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Is there a Role for Agricultural Committees and Stakeholder Panels in Improving Information and Accountability in Extension Service Provision

Evidence from Malawi

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ABSTRACT

This paper looks at village agriculture committees, model villages, and stakeholder panels at various levels as participatory and decentralized structures for improving demand articulation and accountability in agricultural extension service provision in Malawi. It uses various datasets including nationally representative household and community surveys, a survey of service providers, a survey of representatives from the various structures, focus group discussions, and key informant interviews. It employs various estimation methods including matching techniques, matching plus regression adjustments, and an instrumental variables approach.

Results show diverse experiences and functionality of these structures. Contrary to earlier reports, most of these structures are active, except for district stakeholder panels (DSPs), of which only about a quarter are active. Similarly, most of them provide a platform for discussion and feedback on service providers and the quality of their advice, except for DSPs. However, most structures were given poor ratings in terms of their responsiveness to the concerns and issues raised. Household participation in village development or agriculture committees is strongly associated with better household outcome indicators. These village committees, if they are active and responsive to farmers' expressed concerns and needs, can contribute to better community-level outcomes. Results show that these village-level structures matter and that strengthening them is key to addressing their long-term functionality. On the other hand, a model village concept that focuses on an integrated approach to solving communities' challenges is not associated with improved community outcome indicators; therefore, its implementation should be reviewed and improved in order to contribute to development outcomes.

Keywords: extension services; agricultural information; decentralization; community development; demand articulation; accountability

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ACRONYMS

ASP	area stakeholder panel
ATT	average treatment effect on the treated
DAC	district agriculture committee
DAECC	district agricultural extension coordination committee
DAESS	District Agricultural Extension Services System
DSP	district stakeholder panel
EPA	extension planning area
HDDS	household dietary diversity score
ICT	information and communication technology
IFPRI	International Food Policy Research Institute
IV	instrumental variables
KM	kernel matching
MaFAAS	Malawi Forum for Agricultural Advisory Services
MV	model village
NGO	nongovernmental organization
NNM	nearest neighbor matching
USAID	United States Agency for International Development
VAC	village agriculture committee
VDC	village development committee

1. INTRODUCTION

Three-quarters of the world's poor depend on agriculture for their livelihoods and food security (World Bank 2008). But providing state-of-the-art knowledge and services to these rural poor remains a huge challenge to many development practitioners (World Bank and IFPRI 2009; Birner et al. 2009; World Bank 2008; Rivera, Qamar, and Crowder 2001). Well-designed institutional arrangements and governance mechanisms offer the potential to empower citizens from below, increase accountability, and improve public service delivery (Schneider 1999; Speer 2012). Yet, despite the widespread use of institutional arrangements and governance approaches in different forms and across sectors, the connection between these institutional arrangements and their actual benefits and costs receive only mixed empirical evidence (Gaventa and Barrett 2012; Speer 2012).

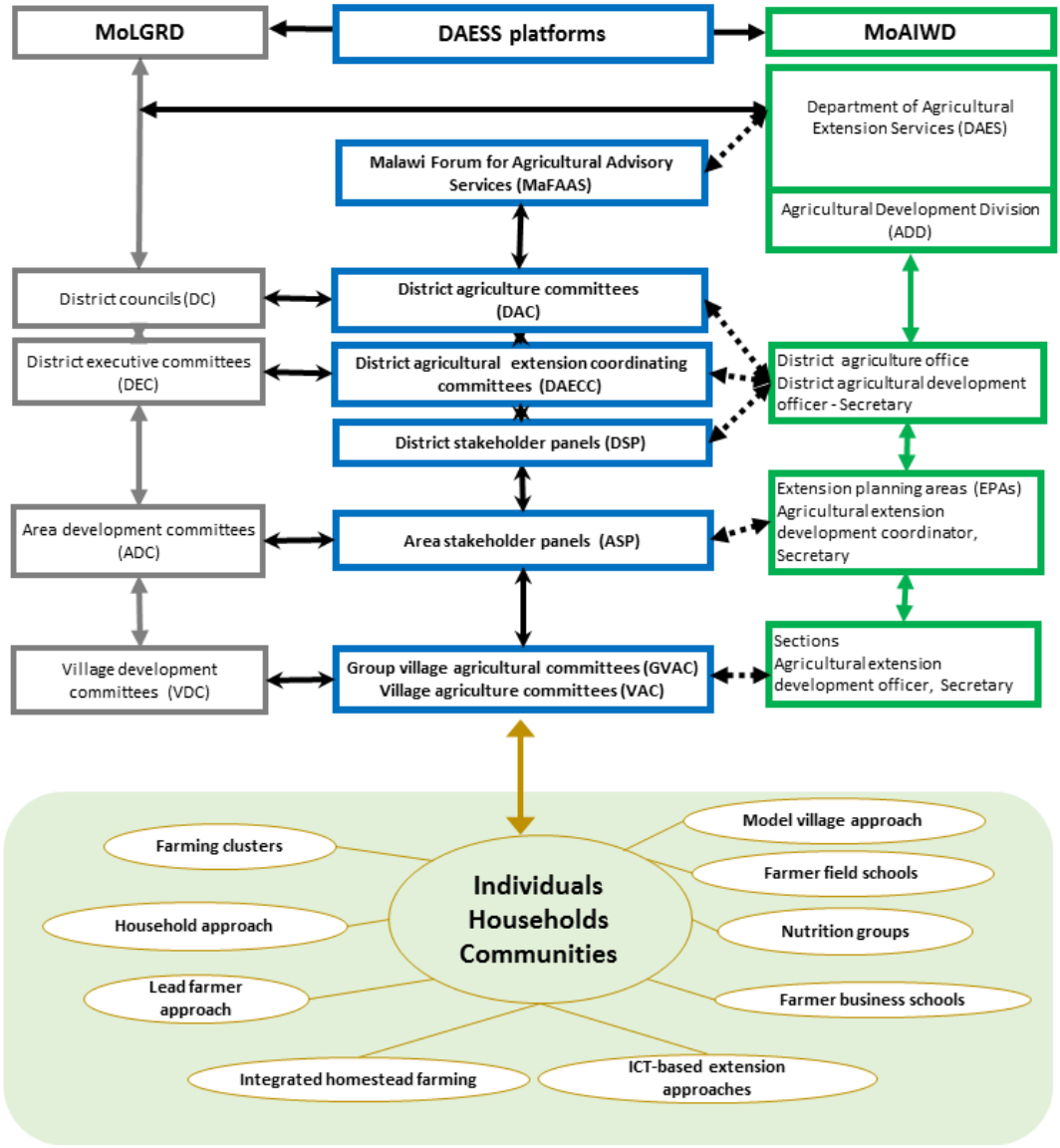
In agriculture, these institutional arrangements exist in the form of, for example, multistakeholder panels, innovation platforms, and participatory market chain approaches, and in countries as diverse as Peru, Burkina Faso, and Indonesia (Devaux et al. 2009; Gibson and Woolcock 2008; Jaramillo and Wright 2015; Resnick and Birner 2010). Although these methods are set to improve extension service delivery, facilitate access to markets, disseminate better agricultural practices, and ultimately, increase farmers' well-being, studies find only mixed evidence that participation delivers on initial expectations (Resnick and Birner 2010; Ragasa, Badibanga, and Ulimwengu 2016). Therefore, more research to understand why and where these institutional arrangements work is paramount. Identifying design features and mechanisms to address remaining capacity, incentive issues

In this paper, we analyze the multilevel structure of the District Agricultural Extension Services System (DAESS) in Malawi. The national extension policy passed in Malawi in 2000 relies heavily on various interlinked structures—from the village to the district and national levels—to (1) reduce information asymmetry between users and service providers, (2) provide platforms for demand articulation and aggregation, (3) coordinate and harmonize the activities and messages of extension service providers, and (4) improve accountability among various service providers in order to provide

better-quality extension services. Put differently, with an emphasis on improving coordination and making agricultural extension services more demand driven, the government of Malawi promoted the creation of various connected structures at various levels, starting with farmers' involvement at the village level, to the area, district and national levels. These different structures are model villages (MVs) and village agriculture committees (VACs) at the village or group village level; area stakeholder panels (ASPs) at the extension planning area (EPA) level; district stakeholder panels (DSPs), district agricultural extension coordination committees (DAECCs), and district agriculture committees (DACs) at the district level; and a national stakeholder panel, the Malawi Forum for Agricultural Advisory Services (MaFAAS), at the national level (Figure 1.1).

Figure 1.1 Agricultural extension governance structures in Malawi

Platforms of the District Agricultural Extension Services System (DAESS, center, in blue) are aligned with the Ministry of Local Government and Rural Development (MoLGRD, left in gray) and supported by the Ministry of Agriculture, Irrigation and Water Development (MoAIWD, right in green)



Source: Modified from Malawi, Ministry of Agriculture, Irrigation and Water Development (2006).

Note: Straight lines reflect reporting lines from the DAESS platforms to the MoLGRDs. For instance, the ASPs report to the area development committees on agricultural development at the area level and the functioning of the ASPs. A similar structure applies to the other levels (village, district). On the other hand, the dashed lines connect MoAIWD with the DAESS platforms in terms of facilitating the existence of these platforms, being part of them (for example, the district agriculture development officer chairs the DAECC), and building their capacity so that these platforms perform their key functions. MoAIWD is also an advocate for the role of MaFAAS at the national level. The DAES is part of MoAIWD, together with the other technical departments concerning fisheries, livestock, crop development, land resources, and agricultural development. The DAESS structure encompasses all of these technical departments, and so the heads of the agricultural technical departments are represented on the DSPs and DAECCs.

Within the DAESS, each structure performs key functions. The MVs are the entry point for agricultural development programs and use participatory approaches to plan, implement, monitor, and evaluate the progress of those programs at the village level. Also at this level, the VACs, which are subcommittees under the village development committees (VDCs), serve as forums for farmers and other relevant stakeholders such as nongovernmental organizations (NGOs) and agribusinesses to express their demands and agree on common issues that require action. ASPs perform a similar function at the EPA level by serving as a discussion space to identify agricultural priorities, ensure representation of varied stakeholders, and aggregate villages' agricultural demands in order to obtain quality responses. At the district level, the DSP collects the agricultural demands expressed at the ASPs and, with extension service providers, coordinates responses to the prioritized agricultural needs. The DAECCs are responsible not only for ensuring that quality extension services are provided throughout the district, but also for advising the DACs on agricultural development issues and for mobilizing resources in support of agricultural extension services. The DACs also connect the multilevel extension structure with other institutions of the local government by being composed of elected members of the district councils.[1] Last, DSPs and DAECCs are linked to the national stakeholder panel (MaFAAS) at the top, which at the same time connects to the higher levels of the Ministry of Agriculture, Irrigation and Water Development. Altogether, this system aims to create pluralistic, demand-driven, and decentralized extension services that assist farmers in an efficient and effective way.

After a decade since they were first established, these decentralized structures are not seen favorably and several studies have pointed to several weaknesses and challenges in their functioning (MEAS 2012; Masangano and Mthinda 2012; Chowa et al. 2013; Magombo 2016; NRI 2017). These weaknesses are summarized as (1) lack of leadership and ownership of the processes, (2) unclear mandates and institutional arrangements in the implementation guide, (3) limited technical and financial support, and (4) weak link to research and national policy processes and coordinating structures (MEAS

[1] The DACs work with the district councils to, for example, make recommendations on extension service policy, support local agricultural institutions and development, assist in resource acquisition, and encourage community participation.

2012; Masangano and Mthinda 2012; Chowa et al. 2013; Magombo 2016; NRI 2017; Ragasa and Mthinda 2018). With funding through the Malawi Agricultural Sector Wide Approach - Support Project (ASWAp-SP) and the Sustainable Agricultural Production Programme (SAPP), starting in 2014, and recently through the Strengthening Agriculture and Nutrition Extension (SANE) project starting in 2015, these structures have been supported and somehow strengthened. Project documents by SANE (MaFAAS, 2017) and preliminary fieldwork conducted by this paper's authors has painted a more positive outlook on these structures and a substantial variation and diverse experiences throughout Malawi in their activity levels. As a result, the present study was initiated to (1) characterize these platforms—how they are structured, how they function, and the nature and type of their activities; (2) explain why these structures are more active in some areas than in others by looking at factors that affect the formation of strong structures; and (3) evaluate whether these panels and committees make positive contributions in their communities, using both qualitative evidence (narratives from communities) and quantitative evidence (average treatment effects using outcome indicators including extension service access, technology adoption, productivity, and food security).

