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The Impact of Market System Development Approaches

The Case of InovAgro in Mozambique

Mulubrhan Amare, Helder Zavale, Jenny Smart, and Hosaena Ghebru

Achieving sustainable agricultural productivity growth in sub-Saharan Africa remains a major development challenge (Abdul and Abdulai 2022; Magruder 2018).[1] Low agricultural productivity in African countries is often attributed to lack of innovation, low adoption of yield-enhancing farm technologies, or both (Walker and Alwang 2015; Anderson and Feder 2004). Several studies show that the challenges to achieving sustainable and higher agricultural productivity arise mainly from market imperfections and frictions affecting the distribution of and access to new technologies and their adoption (Abdul and Abdulai 2022; Magruder 2018; Ragasa and Mazunda 2018; Duflo et al. 2008). In Mozambique, as in many African countries, the majority of rural households are subsistence-oriented and have relatively low levels of both agricultural productivity and market participation (Boughton et al. 2006; Benfica and Tschirley 2012; Benfica et al. 2014). To address these challenges, the Innovation for Agribusiness (InovAgro) project used a market system development (MSD) approach. InovAgro is funded by the Swiss Agency for Development and Cooperation (SDC) and implemented by Development Alternatives (DAI Europe, Ltd.) in partnership with COWI Mozambique.

KEY MESSAGES

- Market system development (MSD) approaches aim to address market failures and frictions that impede adoption of modern yield-enhancing agricultural practices.
- InovAgro value chain interventions:
  - Increased farmers' use of yield-enhancing agricultural inputs.
  - Increased access to agricultural input and output market information.
- InovAgro-facilitated MSD value chain interventions had long-term impacts compared to non-MSD interventions.
- Spillover impacts of the MSD project included an increase in the number of non-InovAgro-facilitated or InovAgro-sponsored MSD value chain interventions.
- The MSD project had a more sustainable impact than non-MSD projects. Notably, the combination approach of using agrodealers, lead farmers, and demonstration plots appears to be necessary to achieve long-term positive effects.
- Large numbers of smallholder farmers who benefited from the project were outside the direct sphere of influence and intended beneficiaries.
- The MSD approach also had unintended effects on access to and control over land by women and youth in the short term.

THE MSD APPROACH

MSD approaches are designed to address some of the common causes of market failures to sustainably meet the needs of rural farmers (Altenburg 2007; Donovan et al. 2015; Osorio-Cortes and Lundy 2018). By improving incentives from within the system, MSD approaches aim to increase adoption and implementation of new practices by system actors (Osorio-Cortes and Lundy 2018). These approaches focus on both input and output market systems – to see what is and is not working and

[1] This policy brief summarizes a longer impact evaluation report, a journal article submission, and an IFPRI discussion paper (Amare et al. 2022a, forthcoming; Amare et al. 2022b, forthcoming).

to identify the constraints to development of well-functioning market systems. Such constraints include inadequacies in support functions or deficiencies in the rules, both formal and informal, that regulate market systems (Tschumi and Hagan 2008; Osorio-Cortes and Lundy 2018). If market systems can be made to function more effectively and efficiently, greater outreach and more sustainable impact can result (Osorio-Cortes and Lundy 2018; Altenburg 2007; Weyori et al. 2018).

According to Maestre et al. (2017), value chain interventions (VCIs) are development activities, investments, and innovations — usually focusing on business processes — along the value chain aimed at achieving certain economic or social objectives. Working in northern Mozambique, the InovAgro project VCIs have promoted the development of inclusive and sustainable market systems such that their impact is felt long beyond the project's lifespan.[2] Specifically, the project aims to increase incomes and improve economic security for poor smallholder farmers through improved agricultural productivity and through development of five targeted high-potential value chains. The three expected indicators of progress toward the first outcome include (i) smallholder farmers' increased productivity for maize, soya beans, pigeon peas, sesame, and groundnuts, (ii) increased numbers of smallholder farmers participating in commercial value chains as a result of increased access to quality agricultural inputs and improved commercial value chain knowledge, and (iii) increased total volume of production for smallholder farmers supported by the InovAgro VCIs for each value chain crop.

