

Pathways to sustainable intensification in Eastern and Southern Africa

Looking Forward, Achieving Impact



Interim Terminal Report for the
Adoption Pathways Project

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Preamble

Nearly a decade and a half into the 21st century, hunger and malnutrition are still harsh realities for more than one billion people around the world. In addition to this, the challenge of feeding a growing world population that is projected to reach 9 billion by 2050 has to be met despite a declining resource base and in particular dwindling supplies of water and land. Achieving this challenge while protecting the natural ecosystem that supports agriculture and other human needs will involve finding smarter ways to produce more with less. To do this in ways that create opportunities for those on land, earning only a meagre income, is no easy task.

Why this Adoption Pathways Project?

It is clear that knowledge gaps about how ecosystems interact with managed agriculture led to farming becoming unsustainable across the world. To avoid that happening in the emerging farming systems of Africa, we need to improve our knowledge base on the economic, social, and environmental necessities for the sustainable growth of our farming systems. This involves a two-part effort:

- First, a strong pillar of research in agricultural sciences (involving many disciplines) to support an intense effort to produce critical knowledge.
- Second, sharing the knowledge that helps understand the puzzles of farming with farmers and testing on their fields to see what works better, and why.

The pathways to sustainable agricultural intensification (SI) may involve two segments. The first pathway will lead farmers to adopt new knowledge and tools to help them cope better with what they do now and help them find what they could do better later. This would only be an intermediate outcome. The second, the lasting adoption-to-impact pathways would lead farmers to long-term adoption/adaptation; paving ways to increased production, profitability and improved livelihoods.

This second segment involves identifying and understanding important drivers or critical enablers of technology adoption: ways to reduce risks and improve profits from farming. Addressing issues of knowledge transfer through better extension, improving credit markets, and identifying infrastructure needs and/or policy directions to make those support services possible would take time and resources. And, it would involve asking pertinent questions.

PERTINENT QUESTIONS



What are the drivers/impediments of adoption of multiple sustainable agricultural intensification (SI) practices under different social, institutional, agro-ecology and market conditions?



Does adoption of SI practices including new varieties lead to positive impact for productivity, incomes, food security and nutrition



Does adoption of SI practices serve as coping strategies to climate-induced production risks?



Can SI, including new varieties and production methods, help men and women on farm equally?



Do existing agricultural policies (e.g. subsidy) trigger adoption of SI practices and improve households' welfare?



What would be better ways to package the evidence and provide support services?

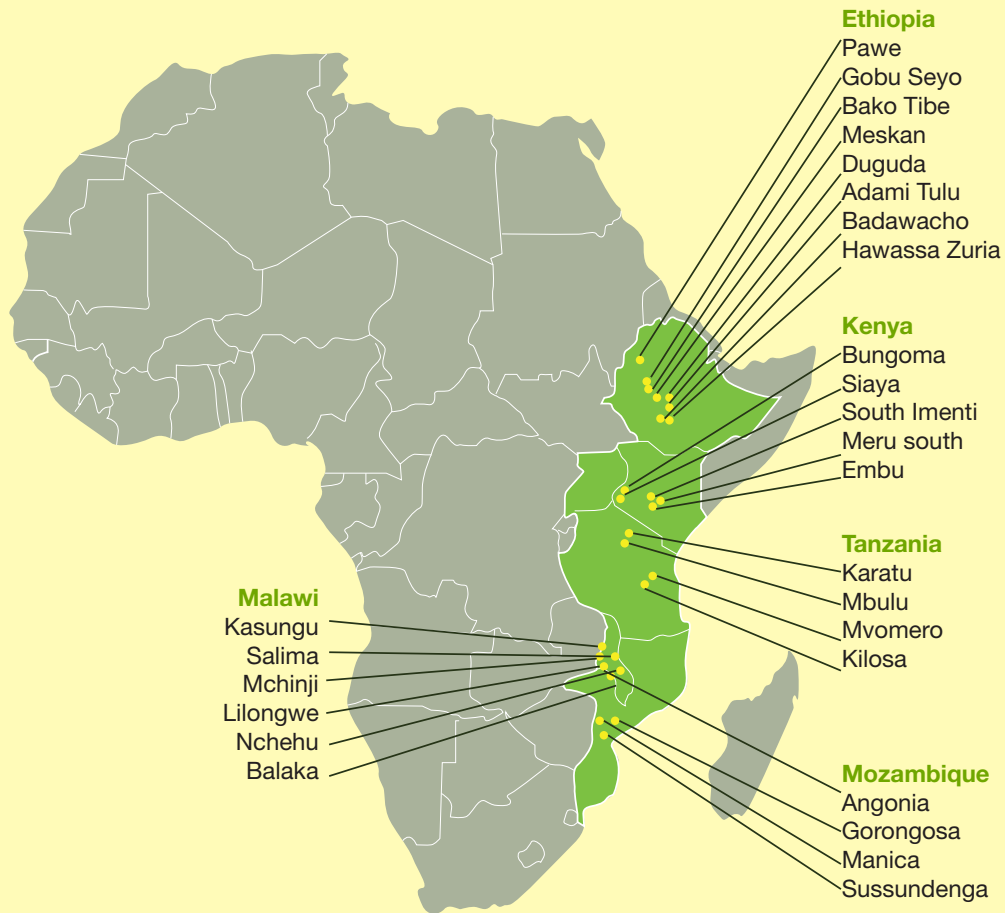


And, how would this new knowledge help develop new policy directions?

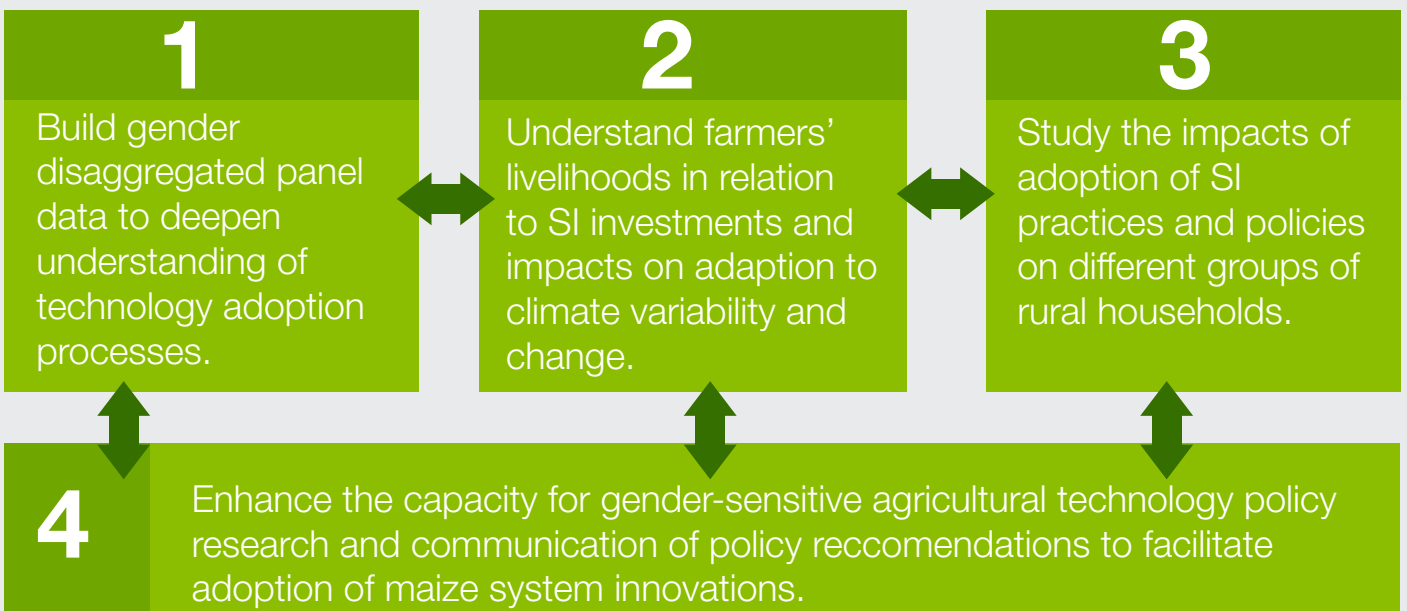
The Adoption Pathways Project was conceived to contribute to the answers to the above questions. It is part of a portfolio of projects that contribute to the broader theme of sustainable intensification research led by the International Maize and Wheat Improvement Center (CIMMYT) and made possible by the contribution

of a dedicated team from national and international research groups brought together by the Australian Centre for International Agricultural Research (ACIAR). The project is undertaken in the five ESA countries of Ethiopia, Kenya, Malawi, Mozambique and Tanzania

Study sites for the Adoption Pathways Project in Eastern and Southern Africa



Specific Objectives of the Adoption Pathways Project



THE JOURNEY SO FAR: key milestones since project inception

• A first round of data collection covering **2,338 men** and **2,504 women** farmers in 2013.