This paper contributes to the literature on the governance of public service delivery in general and agricultural extension modalities in particular on a number of fronts. First, it evaluates the broader institutional context and looks at multiple levels, rather than at a single level or structure, as is common in the literature. We collected detailed information on these structures at different levels (community, EPA, and district) and conducted various primary data collection processes, which allowed us to triangulate data and results from different perspectives. Second, we go a step beyond what is commonly done in the agriculture literature and estimate the effect of these structures on key outcome indicators (access to extension services, technology adoption, productivity, and food security). Moreover, we exploit variation along these structures' characteristics and across the country to assess their connection with different outcome indicators. Third, we use econometric modeling approaches to exploit the representative and large-sample nature of the dataset, and the heterogeneity of structures across Malawi, which is also rarely done to analyze this topic, partly due to previous data constraints. Overall, this study is important not only

for its contributions to the literature on institutional arrangements and rural service provision but also because it feeds into the national extension policy and strategy review and reform processes currently ongoing in Malawi.

The rest of the paper is structured as follows. Section 2 reviews related concepts and theories. Section 3 describes the data sources and methods. Section 4 presents the key results. Section 5 discusses the implications of the findings. Lastly, Section 5 presents some concluding remarks.

2. REVIEW OF RELATED CONCEPTS

The agricultural extension structures in Malawi fit within the broader concept of participatory governance processes. Participatory governance mechanisms are commonly defined as those institutional arrangements that allow regular citizens to have a say in public policies and influence decision-making processes (Brett 2003; Ackerman 2004; Speer 2012). While these institutional approaches vary substantially in form (for example, public hearings, participatory budgeting, multistakeholder panels), the general expectation is that participation empowers citizens, deepens democratic practices, improves public service delivery, and ultimately leads to better societal outcomes (Blair 2000; Fung and Wright 2011; Speer 2012; Gaventa and Barret 2012).

From a theoretical perspective, different strands of literature explain why participatory governance should deliver these positive outcomes. To start, participatory institutions have connections with principal-agent frameworks. That is, via participatory institutions, citizens (the principals) can work closely with elected representatives (the agents) in the design and delivery of public services (Schneider 1999; Ackerman 2004; Speer 2012). This interaction should promote information sharing on local preferences and facilitate monitoring of public spending and service performance (Schneider 1999; Speer 2012). As a result, participatory mechanisms can reduce the agency problem and lead to more accountable and responsive governments (Schneider 1999; Speer 2012).

Participatory governance can also be conceptualized as a collective action problem. On the one hand, participation in these institutional settings is subject to a free-rider problem because individuals who do not attend can benefit from the efforts of those who attend to demand better public services and influence decision-making processes (Olson 1965; Ostrom 1990; Sheely 2015). On the other hand, however, participatory processes can increase the capacity for collective action (Gaventa and Barrett 2012). By providing a forum for citizen interaction, participatory mechanisms can help reduce communication and coordination costs, identify common interests, and build shared norms, all of which

have been identified as important factors to accomplish joint behavior (Ostrom 1990; Agrawal 2001; Barham and Chitemi 2009).

Participatory governance is also associated with social capital, defined by Putnam as the "features of [an] organization, such as trust, norms, and networks, that can improve the efficiency of society by facilitating coordinated actions" (1993, 167). The establishment of participatory institutions that improve public service delivery can be heavily reliant on the existence of social capital. Nonetheless, these very same participatory settings can serve as mechanisms to build a sense of social identity and a more cohesive society (Gaventa and Barrett 2012). Thus, participatory processes that nurture collective action and social capital can be the reason why these settings improve accountability and public service delivery.

In agriculture, various studies have relied on these explanations to argue in favor of participatory processes. Jamarillo and Wright (2015), for instance, explained that participatory budgeting in agricultural policy design in Peru facilitates not only the transmission of information between citizens and the government, but also the sharing of preferences, needs, and commitment among civil society organizations, which makes collective action easier. Similarly, Devaux and others (2009) studied how participatory approaches in the Papa Andina initiative helped identify common interests, promote knowledge sharing, and improve collective action toward pro-poor market chain innovations.

Nonetheless, different reasons explain why participatory approaches might not be successful. In other words, accountable and responsive services do not emerge just because of the establishment of participatory processes. Instead, conditions on the supply and demand sides of service provision are necessary to bring better services to citizens and ultimately improve well-being. Speer's (2012) review piece, for instance, pointed toward the crucial need to have both capable and motivated public officials and citizens to make participatory governance successful, and Fung and Wright (2001) identified the approximate equality of power among participants as an enabling condition for establishing effective processes. Similarly, Gaventa and Barrett (2012) also emphasized associational activity as highly relevant for achieving positive outcomes, whereas Pamuk, Bulte, and Adekunle (2014) analyzed agricultural innovation platforms in eight African countries, concluding that time in existence and ex ante social

capital levels were positively associated with better results. These works, therefore, signal the importance of demand-driven processes whereby citizens are motivated (perceive benefits from participation) and organized, and share common interests (for example, low economic and social inequality) (Faysse 2006; Speer 2012).

On the supply side, governments need administrative and financial capacity to implement and follow through with the decisions reached at participatory institutions (Faysse 2006; Speer 2012). Additionally, political capacity is essential to empowering participatory processes, yet one frequently mentioned reason for why participatory processes fail to deliver the anticipated benefits is elite and interest-group capture (Blair 2000; Mansuri and Rao 2004; Sheely 2015). Put differently, whereas participatory governance relies on transferring decision-maker power to citizens, those with certain powers, such as elected representatives, local leaders, and organized interest groups, might not be willing to do so. In some cases, elites and interest groups opt for disregarding the priorities of the poor, filling out meetings with their representatives and distributing benefits to themselves (Blair 2000; Mansuri and Rao 2004; Sheely 2015). Although in some other cases, capture happens unintentionally and due to factors such as higher education and different time constraints to attend meetings (Mansuri and Rao 2004), the reality is that participatory governance might not always deliver benefits for the most needy.[2]

A related reason for why politicians might be reluctant to transfer power to participatory institutions is that the provision of government goods and services is at the core of political competition. That is, political representatives often make decisions over taxes and transfers by evaluating how to get votes and remain in office (Golden and Min 2013). This decision-making process includes considering, for example, the distribution of core and swing voters; the location of certain racial, ethnic, or ideological groups; and even the timing of delivery so that electoral returns can be maximized (for example, Cox and McCubbins 1986; Dixit and Londregan 1996; Wantchekon 2003; Stokes 2005; Shi and Svensson 2006;

[2] Dasgupta and Beard (2007), for instance, analyzed the World Bank's Urban Poverty Projects in Indonesia and highlighted the importance of elite and nonelite participation through democratic self-governance processes in order to obtain the expected goals. Other studies have also underscored the need for committed local government officials as well as traditional and religious leaders for the success of participatory platforms (for example, Sanyang et al. 2016).

Nichter 2008; Golden and Min 2013). Hence, it is plausible that politicians might not implement the actions and priorities identified at participatory processes if following those decisions does not fit within the overall scheme of getting votes and securing office.[3]

Last, a growing literature explores the role of information and communication technologies (ICTs) as a way to communicate needs and preferences to the government and increase accountability in service provision. For instance, Grossman, Macartan, and Sacramonte-Lutz (2014) showed how the introduction an ICT platform facilitated political communication of interests by marginalized populations in Uganda. Buntaine, Nielsen, and Skaggs (2017) analyzed how ICTs link government's responsiveness to citizen reports with more participation and communication on service provision. The impact of these ICT-based platforms, however, has been mixed to date (for example, Grossman, Humphreys, and Sacramone-Lutz 2016; Marathe et al. 2016; Keefer and Khemani 2014). Moreover, it is not clear how and when ICTs can act as a substitute for or complement to other forms of bottom-up demand articulation such as face-to-face meetings of village committees or stakeholder panels.

This paper contributes to this literature by looking at how multistakeholder platforms and agriculture committees (operating at different levels) affect Malawian households' and communities' well-being. It analyzes whether more active and better-performing structures foster information sharing, collective action, social capital, and more accountable and responsive extension services that ultimately deliver better outcomes at the community and household levels. In doing so, it focuses on those conditions on the supply and demand sides that are necessary for bringing about responsive and accountable extension services. Moreover, it also explores whether elite and group-interest capture and political incentives hinder the connection between participatory processes and better household and community outcomes. That is, we expect more active and better-performing platforms to deliver better

[3] In this respect, Resnick and Birner (2010) studied participatory mechanisms that enabled farmers to provide input into key policy aspects in Senegal, yet the authors showed that this participation did not translate into implemented policies, due mostly to conflicting group interests and political alliances. In Burkina Faso, the lack of financial resources hinders the implementation of discussed policies.

outcomes, but this relationship could be conditional on these participatory processes' not being captured by particularistic interests or dominated by political incentives.

3. METHODS AND DATA SOURCES

This study utilizes various surveys and interviews conducted in Malawi between August 2016 and March 2017 by the International Food Policy Research Institute (IFPRI) and its local partners, including the following:

- Nationally representative survey of 3,001 households in 299 randomly selected communities in 29 districts of Malawi (excluding Likoma)[4] (Table 3.1 shows the breakdown of households and individuals interviewed)
- Census of extension service providers in 15 districts, representing all regions, agricultural development divisions, agroecological zones, and farming systems (shaded districts in Figure 3.1)
- In-depth interviews with 30 service providers from government agencies and NGOs, as well as 71 of their frontline workers, in 15 districts
- Focus group discussions in 12 communities in 8 districts (represented by dots in Figure 3.1)

The household survey's sample size enables analysis and statistical inference concerning Malawi's farming population with a margin of error of less than 3 percent at a 95 percent confidence level. This sample is nationally representative and far larger than the minimum required sample size, estimated using power calculations based on per capita expenditure and receipt of agricultural advice as the outcome variables.

The sample households were asked to list all their plots; therefore, the same household dataset also contains detailed information on 6,282 plots, of which 43 percent are jointly managed by females and males, 22 percent are managed solely by females, and 34 percent are managed solely by males. Maize is the dominant crop, planted in 67 percent of plots, either alone or intercropped. Maize occupies 61 percent of total crop acreage, followed by beans (12 percent), groundnuts (9 percent), and tobacco (5 percent).

Within each household, the primary female and male adults were interviewed separately for modules on technology adoption and access to extension services. In total, 5,069 female and male adults

[4] For these surveys, Mzimba district was divided into north and south, and Lilongwe into east and west.

from the households are included in the sample. Of these, 531 respondents are lead farmers, trained by extension agents to help disseminate improved technologies and train other farmers.

In addition, we were able to access limited data from a census of ASPs, DSPs, and DAECCs in 10 districts (marked in Figure 3.1 as the 10 USAID Feed the Future zones of influence) conducted by the USAID-funded project titled Strengthening Agricultural and Nutrition Extension from August to September 2016.

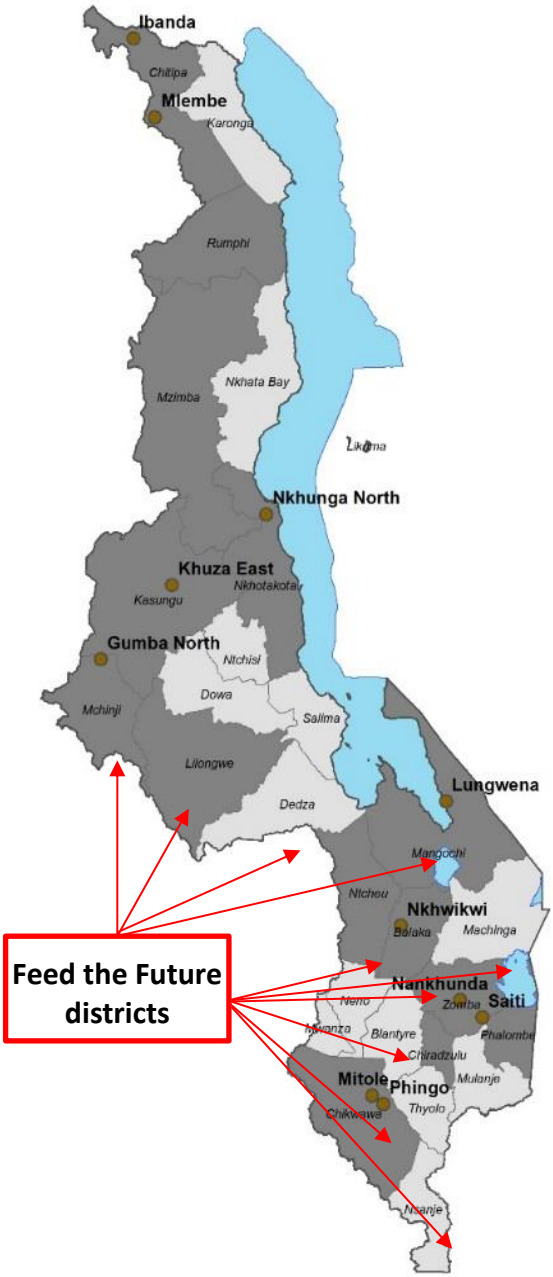
These sources were complemented by key informants' interviews, authors' observations, and a literature review. We combine quantitative and qualitative approaches and data triangulation to ensure an unbiased and rigorous assessment of these structures.

