand:

'Since using the sheller the men are working more on shelling the peanuts, but in fact women's work is the same as before using the machine because the plantation is bigger, during the day we continue our work in the home like before (washing, cooking, taking care of children) and then at night we have to blow the powder from all the seeds that have been cleaned before shelling starts again the next day. The shop has placed the order so we have to work fast to respond.' (Female – peanut sheller household).

By contrast, women in rice mower households report the rice mower has saved them time and reduced their workload. While both women and men harvested rice together prior to the adoption of the rice mower, there is a perception that women, in particular, have been able to save time and reduce their labour – firstly there has been a shift in the responsibility and labour for cutting and threshing from women to men; and secondly because women no longer have to prepare food for hired labour, this has allowed them to shift time to other activities.

'Before the women were mostly cutting the paddy with the sickle, but now the men are using the machine and the women are not responsible. It's the same for threshing. Before using the machine for one hectare it would take us four days with 10-15 people cutting by sickle. Now with the machine we mix – so for one hectare we have 5 people cutting with sickle and also the machine – it takes one day' (Female – rice-mower household)

Agricultural technologies are physical assets which allow the individuals who own or use them to generate an income through increasing the yield/value of agricultural outputs available for consumption and for sale in the marketplace. The research found that **income had increased for households using labour-saving technologies as a result of increased agricultural production and sale**. All women and men reported that the amount of crop they had available for sale had increased since using labour-saving technologies (W: 100%; M: 100%). When asked whether household income had changed since using the labour-saving technologies, women and men agreed their income had increased (W: 89%; M: 100%). For the women that believed their income had not increased, all were from rice mower households.

The research also found that **men's higher rate of access, ownership and knowledge of how to operate labour-saving technologies provides greater opportunities for men to earn an income from technologies than women**. The assessment found men who own mini-power tillers and rice mowers are currently earning an income by renting them directly to other men farmers, and men with knowledge of how to operate the tiller and rice-mower are being hired (primarily by women) to operate them:

'I will rent the machine to other farmers for \$20/day – this includes gasoline – so I earn about \$10 because I also need to take care of the machine and some people use the gears carelessly.' (Male – mini-power tiller household)

This has implications for the size of women and men's income streams and the influence and control they have over agricultural income and household expenditure. **When asked who was responsible for decisions on how to spend income from the sale of crops, men were much more likely to indicate they were the primary decision-maker in rice mower households (100%) and mini power-tiller households (60%) compared to peanut sheller households where the majority of men made decisions jointly with their spouse (75%)**. Women confirmed men were the primary decision-maker in rice mower households (100%) and mini-power tiller households (80%) compared to peanut sheller households where the majority of women made decisions jointly with their spouse (75%).

Qualitative data describes a complex pattern of household financial management strategies for women and men. **While household income has increased as a result of adopting labour-saving technologies, shifts in gender and power dynamics relating to decision-making on household expenditure have been minimal**, and women do not control the benefits that accrue from the use of such technologies. Women reported that even though women 'store' or 'keep' the family's money, women and men are often responsible for different types of household expenditure, and gender norms dictate a much narrower set of decisions that women can make independently compared to men.

'The wife keeps the money only – she does not know where the husband spends it – on cock fighting or on alcohol and cigarettes. We are busy looking after the house, we have not control over what he uses the money for. If we do not give him money to buy alcohol or cigarettes, then there are going to be problems later on.' (Female – peanut sheller household).

'I keep the money and when he needs some, he will ask me for it. If I want to spend on something I need to ask him. If he agrees I will buy, if he shakes his head I will not buy. He is the head of the family.' (Female – rice-mower household)

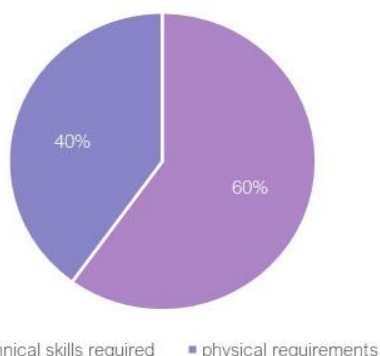
The research found **food availability and access has indirectly improved for peanut sheller and rice-mower households through increased household income and directly improved for mini-power tiller households through increased productivity.** When asked whether the amount of food available for household consumption had increased since using the labour-saving technologies, women and men in user households agreed the amount of food had increased (M:100%; W:89%). Of those that felt it had not increased, all were women from rice-mower households. When asked whether the household was consuming more diverse and nutritious foods since using the labour-saving technologies, 100% of women and men agreed that this was the case and the majority indicated these foods came from their own production rather than being purchased.

'Yes, it has changed a lot – we are growing many different vegetables and although the market is far from here, when we sell our vegetables then my husband or sons will go on the motorbike and buy meat and fish because it is good for the family health' (Female – mini-power tiller household)

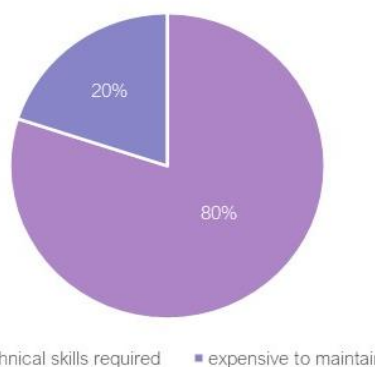
Men and women are similar in what they perceive to be the advantages of labour-saving technologies with time saved, improved yields and increased income consistently recognised as the main advantages (with no significant differences across technologies). However, men were more likely to identify a greater range of benefits than women (including saves money, easy to use and reduces hired labour) which is likely to be a reflection of the fact they are the primary users of technology.