• MoU between **CIMMYT** and **Egerton University** in Nov 2014.

• Collaboration with the **Development Fund of Norway (DFN)** started in 2014.

• Capacity development of partners in large survey **data collection, coordination** and **analytical methods**.



Trained **more than 120** enumerators, field supervisors and data entry clerks

• Supported **graduate-level** training by way of providing **access to data sets** and **technical support** to graduate students.

• As of December 2015, produced 15 peer reviewed papers, 33 discussion **papers** and 8 policy **briefs**.

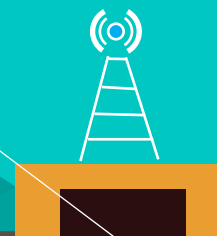


• **Various media** including Kenya Broadcasting Corporation, Kenya Woman, Scidev.net, and the Kenyan newspaper *Daily Nation* carried reports on the project and its outputs (see List of media reports at the end of this report).

• To strengthen the field capacity of national partners, the project purchased **5 field vehicles**.



• Presentations based on the **research conducted under APP** were made to various audiences.



• Second round of data collection initiated in second half of 2015. Three-wave panel datasets (2010/11, 2013, 2015/16) from all 5 countries is being assembled, cleaned and collated and will be available to all partners starting June 2016.

What did **the project do to deliver** on the **objectives?** A summary.

The Adoption Pathways Project has since its inception generated substantial outputs that can enrich existing agricultural information and change old agricultural information/data, build new knowledge and enable policy makers, donors and programs to enact research based decisions that facilitate technology adoption and improves livelihoods of smallholder farmers including women. A summary of these outputs include:





How can findings from **Adoption Pathways research inform policies?**

The lessons emerging from the completed research activities can be summarized as follows.

LESSON 1:

Win-win outcomes are possible with adoption of sustainable agricultural practices (SIPs).

The project research outputs, based on cross-sectional data, provide evidence of win-win-win outcomes (in terms of crop income, food and nutrition security, environment and risk) if implemented as composites of practices. However, for farmers to successfully progress towards a more complete adoption of multiple combinations of practices; a number of information and resource constraints have to be overcome. Our research shows a large role for information, extension and adaptive research to improve farm management and produce evidence on where and when such benefits would occur. This is because the adoption of multiple practices combined in specific patterns and in a judicious manner is necessarily a knowledge intensive process.

LESSON 2:

With limited market access and few opportunities for specialization, food security and nutrition depends on autonomous production and crop diversification at the household level.

The empirical studies associating food security with intensity of adoption (acreage) of improved varieties suggests that own farm production; offer one of the most important opportunities among other alternative routes to food security in rural areas. A recently completed paper shows significant effect of adoption of maize-legume diversification and modern seeds on child stunting, per capita consumption of calorie, protein, and iron and diet diversity, These effects were especially manifest when modern seeds and maize-legume diversification occurred simultaneously. These results confirm the need to strengthen smallholder diversification in the face of limited access to diverse diets through local food markets.

LESSON 3:

The role of social capital is important for the adoption of SIPs.

A variety of social capital indicators were found to be important for the adoption of SIPs. These included factors such as membership to various economic interest and social groups, availability of friends or relatives who could provide support in times of need, and acquaintances in positions of importance, power or influence. The message from this is that opportunities to build the social capital of farming communities, and formalizing and supporting farmers' groups is an important to create networks of information exchange, market access and resource mobilization.

LESSON 4:

Investments in public goods needed for sustainable intensification.

The influence of public goods on adoption was found in the strong positive association between extension contacts, and farmers' perceptions of these services on probability of adoption of various SIPs. Where farmers had favorable views of extension workers, there was also a greater chance that these farmers would adopt various improved practices. Moreover, the extension staff to farmer ratio was also a strong predictor of adoption of SIPs. Strengthening agricultural extension services and expanding the space of agricultural advisory services to include multiple players should be a policy priority.

LESSON 5:

Strengthening and protecting the assets of the poor should be central to successful adoption of SIPs.

Private asset endowments (such as land, equipment, livestock) were consistently associated with higher probability of adoption of SIPs. Thus suggesting that those without these assets are less able to access liquidity (or credit markets) to finance adoption of SIPs while those with these assets are probably able to liquidate some of it to generate the finances for input purchases and other farm investments. Moreover ownership of farm equipment enables for timely operations and circumvents labor bottlenecks thereby making it possible for farmers to implement improved production practices more effectively. The policy message being that building up systems for financial inclusion is important, and strengthening and protecting the assets of the poor should be central to agricultural development policies.

LESSON 6:

Gender equity in technology adoption and outcomes is still elusive. This is manifest both between households or between individuals within households.

Gender gaps that disadvantage women in technology adoption, food security and market access were observed both between and within households. The need to devise positive interventions to facilitate equal access to resources and rectify social impediments to gender equality was confirmed. Especially paying attention to individual differences within households, cognizant that a household is an institution composed of unique individuals with complex social and economic interrelationships.

How will Adoption Pathways project achieve **impacts and leave a legacy?**

The achievements in the adoption pathways project are but milestones in the long journey towards impact. Much remains to be done for the project to meet its aim “generating knowledge on constraints to, and incentives for, faster technology adoption” and for the project to have impacts on the livelihood of rural African in East

and Southern Africa and beyond. The research ideas summarized in this brief are based on lessons learned from the four years of the project. To make these results achieve impact, the following aspects will need to be sustained in the coming years.



Sustaining long term panel data generation and analysis.

An important activity for ensuring the sustainability of the Adoption Pathways project and to fill outstanding knowledge gaps on adoption and impact pathways analysis will require the development of long term panel data sets. A collaborative effort in panel data construction to supplement and sustain what has been achieved in this project is proposed. These collaborations are likely to involve Universities, think tanks and international institutions (both CGIAR and non-CIGAR) supported by regional counterparts such as Regional Networks of Agricultural Policy Research Institutes (ReNAPRI), Centre for Coordination of Agricultural Research and Development for Southern Africa (CARDESSA) and Association for Strengthening Agricultural Research in East and Central Africa (ASARECA) among others. A formalized framework for collecting, curating and disseminating these data is one of the things that can help achieve long term impacts from the Adoption Pathways project.



Scaling up project research outputs and policy dialogue.

To encourage scaling up of the promising suites of SIPs identified in this project, stakeholders need access to information about successes in adoption of SIPs that can inspire them to act. Despite comprehensive data and reasonable research results having been generated so far in this project, much work will remain to be done to take research products (including new data to replace outdated data) to policy makers, farmers, researchers, input suppliers, development partners, and other along the R4D continuum. In the project countries, there are significant gaps in the technical skills and staff time to advance high quality research and to undertake policy outreach. This has implications on sustainability of the results of a project like this one. New partnerships are essential for scaling up research results and undertaking policy dialogue to achieve lasting and meaningful changes at scale. To sustain the work of adoption pathways project, close collaboration between various institutions such national and regional think-tanks policy and research institutes is crucial to undertake policy dialogue and national policy consultations.

Using the results from this project to participate in scientific and policy forums should be an important avenue for integrating micro-data to policy making process and contributing to policy dialogue and formulation in the region.



Seeking answers to outstanding questions on the dynamics of technology adoption and impact analysis.

The micro-econometric adoption and impact analysis of SIPs carried out so far in the project relied on cross-sectional data. With cross-sectional data; important policy and dynamics questions such as household adoption and welfare mobility pattern overtime cannot be answered. Analyses using longitudinal data will help in answering the questions as to who is persistently adopting and disadopting, who is getting ahead, who is falling behind and who is staying where they and so forth. Future research of Adoption Pathways should concentrate on understanding dynamics of adoption and uptake pathways and welfare dynamics including exploring the economies of scope and risk management benefits of dynamics adoption of SIPs. The study of the dynamics of adoption and the resulting impacts requires several waves of data collected at reasonable time intervals to get more variation on the myriad biophysical and socio-economic variables underpinning adoption and impacts of SIPs.



Prioritizing women empowerment as a critical pillar in sustainable agricultural intensification.

In recent decades there has been an encouraging emphasis on the role of women in technology adoption, agricultural productivity and food security. However, the literature is limited on how, why and where the role of gender within a household (male headed households) matter for food security, technology adoption and agricultural productivity. The Adoption Pathways project is in a good position to answer these questions because it has developed unique gender disaggregated data sets. Nevertheless, questions remain on how women in multi-adult households can contribute to technology adoption, agricultural productivity and food and nutrition security. Some of these questions are about intra-household dynamics and how these affect women's participation in agriculture. For example: what are the pathways through which empowering women within a household can participate in accelerated technology adoption?: Is it through improving women's access to technologies on plots and crops that they already manage?