The InovAgro project had four main areas of intervention (access to agricultural inputs, spcifically certified seeds; output marketing, including the development of buying networks through commodity aggregator traders; access to finance; and land tenure and economic security). The InovAgro project VCIs facilitated the acquisition of land titles, national identification cards, and tax registrations by smallholder farmers. They also attempted to increase smallholder farmers' access to interconnected services such as finance by (i) facilitating financial institutions' relationships with smallholder farmers and the former's willingness to offer loans, (ii) establishing savings groups among smallholders to enable group purchases of certified seed and other agricultural inputs, and (iii) promoting the relationship between smallholder farmers and service providers to improve agricultural production and productivity. However, our evaluation only looked at input distribution and the associated demonstrations.

EVALUATING THE MSD APPROACH

In 2014, SDC in collaboration with the International Food Policy Research Institute (IFPRI) launched an evaluation of InovAgro's impact on households and markets. Randomly assigning some households to various treatment arms (treatment communities) was difficult in the context of the project's interventions since the systemic MSD approach chosen supported private companies in adopting new ways of reaching more clients. Thus, the intervention modality itself made it impossible to have strict exclusion criteria to avoid contamination. Moreover, the adaptive nature of the MSD approach, which is highly responsive to supply and demand forces, made it difficult to randomize treatment exposure to the project.

A modified randomized controlled trial (RCT) was conducted using a spatial identification strategy to classify beneficiary and nonbeneficiary households to evaluate the impact of the InovAgro VCIs at both the household (micro) and market (macro) level. For the former, the study analyzed the impact on households' input use, agricultural productivity, women and youth empowerment, and land rights. For the latter, the study explored four InovAgro VCI outcome indicators to evaluate systemic (long-term), sustainability, large-scale (spillover or multiplier), and unintended (positive or negative) effects.

To define beneficiary and nonbeneficiary groups in the context of the spatial identification strategy, we used terrain adjusted walking distance, measured in time, to classify households. Using a cutoff point of 60 minutes median walking time to the nearest VCI, households within this distance are classified as treatment households, and those with a longer walking time are classified as control households. We further divided treatment households into those exposed to an MSD approach and those not exposed. Among MSD exposed households, we distinguish those exposed to an InovAgro-facilitated MSD approach and those exposed to a non-InovAgro-facilitated MSD approach. Among the control households,

[2] InovAgro project implemented VCIs in 11 districts from 3 provinces (6 districts in Zambezia province, 3 in Nampula province, and 2 in Cabo Delgado province). Administratively, Zambezia province belongs to the central region, while Nampula and Cabo Delgado belong to the northern region. However, consistent with other authors, we classify Zambezia as northern Mozambique. This is because Zambezia's agroecological conditions and cultural habits, especially in northern Zambezia where all 6 InovAgro target districts are located, are more like the northern region than the central region. Furthermore, surplus agricultural production from northern Zambezia to a large extent feeds into the Nacala corridor in the northern region, given their proximity.

we used a cutoff of 60 minutes median walking time to the nearest treatment household. Control households with walking times less than the cutoff are classified as indirect control households and those with longer walking times are classified as pure control households. We further divided indirect control households into those exposed to an MSD approach and those not exposed.

The study investigated the household- and market-level impacts of one intervention (input supply) and the three modalities used to reach smallholder farmers (agrodealers, lead farmers, and demonstration plots). The impact evaluation study employed three waves of household-level panel data (*wave one*: InovAgro Impact Evaluation Survey [IIES] conducted in 2015 [baseline study], hereafter referred to as IIES 2015; *wave two*: IIES 2017 conducted in 2017 [midline survey]; and *wave three*: IIES 2019 conducted in 2019 [endline survey]). All three waves of the IIES covered two districts (Alto Molocue and Molumbo) in the northern Zambezia province, and the IIES 2015 was administered before the InovAgro project launched VCIs in both study districts. InovAgro project VCIs began to be implemented in both study districts in early 2016 and continued until at least 2019. A total of 1,733 households were interviewed in all three waves of the panel data with an attrition rate of 8.1 percent between the IIES 2015 and IIES 2019. Key informant interviews (KIIs) and focus group discussions (FGDs) with local stakeholders, including market actors and local authorities, were complemented with two rounds of geospatial data (2017 and 2019).