Table 3.1 Survey sample size by region and district, at both individual and household levels

District	Number of sample households	% female-headed households	% youth-headed households (age < 35 yrs.)	Number of respondents	% female respondents	Number of lead farmers
Northern region	240	23	43	417	54	47
Chitipa	30	23	60	54	57	6
Karonga	30	27	47	53	58	6
Mzimba North	50	22	42	83	51	10
Mzimba South	80	23	40	141	55	16
Nkhata Bay	30	20	37	50	50	5
Rumphi	20	25	35	36	56	4
Central region	1,361	25	45	2,305	55	231
Dedza	241	25	46	414	56	45
Dowa	110	25	50	190	54	22
Kasungu	110	25	50	189	54	19
Lilongwe East	180	27	39	273	55	33
Lilongwe West	270	27	44	461	56	36
Mchinji	170	25	42	299	54	33
Nkhotakota	40	20	45	65	52	6
Ntcheu	160	24	49	277	53	24
Ntchisi	30	20	53	52	54	5
Salima	50	24	44	84	50	8
Southern region	1,400	25	46	2,347	54	253
Balaka	130	27	47	220	55	25
Blantyre	191	26	45	317	52	36
Chikwawa	121	25	40	216	55	22
Chiradzulu	38	22	49	63	52	6
Machinga	270	26	48	463	54	42
Mangochi	210	26	46	341	55	41
Mulanje	90	23	47	151	53	17
Mwanza	20	25	45	34	56	4
Neno	20	25	55	32	53	4
Nsanje	70	23	43	107	51	12
Phalombe	50	22	54	88	55	10
Thyolo	80	24	40	124	55	13
Zomba	110	25	53	191	57	21
National	**3,001**	**25**	**46**	**5,069**	**54**	**531**

Source: Household survey by International Food Policy Research Institute (2016).

Figure 3.1 Map of Malawi, indicating focus districts for the study of extension service providers and focus group discussions



Source: Map from MASDAP (2016); raw data from International Food Policy Research Institute interviews, December 2016 to March 2017.
Note: All districts were covered in the household and community surveys. Those shaded in dark gray are the 15 focus districts of the census of service providers; those with dots are the locations of the focus group discussions; and those marked as Feed the Future districts have detailed information from a census of area stakeholder panels, district stakeholder panels, and the District Agricultural Extension Services System.

Most of the variables (for respondents, households, and communities) included in the analysis are from the nationally representative household and community surveys collected by IFPRI from August to October 2016 (see more details in Ragasa and Niu 2017). The large sample size enables analysis and statistical inference concerning Malawi's farming population with a margin of error of less than 3 percent at a 95 percent confidence level. This sample is nationally representative and far larger than the minimum required sample size, estimated using power calculations based on per capita expenditure and receipt of agricultural advice as the outcome variables.

Information on participation in and use of these different structures by the service providers and extension workers was sourced from the inventory of service providers and interviews with extension agents, which are described in detail in Ragasa and others (2017). Information on farmers' participation and insights on the workings and functioning of VDCs/VACs was sourced from the focus group discussions. A total of 22 gender-disaggregated focus group discussions were undertaken, with a total of 113 male and 141 female respondents, sampled from 11 communities in 8 districts from the same geographic areas as the household and community surveys. The locations of these focus group discussions are shown by dots in Figure 3.1. Our sampling approach purposively chose a mix of very remote and more central communities to compare their experiences. These discussions were completed in January–February 2017. Focus group discussions were led by local enumerators fluent in the local Chichewa, Chibandya, and Chinyika languages. Discussions were recorded, transcribed, and translated, and then thematically coded according to a set of predetermined and empirically driven themes using NVivo 11.

The census of the ASPs, DSPs, and DAECCs interviewed members of these extension platforms to ask a variety of questions about their organization and functioning. The data collection targeted 5 respondents per platform, including the chair, the secretary, the treasurer, and two other members, in order to get different perspectives. In some cases, however, due to availability, the enumerators ended up

interviewing alternative respondents (for example, the vice chair) or did not interview 5 respondents per panel. The final number of respondents was 721 members of 130 ASPs, 6 DSPs (4 were found inactive), and 10 DAECCs in the 10 focus districts (see Figure 3.1). The answers given by these members were then used to calculate a value for each platform using the average response or the majority of the responses.[5]

Our analysis focuses on both the household and community levels, and aims to explain (1) the formation and varied characteristics and performance of VDCs/VACs at the community level and (2) conditional on their presence, participation of farmers in VDCs/VACs. Further, we investigate whether farmers' participation in VDCs/VACs is associated with better household outcomes, while controlling for other channels that may perform similar functions as the VDC/VAC. Last, we examine whether the presence and performance of a VDC/VAC and its complementary structures (MV, ASP, DSP, and DAECC) are associated with better outcomes at the community level.

Modeling Farmers' Decision to Participate in Village Agriculture or Development Committees

We model farmers' participation in VDCs/VACs in a random utility framework. Utility, *U*, is determined by a set of farm, household, and community variables, *X*, which also influence farmers' ability and willingness to participate on these committees. The farmer is assumed to maximize utility:

$$MAX\ U = f(X). \tag{1}$$

We postulate that maize farmer *i* will participate in VDC/VAC *v* at time *t* if the expected utility derived from participating, U_{ivt}, is greater than the expected utility, U_{int}, of not participating, *n*. Expected utility from participation includes greater social capital, articulation of demands and concerns, and better access to information and services for improved welfare. This utility can also change over time, *t*. The net utility is represented by

$$U^* = U_{ivt} > U_{int}, \tag{2}$$

[5] For example, if the majority of the respondents within the panel reported that the platform had bylaws, then that platform was considered to have bylaws.

where U^* represents the benefits of participating in VDC/VAC *v* as opposed to not participating, *n*. While U^* itself is unobserved, we can observe the committee or panel that the farmer participates in as his or her revealed preference. The probability that farmer *i* participates in a VDC/VAC can be denoted by $Pr(I = 1)$. If the farmer does not participate in a VDC/VDC, U^* takes a value of 0.

If we assume a linear relationship, U^* can be written as

$$U_{ivt}^{*} = \beta_{vt} X_{it} + u_{ivt}, \tag{3}$$

where β_{vt} is a vector of coefficients to be estimated and *u* is a vector of random disturbances of the unobserved factors affecting the participation decision. In a smallholder environment with widespread market imperfections, utility maximization may differ from profit maximization. Hence, the variables included in *X* should cover a broad set of socioeconomic variables that also capture individual market access conditions, connectivity, incentives, ability, and risk preferences.

Modeling the Effect of Development Committees and Stakeholder Panels on Community-Level Outcomes

We model the value addition of VDCs/VACs at both household and community level. In theory, the impact of a committee should be evaluated by estimating the average treatment effect on the treated (ATT),

$$E(W_{(i/j)}|I = 1) = E\left(Y_{(i/j)1}\middle|I = 1\right) - E(Y_{(i/j)0}|I = 1), \tag{4}$$

where $W_{(i/j)}$ denotes the unbiased welfare effect for households *i* that participate in VDCs/VACs (or for communities *j* with active VDCs/VACs). $Y_{b(i/j)1}$ is the outcome indicator for participation in a VDC/VAC for households (or the presence of an active VDC/VAC for communities), and $Y_{(i/j)0}$ is the outcome variable if the same households were not participating in a VDC/VAC (or if the same community does not have an active VDC/VAC). Unfortunately, the same households or communities are not observed with changes in their welfare both with and without participation in or presence of a VDC/VAC over time, so in reality one has to compare participating and nonparticipating households, and communities with and without a VDC/VAC, that are not identical:

$$E(W_{(i/j)}|I=1) = E\left(Y_{(i/j)1}\middle|I=1\right) - E(Y_{(i/j)0}|I=0), \quad (5)$$

where $(Y_{(i/j)0}|I=1)$ is the outcome for households not participating in a VDC/VAC or communities without a VDC/VAC. Equations (4) and (5) lead to identical results when there is no systematic difference between participating and nonparticipating households and between communities with or without a VDC/VAC, except for the VDC/VAC itself. Yet whenever participating and nonparticipating households, and communities with or without a VDC/VAC, differ in terms of observed or unobserved characteristics, equation (5) will lead to biased impact estimates, where *Bias* can be represented as

$$Bias = E\left(Y_{(i/j)0}\middle|I=1\right) - E(Y_{(i/j)0}|I=0). \quad (6)$$

Our study builds on observational data in a context in which households self-select into VDC/VAC participation. Those households who are better off; are more connected; and have greater access to information, services, and resources are probably more likely to participate in a VDC/VAC. Similarly, those communities that are better off; are more connected; and have more access to information, services, and resources are probably more likely to have an active VDC/VAC. We use several techniques to minimize selection bias. We estimate multivariate regressions capturing, as much as we can, the observed heterogeneity across households. We use an extensive list of available controls characterizing the farm and agroecology, household, market, community, area, and district conditions. Alternatively, we use matching techniques to reduce the selection bias and ensure that similar sets of households and communities are compared.

To match treatment and control households and communities, we use nearest neighbor matching (NNM), radius matching, and kernel matching (KM), three algorithms commonly used for empirical analysis (Caliendo and Kopeinig 2008). In addition, we use another set of matching techniques, stratification using propensity scores and inverse-probability-of-treatment weighting, to further check the consistency of results across different matching methods. The last one is particularly useful to reduce selection bias in studies with observational data and produces unbiased estimates with small samples

(Pirracchio, Resche-Rigon, and Chevret 2012; Hirano and Imbens 2001; Imbens 2000). This is particularly useful for the community-level analysis, whose sample size is only 299. Last, we use the matched samples to run regression adjustments. We show the balancing and bias reduction tests from the different estimation methods in Appendix Table A.1 and graphs of the propensity scores of the samples in Appendix Figure A.1. As shown in Appendix Table A.1, matching techniques have substantially reduced the selection bias based on observable characteristics. At the household level, all the matching methods result in a major reduction in bias; at the community level, the highest reduction in bias is obtained through NNM.

It should be stressed that matching techniques build on the conditional independence assumption, which is also called *selection on observables* (Rosenbaum and Rubin 1983). This means that the method controls only for observed heterogeneity between treatment and control households. Estimates of the ATT may still be biased when there is unobserved heterogeneity. We test for the influence of such hidden bias by calculating Rosenbaum bounds (Becker and Caliendo 2007; DiPrete and Gangl 2004). Our estimations show that the critical value for bias from unobserved heterogeneity is high (more than 10 in most cases), indicating that the results are not sensitive to bias caused by unobserved heterogeneity. The lower bound of > 10 means that matched households and communities with the same observed covariates would have to differ in terms of unobserved covariates by a factor of more than 10 in order to invalidate the inference of a significant treatment effect. This shows confidence in the estimates.

Alternatively, we used multivariate regression, with various household-, community-, area-, and district-level controls, and the instrumental variables (IV) technique to check for consistency and robustness of our results. The IV technique requires that an instrument be used in the reduced-form model (the first stage) that is not in the structural model (the second stage); the instruments should be correlated with the potentially endogenous variables but not correlated with the error term in the structural model when conditioned on other covariates. The predicted probabilities in the first-stage regression models are used as the instruments in the second stage (following the approach proposed by Adams, Almeida, and Ferreira 2009). The IV technique was used to control for possible endogeneity of VDC/VAC participation

in the household welfare models and for the presence of an active and responsive VDC/VAC in the community welfare models.

The instruments used for respondents' participation in a VDC/VAC (at the respondent and household level) are the perceived usefulness of the VDC/VAC, averaged at the community level, and the percentage of people in the village participating in the VDC/VAC, less the respondent. Households are hypothesized to participate in a VDC/VAC if they perceive it to be useful. Beyond their effect on VDC/VAC participation, the perceived usefulness of VDCs/VACs and the proportion of VDC/VAC participants are not likely to affect household welfare directly. Empirically, the F statistic of these instruments is 15.21 in the first-stage model, and they are not significant in the second-stage household outcome models. The instruments tried and used for the presence of an active and responsive VDC/VAC (at the community level) are the distance to the nearest extension agent, the number of lead farmers in the community, whether the extension agent lives in the community, the community population, and the degree of diversity in the community. Extension agents, often with the support of lead farmers, are the ones who set up these committees, making them appropriate to use as instruments. Larger and more diverse communities—with diversity considered in terms of religion and language—can be harder to manage and less likely to undertake collective action (Bernard, de Janvry, and Sadoulet 2009). Empirically, the F statistic of these instruments is 10.22 in the first-stage model, and they are not significant in the second-stage, community-level outcome models.