- Or should women be involved in joint management in traditionally male managed crops and plots? Is household technology adoption and productivity best served through greater involvement of women in traditionally "men's crops" e.g. cash crops?
- Is household technology adoption and productivity best served through improvements in access to resources and technologies targeted at "women's crops" e.g. vegetables and small livestock?
- Does joint management of "women and men's" plots and crops lead to better technology adoption and productivity outcomes?
- Are women empowered when resources are jointly or individually owned and/or managed?



Capacity development.

During the third annual meeting of the project one, of the key issues raised and discussed was capacity development of partners. The first phase of the project witnessed that partners, particularly national partners, have limited technical capacity and staff to advance high quality research using the state of the art methods. The key guiding principle of capacity building beyond the Adoption Pathways project will be primarily that of ensuring sustainability of the work already achieved and started. Most particularly will be the need to build on capacity for continuous panel data collection, curation and dissemination. These efforts should focus on:

- Retooling existing and long-serving staff on extant and new methodologies
- Support training of young scientists as part of preparing young scientists for future leadership in NARs and universities in their countries.
- Promote and increase the utilization of the Adoption Pathways data by graduate students, scientists, policy makers.

The **enablers and impacts** of sustainable agricultural intensification practices: a summary of some **research results**

1

Portfolio selection: technology combinations lead to highest economic and environmental impacts

To achieve sustained high productivity food systems, improved and resilient varieties, application of adequate amounts of fertilizer and high standards of agronomic practices are required. A research paper based on data from Ethiopia and Malawi showed that adopting a suite of SIPs (minimum tillage, legume intercropping and rotations) together with complementary inputs such as improved seeds can raise the net maize income in Ethiopia by 47 to 67 percent and 117 to 171 percent in Malawi and reduce (or at least not increase) fertilizer and chemical pesticides application without necessarily reducing farmers' net crop income.

For more information contact: Menale Kassie at mkassie@icipe.org.

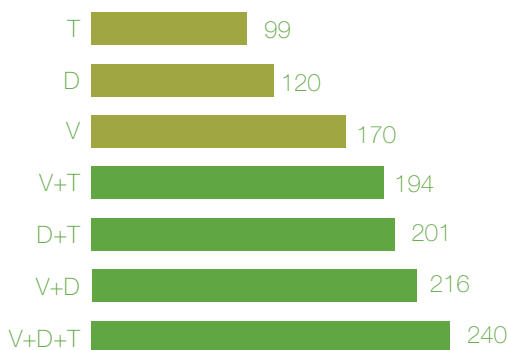
IMPROVED SEEDS ADOPTED IN COMBINATION WITH OTHER SI PRACTICES CAN RAISE THE NET MAIZE INCOME BY:



117% - 171%
in Malawi

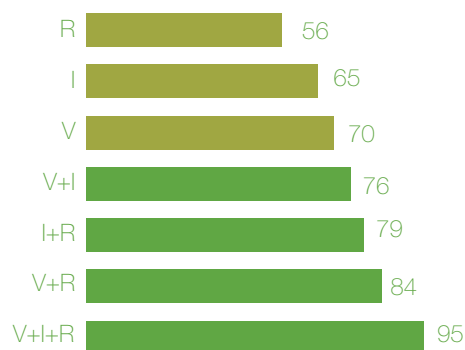
47% - 67%
in Ethiopia

Impact of SI practices adoption on net maize income in Ethiopia (\$/ha)



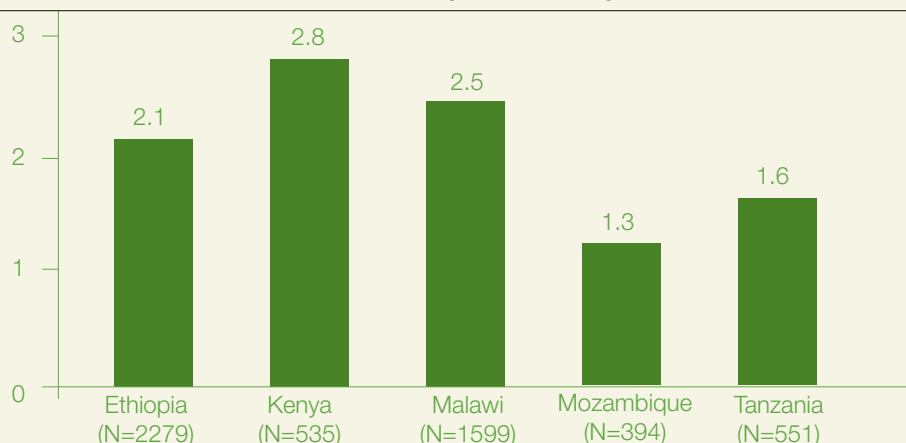
Note: V-improved maize varieties; D-crop diversification (legume-maize intercropping & rotation), T-minimum tillage (zero/one pass)

Impact of SI practices adoption on net maize income in Malawi (\$/ha)

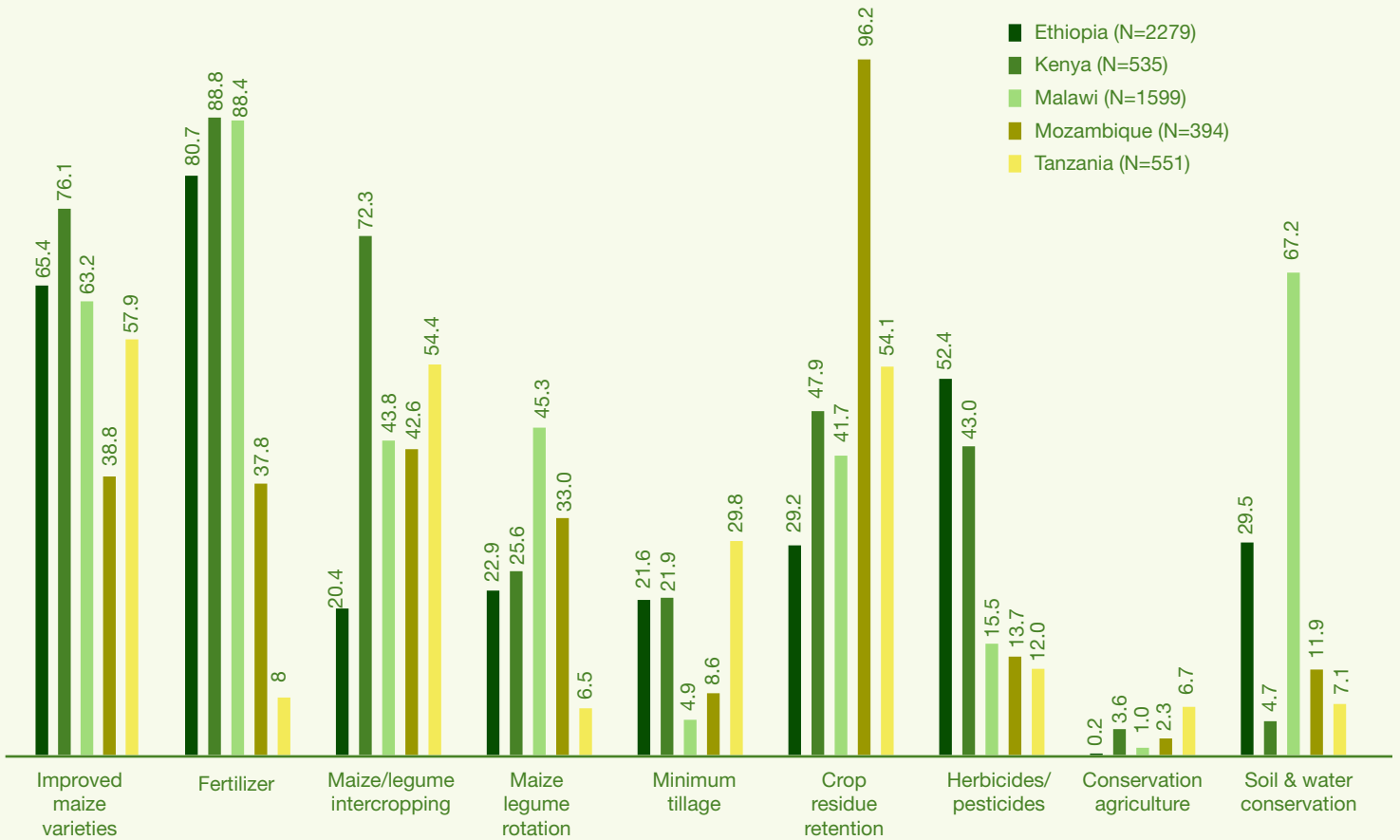


Note: V-Improved maize varieties; I-legume maize intercropping; and R-legume-maize rotation