As described two paragraphs above, the geospatial data enabled the study team to categorize all sampled households into four groups: (i) MSD beneficiary–InovAgro-facilitated; (ii) MSD beneficiary–non-InovAgro-facilitated; (iii) non-MSD beneficiary; and (iv) nonbeneficiary (control households). Of the 185 VCIs in the geospatial data, 38.9 percent employed an InovAgro-facilitated MSD approach, 30.3 percent employed a non-InovAgro-facilitated MSD approach, and 30.8 percent employed a non-MSD approach.

The study used a fixed effects analysis on a matched sample using the three-wave panel data to isolate InovAgro project effects and account for the possible influence of external factors (such as government policy, improved infrastructure, natural disaster, natural learning, and adaptation). The analysis compared the change in outcomes before and after the InovAgro interventions for intended smallholder farmer beneficiaries and nonbeneficiaries. This method also helped account for any pretreatment differences among beneficiaries and nonbeneficiaries (Angrist and Pischke 2008). The fixed effects analysis has the advantage that it nets out the effects of additive factors that have fixed (time-invariant) impacts on outcome indicators or that reflect common trends affecting treatment and nontreatment equally, such as changes in prices, devaluation, and flood or drought (Ravallion 2007; Angrist and Pischke 2008).[3]

KEY FINDINGS

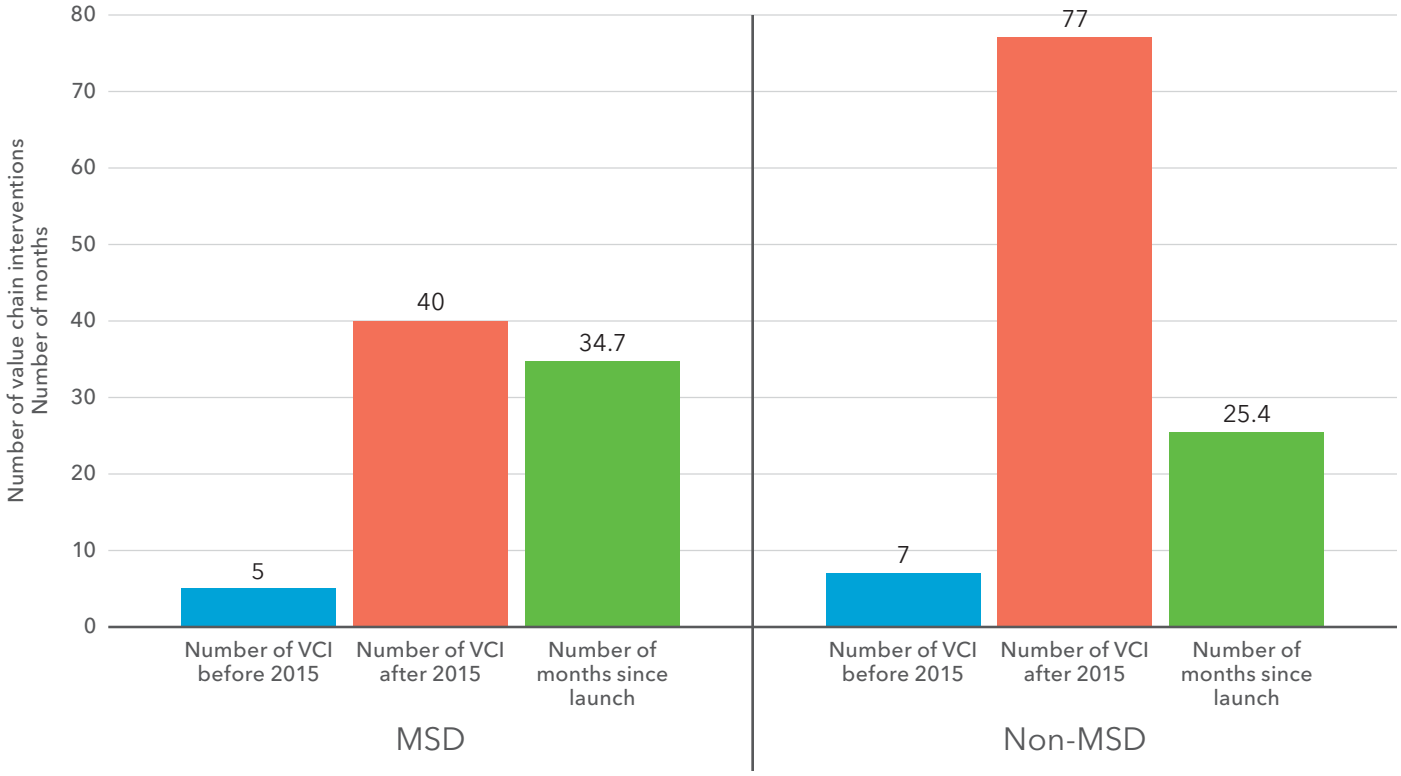
Household-level impact of MSD project

The study found that InovAgro project VCIs had a positive and significant impact on households' likelihood of using agrochemicals including pesticides and herbicides and their use of fertilizer. This positive impact remained robust whether households were exposed to a single VCI (agrodealers, lead farmers, or demonstration plots) or all three VCIs (the "complete package"). We also differentiated short- and long-term impacts of VCIs. We used the two-year gap between IIES 2015 and IIES 2017 to evaluate the short-term impact of the project, and the four-year gap between IIES 2015 and IIES 2019 to identify long-term impacts of the