Characterizing and Measuring the Performance of Various Governance Structures

In this paper, we define the measures of performance in terms of achieving VDC/VAC objectives: (1) to act as platforms for discussion that bring different stakeholders together, (2) to act as platforms for monitoring and providing feedback on service quality, and (3) to respond to the demands and needs articulated by the communities. Table 3.2 shows the indicators used for these performance measures.

The first two measures are relatively straightforward and are calculated directly from the responses of committee or panel members interviewed. There are some inconsistencies across the

respondents on the status of each structure, but aggregating these responses using mean, median, or mode does not alter the results. The third measure is based on perception questions asked of representatives of lower-level structures, who are supposed to be the members of the committees or panels being assessed. For example, we asked sample households their perception of the responsiveness of village committees, asked the village committee chairs and representatives their perception of the responsiveness of the ASPs, asked the ASP representatives their perception of the responsiveness of the DSPs, asked the DSP representatives their perception of the responsiveness of the DAECC, and asked the DAECC representatives their perception of the responsiveness of the DAC. This third measure is where we observed many inconsistencies. For example, some households rated inactive VDCs/VACs as highly responsive, and some ASP representatives rated inactive DSPs as responsive. These responses could be for a number of reasons. Regarding VACs/VDCs, there seems to be confusion on their difference, and any community meeting seems to be associated with the VDC/VAC. Overall, there seems to be lack of awareness of and information on what VDCs/VACs are and what they do in the community. Despite enumerators' emphasizing the time frame of within the last two years, some respondents may still have confused this period with previous years. Some of the structures could have been active in the past but are not longer active and therefore respondents are providing past information. Or the inconsistencies simply could reflect that respondents do not know much about the structures under study. Alternatively, it could also be that respondents are, to a certain extent, providing the information the interviewer is expecting to hear as opposed to the reality of the situation. However, this latter reason can be ruled out because other respondents gave varied responses, and many responded with low ratings.

Another limitation of this perception measure is that the responses are conditional on respondents' knowledge of and participation in these committees and panels. This becomes an issue if participation is low and there are not enough responses in the sample for aggregation. For example, participation in VDCs/VACs is 35 percent of households who know that a VDC/VAC exists in the community. There are some VDCs/VACs in which there is only one participant in our sample, and therefore, the rating on responsiveness depends only on this sole respondent. Fortunately, there are only

five of these VDCs/VACs, and the results are consistent even if we drop these observations. The ratings for the large majority of VDCs/VACs are aggregated across at least five responding households.

In addition, we characterize these structures in terms of their formal governance structure, organization, management, members' participation, and composition. In Malawi, there are no strict guidelines on the structure and composition of these bodies (personal communication, Clodina Chowa, former director of the Department of Agricultural Extension Services, April 20, 2017). Moreover, the literature shows mixed results in terms of desirable characteristics for these committees and panels. For example, the existence of bylaws and common action plans can facilitate shared norms and values, which should have a positive effect, according to the collective action literature. However, empirical studies by Ragasa and Golan (2014); Bernard, de Janvry, and Sadoulet (2009); and Bernard and colleagues (2008) had mixed findings depending on the type of producer organization and the country. Heterogeneity of members can also play a role in the functioning of producer groups, stakeholder committees, and panels. More diverse groups with more heterogeneous preferences and interests can be harder to coordinate and therefore find it harder to achieve successful collective action (see Mansuri and Rao 2004; Ragasa and Golan 2014; Faysse 2006). The gender composition of membership and management can also play a role. Barham and Chitemi (2009) showed that the ratio of males to females is positively associated with the group's performance, and Agarwal (2001, 2009, 2010) showed a positive significance in group dynamics of a greater female proportion in leadership.

Table 3.2 shows the different indicators generated to characterize the different structures. We do not make any a priori assumptions on what are desirable or undesirable characteristics, but rather we test these hypotheses by linking them to several performance and outcome indicators. We use correlation and factor analysis to understand how these indicators are linked to each other.

Table 3.2 Indicators, hypotheses, and literature review of potential indicators of performance

Characteristic	Indicator	Hypothesis	Findings in the literature
PERFORMANCE 1: INDICATORS OF HOW ACTIVE THE STRUCTURES ARE			
Internal mobilization	Frequency of meetings		
Management commitment	Frequency of the chair's reporting to the committee members		
Linkage to other structures	Dummy for and frequency of participation in ASP, DSP, DAECC, and DAC		
PERFORMANCE 2: INDICATOR OF MONITORING AND PROVIDING FEEDBACK ON QUALITY OF AGRICULTURAL EXTENSION SERVICES			
Systems of providing feedback on service provision	Provides a platform for discussing feedback on the quality of agricultural extension services		
PERFORMANCE 3: INDICATOR OF RESPONSIVENESS OF THE STRUCTURES			
Perceived responsiveness of the structures	Responses to the question on whether concerns/issues raised in these structures were addressed fully, addressed partially, or not addressed at all		
CHARACTERISTICS OF THE STRUCTURE			
Formal governance rules and professional management	Has bylaws, long-term plan, action plan, written organizational structure, and system of record keeping	+/-	The existence of bylaws and common action plans can facilitate shared norms and values, which should have a positive effect, according to the collective action literature. However, empirical studies by Ragasa and Golan (2014); Bernard, de Janvry, and Sadoulet (2009); and Bernard and others (2008) had mixed findings depending on type of producer organization and on country.
Size of membership and participation	Number of people attending as absolute number and as percentage of total population of community	+/-	Mixed results: Participation in meetings is a measure of members' interest and ability to mobilize; however, larger groups are harder to coordinate, according to the collective action literature, and therefore should have a negative effect (Ragasa and Golan 2014; Ragasa, Badibanga, and Ulimwengu 2016).
Diversity of participation	We measure three dimensions of diversity: (1) by gender, (2) by age, and (3) by type of stakeholder (small farmer, large farmer, local councilor, and so on). For gender, we use the following indicators: (1) percentage of women participating and (2) dummy variables for gender balance in membership, defined as (a) 50:50, (b) 40:60 female to male, and (c) 25:75 female to male (similar to the findings of Agarwal 2009, 2010).	+/-	More diverse groups with more heterogeneous preferences and interests make it harder to coordinate and harder to achieve successful collective action. Mixed outcomes (see reviews by Mansuri and Rao 2004; Ragasa and Golan 2014; Faysse 2006). For gender, Barham and Chitemi (2009) showed that a greater ratio of males to females has a positive effect, but Agarwal (2001, 2009, 2010) showed a positive significance of a greater female proportion in leadership.
Diversity in decision making	Number of different types of stakeholders with voting powers (small farmers, large farmers, local councilors, and so on)	+/-	Mixed results (Ragasa and Golan 2014; Ragasa, Badibanga, and Ulimwengu 2016). Bernard, de Janvry, and Sadoulet (2009) showed mixed results depending on the type of producer organization; Bernard and Spielman (2009) showed insignificance of diversity alone but negative significance when it is interacted with group heterogeneity.
Active participation by small farmers	Percentage of time during meetings when small farmers express their voices	+/-	More participation of small farmers should discourage elite and interest-group capture and thereby connect these extension structures with more benefits for farmers.

Source: Authors' compilation from literature as cited.

Note: ASP = area stakeholder panel; DAC = district agriculture committee; DAECC = district agricultural extension coordination committee; DSP = district stakeholder panel.

Definition and Measurement of Variables

The indicators for the characteristics and performance of the various structures are modeled to explain various outcome indicators at the household and community levels, which include the following:

Access to extension services

Access to agricultural extension and advisory services is measured as a dummy variable corresponding to the question, "Did you or anyone in your household receive any advice on agricultural production or marketing?" We asked this question for both the past 12 months and the past 2 years. The source(s) and topic of extension services received (agricultural production, marketing, environment, or nutrition) are included in the datasets, and we use them for disaggregated analysis and measuring heterogeneous effects.

Awareness and adoption of improved technologies

Agricultural technologies or management systems referenced in this paper are those mainly promoted in Malawi, as identified in discussions with scientists and extension workers: minimum tillage, soil cover, intercropping, crop rotation, composting pits, composting toilets, pit planting, organic manure making and application, water harvesting, planting vetiver grass, and using bunds and ridges. For each respondent, we captured the number technologies known, tried out, and adopted, as count data from 0 to 11. In addition to these management practices, we include two heavily promoted external inputs, chemical fertilizer and improved seeds. In our analysis, we use the quantity of fertilizer used (both subsidized and not) and the percentage of land area planted with modern varieties and certified seeds.

Agricultural productivity

Following Owens, Hoddinott, and Kinsey (2003) and Peterman and colleagues (2011), we use the value of yield per hectare of various crops as the measure of farm productivity.[6] Productivity value is calculated by multiplying the quantity of each crop produced per hectare by the farmgate or market price for the produce at the household or village level (whichever is available in the datasets). The value of production

[6] We focus here on crop productivity and exclude that of livestock.

is used because the majority of the plots were intercropped, making area estimates for each crop difficult to calculate.

Food security

We use indicators of dietary diversity to measure food security, given research findings that connect a more diversified diet with improvements in nutritional parameters.[7] Several dietary diversity indicators are used. First, following a widely used approach documented by Swindale and Bilinsky (2006), we use the household dietary diversity score (HDDS) in our analysis. The HDDS is a count of food groups, out of 12, that household members have consumed over a 7-day reference period. HDDS food groups used that are relevant for Malawi are cereals, roots and tubers, vegetables, fruits, meat, eggs, fish and seafood, pulses and legumes, milk and milk products, oils and fats, sugar and honey, and others. Second, a food consumption score is calculated using the frequency of consumption of different food groups by a household during the 7 days before the survey. Third, a household food insecurity access score is calculated following the questions adopted by Coates, Swindale, and Bilinsky (2007) reflecting the food insecurity of members of the household.

All of these outcome variables are at the household level. We computed the mean of these indicators to calculate community-level outcome indicators. Appendix Table A.2 shows the descriptive statistics of the outcome indicators and control variables at the community level. Appendix Table A.3 shows the descriptive statistics at the household level.

Various estimation models are used. First, we use a probit model to explain respondents' and households' participation in VDCs/VDCs and to link VDC/VAC participation with households' access to agriculture advice. Second, we use Tobit models to explain household-level and community-level

[7] Research implemented by IFPRI (for example, Hoddinott and Yohannes 2002) has confirmed that a more diversified diet is associated with improvement in nutritional parameters, including birth weight, child anthropometric status, improved hemoglobin concentrations, caloric and protein adequacy, percentage of protein from animal sources (high-quality protein), and per capita consumption (a proxy for household income). Studies validating dietary diversity against nutrient adequacy in developing countries have confirmed a positive relationship and a consistently positive association between dietary diversity and child growth (Ruel 2002; Arimond and Ruel 2002; Working Group on Infant and Young Child Feeding Indicators 2006; Smale, Moursi, and Birol 2015).

outcome variables (extension services access, technology adoption, productivity, and food security indicators). The outcome indicators are truncated (nonnegative for all, and some having upper bounds) to make the Tobit models relevant. Last, multinomial and ordered probit are used to explain the presence of active and responsive VDCs/VACs.

4. RESULTS

Descriptive Analysis

Table 4.1 shows the descriptive statistics for performance at various levels and the indicators of structure characteristics. In terms of performance, we find that most VDCs/VACs, ASPs, DAECCs, and DACs were active and reported some activities; however, DSPs tended to be the less active platforms.[8] A similar pattern is observed when comparing structures in terms of whether or not they provided their members a platform for giving feedback on the quality of extension services, with DSPs reporting the lowest value. This is not surprising, given that 4 out of the 10 DSPs analyzed were not organized or even meeting at the time of the data collection.

In terms of connections with other structures of the DAESS, we explore not only the frequency of meetings but also whether the representatives that attend other meetings report back to the rest of platform members on what transpired during such gatherings. These linkages across the DAESS are essential for having a well-functioning extension system and for facilitating the communication of agricultural needs that can ultimately bring better services to farmers. As before, we see that DSPs perform relatively worse than the other platforms because the majority of the respondents almost never meet with the DAECC and only half of the DSPs tend to report back about what happened during DAECC meetings. In contrast, most DAECCs (90 percent) report back to their members their discussions at the DAC level, and about half of these DAECCs meet with the DAC about once or twice a year. Similarly, about 70 percent of the ASPs report back to members on their discussions at the DSP level, and about 40 percent of the ASPs also indicate meeting once or twice a year with the DSP. As for the VDCs/VACs, about 72 percent report back to their members on their discussions at the ASP level, and half of the VACs/VCDs indicate meeting monthly with ASPs.