Number of different sustainable intensification practices adopted at the farm: 2013 Adoption Pathways Survey



Adoption of sustainable intensification practices(% of farmers): 2013 Adoption Pathways Survey



2

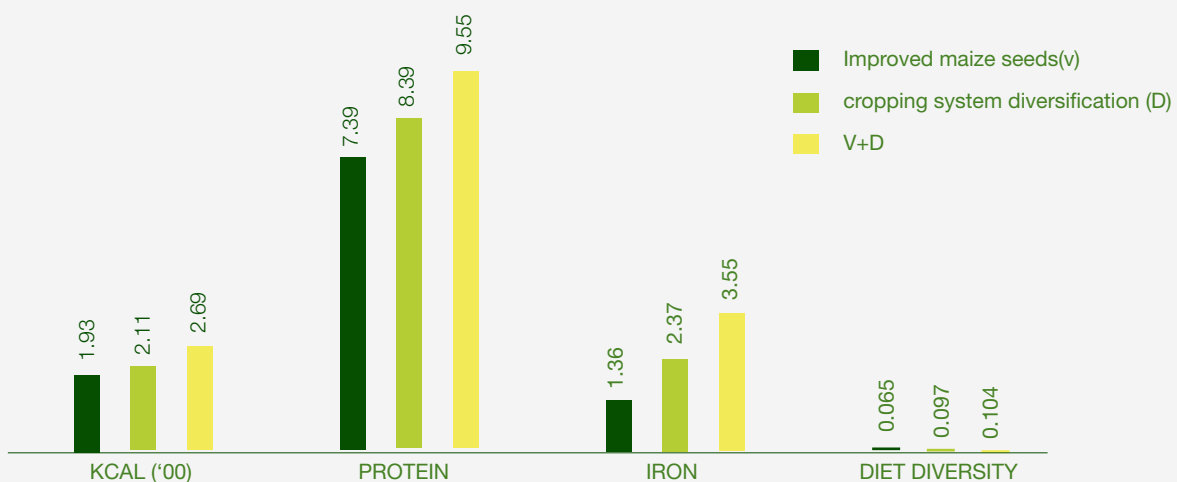
Boosting nutrition through adoption of SI practices

Malnutrition and food insecurity are key development challenges in sub-Saharan Africa (SSA), causing widespread diseases, poor health and even death. Promoting diversification of agricultural food production to enhance nutrition and alleviate micronutrient deficiency while improving and or maintaining natural resource base is essential particularly where farmers have limited opportunities for specialization and constrained access to diversified diets through local food markets. Using panel data in Ethiopia, the impacts

of adoption of combination of SI practices (cropping systems diversification - (legume inter-cropping and rotation and improved maize seeds) on household nutrition was carried out. Results showed that 27%, 29%, 50% and 7% increase in Kcal, protein, iron and diet diversity respectively, when crop diversification was adopted jointly with improved maize varieties.

For more information contact: Menale Kassie at mkassie@icipe.org

Impacts of SI practices adoption on nutrition



3

Input subsidies or extension: which policy should take precedence when supporting farmers?

In a policy simulation study, the role of alternative policies such as input subsidy policies, investments in agricultural extension and access to markets in predicting the adoption of minimum tillage and mulching as components of SIPs was analysed. Using data from 2,700 households in Ethiopia, Kenya, Malawi and Tanzania, and controlling for household and farm level factors, the simulated probabilities of adoption of minimum tillage and mulching were carried out based on varying levels of extension to farmer ratio, credit availability and government expenditures on input subsidies. The results indicate that the impact of input subsidies in predicting the adoption of the SIPs studied implies that lowering costs of complementary inputs (fertilizers, seeds, herbicides, and equipment) is

central in encouraging adoption of SIPs. Considering that subsidies are essentially ways to reduce prices of inputs, diverse options for structurally lowering input-output price ratios should be of much policy interest. Second, investing in agricultural extension systems and increasing the number of extension personnel (increasing the extension personnel to farmer ratio for example) and expanding the reach of publicly funded extension systems among other complimentary providers is a crucial element in the success of adoption of SIPs as was confirmed by the significant predictive power of high density of extension staff per farmer on probability of SIPs adoption in the policy simulations.

For more information contact: Paswel Marennya at P.Marennya@cgiar.org



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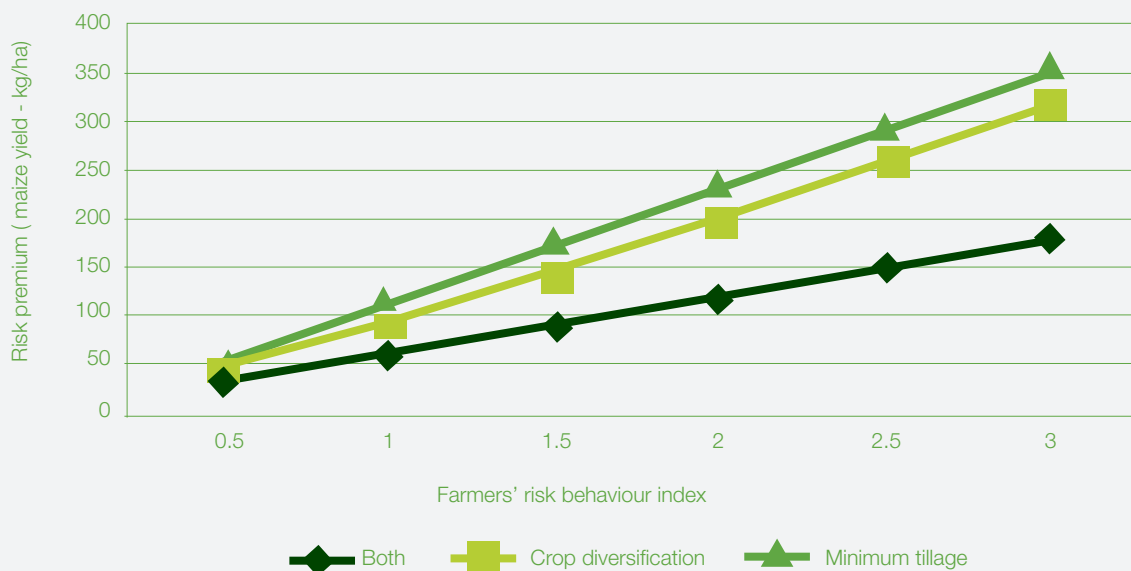
Technology adoption and managing the risky business of smallholder farming

Smallholder agricultural production in Africa is done under various abiotic and biotic stressors. It is a truism that risks are an unavoidable part of many economic and social undertakings. In smallholder agriculture, managing these risks is an important aspect of protecting livelihoods and opening up opportunities for investment and income growth. A higher crop yield and a reduction in the chance of crop failure were achieved when farmers jointly adopted crop diversification (legume intercropping

and rotations) and minimum tillage. The adoption of these two SIPs was found to be associated with changing the distribution of maize yields above the mean suggesting reduced probability of crop failure. When analysing how to achieve productivity and resilience, these and other SIPs can be seen as important risk mitigation strategies.

For more information contact: Menale Kassie at mkassie@icipe.org

SI practice options impact on production risk



“...adoption of appropriate agronomic and resource-management practices among smallholder farmers should be promoted as elements of productivity enhancement but also as opportunities for production risk mitigation”.

4

No shortcuts: Food security is tied to adoption of hybrids and other improved varieties

Even when research and extension systems have evidence that improved varieties are superior in terms of yield, their impact on household welfare cannot be taken for granted. Research that evaluated the impact of improved maize varieties on food security and other welfare indicators found strong empirical connections between the area planted under improved varieties. The

empirical association of better varieties and food security outcomes suggests that few shortcuts exist for rural households to secure food security absent adequate or income and market mediated food access.

For more information contact: Menale Kassie at mkassie@icipe.org

The per capita food consumption more than doubled from

\$124
at **0.125 acres**

to **\$283**
at **10-acres**

An additional acre of land allocated to improved maize varieties reduced the probabilities of chronic food security from between

0.7 - 1.2%

and a similar reduction in transitory food security from

1.1 - 1.7%

under improved maize varieties

The chance that a household would be in a food surplus category increased from

1.4% at
0.125-acres

to **25%** at a
10-acres

improved seed allocation

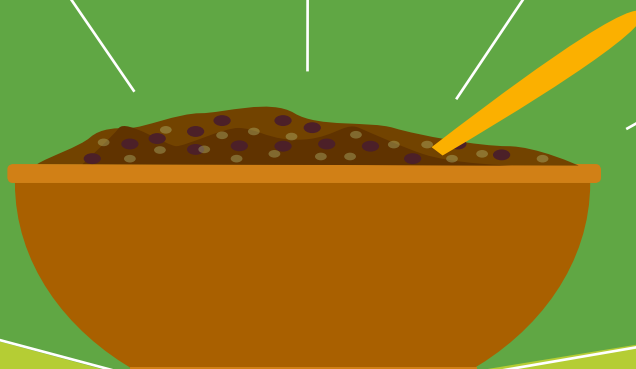
The increase in the chance that a household would be food secure after growing improved maize varieties was

18%

There was a

1.2%

increase in the probability of breakeven and food surplus food security after growing improved maize varieties



6

How to achieve inclusive policy support for rural households: results from an agricultural household model

Malawi has one of the highest population densities in East and Southern Africa. In the absence of alternative economic opportunities, many households can remain stuck in an endless poverty trap of low agricultural productivity and low incomes. The government of Malawi has in recent years implemented large scale fertilizer and seed subsidies in an effort to boost maize production and avoid food crises.