project. InovAgro VCIs had positive and significant effects on beneficiaries' access to information on both agricultural input and output markets, whether they were exposed to a single VCI or the complete package, a result that remained robust in both the short and long term. This evidence is consistent with emerging empirical evidence from sub-Saharan Africa showing that an extension program featuring agrodealers, demonstration plots, and lead farmers contributed to statistically significant increases in the access to information on both agricultural input and output markets (Latynskiy and Berger 2016; Kijima et al. 2012; Yitayew et al. 2021). The study showed that InovAgro VCIs boosted maize productivity and increased the commercial orientation of farmers among beneficiaries.

Similarly, the study documented an unintended negative effect of InovAgro VCIs on access to, and control over, land by women and youth in the short term, although this adverse effect on women's land rights was

[3] We furthermore conducted a test of parallel trends to see if there was a significant change in trends in both the treatment and control cohorts during the post-intervention period by checking which slope coefficients were statistically significant and performing contrast comparisons. We did not find sufficient evidence to reject the null hypothesis of parallel trends.

FIGURE 1 Number of VCIs and duration, measured in months, since intervention's launch



reversed in the longer term. Short-term adverse effects of the project could be associated with the fact that more commercialized agricultural practices may not guarantee a desirable outcome for the land tenure security of vulnerable groups, since greater profitability in agriculture could increase competition for land and thus lead to the exclusive control of such resources by the (usually male) household head. InovAgro VCIs had a positive impact on nonagricultural income-generating activities for women and youth in the short term, whether they were exposed to a single VCI or the complete package. Exposure to the complete package had a positive impact on overall household welfare.