When looking at the characteristics of these structures, we observe that the majority have formal management systems in place, specifically having bylaws; short-term action plans; organizational

[8] Note that active platforms are those that use bylaws, have short-term plans, meet at least yearly, report back to members when meeting with other panels/committees, share reports at least annually, and have record-keeping processes.

structures that define authority and responsibilities; and record-keeping tools such as minutes of discussions, a list of activities in progress, a list of tasks assigned to each member, and attendance sheets. Again, DSPs perform worse than the other platforms. For instance, around 85 percent of all VDCs/VACs, ASPs, and DAECCs have record-keeping processes, whereas only 40 percent of the DSPs do. With respect to attendance as a share of expected participants/members, the descriptive statistics suggest substantial variation, with VDCs/VACs reporting the lowest levels and DAECCs the highest. Additionally, farmers tend to be well represented across the VDCs/VACs, ASPs, and DSPs. Women, on the other hand, are better represented on VDCs/VACs and ASPs than on DSPs and DAECCs, which could reflect women's difficulty in traveling long distances to attend DSP and DAECC meetings. Also, the highest share of VDCs/VACs and ASPs indicate meeting monthly, whereas the highest share of DSPs and DAECCs indicate meeting quarterly instead. In terms of the chair's sharing reports with the other members as well, the descriptive statistics indicate substantial variation across the different DAESS levels. For instance, whereas VDCs/VACs and ASPs engage in this reporting monthly, this frequency decreases for most DSPs and DAECCs.

Overall, these descriptive statistics suggest that despite variation in their characteristics and performance levels, these platforms are, to an extent, making the DAESS work. This observation contrasts with the general perception that these structures are nonfunctional (MEAS 2012; Chowa, Garforth, and Cardey 2013; Masangano and Mthinda 2012) but corroborates recent studies showing that DAESS structures are somewhat operational because more than half of government and nongovernment extension service providers use VACs and ASPs to gather feedback on farmers' demands and needs (Ragasa et al. 2017).

Table 4.1 Descriptive statistics of the indicators of structure characteristics and performance

Indicator	VDCs/ VACs (*N* = 299)	ASPs (*N* = 84)	DSPs (*N* = 10)	DAECCs (*N* = 10)	DACs (*N* = 10)
MEASURES OF STRUCTURE PERFORMANCE					
1. How active the structure is in terms of frequency of meetings and links to higher-level structures (0/1)					
Active (meets at least once per year)	0.84	0.90	0.20	0.60	1.00
Not active (almost never meets)	0.16	0.10	0.80	0.40	0.00
2. Degree of functionality and responsiveness to needs and concerns raised (conditional on being active) (0/1)					
Active, but not responsive (meets at least once per year)	0.85	0.89	1.00	0.56	0.64
Active and responsive (based on average ratings of the sample members)	0.15	0.11	0.00	0.44	0.36
3. Farmers have the opportunity to provide feedback on the quality of governmental extension services (0/1)	nd	0.79	0.40	0.82	nd
CHARACTERISTICS OF STRUCTURE					
Has formal management system					
Bylaws used (0/1)	0.73	0.92	0.50	0.90	Nd
Has long-term plan	0.70	0.18	0.00	0.00	Nd
Has short-term action plan (0/1)	0.72	0.70	0.30	0.80	Nd
Has written organizational structure (0/1)	0.75	0.87	0.60	1.00	Nd
Has record-keeping system in place (0/1)	0.88	0.87	0.40	0.80	Nd
% of attendees as ratio of expected participants (membership)	11.75	67.00	46.00	73.00	Nd
Frequency of meeting					
Almost never	0.08	0.01	0.40	0.00	Nd
Once or twice yearly	0.21	0.02	0.20	0.20	Nd
Quarterly	0.00	0.10	0.40	0.80	Nd
Monthly or more frequently	0.71	0.87	0.00	0.00	Nd
Frequency of chair's sharing reports with members					
Almost never	0.11	0.01	0.50	0.00	Nd
Once or twice a year	0.26	0.10	0.20	0.30	Nd
Quarterly	0.00	0.38	0.30	0.70	Nd
Monthly	0.63	0.51	0.00	0.00	Nd
% of women in membership					
Almost none	0.30	0.05	0.40	0.20	Nd
A quarter	0.24	0.73	0.40	0.60	Nd
Half	0.43	0.16	0.20	0.10	Nd
Almost all	0.30	0.00	0.00	0.00	Nd
% of attendees who are farmers					
Almost none	0.15	0.07	0.40	Na	Nd
A quarter	0.17	0.10	0.00	Na	Nd
Around half	0.29	0.27	0.60	Na	Nd
Almost all	0.39	0.47	0.00	Na	Nd
LINKAGE TO HIGHER-LEVEL STRUCTURES					
Reports back on what transpired at higher-level meetings (0/1)	0.72	0.71	0.50	0.90	Nd
Frequency of attending higher-level meetings					
Almost never	0.32	0.27	0.50	0.10	Nd
Once or twice a year	0.15	0.38	0.20	0.50	Nd
Quarterly	0.00	0.26	0.30	0.40	Nd
Monthly	0.53	0.07	0.00	0.00	Nd
Has an agriculture subcommittee (VAC) (0/1)	0.54	na	na	na	Na
Model village concept is implemented (0/1)	0.20				

Source: IFPRI survey (2016); SANE survey (2016).

Note: [a] Note that the four DSPs that were found inactive and not even interviewed at the time of the data collection were given the minimum values for all variables. ASP = area stakeholder panel; DAC = district agriculture committee; DAECC = district agricultural extension coordination committee; DSP = district stakeholder panel; VDC/VAC = village development committee or village agriculture committee. Na=not applicable, nd=no data

Determinants of Respondents' Participation in Village Development or Agriculture Committees

Participation in VDCs/VACs seems to be strongly associated with age, literacy, gender, being a lead farmer, the importance of farming in the household's occupation, the farm's level of commercialization, risk aversion, and the household's connectivity or social capital (Table 4.2).

The older respondents are, the more likely they are to participate, but the squared term also shows that the very old are less likely to participate. At the age of 53, the likelihood of participation drops. Male respondents and those with a higher literacy level are more likely to participate, although the statistical significance is weak. As expected, participation is more likely the more important agriculture is for the household livelihood as well as the more commercial the farm is. Participation is less likely for more risk-averse households, whereas wealth does not seem to affect participation. Also, as expected, lead famers are more likely to participate in VDCs/VACs and often help the government extension agents organize and facilitate these meetings.

The more connected the household members are and the stronger their social capital is, the more likely it is that they participate. This implies that VDCs/VACs are not substitutes for other social networks and connections. Moreover, this may reflect that those people active in community activities and meetings are also members of associations and organizations, given that, frequently, the channels of communication about community meetings are through existing organizations and associations. This also questions the value of adding VDCs/VACs to existing structures.

In terms of alternative ways of accessing agricultural information, VDC/VAC participation is strongly associated with more access to information via other modes and channels (for example, farmer field days or interactions with extension workers), except radio. This of course suggests a correlation between seeking agricultural information and participating in community functions, and hence, questions the value addition of VDCs/VACs to existing

structures in the community. Nonetheless, those getting information from the radio are less likely to participate in VDCs/VACs. Given that the use of radio is commonly associated with remoteness and less mobility and connectivity, it is not surprising to see that those relying mainly on radio for information are less likely to participate in VDCs/VACs.

We also controlled for the "quality" and responsiveness of VDCs/VACs, proxied by whether there are opportunities for people to raise their concerns, whether those concerns are discussed, and whether they are addressed. The results show that respondents are more likely to participate in committees that are more active and more responsive. This implies that high or low participation may be just a reflection of the perceived usefulness of the VDC/VAC.

Table 4.2 Results of the likelihood of respondents' participation in village committees

Explanatory variable	**Participation in village committees** (0/1)
Characteristics of the respondent	
Age of respondent	0.009**
	(0.004)
Age squared	-0.000*
	(0.000)
Can read or write Chichewa (= 1)	0.019
	(0.032)
Can read or write English (= 1)	0.054*
	(0.031)
Lead farmer (= 1)	0.366***
	(0.033)
Years of formal education[a]	0.006
	(0.005)
Male (= 1)	0.056*
	(0.029)

Table 4.2 continued

Explanatory variable	Participation in village committees (0/1)
Household and head characteristics	
Number of adults (≥ 18 years old) in the HH	0.002
	(0.012)
Value of 11 asset types owned by HH in 2015	0.000
	(0.000)
Total landholdings in 2015 (acres)	-0.004
	(0.004)
Total livestock units	0.001
	(0.001)
Level of commercialization (% of crops sold)	0.002***
	(0.001)
Simpson index of diversification[b]	-0.024
	(0.041)
Farming is the main occupation of the head (= 1)	0.084***
	(0.023)
Measure of connectivity of head	
Frequency of watching television[c]	-0.014
	(0.011)
Frequency of going to the nearest town[c]	-0.016
	(0.013)
Frequency of going to the nearest market[c]	0.030**
	(0.014)
Number of people in the social network on agriculture[d]	0.001
	(0.010)
Head or members belong to associations or organizations (= 1)	0.066***
	(0.024)
Measure of risk aversion of head (control = high risk taker)	
Head is very risk averse (= 1)	-0.073**
	(0.030)
Head is somewhat risk averse (= 1)	-0.144***
	(0.030)
Head is somewhat of a risk taker (= 1)	-0.069*
	(0.039)
Alternative modes or channels for accessing information used by the respondent[e]	
Farmer field days (= 1)	0.089*
	(0.047)
Farmer cluster (*ulimi wa mndandanda*) (= 1)	-0.034
	(0.060)
Farmer field schools (= 1)	0.101*
	(0.055)

Table 4.2 continued

Explanatory variable	Participation in village committees (0/1)
Farmer business schools (= 1)	0.010
	(0.095)
Farm demonstrations (= 1)	0.141***
	(0.037)
Print or resource materials on agriculture or nutrition (= 1)	0.015
	(0.081)
Library or resource center in the community (= 1)	-0.016
	(0.321)
Agricultural training center (= 1)	0.134*
	(0.078)
Radio (= 1)	-0.127***
	(0.024)
Television (= 1)	-0.013
	(0.118)
Phone/SMS (= 1)	0.041
	(0.070)
Face-to-face visits from extension workers (= 1)	0.133***
	(0.031)
Mobile vans (= 1)	-0.033
	(0.068)
Responsiveness of the village committee (control = no discussions, not responsive)	
There are discussions, but committee is not responsive to concerns raised	0.196***
	(0.073)
There are discussions, and committee is somewhat responsive to concerns raised	0.172***
	(0.057)
There are discussions, and committee is responsive to concerns raised	0.224***
	(0.047)
Community fixed effects[f]	yes
Observations (members of households)	3,224
Pseudo R^2	0.29
Log likelihood	-1,588.150
Chi-squared	1,146.887

Source: International Food Policy Research Institute household and community surveys (2016).

Note: Figures are the marginal effects from a dprobit model. Standard errors in parentheses. The figures for those designated "(= 1)" are discrete change of dummy variable from 0 to 1. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. [a] We also tried a dummy for formal education (with/without), a dummy for primary education (with at least / without), and inclusion of a squared term, and results are consistent. [b] This is defined at household level as 1 minus the summation of the square of the share of land allocated to each crop. The index is 0 if all land is allocated to a single crop. [c] Likert scale, 1–5, with 1 being the most frequent. [d] The number reported by respondents as the people in their network with whom they discuss agriculture. [e] Respondents can have multiple channels. [f] We also used extension planning area and district fixed effects in alternative models, and the results are very similar. HH = household.

Effects of Participation in Village Committees on Household Welfare (Household Level)

Various models consistently show that household participation in a VDC/VAC is strongly associated with greater access to extension services as well as agricultural technology awareness and adoption (Table 4.3). This access and technology adoption seem to be the channels and mechanisms linking VDC/VAC participation with productivity and food security. Beyond these mechanisms, however, we do not see other direct effects of participation in a VDC/VAC on productivity and food security.

These findings are also reflected in our qualitative evidence, which indicates the value of these committees (especially VACs) for coordinating agricultural activities with extension workers, teaching farmers agricultural practices, and identifying the beneficiaries of the fertilizer subsidy program. Moreover, the focus group discussions also revealed that these committees serve somewhat as a mechanism for demand articulation. For instance, male farmers in the central region of Chitipa indicated that the VAC is used not only for sharing agricultural messages and teaching about the right time for certain agricultural practices, but also to voice "farmers' needs when there is no extension worker." A group of female farmers in this same district also explained that during a period of hunger, they "requested an irrigation scheme and got it," and another group of female farmers in the Mangochi district also mentioned using the VAC to "request information and send complaints." Interestingly, in the absence of a VAC, the VDC also performs this demand articulation function because, according to female farmers in the district of Zomba, "the VDC follows up the extension worker to make sure they are doing their work." This evidence therefore suggests that, at least in some cases, the connection between better outcomes at the household level and participation in the VDC/VAC can happen because these committees offer participants the opportunity to express their demands and voice their concerns. This functionality is essential for making agricultural extension service provision in Malawi more accountable and responsible to farmers' needs.