A major feature of the subsidy programme is to target households with reasonable amounts of land at the risk of ignoring the equity issues arising from the fact that

near-landless or landless households may be by passed by the subsidy programme. To rectify this situation, one suggestion, based on the notion that fertilizer is a land augmenting technology, the subsidy need not ignore those with limited land. If this kind of inclusion is not possible, then safety net employment programs should be put in place to reach those with little or no land who may not benefit from input subsidy program. Otherwise a large portion of poor rural households may miss out on these public programs.

For more information contact: Stein Holden at stein.holden@nmbu.no



Fertilizer subsidies need not ignore those with limited land

Take-aways from the Malawi household models



Land-poor households are much more vulnerable to price shocks and limited market access than more land-rich households.



Access to subsidized fertilizer can stimulate demand for land through the land rental markets and/or reduce the supply of land in these rental markets.



Access to subsidized improved maize seeds can crowd out commercial demand for improved maize seeds.

7

Balancing risk and resource allocation: learning from farmers

The UQ research team, in close collaboration with the CIMMYT and national partners in Ethiopia, developed a new tool – a farm household decision analysis model that captures the reality of decision making by poor farm households. The model incorporates farmers' well-known tendencies for risk aversion and the safety-first approach to ensuring family food security in determining options to improve their livelihood attainments working within tight resource constraints and limited opportunities for trade-linked exchange. Initial results from the Central Rift Valley region of Ziway, Ethiopia, indicate that farmers have limited ex post risk management measures, and hence they tend to discount potential gains more heavily and prefer farming systems that are more like the status

quo. While those with access to irrigation and markets can improve income significantly through diversified farming systems involving multiple cropping, staggered planting and the use of improved varieties and practices, maize-legume farming systems appear to be the solution for more risk averse farmers who have limited abilities for risk mitigation. It is unlikely that the majority of farmers who own less than 0.9 ha of land will find full self-sufficiency of family food requirements from a family farm, unless intensive multi-crop farming systems can be supported with irrigation, making the farm less sensitive to variation in climate.

For more information contact: Thilak Mallawaarachchi at t.mallawaarachchi@uq.edu.au



The failure [of farmers to adopt what appear to be technically and economically superior technologies], it appears, is not in the farmers' way of thinking, but in the way economists and other analysts saw the farmers' operating context and failed to recognize their behavioural constraints.

Identifying and Rectifying Gender Gaps: results on technology adoption, food security and market access

1

Looks can be deceiving: why do households headed by men have better food security security than otherwise similar households headed by women?

The notion of gender equality is central to the very concept of social development. The research results summarized here explained why given equivalent opportunities in terms of resources and demographic profiles to those of male-headed households (MHHs), female-headed households (FHHs) still tended to perform worse than their MHH counterparts in terms of

food security, technology adoption and market access. The results from this research suggested that the food security status of households headed by women would be enhanced by improving the resource levels and the quality of those resources available to households headed by women.

If the level of resources/characteristics and return on resources of

(were to) **FHHs = MHHs**

that would be enough to reduce their food insecurity status by

11.5%

in Kenya

6.0%

in Malawi

If returns on current levels of resources of

(were to) **FHHs = MHHs**

de jure FHHs food insecurity would reduce by

4.2%

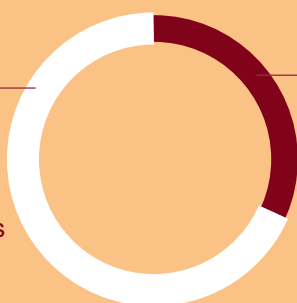
in Kenya

9.8%

in Malawi

73% (63%)

of the gender food security gap is explained by observable differences in levels of resources between *de jure* FHHs and MHHs in Kenya (Malawi)



27% (37%)

of the gender gap is attributable to differences in returns to resources in Kenya (Malawi).

This implies that appropriate policy responses aimed at closing gender gaps in agriculture should concern themselves with closing observed resource gaps but also deal with subtler issues behind those gaps. These latter issues include the quality of those resources, their

differential returns compared to resources held by men and other hard-to-observe social norms and biases that sustain gender gaps in agriculture.

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2

Gender differences in market access: can female-headed households be better off?

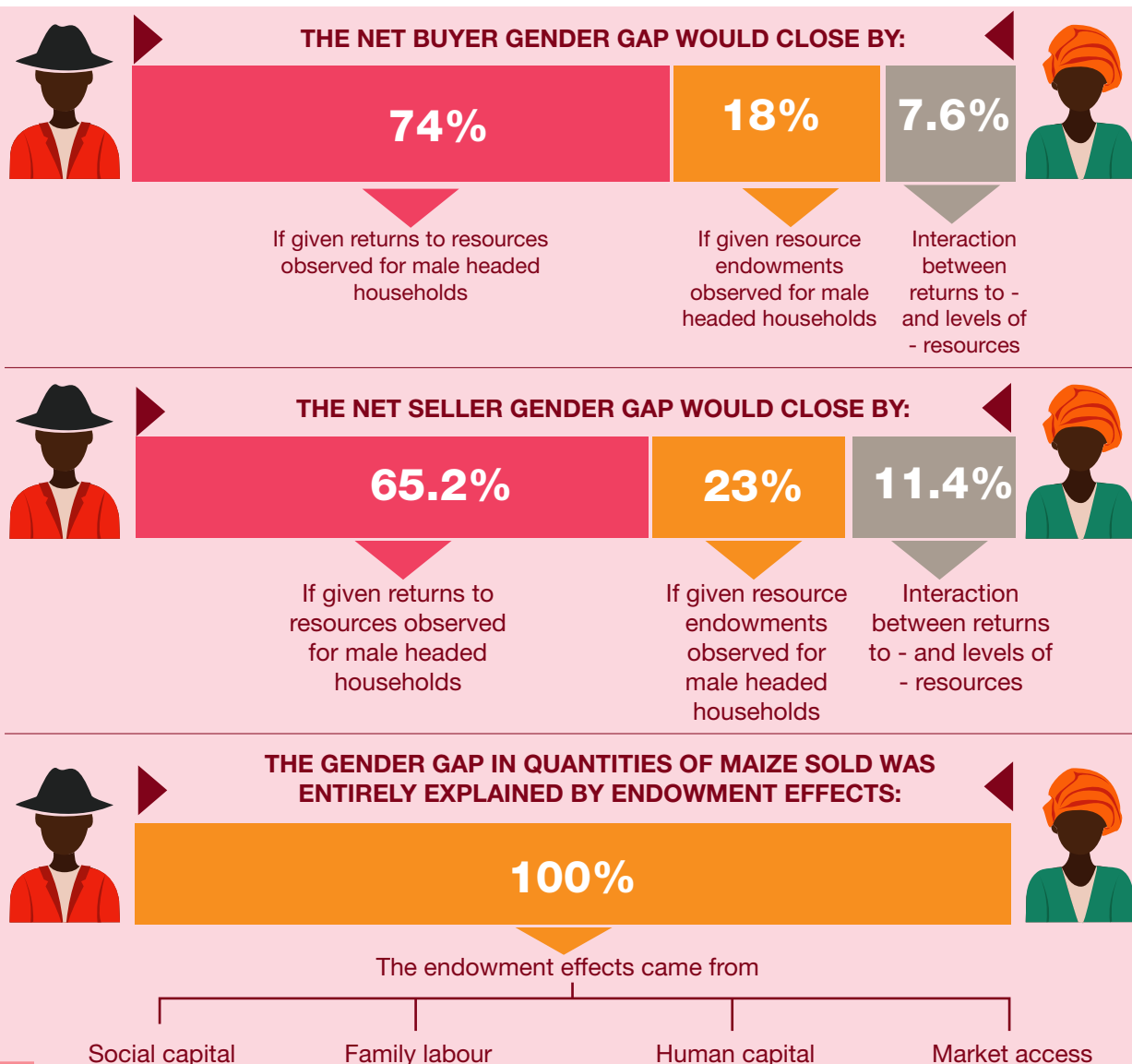
Gender based differences are major determinants of successful participation in agricultural markets among rural households in sub-Saharan Africa. Critical knowledge gaps remain on how to improve women's participation in markets so that opportunities for agricultural development are inclusive, equitable and broad based. Gender differences in agricultural productivity have received more empirical attention than aspects of market participation. Using data from Ethiopia, the study summarized here analysed the factors that may underlie differences in maize market participation based on the gender of the household head. This research examined the implications of the gender of the household head on market participation among 2,800 smallholder maize farmers in Ethiopia and Kenya.