Market-level impact of MSD interventions

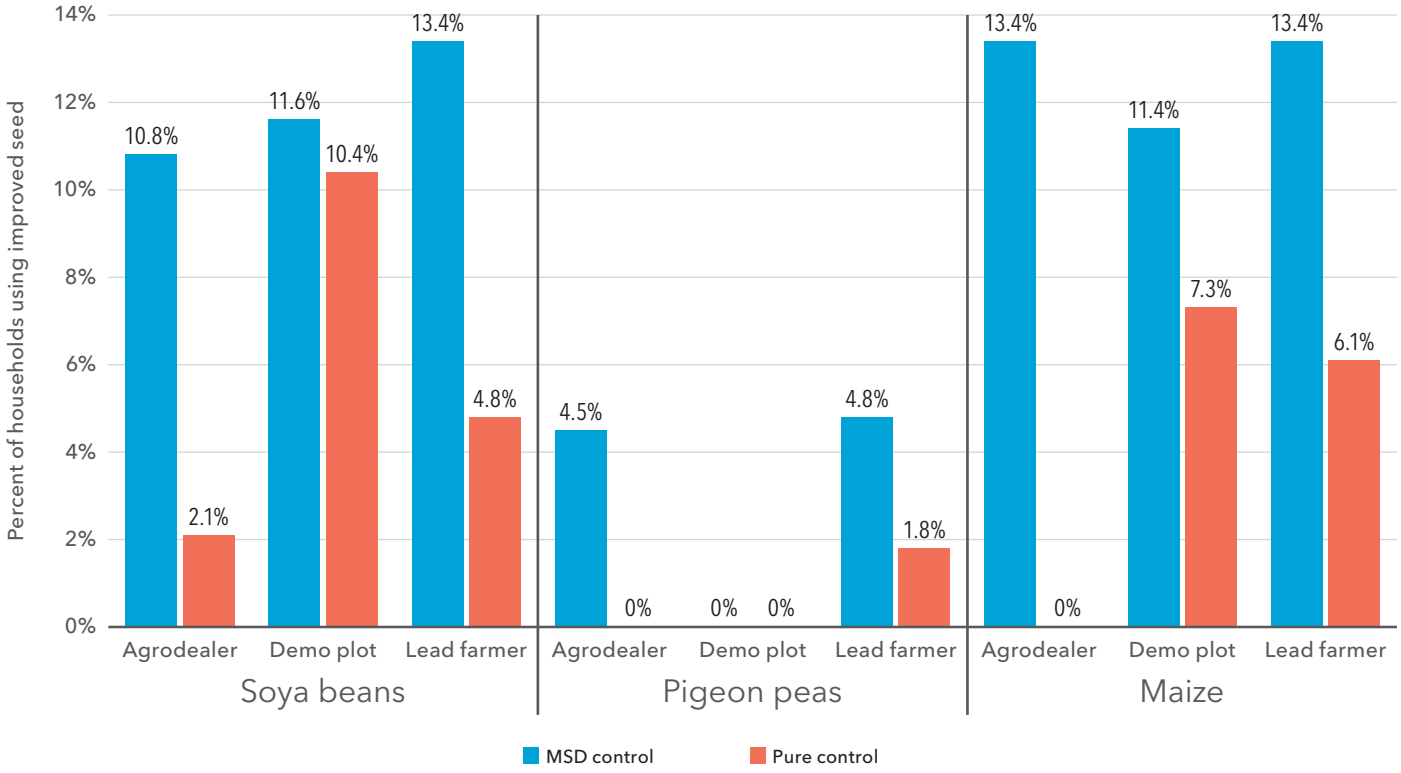
The study evaluated the extent to which InovAgro VCIs resulted in market changes by focusing on four outcome indicators: (i) long-term systemic effects, (ii) sustainability effects, (iii) large-scale (spillover) effects, and (iv) potential unintended effects.

Long-term effects

The study investigated the potential crowding-in or "copying" effect of InovAgro VCIs by comparing the number of InovAgro-facilitated MSD VCIs with the number of non-InovAgro-facilitated MSD VCIs before and after the launch of InovAgro activities. The first two bars in Figure 1 show the crowding-in effect of InovAgro VCIs. The results show the role InovAgro has played in bringing more MSD VCIs into the system (that is, crowding-in effects). The green bar in Figure 1 compares the average time elapsed since the intervention's launch for InovAgro-facilitated versus non-InovAgro-facilitated MSD VCIs. On average, non-InovAgro-facilitated MSD VCIs had a significantly shorter time elapsed since the intervention's launch than InovAgro-facilitated VCIs.[4] Overall, the number of non-InovAgro-facilitated VCIs increased significantly (Figure 1). Similarly, on average, the time elapsed since the intervention's launch was significantly shorter for non-InovAgro-facilitated MSD VCIs than for InovAgro-facilitated ones. Both results indicate the facilitative role InovAgro played in bringing more MSD VCIs