Effects of Village Committees and Model Villages on Community Welfare (Community Level)

Table 4.4 shows a strong association between the presence of an active and responsive VDC/VAC and greater access to agricultural advice in the community. There is also a strong association between an active and responsive VDC/VAC and a greater number of technologies known, tried out, and adopted by farmers in the community. These results are consistent when using other estimation models, including propensity score matching and instrumenting the responsiveness of VDCs/VACs with the distance in kilometer to an extension agent, the size and diversity of the community, whether an extension agent lives in the community, and the number of lead farmers in the community. These results therefore show that the presence of these participatory platforms at the community level makes these communities more receptive to new agricultural methodologies, which can prove crucial to satisfying food security. Moreover, these results, together with the qualitative evidence that emphasizes how VDCs/VACs are used to disseminate agricultural information, suggest that these group settings can be helpful for farmers to discuss new technologies, address potential problems, and ultimately support each other in the adoption of better practices.

Effect of Higher-Level Structures on Community Welfare (Community Level)

In terms of higher-level structures (active and responsive panels and coordination committees at the area and district levels), there are some consistent patterns across various models (Table 4.5). Areas and districts with active stakeholder panels and coordination committees have greater access to agricultural advice in the community and more technologies known and adopted, conditional on having an active VDC/VAC. In fact, we see strong correlation of a responsive VDC/VAC with the functionality and responsiveness of the higher structures at the area and district levels. This means that the ability of the VDC/VAC to respond to the needs and demands of the communities may be dependent on the ability and responsiveness of the higher-level structures at the area and district levels. These results imply an interdependence and complementarity of these structures and suggest the need for a holistic, rather than piecemeal, approach to strengthening the whole system.

One issue that deserves discussion is the interaction between these platforms and development projects in the communities. The outcome variables at the community level may be just a reflection of the presence and intensity of activities of various development projects and programs. Of the sample communities, almost all (96 percent) have had development projects or programs implemented in the last five years. Most of them have had two or three development projects or programs with agriculture or food security as a major or minor component in them. So we do not see much variation across communities in terms of the presence and number of development projects in the sample communities. Therefore, it seems that the presence of development projects has a confounding effect on the presence or functionality of the VDC/VAC and other, higher-level platforms.

Correlates of Active and Responsive Village Committees (Community Level)

Table 4.5 shows no strong and consistent associations between VDC/VAC characteristics and their performance indicators. In most models, VDCs/VACs that are active but not responsive and those that are responsive are different in terms of the frequency of reporting by the chair, ASP-related activities, and concerns raised and addressed in the ASP. A greater percentage of women attending the VDC/VAC is associated with a more active and responsive VDC/VAC in most models. A record-keeping system, an action plan, and greater participation have no strong and consistent associations with how responsive VDCs/VACs are.

Appendix Table A.4, using outcome indicators at the community level, shows clearer patterns. The number of different stakeholders participating in a VDC/VAC is positively associated with the number of technologies households in the community are aware of and have tried, and with the average crop productivity in the community; however, it is negatively related to access to extension services in 2015. The percentage of time that smallholder farmers versus large farmers spend articulating and expressing their concerns during meetings is associated with the number of technologies tried out, which suggests that farmers may be spending this time talking about how to make these technologies work for them. A greater proportion of women participating in a VDC/VAC is associated with more agricultural

technologies adopted. This finding relates to recent studies that highlight the importance of making agricultural information available to both men and women in order to increase households' food security (Ragasa, Aberman, and Alvarez-Mingote 2017). The presence of a record-keeping system in the VDC/VAC is related to greater access to advice. Model village implementation is strongly associated with a greater number of technologies tried out in the community.

Table 4.3 Impact of household participation in village committees on household welfare indicators

	Stratification using PS			PSM using NN			IPTW			Matching + regression adjustment			IV		
	ATT	S.E.		ATT	S.E.		ATT	S.E.		ATT	S.E.		ATT	S.E.	
Access to some agricultural information (0/1)	0.10	0.02	***	0.08	0.03	***	0.11	0.02	***	0.09	0.03	***	0.17	0.08	**
Number of technologies known	0.08	0.09					0.11	0.07		0.11	0.07		0.33	0.15	**
Number of technologies tried out	0.11	0.06		0.10	0.08		0.11	0.06		0.11	0.06		0.18	0.11	
Number of technologies adopted	0.12	0.04	***	0.16	0.05	***	0.13	0.03	***	0.11	0.04	***	-0.15	0.07	**
Quantity of chemical fertilizer used during last rainy season (kg)	1.32	2.08		1.95	2.99		1.41	1.86		0.70	1.88		12.72	3.56	***
% of acreage planted with modern variety	0.03	0.01	*	0.04	0.02	*	0.05	0.01	***	0.05	0.02	**	0.07	0.03	**
Value of crop production per hectare (MWK '000/ha)	-3.13	1.95		-2.16	2.69		-2.00	1.62		-2.79	1.55		-0.25	2.62	
Total value of production per household (MWK '000)	-5.98	3.61		-5.88	4.76		-2.10	2.98		-4.67	2.77		-0.72	4.31	
Household dietary diversity score (0–10)[a]	0.02	0.05		-0.01	0.08		0.04	0.05		0.01	0.05		0.11	0.09	

Source: International Food Policy Research Institute household and community surveys (2016).

Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. [a] We found a similar insignificant ATT for the other measures of food security. ATT = average treatment effect on the treated; IPTW = inverse-probability-of-treatment weighting; IV = instrumental variables approach; MWK = Malawian kwachas; PS = propensity score; PSM using NN = propensity score matching using nearest neighbor matching (using radius matching and kernel matching gave similar results).

Table 4.4 Impact of village committees and model villages on community welfare indicators

	Stratification using PS			PSM using NN			IPTW			Matching + regression adjustment			IV		
	ATT	S.E.		ATT	S.E.		ATT	S.E.		ATT	S.E.		ATT	S.E.	
Active VDC versus nonactive VDC															
% with access to extension services	0.04	0.02	*	0.04	0.02	*	0.13	0.03	**	0.10	0.04	*	0.06	0.02	*
Average number of technologies known of	0.94	0.36	**	0.79	0.34	*	0.60	0.22	**	0.85	0.41	*	0.30	0.13	**
Average number of technologies tried out	0.68	0.19	**	0.88	0.34	**	0.47	0.16	**	0.82	0.24	**	0.29	0.13	**
Average number of technologies adopted	0.05	0.21		0.08	0.26		0.20	0.10	*	0.06	0.15		0.00	0.34	
Average quantity of chemical fertilizer used (kg)	4.65	8.46		-6.99	14.90		8.66	6.17		0.30	10.20		17.06	19.16	
Average % of acreage planted with modern variety	-0.03	0.02		-0.01	0.05		-0.01	0.02		-0.02	0.03		-0.04	0.06	
Average value of production per hectare (MWK ’000/ha)	-5.41	6.58		0.96	9.13		-7.74	5.76		-4.43	6.92		-27.89	17.04	
Average production value per household (MWK ’000)	-18.00	11.19		0.66	18.85		25.60	8.81		-13.20	14.37		4.28	32.26	
Household dietary diversity score (0–10)	0.09	0.19		0.07	0.34		-0.11	0.14		0.12	0.23		-0.76	0.53	
Nonresponsive versus responsive VDC (conditional on being active)															
% with access to extension services	-0.01	0.04		0.01	0.05		-0.01	0.03		-0.02	0.05		-0.10	0.06	
Average number of technologies known of	0.26	0.41		-0.08	0.67		-0.11	0.34		0.09	0.57		1.50	0.54	***
Average number of technologies tried out	0.68	0.19	**	0.88	0.34	**	0.47	0.16	**	0.82	0.24	**	0.29	0.13	**
Average number of technologies adopted	0.55	0.24	*	0.40	0.13	**	0.32	0.12	**	0.55	0.26	**	1.34	0.41	***
Average quantity of chemical fertilizer used (kg)	4.65	8.46		-6.99	14.90		8.66	6.17		0.30	10.20		17.06	19.16	
Average % of acreage planted with modern variety	-0.03	0.02		-0.01	0.05		-0.01	0.02		-0.02	0.03		-0.04	0.06	
Average value of production per hectare (MWK ’000/ha)	-4.31	5.58		0.86	7.13		-7.74	6.66		-4.43	8.92		-23.89	16.04	
Average production value per household (MWK ’000)	-19.00	12.19		0.66	19.85		27.60	6.61		-17.70	14.37		4.38	33.26	
Household dietary diversity score (0–10)	0.09	0.19		0.07	0.34		-0.11	0.14		0.12	0.23		-0.76	0.53	
Active VAC versus nonactive VAC															
% with access to extension services	0.07	0.03	*	0.07	0.02	**	0.07	0.03	*	0.09	0.04	*	0.19	0.07	***
Average number of technologies known of	0.94	0.36	**	0.79	0.34	*	0.60	0.22	**	0.85	0.41	*	0.30	0.13	**
Average number of technologies tried out	0.68	0.19	**	0.88	0.34	**	0.47	0.16	**	0.82	0.24	**	0.29	0.13	**
Average number of technologies adopted	0.02	0.42		0.88	0.34	**	0.47	0.16	**	0.01	0.55		0.61	0.30	*
Average quantity of chemical fertilizer used (kg)	-9.82	6.68		-5.77	9.83		-8.91	6.71		-8.44	8.71		2.24	22.92	
Average % of acreage planted with modern variety	0.04	0.02	*	0.03	0.05		0.04	0.02	*	0.03	0.03		0.39	0.32	
Average value of production per hectare (MWK ’000/ha)	-5.31	6.58		0.76	9.13		-8.74	5.76		-5.43	7.92		-27.89	17.04	
Average production value per household (MWK ’000)	-20.00	11.19		0.56	18.85		25.60	8.61		-13.20	13.37		4.28	32.26	

Table 4.4 continued

	Stratification using PS			PSM using NN			IPTW			Matching + regression adjustment			IV		
	ATT	S.E.		ATT	S.E.		ATT	S.E.		ATT	S.E.		ATT	S.E.	
Household dietary diversity score (0–10)	0.07	0.19		0.06	0.40		-0.11	0.14		0.12	0.23		-0.76	0.53	
Nonresponsive versus responsive VAC (conditional on being active)															
% with access to extension services	0.14	0.05	**	0.14	0.06	**	0.09	0.04	**	0.13	0.05	**	0.11	0.05	*
Average number of technologies known of	0.36	0.65		0.59	0.65		0.59	0.65		0.29	0.90		1.00	0.46	**
Average number of technologies tried out	0.68	0.19	**	0.88	0.34	**	0.47	0.16	**	0.82	0.24	**	0.29	0.13	**
Average number of technologies adopted	0.02	0.42		0.58	0.65		0.57	0.65		0.01	0.55		0.61	0.35	*
Average quantity of chemical fertilizer used (kg)	-9.82	6.68		-5.77	9.83		-8.91	6.71		-8.44	8.71		2.24	22.92	
Average % of acreage planted with modern variety	0.04	0.02	*	0.03	0.05		0.04	0.02	*	0.03	0.03		0.39	0.12	**
Average value of production per hectare (MWK ’000/ha)	-6.01	5.58		0.76	9.13		-8.74	5.76		-5.43	7.92		-20.89	14.04	
Average production value per household (MWK ’000)	-16.00	11.19		0.56	18.85		25.60	8.61		-13.20	13.37		4.68	30.26	
Household dietary diversity score (0–10)	0.09	0.19		0.07	0.34		-0.11	0.14		0.12	0.23		-0.76	0.53	
Model village															
% with access to extension services	-0.03	0.04		-0.09	0.07		-0.04	0.04		-0.03	0.04		-0.06	0.09	
Average number of technologies known of	-0.04	0.29		-0.24	0.58		-0.17	0.28		-0.17	0.43		-0.06	0.09	
Average number of technologies tried out	0.16	0.24		0.00	0.42		0.12	0.22		0.11	0.35		0.87	0.56	
Average number of technologies adopted	-0.01	0.15		0.02	0.22		-0.06	0.13		-0.03	0.16		-0.72	0.42	
Average quantity of chemical fertilizer used (kg)	-9.82	6.68		-5.77	9.83		-8.91	6.71		-8.44	8.71		2.24	22.92	
Average % of acreage planted with modern variety	0.04	0.02	*	0.03	0.05		0.04	0.02	*	0.03	0.03		0.39	0.32	
Average value of production per hectare (MWK ’000/ha)	-5.61	6.58		0.66	7.13		-5.54	5.76		-5.43	7.92		-21.89	17.04	
Average production value per household (MWK ’000)	-18.00	11.19		0.56	18.85		19.60	8.61		-14.20	14.37		3.08	32.26	
Household dietary diversity score (0–10)	0.08	0.18		0.07	0.34		-0.10	0.14		0.14	0.23		-0.56	0.33	

Source: International Food Policy Research Institute household and community surveys (2016).

Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. [a] We found a similar insignificant ATT for the other measures of food security. ATT = average treatment effect on the treated; IPTW = inverse-probability-of-treatment weighting; IV = instrumental variables approach; MWK = Malawian kwachas; NN = nearest neighbor matching; PS = propensity score; PSM using NN = propensity score matching using nearest neighbor matching (using radius matching and kernel matching gave similar results); VAC = village agriculture committee; VDC = village development committee.

Table 4.5 Effect of the functionality of higher-level platforms on community welfare indicators

	Stratification using PS			PSM using NN			IPTW			Matching + regression adjustment			IV		
	ATT	S.E.		ATT	S.E.		ATT	S.E.		ATT	S.E.		ATT	S.E.	
Active VDC with active ASP versus nonactive ASP															
% with access to extension services	0.05	0.02	*	0.05	0.02	*	0.15	0.03	**	0.12	0.04	*	0.08	0.02	*
Average number of technologies known of	1.22	0.32	**	0.88	0.28	**	0.76	0.30	**	0.96	0.38	*	0.35	0.12	**
Average number of technologies tried out	0.68	0.19	**	0.88	0.34	**	0.47	0.16	**	0.82	0.24	**	0.29	0.13	**
Average number of technologies adopted	0.05	0.20		0.08	0.25		0.21	0.11	*	0.06	0.12		0.01	0.31	
Active VDC with responsive ASP versus nonresponsive ASP															
% with access to extension services	0.06	0.02	*	0.06	0.02	*	0.16	0.03	**	0.13	0.04	*	0.08	0.02	*
Average number of technologies known of	1.23	0.34	**	0.92	0.38	*	0.78	0.31	**	0.98	0.33	*	0.37	0.15	**
Average number of technologies tried out	0.72	0.21	**	0.88	0.34	**	0.49	0.16	**	0.85	0.24	**	0.31	0.14	**
Average number of technologies adopted	0.07	0.22		0.09	0.23		0.22	0.12	*	0.08	0.13		0.02	0.20	
Active VDC with active higher structures versus nonactive higher structures[a]															
% with access to extension services	0.05	0.02	*	0.05	0.02	*	0.15	0.03	**	0.12	0.04	*	0.08	0.02	*
Average number of technologies known of	1.22	0.32	**	0.88	0.28	*	0.76	0.30	**	0.96	0.38	*	0.35	0.12	**
Average number of technologies tried out	0.68	0.19	**	0.88	0.34	**	0.47	0.16	**	0.82	0.24	**	0.29	0.13	**
Average number of technologies adopted	0.05	0.20		0.08	0.25		0.21	0.11	*	0.06	0.12		0.01	0.31	
Active VDC with responsive higher structures versus nonresponsive higher structures[a]															
% with access to extension services	0.06	0.02	*	0.06	0.03	*	0.16	0.03	**	0.13	0.04	*	0.09	0.02	*
Average number of technologies known of	1.25	0.35	**	0.89	0.28	*	0.79	0.32	**	0.98	0.32	*	0.37	0.14	**
Average number of technologies tried out	0.72	0.20	**	0.93	0.32	**	0.55	0.18	**	0.85	0.25	**	0.33	0.11	**
Average number of technologies adopted	0.08	0.19		0.09	0.18		0.24	0.13	*	0.07	0.11		0.02	0.30	

Source: International Food Policy Research Institute household and community surveys (2016).

Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. [a] Ratings for higher structures are the average ratings of the district-level structures (district stakeholder panels, district agricultural extension coordination committees, and district agriculture committees). ASP = area stakeholder panel; ATT = average treatment effect on the treated; IPTW = inverse-probability-of-treatment weighting; IV = instrumental variables approach; PS = propensity score; PSM using NN = propensity score matching using nearest neighbor matching (using radius matching and kernel matching gave similar results); VDC = village development committee.

Table 4.6 Results of estimation models linking VDC/VAC characteristics and performance (community level)

	(1) Multinomial logit		(2) Ordered logit
	Inactive VDC/VAC compared with responsive VDC/VAC	Active but not responsive VDC/VAC compared with VDC/VAC	
% of population participating	0.011	0.030***	-0.014***
	(0.009)	(0.008)	(0.005)
Number of different stakeholders attending	-0.090	0.048	0.034
	(0.069)	(0.064)	(0.051)
% of time during meetings that small farmers express their needs	-0.088	-0.195	0.098
	(0.163)	(0.152)	(0.116)
% of attendees who are women	-0.402*	-0.053	0.248
	(0.228)	(0.208)	(0.164)
Frequency of meeting	-0.132	0.057	0.037
	(0.231)	(0.204)	(0.162)
Has an action plan (= 1)	0.029	-0.397	0.148
	(0.434)	(0.371)	(0.289)
Has a record-keeping system in place (= 1)	1.905*	0.603	-1.006*
	(1.116)	(0.629)	(0.538)
Frequency of reporting by chair (1–4 scale)	-0.209	-0.538*	0.307
	(0.326)	(0.283)	(0.225)
Frequency of attending ASP meetings (1–4 scale)	0.280	-0.138	-0.094
	(0.220)	(0.194)	(0.155)
Concerns of community are addressed in ASP (1–3 scale)	0.074	-0.726**	0.142
	(0.242)	(0.321)	(0.199)
Model village approach introduced in community (= 1)	0.194	-0.592	0.032
	(0.409)	(0.450)	(0.322)
Constant	-0.976	1.458	
	(1.448)	(1.094)	
Observations	272		272
Log likelihood	-246.067		-261.267
Chi-squared	44.171		13.771

Source: International Food Policy Research Institute household and community surveys (2016).

Note: Figures are marginal effects. Standard errors in parentheses. Variables with designation "(= 1)" are dummies, and the figures represent discrete change of dummy variable from 0 to 1. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. ASP = area stakeholder panel; VDC/VAC = village development committee or village agriculture committee.

5. DISCUSSION

Results show that households' participation in village development or agriculture committees (VDCs/VACs) is strongly associated with the outcome indicators (greater access to extension services, agricultural technology awareness and adoption). This is similar, for instance, to the findings of Jaramillo and Wright (2015), who concluded that voluntary participatory panels in Peru were connected with more active and effective agricultural policy. These results are also related to those of Cavatassi and others (2011), who found farmers' participation in multistakeholder panels to be related to higher yields and gross margins. Nonetheless, households' participation in these VDCs/VACs is conditioned on the committees' being active and responsive, which implies that high or low participation may be just a reflection of the perceived usefulness of these committees and panels. Put differently, households might be motivated to participate in these platforms only when they are perceived as useful, as opposed to having the required motivation, organizational capacity, and joint action to make them work in the first place. Most structures were given poor ratings in terms of their responsiveness to the concerns and issues raised, and this is clearly an issue that needs to be addressed to strengthen community participation and extension service delivery in Malawi.

Second, there is low awareness of these committees and panels, and much confusion on their roles and functions, as implied by the inconsistent responses provided by village opinion leaders and sample household members. In relation to strengthening the quality of these committees and panels, greater attention will be needed to strengthen the awareness and knowledge of the rural population about these structures to ignite their interest and incentive to participate and remain active.

Third, we show that an active and responsive VDC/VAC can contribute to better community-level outcomes (greater access to agricultural advice, greater number of technologies tried out by farmers, and better food security indicators), and this is consistent across various estimation models. We also demonstrate that active panels and coordinating committees at the area and district levels are associated with better outcome variables at the community level. Those that have a feedback and monitoring system

on extension service provision have greater access to extension services and a greater number of agricultural and climate-smart technologies tried out. This result relates to the findings of Masset and Haddad (2015), who also found that adding feedback modules during the implementation of farmer field schools led to increases in farmers' agricultural knowledge and practices. More broadly, these findings are an important contribution to the existing literature in that they show that participatory governance mechanisms at different levels can have strong associations with community-level outcomes. Whereas most studies analyze participation at one level, we show that citizens' engagement at different levels can deliver benefits all the way down to the community. In addition, these results signal the importance of building system capacity so that the different structures can support and be responsive in delivering better extension services to farmers, which ends up benefiting entire communities. Our results show a strong correlation of a responsive VDC/VAC with the functionality and responsiveness of the higher structures at the area and district levels, implying interdependence and complementarity of these structures, and suggesting the need for a holistic approach in strengthening these structures.

Fourth, with the aim of identifying characteristics of an active and responsive VDC/VAC, results show that formal guidelines or structures attached to the VDC/VAC may not always be better than less rigid ones. In some models, the presence of a record-keeping system in a VDC/VAC is related to greater farmer access to advice. However, the presence of a long-term plan or action plan and a greater proportion of the population participating in these committees have no strong and consistent associations with how responsive the VDCs/VACs are. The frequency of meetings also is not statistically significant. This is not surprising, given the mixed findings in the existing literature (for example, Bernard et al. 2008; Bernard, de Janvry, and Sadoulet 2009; Ragasa and Golan 2014). Nevertheless, some characteristics seem to matter. The frequency of reporting by the chair of what transpired in area- or district-level stakeholder panels is associated with the responsiveness of the VDC/VAC in most models, which again reflects the importance of having a well-functioning extension system or structure in place.

Last, in terms of the diversity of participants, in most models we find that a greater percentage of women attending the VDC/VAC is associated with a more active and responsive VDC/VAC as well as

more agricultural technologies adopted in the community. This beneficial role of women in the VDC/VAC aligns with other studies that have also found female leadership as having a positive effect on the performance of participatory processes (for example, Barham and Chitemi 2009; Agarwal 2001, 2009, 2010). Additionally, the number of different stakeholders participating in a VDC/VAC is positively associated with the number of technologies households in the community are aware of and have tried, as well as the average crop productivity in the community. Also, a greater active participation by small farmers versus medium and large farmers in the discussions and deliberations during VDC/VAC meetings is associated with more technologies tried out in the community. This suggests that VDC/VAC meetings are successful at addressing social and economic inequalities, and deliver benefits to those who can benefit the most from these committees. Moreover, this last set of results reflects the importance of these committees' being open to the needs of the community at large (including those of women and smallholder farmers) instead of being captured by the agricultural priorities of a few influential elite members. In other words, in the Malawian context, VDCs/VACs seem to be effectively working as a mechanism for the sharing of information that helps communities adopt new agricultural technologies.

6. CONCLUSIONS

This paper provides new empirical evidence on the effectiveness of village structures and stakeholder panels, utilizing unique representative and large-sample datasets on households, communities, and various structures (VDCs/VACs, ASPs, DSPs, and DAECCs), and contributing to scarce statistical analysis on this topic on various fronts. First, our results show that active and responsive village committees and stakeholder panels contribute to household and community welfare. That is, these participatory processes play a role in sharing information and facilitating the adoption of agricultural technologies that benefit farming households and communities. Moreover, despite earlier claims that these structures are largely dysfunctional in Malawi, our results show otherwise and suggest that these structures are more heterogeneous than initially thought. These results also stand in contrast to earlier studies showing similar structures as largely ineffective (such as the research-extension-farmer-industry linkage committees in Ghana and Nigeria or the agricultural and rural management councils in the Democratic Republic of the Congo). Of course, these findings might just be a result of recent support for VDCs/VACs provided through several development projects.

Importantly, our results show that it is not the presence of these structures that matters, but rather their quality and how they bring concrete benefits to participants makes the difference. These structures should therefore be further strengthened as long as the benefits exceed the costs of establishment, implementation, and monitoring. Current capacity strengthening of these structures seems to be done mechanically, focusing on their setup without providing adequate support for their long-term functionality, such as designing monitoring practices and tracking key objectives. It is paramount that strengthening interventions target these much-needed operational areas. Moreover, results show specific elements of these village committees that can be strengthened, including improving the record-keeping system of the VDC/VAC; encouraging different types of stakeholders, a greater proportion of women, and a greater number of smallholder farmers to participate and actively discuss in the VDC/VAC; and greater participation and a feedback system with higher-level structures at the area and districts levels. A

model village concept that focuses on an integrated approach to solving communities' challenges is not associated with better community outcomes, and its design and implementation should be reviewed and improved for it to contribute to community development.

Our results are robust across different estimation models. Nonetheless, our study is not without some limitations. First, there are no baseline data to compare what happened before and after the implementation of these committees and panels. Hence, our study relies on econometric techniques including matching and IV techniques to address selection bias and unobserved heterogeneity across households and communities. Second, we do not have data on the costs of implementing and monitoring these structures, nor on the sources of such funding. It could be that donors' and NGOs' financial support is the reason why some structures perform better than others; however, it could also be that some structures are better at raising funds and at receiving contributions from their members. Thus, exploring how variation in the sources, the amount, and the use of such funding affects these structures' performance can be the focus of future research.