Generally, male headed households (MHHs) were found to be more likely to be net sellers of maize and female headed households were more likely to be net buyers of the commodity. An empirical decomposition of these gaps showed that factors related to returns to (rather than the observed levels of) assets such as farm size,

human capital or social networks accounted for 74% of the gender gap in favor of MHHs in terms of ability to enter markets as net maize sellers. In terms of being net maize buyer, 65% of the gap was explained by these returns effects.

Somewhat differently, the gap between FHH and MHHs regarding quantities of maize sold was largely explained by endowment effects. This is consistent with the notion that the ability to generate sellable surpluses is in fact driven largely by differences in input use levels, land size and other resources necessary to generate sellable quantities of maize. This agrees with the frequent finding in the literature that women are likely to be as productive as men once resource endowments are equalized. However, market access and participation appear to be mediated by overwhelming structural issues related to transactions costs, information and returns to assets that enable market access.

For more information contact: Paswel Marennya at P.Marennya@cgiar.org



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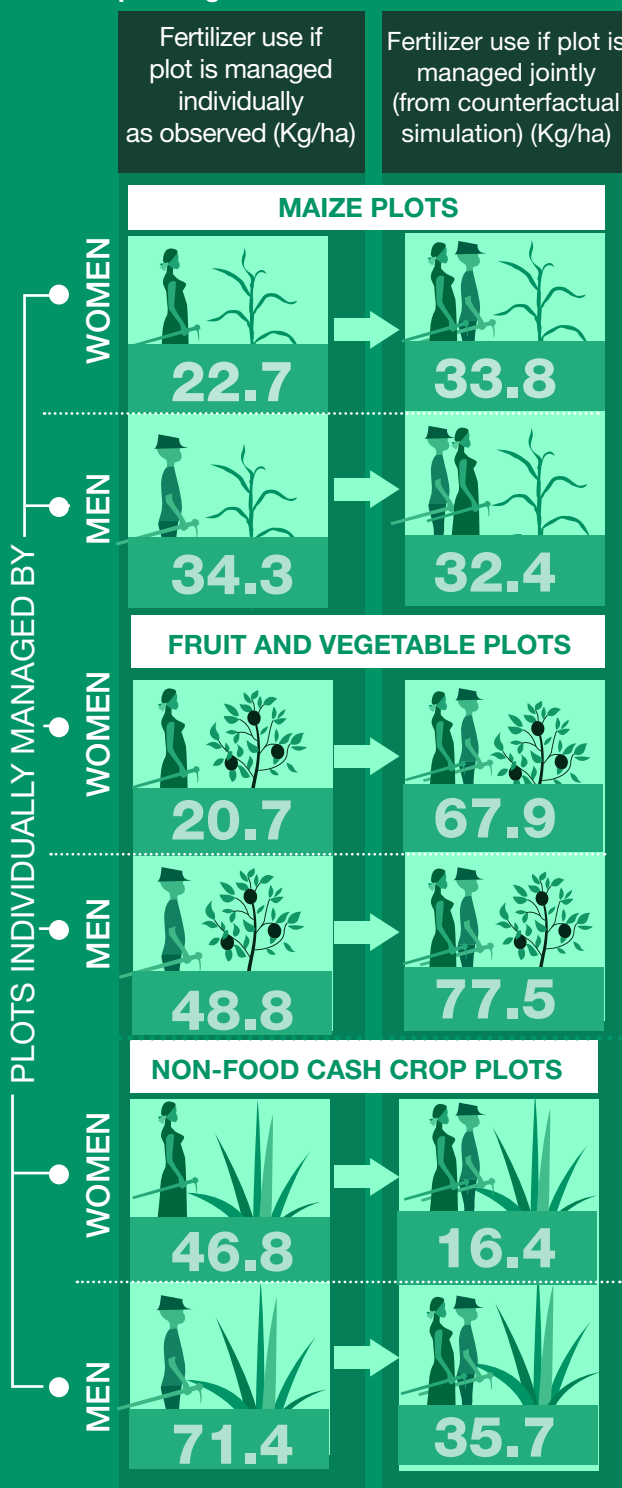
Examining intra-household input use: how to enable women access more agricultural inputs

Using plot level data, the study summarized in this section examined the differential fertilizer application rates on plots managed individually by men, women, or jointly in dual adult households in three districts in south-central Mozambique. The results suggest that—controlling for the demographics of the manager and plot characteristics—joint management of agricultural plots was associated with higher fertilizer application rates on maize plots but with lower fertilizer application on non-food cash plots. The results seem to suggest that because jointly managed plots is not straightforward or assured received more inputs; if equitable sharing of proceeds from

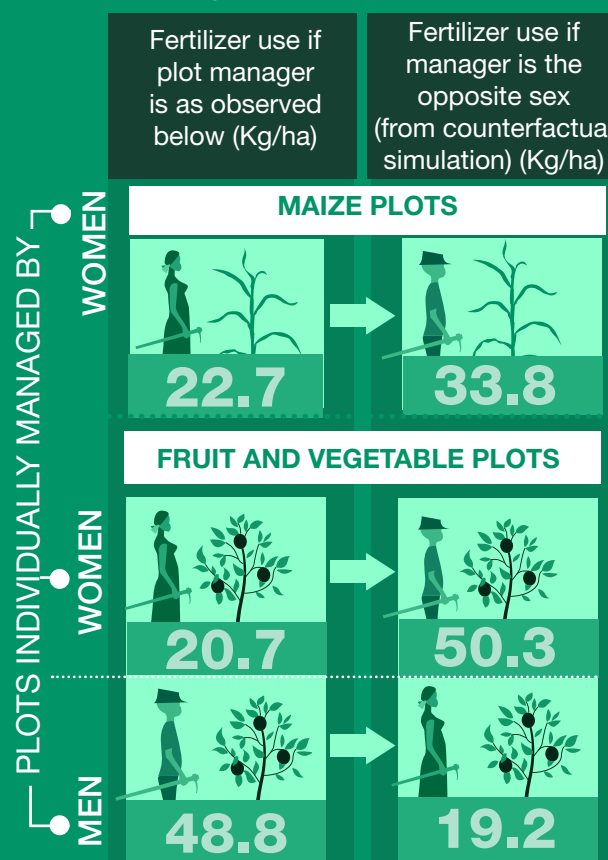
jointly managed plots, then efforts to increase access to inputs by women may need to be targeted at plots already managed by women themselves. In land-scarce environments where women are less likely to have parcels to cultivate autonomously, these results suggest that improving women’s bargaining power regarding the destiny of crops produced and financial proceeds from jointly managed plots can be a critical factor in facilitating gender equality in input use and benefit accrual.

For more information contact: Paswel Marenya at P.Marenya@cgiar.org

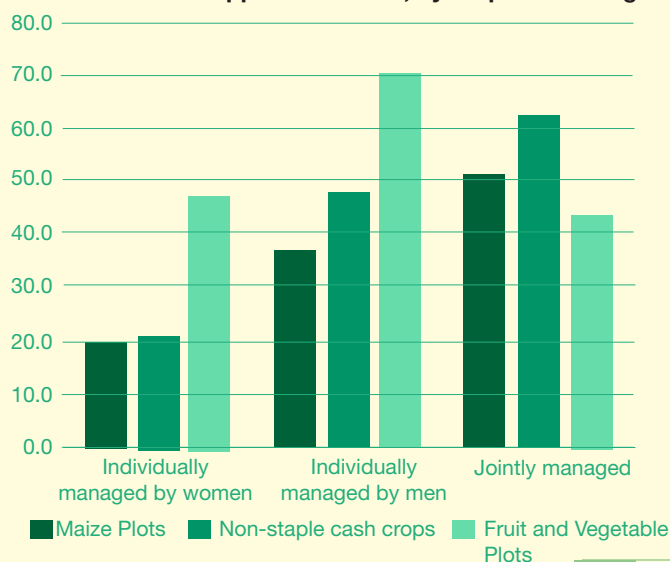
Significant differences were observed in fertilizer use depending on HOW THE PLOT WAS MANAGED



Significant differences were observed in fertilizer use depending on THE SEX OF PLOT MANAGER



Plot fertilizer application rates, by crop and manager



4

Developing the Women Empowerment in Agriculture Index (WEIA).