[4] As part of the facilitative role that InovAgro VCIs set out to achieve, one of the major activities of the project was focused on understanding where market systems fail to serve the needs of the poor and taking action to correct those failings. For this purpose, a systemic change is hereby defined as "transformations in the structure or dynamics of a system that lead to impacts on the material conditions or behaviors of large numbers of people," either through crowding-in or by copying other VCIs due to the InovAgro effect on improving the business environment.

FIGURE 2 Sustainability effect on use of improved seeds, by crop and modality



into the system (crowding-in effects). Given these overall market (systemic) effects, MSD and InovAgro effects (impacts) are used interchangeably hereafter.

Sustainability effects

The potential sustainability effect of the InovAgro VCIs was investigated using the same three waves of data (IIES 2015; IIES 2017; IIES 2019) to monitor the history of household adoption of modern farming practices (such as use of fertilizer, agrochemicals, and certified seeds), and comparing those who benefited from MSD VCIs with those exposed only to non-MSD VCIs.[5] InovAgro VCIs were found to be more sustainable than non-MSD VCIs: the proportion of households that continued to use modern farm practices was significantly larger for households treated or exposed to InovAgro VCIs than those treated or exposed to non-MSD VCIs. Interestingly, this result is even more robust and consistent for two InovAgro value chain crops (soya beans and pigeon peas). The finding remains robust regardless of the type of VCI (agrodealer, lead farmer, or demonstration plot). Overall, these findings are consistent with empirical evidence that shows that the sustainable effects of using innovations at scale depend significantly on long-term engagement with local value chain actors equipped with sufficient capacity and resources to inform their objectives and vision (Cole and Fernando 2021; Hartmann and Linn 2008; Tomich et al. 2019; Vanloqueren and Baret 2009). They also reinforce the skepticism around non-MSD programs that focus on free or subsidized direct delivery of services, which are prone to dropouts as soon as support is withdrawn.

Spillover effects

The study defined spillover or multiplier effects as referring to wider changes resulting from benefits to large numbers of smallholder farmers beyond the project's direct domain of intervention. These effects were investigated by comparing use of modern farming practices among MSD control households (those within a buffer cutoff proximity to MSD-exposed households) versus pure control households (those outside the buffer cutoff proximity to VCI-exposed households). The proportion of households that were new users of modern farming practices (those who did not use them in the 2016/17 agricultural season but did in the

[5] We defined a sustainability effect to have occurred if the proportion of MSD-exposed households continuing use of modern farming practices is significantly larger than the proportion of non-MSD exposed households.

2018/19 agricultural season) was significantly larger for (InovAgro) MSD control households than for pure control households. Figure 2 shows results for use of improved seeds. Overall, the study results support the spillover hypothesis by showing the project's effect in benefiting large numbers of smallholder farmers beyond its direct sphere of influence and intended beneficiaries, with the exception of households in the pure control group.

Potential unintended effects

InovAgro VCIs reduced households' crop diversification, which was expected since the project encouraged smallholder farmers to specialize. MSD VCIs also increased household income diversification and migration, while non-MSD VCIs decreased both, again expected given the focus on specialization. The InovAgro project's negative short-term impact on access to, and control over, land by youth highlights that more commercialized agricultural practices (due to intensive MSD VCIs) may not guarantee a favorable outcome for this vulnerable group, since higher profitability in agriculture could lead to exclusive control of resources (such as land) by household heads. The unintended negative consequence of reduced land availability for youth due to successfully increasing household income could be reframed as a positive consequence: as the value of land increases, so does respect for it by all, including youth, potentially resulting in a more committed generation of young farmers.