However, **men and women differ in what they perceive to be the disadvantages of the technology** – across all three technologies **women reported that the technical skills required for operation and physical requirements for use as disadvantages.** Although 85% of men see technical skills required for operation as a disadvantage, qualitative data reveals that this is actually in relation to the maintenance and repair of technologies for which they have not yet received training. **Men are more likely to see affordability and ongoing cost of maintenance as disadvantages, reflecting their ongoing engagement and use of the technologies.**

Women: disadvantages of labour-saving technologies



Men: disadvantages of labour-saving technologies



Encouragingly, even taking the above into consideration, **when asked whether they would recommend promoted technologies to other families, 100% of women and men responded yes, they would.**

Recommendations

Research recommendations aim to contribute to ensuring the scale up of technologies which reflect women farmers preferences and needs and that extend the benefits of adoption in strengthened food security, increased agricultural productivity and income and reduced time and labour burden for women farmers.

Use

Design for her...gender-specific criteria for technology selection: for women's specific needs and constraints to be addressed in technology development women need to be engaged in the design/selection process. TOMAK2 will introduce

agricultural technologies which extend well beyond labour-saving mechanisation including: improved seed varieties, agricultural production techniques, post-harvest management practices, as well as fertilisers and pesticides. Recognising the limited opportunities for programming to influence the design of such technologies, the program should set gender-specific criteria to guide the selection and introduction of agricultural technologies. For example, in the case of mechanised labour-saving technologies, selection could include an assessment of gender-specific perceptions on ease of use (weight, manoeuvrability, operational complexity including skill requirements) and explore possible adaptations where required.

Dissemination

The gender-sensitive extension agent: time and mobility constraints combined with low levels of education and exposure to technology constrain women's access to the information and know-how needed to adopt technologies. Additionally, extension services target household decision-makers and/or asset owners, which in dual-headed households are nearly always assumed to be the man, leading to a lower provision of services to women. Future extension agent delivery models should emphasise: field demonstrations and hands-on-sessions; picture-based extension through innovative (and cost-effective) methods such as 3G based extension platforms that can support rich content tailored for women (videos; audio messages, text messages and potentially virtual support); and where possible, field training and extension should be delivered by women extension agents at times and locations suitable for women farmers.

She who learns, teaches – leverage women farmers within 'champion' farming families: the research found time and mobility constraints will continue to limit women farmers accessing information and public extension services in the short-to-medium term. Women farmers are therefore likely to rely on informal social networks more than men to access information about agricultural technologies. TOMAK2 will combine family-centred extension approaches with farmer field schools to develop and sustain capacities and maximise the impact of technical assistance. 'Champion farming families' will be recruited to establish demonstration areas where both male and female family members can jointly showcase technical knowledge and skills as well as gender-equitable behaviours. Future delivery models should ensure women champion farmers have equal opportunity to develop technical know-how in technologies and to encourage adoption through peer effects.

Adoption

Savings groups are only a first step...improved access to subsidies and income-generation opportunities for women: women farmers lack access to the savings and credit required to invest in agricultural technologies. TOMAK2 will meet the need for improved access to financial products for women farmers through savings groups which allow for small transactions proportionate to the ability of women farmers to save, borrow and repay. Nevertheless, what makes savings groups a suitable and desirable service for women farmers, is also what makes them typically insufficient for the larger capital investments needed for technology adoption. Women farmers need long-term and larger amounts of credit to build assets and invest in technologies *combined* with access to small-business skills, knowledge and opportunities, and time for entrepreneurial activities that can enable them to service such credit. TOMAK2 will need to adopt a holistic approach and use a package of combined and complementary interventions including access to credit; cost-share or subsidies that are tailored to women farmers' situations; and increased income-generation opportunities for women.

Take it to the farmer...private sector partnerships to increase women's technology adoption: TOMAK2 has an opportunity to leverage existing partnerships with agricultural input suppliers and build their capacity to better service the needs of their diverse client base, by including women in their business and distribution models. Women are customers in their own right, and although they are more limited in mobility and their purchases are smaller in scale, they are more loyal customers (based on convenience) and rely more on the supplier for advice on brand selection and application. Capacity strengthening activities may include making input suppliers' distribution and marketing practices more gender-sensitive, such as improving supplier distribution practices to more effectively reach women directly on their farms through either gender-sensitive agro-agent networks or the adoption of other effective last mile distribution practices such as mobile input shops.

Use

Tackle gender norms on...and off the farm: women farmers are less likely to have access and ownership of technologies, and despite their considerable labour both on and off the farm, have limited influence and control over decisions relating to agricultural production and income. TOMAK2 will implement gender-transformative interventions that generate behaviour change and promote household dialogue in the areas of labour, income management and asset ownership. These interventions have shown promising results in achieving more joint decision-making and sharing of productive and domestic tasks but they need to be sustained over time. The 'champion farming family' model provides an opportunity to embed gender-equitable behaviours and practices at the household *and* community-levels, and behaviour change methodologies should be given equal priority and weighting to the technical agricultural assistance that will be delivered.