In order to achieve equity, both men and women have to be empowered to make informed decisions and participate meaningfully in agricultural production. Greater understanding of how the rural development context affects men and women in their participation in development activities is critical for the effectiveness of

development of interventions. In relation to this, the APP data from Tanzania and Ethiopia were used to compute the Women Empowerment in Agricultural Index (WEAI). The data captured four domains of empowerment (4DE)³ instead of the 5DE proposed by USAID. Findings from the two countries are discussed below.



Findings from Tanzania

While a full-scale women empowerment index was not computed, the disempowerment measure suggests women may be empowered in terms of social capital (as defined by group membership), compared to men. Access to credit, participation in speaking in public, and control of assets and income are areas of disempowerment to be dealt with. Women's relative autonomy in production should be matched by the ability to make production decisions, control resultant incomes and participate in community governance.



Findings from Ethiopia

A similar story emerged in Ethiopia where women tended to be more disempowered compared to their male counterparts. The indicators that contributed the most to women's disempowerment in Ethiopia were input in productive decisions; ability to speak in public, ownership and control over resource use and control over use of income. Over half of the women were found to not belong to any group compared to only 35 percent men. On the other hand, almost half of the observed disempowerment among men is attributed to autonomy in production indicators and access to and use of credit.

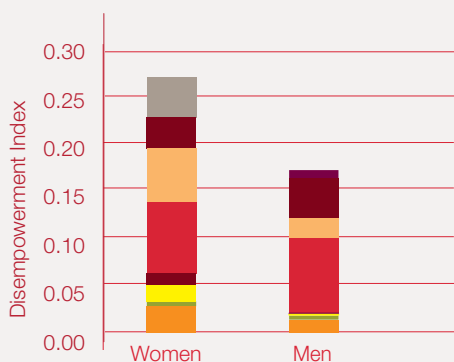
In summary, the comparisons of the national level analysis from the two countries bring out important differences that require focused attention when dealing with disempowerment in different contexts. Lack of autonomy in production is an area that makes a significant contribution to disempowerment in Ethiopia while in Tanzania access to and decision on use of credit

is a major source of disempowerment. Access to and use of credit seemed to be a common constraint in both countries, but its level of importance was different being more significant in Tanzania.

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3 These domains include production, resources, income and leadership. The fifth domain was time used in productivity, domestic tasks and leisure. Each domain except income has more than one indicator. The input in productive decisions and autonomy in production and group membership and speaking in public indicators represent production and leadership domains respectively. Ownership of assets, purchase, sale or transfer and access to and decision about credit fall under resource domain.

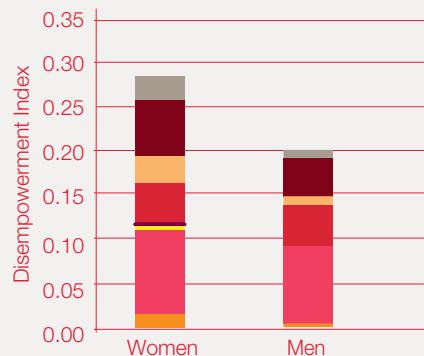
Contribution of each indicator to disempowerment in Tanzania



Speaking in public
 Group member

Purchase, sale, or transfer of assets
 Ownership of assets

Contribution of each indicator to disempowerment in Ethiopia



Control over use of income
 Access to and decisions on credit

Autonomy in production
 Input in productive decisions

Further readings:

The results presented in this brochure are a summary of a series of publications that have variously been produced by researchers working within the Adoption Pathways Project and in collaborating projects. These are listed below to provide the interested reader with a more complete reading of these results and some of these publications are available at <http://aci.gov.au/aifsc/projects/adoption-pathways>, publisher/journal websites and project partner websites.

Journal Articles

- 1 Beyene, A.D. and Kassie, M. 2015. Speed of adoption of improved maize varieties in Tanzania-an application of duration analysis. Accepted for publication in *Technological Forecast and Social Change*, 96:298-307.
- 2 Hailemariam, T., Kassie, M., Bekele, S. and Kholin, G (2013) Cropping Systems Diversification, Conservation Tillage and Modern Seed Adoption in Ethiopia: Impacts on Household Income, Agrochemical Use and Demand for Labor. *Ecological Economics*, 93: 85-93.
- 3 Holden, S. T. and Lunduka, R. (2013). Who benefit from Malawi's input subsidy program? *Forum For Development Studies* 40(1), 1-25
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- 5 Kassie, M., Jaleta, M., and Mattei, A. (2014). Evaluating the impact of improved maize varieties on food security in rural Tanzania: A continuous treatment approach. *Food Security*, 6:217-230.
- 6 Kassie, M., Teklewold, H., Marennya, P., Jaleta, M. and Erenstein, O. 2015. Production risk and food security under alternative technology choices in Malawi. Application of a multinomial endogenous switching regression. *Journal of Agricultural Economics*. doi: 66(3): 640-659.
- 7 Kassie, M., Teklewold, M., Jaleta, M., Marennya, P., and Erenstein, O. (2015). Understanding the adoption of a portfolio of sustainable intensification practices in eastern and southern Africa. *Land use Policy*, 42: 400-411.
- 8 Kassie, M, Simon, W., and Jesper, S. (2014). What determines gender inequality in household food security in Kenya? Application of exogenous switching regression. *World Development*, 56: 153-171.
- 9 Kassie, M., Stage, J., Teklewold, H.; and Erenstein, O. (2015). Gendered food security in rural Malawi: Why is women's food security status lower? *Food Security*, 7:1299-1320.
- 10 Marennya, P., Kassie, M. and Tostao, E. (2015). Fertilizer use on individually and jointly managed crop plots in Mozambique. *Journal of Gender, Agriculture and Food Security*, 1(2), pp 62-83.
- 11 Marennya, P., Kassie, M., Jaleta, M., Rahut, D. (forthcoming). Maize market participation among female and male headed households in Ethiopia. Accepted for Publication in *Journal of Development Studies*.
- 12 Tessema, Y., J. Asafu-Adjaye, D. Rodriguez, T. Mallawaarachchi and B. Shiferaw (2015) 'A Bio-economic Analysis of the Benefits of Conservation Agriculture: The Case of Smallholder Farmers in Adami Tulu District, Ethiopia', forthcoming, *Ecological Economics*.
- 13 Wagura, S.; Kassie, M. and Shiferaw, B. (2014). Are there systematic gender differences in the adoption of sustainable agricultural intensification practices? Evidence from Kenya. *Food Policy*, 49:117-127

Discussion papers

- 1 Asafu-Adjaye, J, Mallawaarachchi, T. and Yirga, C. (2014). Understanding farmers' ex-ante risk management and ex-post risk coping strategies for climate risk: A case study of smallholder farmers in North West Ethiopia. Adoption Pathways Project Working Paper No. 4/2015.
- 2 Hitomi, K. (2014). Women's empowerment in agriculture in Tanzania using Adoption Pathways Survey. Adoption Pathways Project Working Paper No. 6/2015.
- 3 Holden, S. T. (2013). Input subsidies and demand for improved maize: Relative prices and household heterogeneity matter! CLTS Working Paper No. 6/2013. Centre for Land Tenure Studies, Norwegian University of Life Sciences, Ås, Norway.
- 4 Holden S.T. (2013). High discount rates: - An artifact caused by poorly framed experiments or a result of people being poor and vulnerable? CLTS Working Paper No. 8/2013. Centre for Land Tenure Studies, Norwegian University of Life Sciences, Ås, Norway.
- 5 Holden S.T. (2014). Agricultural Household Models for Malawi: Household heterogeneity, market characteristics, agricultural productivity, input subsidies, and price shocks. A Baseline Report. CLTS Working Paper No. 5/2014. Centre for Land Tenure Studies, Norwegian University of Life Sciences, Ås, Norway.
- 6 Holden, S.T. (2014). Risky choices of poor people: Comparing risk preference elicitation approaches in field experiments. CLTS Working Paper No. 10/2014.
- 7 Holden, T.S., and Fisher M. (2014). Can adoption of improved maize varieties help smallholder farmers adapt to drought? Evidence from Malawi. CLTS Working Paper No 1/15.
- 8 Holden, S. T. and Julius Mangisoni (2013). Input subsidies and improved maize varieties in Malawi: - What can we learn from the impacts in a drought year? CLTS Working Paper No. 28 Pathways to sustainable intensification in Eastern and Southern Africa Evidence, Lessons and Outreach 7/2013. Centre for Land Tenure Studies, Norwegian University of Life Sciences, Ås, Norway.
- 9 Holden, S. and T. Mallawaarachchi (2015b) 'Climate adaptation in agriculture: Arriving at robust policy insights with bioeconomic micro-simulation models'. Paper presented at the International Conference of Agricultural Economists, IC AE 2015.
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- 11 Kankwamba, H., Mangisoni, J.(2015) Are sustainable agricultural practices improving output and incomes of smallholder farmers in Malawi? <https://www.conftool.com/icae2015/index.php?page=browseSessions&presentations=show&search=henry>
- 12 Katengeza, S., Kankwamba, H., and Mangisoni, J.H (2014). Maize and legume technology adoption in Malawi: Gender, social networks and SIMLESA program effects. Adoption Pathways Project Working Paper No. 7/2015.
- 13 Kassie, M., Erenstein, O. Jaleta, M., Marennya, P. and Mekuria, M. (2015) Technology diversification: Assessing impacts on crop income and agro-chemicals use in Malawi. https://www.conftool.com/icae2015/index.php?page=browseSessions&form_session=80
- 14 Kassie, M. and Marennya, P. (2015). Pathways to sustainable intensification in Eastern and Southern Africa Evidence, Lessons and Outreach
- 15 Kassie M., Marennya, P., Teklewold, H., Erenstein, O. and Qaim, M. (2016). Does adoption of cropping system diversifications and modern seeds affect nutrition security in Ethiopia? Evidence from Panel data analysis. Under review in *World Development*.