Cost-effectiveness of the project

InovAgro's cost-benefit ratio has been shown to be quite high. Egger and Zhou (2022) report that since 2015 InovAgro has reached 37,800 beneficiaries, who generated a cumulative additional net income of US$34.37 million in the five targeted value chain crops. The number of project beneficiaries and the generated net income are both well above the InovAgro objectives defined at the beginning of 2018 (additional net income of US$8.5 million for 30 million beneficiaries). In terms of efficiency, Zhou estimates that the ratio of InovAgro income benefits to its costs reached 2.64 for the period 2015 to 2021, a cost-benefit ratio that is comparable to those of other MSD projects. However, this comparison should be put into context for at least two reasons. First, InovAgro project was implemented in northern Mozambique, where the population is widely dispersed, while other MSD projects were implemented in countries with much higher population densities (like Bangladesh, Nigeria, and Rwanda), which affords greater access to value chain actors. Second, economic activity benefiting the poorest households is much weaker in northern Mozambique than other countries where MSD projects were implemented. In addition, the InovAgro project was limited in the districts and value chains from which it could collect empirical results data to evaluate the project in terms of relevance, coherence, effectiveness, efficiency, impact, and sustainability, given that many InovAgro partners took InovAgro VCIs to other districts and used other crops that were not monitored.

CONCLUSION AND POLICY IMPLICATIONS

Overall, the study of the InovAgro project provided evidence of the positive impact of the MSD approach at the household (farmer) level, improving beneficiaries' use of modern farming practices and access to agricultural market information. The project VCIs boosted maize productivity and increased the commercial orientation of beneficiary smallholder farmers. Exposure to all three VCIs simultaneously (the complete package) improved overall household welfare, suggesting that more intense VCIs may be necessary to achieve long-term positive effects. At the market level, the study found evidence of greater systemic effects, benefiting large numbers of smallholder farmers beyond the project's direct sphere of influence. It also found greater sustainable long-term effects of MSD VCIs on household adoption of modern agricultural practices and access to information on input and output markets than those associated with non-MSD project VCIs. InovAgro VCIs helped private sector actors to lead initiatives and transform the way that agricultural market systems operate in northern Mozambique. InovAgro VCIs also created beneficial competition between private seed companies and built stronger relationships along the supply chains. However, when working with private partners, seed companies and donors that provide large subsidies are required to move away from VCIs that distort markets and threaten the viability of agrodealers by bypassing the county's agricultural distribution networks.

On the other hand, both the MSD (InovAgro) and non-MSD project VCIs reduced households' crop diversification, thus reducing access to, and control over, land by youth. Unless deliberate measures are taken to mainstream gender and youth issues in the design and implementation of similar MSD projects, these unintended effects may undermine their potential to generate desirable outcomes for all. The study contributed new empirical evidence on the causal effects of the InovAgro VCIs that applied the MSD approach, for which there is an abundance of opinion pieces but still relatively scant empirical evidence. The study used a modified RCT approach to evaluate the impact of selected value chains

(maize, soya beans, and pigeon peas); future studies may complement the RCT approach with detailed value chain analysis to address our evaluation's limitations with more value chain crops across different agroecological zones and measured over different periods. Future studies that take these into account may generate additional insights on the inclusive and sustainable impact of MSD VCIs.

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Mulubrhan Amare is a research fellow in the Development Strategies and Governance Division (DSGD) of the International Food Policy Research Institute (IFPRI), based in Washington, DC, USA. **Helder Zavale** is an assistant professor at Eduardo Mondlane University (UEM), based in Maputo, Mozambique. **Jenny Smart** is a senior program manager in DSGD of IFPRI, based in Washington, DC. **Hosaena Ghebru** was a research fellow in DSGD of IFPRI, based in Washington, DC, when he primarily contributed to this work.

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1201 Eye St, NW, Washington, DC 20005 USA | T. +1-202-862-5600 | F. +1-202-862-5606 | Email: ifpri@cgiar.org | www.ifpri.org | www.ifpri.info

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