- 16 Kassie, M., Stage, J., Teklewold, H., Erenstein, O. (2014). Gendered food security in rural Malawi: Why is women's food security status lower? Adoption Pathways Project Working Paper No. 1/2015.
- 17 Kassie, M., Teklewold, H., Alene, A., and Dil, R. (2014). Adoption and economics of multiple sustainable Intensification Practices in Ethiopia: Evidence from Panel data analysis. Adoption Pathways Project Working Paper No. 2/2015.
- 18 Kassie, M., Teklewold, M., Jaleta, M., Marenya, P., Olaf, E., Mekuria, M. (2014). Technology diversification: Assessing impacts on crop income and agrochemical uses in Malawi. Adoption Pathways Project Working Paper No. 5/2015.
- 19 Mallawaarachchi, T., J. Asafu-Adjaye and M. Kassie (2015) 'Sensitivity of farm household resource allocations to rainfall uncertainty and technology mix: a state-contingent analysis of adaptation choice under Ethiopian settings'. Paper presented at the 59th Annual Conference of the Australian Agricultural and Resource Economics Society, Rotorua, New Zealand.
- 20 Marenya, P.P., Kassie, M., Jaleta, M. (2015) Adoption of conservation agriculture under alternative agricultural policy and market access indicators: Evidence from Eastern and Southern Africa. https://www.conftool.com/icae2015/index.php?page=browseSessions&form_session=79
- 21 Marenya, P., Kassie, M., Jaleta, M., and Rahut, D. (2014). Does gender of the household head explain smallholder farmers' maize market positions? Evidence from Ethiopia and Kenya. Adoption Pathways Project Working Paper No. 8/2015.
- 22 Marenya, P., Kassie, M., Jaleta, M., Rahut, D., and Erenstein, O. (2014). Adoption of conservation agriculture under alternative agricultural policy and market access indicators: Evidence from Eastern and Southern Africa. Adoption Pathways Project Working Paper No. 11/2015.
- 23 Moore, A., Magnan, N. Meinzen-Dick, R, Holden. S.T and Obare, G. (2014). Male and female risk preference and maize technology adoption in Kenya. Paper presented at the Agricultural & Applied Economics Association's 2014 Annual Meeting, Minneapolis, MN, July 27-29, 2014.
- 24 Mulwa, C., Marenya, P., Rahut, D. and Kassie, M. Response to climate risks among smallholder farmers in Malawi: A Multivariate Probit model application. Adoption Pathways Project Working Paper No. 3/2015.
- 25 Mulwa, C. Marenya, P., Rahut, D. and Kassie, M. (2015) Response to Climate Risks among Smallholder Farmers in Malawi: A Multivariate Probit Assessment of the Role of Information, Household Demographics and Farm Characteristics. https://www.conftool.com/icae2015/index.php?page=browseSessions&form_date=2015-08-14&presentations=show
- 26 Muricho, G.; Kassie, M., Obare, G. (2014). Determinants of market participation regimes among smallholder maize producers in Kenya: A panel data analysis. Paper submitted to the 29th IAAE conference, August 2015, Milan, Italy. Adoption Pathways Project Working Paper No. 12/2015.
- 27 Muricho, G., Kassie, M. And Obare, G. (2015) Determinants of Market Participation Regimes among Smallholder Maize Producers in Kenya https://www.conftool.com/icae2015/index.php?page=browseSessions&form_session=89
- 28 Nyaa, M. (2015). Adoption of sustainable agricultural intensification technology under small-scale maize-legumes production in Mvomero and Kilosa districts. Msc thesis.
- 29 Ogutu, W.N., Obare, G., and Kassie, M. (2014). Plot level determinants of the number of sustainable agricultural intensification practices adopted in a maize-legume cropping system in Kenya. Adoption Pathways Project Working Paper No. 9/2015.
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- 31 Skjeflo, S. and Holden, S. T. (2013). A 2008/2009 Social Accounting Matrix of Central and Southern Malawi. Adoption Pathways Project Working Paper No. 1/2014.
- 32 Skjeflo, S. and Holden, S. T. (2014). Economy-wide effects of input subsidies in Malawi: Market imperfections and household heterogeneity. CLTS Working Paper No. 7/2014.
- 33 Stein T. Holden and Christopher J. O'Donnell (2015). Maize Productivity and Input Subsidies in Malawi: A State-Contingent Stochastic Production Frontier Approach. Contributed paper presented at the 14th European Conference on Efficiency and Productivity Analysis(ECEPA), Helsinki, Finland, 15-18. June 2015.

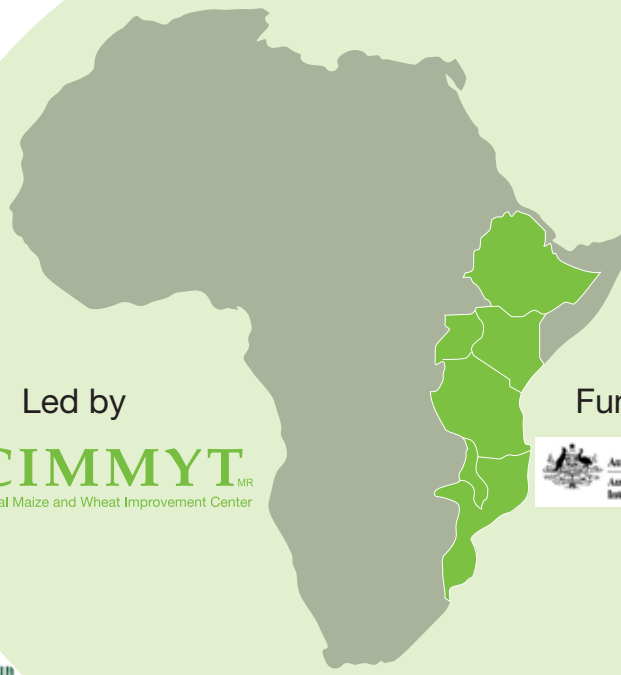
Policy Briefs

- 1 Food security as a gender issue: Why are female-headed households worse off compared to similar male-headed counterparts? Socioeconomics program Policy brief No 1.
- 2 Give and Take: Tackling trade-offs in crop residue use for conservation agriculture in Kenya. Socioeconomics program Policy brief No 2.
- 3 Input subsidies and improved maize varieties in Malawi: What can we learn from the impacts in a drought year?
- 4 Improved maize varieties and household food security: Achieving impact in Tanzania. Socioeconomics program Policy brief No 6.
- 5 Love, A., Magnan, N., and Colson, G.J (2015). Mens' and women's risk preferences: Evidence from the adoption of maize technology in Kenya. Adoption Pathways Policy brief No. 1
- 6 Low risk, high returns: How adoption of crop diversification and minimum tillage is a win-win for smallholder farmers in Malawi. Socioeconomics program Policy brief No 5.
- 7 Sustainable agricultural intensification in Ethiopia: Achieving maximum impact through adoption of suites of technologies. Socioeconomics program Policy brief No 3.
- 8 Sustainable agricultural intensification through multi-technology adoption: A regional overview from East and Southern Africa. Socioeconomics program Policy brief No 4.

Media Stories

- 1 Female-headed households 'prone to food insecurity', Available at <http://www.scidev.net/sub-saharan-africa/food-security/news/female-households-food-insecurity.html>.
- 2 Female headed households require more than farm input to boost food production, Available at <http://awcfs.org/kw/article/female-headed-households-require-farm-input-boost-food-production/>

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