APPENDIX

Table A.1 Reduction of bias from the matching techniques

Sample	Pseudo R^2	LR chi^2	$p >$ chi^2	Mean bias	Median bias	*B*	*R*	% variation
Household participates in VDC/VAC or not (household level)								
Unmatched	0.21	1,215.68	0.00	18.30	10.70	14.60	0.00*	60.00
Matched	0.01	24.63	0.74	2.00	1.60	16.60	1.13	25.00
Active versus nonactive VDC/VAC (community level)								
Unmatched	0.24	56.94	0.04	14.30	11.80	90.5*	0.09*	25.00
Matched	0.05	6.08	1.00	5.40	3.90	54.1*	0.80	13.00
Responsive versus nonresponsive VDC/VAC (conditional on being active) (community level)								
Unmatched	0.28	56.33	0.05	16.90	13.40	123.3*	0.38*	25.00
Matched	0.06	5.31	1.00	9.10	7.60	58.3*	0.80	4.00
Model village versus not (community level)								
Unmatched	0.26	77.27	0.00	15.50	12.50	136.7*	1.05	25.00
Matched	0.03	5.25	1.00	6.50	6.10	43.6*	0.71	21.00

Source: Results from Stata program using IFPRI survey (2016) and SANE survey (2016)

Note: These figures are from nearest neighbor matching. The other matching techniques yielded similar results. * If *B* > 25 percent, *R* is outside [0.5; 2]. *B* = XX; LR = XX; *R* = XX; VDC/VAC = village development committee or village agriculture committee.

Table A.2 Descriptive statistics of the outcome indicators and control variables at community level (*N* = 299)

Variable	Mean	Std. dev.	Min.	Max.
OUTCOME VARIABLES				
Received agriculture advice in past 12 months (0/1)	0.53	0.23	0.00	1.00
Average number of technologies known	5.16	1.81	1.00	10.00
Average number of technologies tried	2.91	1.27	0.00	7.00
Average number of technologies adopted	1.54	0.86	0.00	5.00
Average quantity of chemical fertilizer used in rainy season (kg)	73.09	43.46	0.00	230.00
% of land area planted with modern varieties	0.93	0.14	0.25	1.00
Value of production per hectare (MWK '000/ha)	66.57	37.34	6.29	179.78
Total value of production of the household (MWK '000)	99.75	67.62	3.57	378.97
Household dietary diversity score	4.72	1.11	2.00	8.00
Food consumption score	31.71	8.01	13.25	58.50
Household food insecurity access score	9.38	4.77	0.00	22.00
TREATMENT				
VDC/VAC is responsive (1–3 scale)	1.96	0.53	1.00	3.00
VAC is present (0/1)	0.54	0.50	0.00	1.00
Community is a model village (0/1)	0.20	0.40	0.00	1.00
COMMUNITY CHARACTERISTICS				
Measures of economic well-being				
% of population with neat shoes and clothing	0.75	0.44	0.00	1.00
% of houses made of burnt brick	0.63	0.48	0.00	1.00
% of houses made of iron sheet	0.27	0.44	0.00	1.00
Average landholdings (acres)	2.77	1.25	0.82	11.75
Average household assets (MWK '000)	14.76	12.61	0.00	112.50
Average livestock units	7.38	6.29	0.00	35.50
Provision of services				
Community has electricity (0/1)	0.36	0.48	0.00	1.00
Community has health center (0/1)	0.25	0.43	0.00	1.00
Community has elementary school (0/1)	0.81	0.40	0.00	1.00
Community has mill (0/1)	0.70	0.46	0.00	1.00
Community has storage facilities (0/1)	0.20	0.40	0.00	1.00
Community has irrigation (0/1)	0.26	0.44	0.00	1.00
Number of projects in the last 5 years	3.01	1.61	0.00	9.00
Number of farm demos in the last 5 years	1.94	2.07	0.00	11.00
Contract farming is present in the community (0/1)	0.31	0.46	0.00	1.00
Distance to government extension agent (km)	6.61	8.14	0.00	45.00
Extension agent lives in the community (0/1)*	0.24	0.43	0.00	1.00
Number of extension agents working in the community*	1.19	0.74	0.00	8.00
Number of lead farmers in the community*	2.61	2.98	0.00	40.00
% of population receiving fertilizer subsidy	0.30	0.19	0.00	0.90

Table A.2 continued

Variable	Mean	Std. dev.	Min.	Max.
Livelihood				
Farming is the main employment (0/1)	0.93	0.26	0.00	1.00
Number of nonagriculture-related main activities	2.13	1.24	0.00	4.00
Average % of crops sold	7.70	5.95	0.00	24.91
Score for crop diversification (Simpson index of diversification)	0.60	0.13	0.00	0.89
Social capital				
Number of associations	2.03	1.93	0.00	15.00
Number of farmer clusters	3.22	23.87	0.00	400.00
Political capital				
Member of Parliament is a current resident in the community (0/1)*	0.08	0.28	0.00	1.00
Member of Parliament was a resident in the community (0/1)*	0.10	0.31	0.00	1.00
Number of visits of a member of Parliament*	1.66	6.28	0.00	70.00
Share of registered voters (1–3 group)*	2.26	0.62	1.00	3.00
Local councilor is an important figure (SD, D, A, SA)*	2.96	1.09	1.00	4.00
Local councilors do their work (SD, D, A, SA)*	2.52	1.14	1.00	4.00
Size and diversity				
Population of the community ('000)*	2.38	3.10	0.11	20.00
Main religion is practiced by more than 75% in the community (0/1)*	0.80	0.40	0.00	1.00
Main language is spoken by more than 75% in the community (0/1)*	0.88	0.33	0.00	1.00
Geographical factors				
Distance from the middle of village to nearest paved road (km)	15.17	18.16	0.00	132.00
Distance from the middle of village to nearest market (km)	3.64	4.95	0.00	30.00
Distance to nearest city (20,000 population) ('000 km)	45.68	23.87	2.10	147.38
Average monthly rainfall (mm)	23.11	1.39	20.69	26.63
Number of years with extremely low rainfall	2.82	0.93	1.00	4.00

Source: Authors' calculations from International Food Policy Research Institute household and community surveys raw data (2016).

Note: * Instruments tested; SD, D, A, SA are Likert scale defined as SD=1=Strongly Disagree, D=2=Disagree, A=3=Agree, and SA=4=Strongly Agree; MWK = Malawian kwachas; VDC/VAC = village development committee or village agriculture committee.

Table A.3 Descriptive statistics of the outcome indicators and treatment and control variables at household level (*N* = 3,001)

Variable	Mean	Std. dev.	Min.	Max.
OUTCOME VARIABLES				
Received agriculture advice in past 12 months (0/1)	0.54	0.50	0.00	1.00
Number of technologies known	5.17	1.76	1.00	10.00
Number of technologies tried	2.91	1.25	0.00	7.00
Number of technologies adopted	1.41	0.80	0.00	4.50
Quantity of chemical fertilizer used in rainy season (kg)	73.03	43.57	0.00	230.00
% of land area planted with modern varieties	0.93	0.14	0.25	1.00
Household dietary diversity score	4.82	2.14	0.00	10.00
Food consumption score	34.62	18.52	0.00	126.00
Household food insecurity access score	9.90	7.61	0.00	27.00
Value of crop production (MWK)	204.45	107.36	1.96	4,043.25
Value of production (MWK/hectare)	80.97	60.62	1.28	704.15
TREATMENT				
Household member participates in VDC/VAC (0/1)	0.46	0.50	0.00	1.00
CONTROLS				
Total livestock units	12.70	19.12	0.00	227.00
Cropland (acres)	2.41	2.04	0.00	21.27
Landholdings (acres)	2.78	3.22	0.00	79.47
Value of assets (MWK '000)	581.00	2,92.00	0.00	16,000.00
Index of connectivity*	0.00	1.00	-2.39	2.79
Male head (0/1)	0.75	0.43	0.00	1.00
Age of head	39.00	30.00	16.00	90.00
Head is very risk averse (0/1)	0.44	0.50	0.00	1.00
Head is risk averse (0/1)	0.27	0.44	0.00	1.00
Head is a risk taker (0/1)	0.11	0.31	0.00	1.00
Head is a high risk taker (0/1)	0.18	0.39	0.00	1.00
Head has up to primary education (0/1)	0.22	0.41	0.00	1.00
Farming is main employment of head (0/1)	0.66	0.47	0.00	1.00
Household size	5.07	2.39	1.00	32.00
Members have mobile phone (0/1)	0.90	0.94	0.00	7.00
Number of association participations	0.35	0.66	0.00	7.00
Household has lead farmer (0/1)	0.16	0.36	0.00	1.00

Source: Authors' calculations from International Food Policy Research Institute household and community surveys (2016) raw data.

Note: *Composite index for frequency of using mobile phone and radio, and going to market or nearest town computed using principal component analysis. MWK = Malawian kwachas; VDC/VAC = village development committee or village agriculture committee.

Table A.4 Linkage of VDC/VAC characteristics with community-level outcome indicators

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	% of HHs accessing advice		Average number of technologies known		Average number of technologies tried out		Average number of technologies adopted		Average quantity of chemical fertilizer applied (kg)		Average value of production per hectare		Average HDDS	
Responsiveness of VDC/VAC (control = responsive)														
VDC/VAC is not active (= 1)	-0.075*		-0.140		-0.264*		0.202		-4.386		-5,303.830		0.142	
	(0.040)		(0.284)		(0.152)		(0.158)		(8.171)		(6,057.768)		(0.174)	
There are discussions, but not responsive to concerns raised (= 1)	-0.164***		-0.171		-0.239		0.041		10.819		5,041.517		-0.537**	
	(0.051)		(0.369)		(0.196)		(0.203)		(10.484)		(7,759.769)		(0.226)	
There are discussions, and somewhat responsive to concerns raised (= 1)	-0.066**		0.140		0.005		0.096		2.686		-2,091.998		-0.058	
	(0.030)		(0.213)		(0.114)		(0.118)		(6.021)		(4,534.294)		(0.130)	
Characteristics of VDC/VAC														
% of population participating		-0.001		-0.005		0.002		-0.002		0.009		-37.584		-0.002
		(0.001)		(0.004)		(0.002)		(0.003)		(0.129)		(96.361)		(0.003)
Number of different stakeholders who are attending		-0.018***		0.089**		0.044**		0.014		-0.803		2,005.462**		0.036
		(0.006)		(0.042)		(0.022)		(0.024)		(1.206)		(900.339)		(0.028)
% of time during meetings that small farmers express their needs		0.019		0.071		0.128***		-0.142***		2.288		1,530.148		-0.090
		(0.013)		(0.090)		(0.046)		(0.052)		(2.578)		(1,933.604)		(0.058)
% of attendees who are women		0.012		0.143		0.040		0.154**		1.004		-764.849		-0.004
		(0.018)		(0.123)		(0.063)		(0.070)		(3.583)		(2,662.033)		(0.080)
Frequency of meeting		0.001		-0.382***		0.007		0.074		-3.523		-3,675.109		-0.157**
		(0.017)		(0.118)		(0.062)		(0.070)		(3.474)		(2,543.548)		(0.078)
Has action plan (= 1)		0.042		-0.027		-0.006		-0.060		-7.934		1,218.129		-0.046
		(0.033)		(0.222)		(0.114)		(0.127)		(6.470)		(4,807.688)		(0.145)
Has a record-keeping system (= 1)		0.102*		0.026		0.024		0.177		-12.338		1,397.460		0.040
		(0.054)		(0.369)		(0.189)		(0.211)		(10.605)		(7,895.576)		(0.239)
Frequency of reporting by chair		0.004		0.162		-0.239***		0.003		7.946		3,643.815		0.078
		(0.024)		(0.165)		(0.085)		(0.094)		(4.845)		(3,560.405)		(0.108)

Table A.4 continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	% of HHs accessing advice		Average number of technologies known		Average number of technologies tried out		Average number of technologies adopted		Average quantity of chemical fertilizer applied (kg)		Average value of production per hectare		Average HDDS	
Frequency of attending ASP meetings		0.010		0.051		0.019		0.034		2.596		1,959.928		-0.007
		(0.017)		(0.113)		(0.058)		(0.065)		(3.267)		(2,436.240)		(0.074)
Concerns of community are addressed in ASP (1–3)		0.012		0.146		-0.043		0.146		6.066		3,340.085		-0.085
		(0.041)		(0.278)		(0.143)		(0.158)		(8.053)		(6,029.562)		(0.182)
Model village (= 1)	-0.046	-0.029	0.149	-0.091	0.290**	0.276**	-0.027	-0.049	-7.127	-4.216	-1,733.795	-5,478.265	0.102	0.001
	(0.032)	(0.034)	(0.228)	(0.233)	(0.123)	(0.120)	(0.127)	(0.134)	(6.455)	(6.711)	(4,898.002)	(5,032.500)	(0.140)	(0.152)
Has village agriculture committee (= 1)	-0.013	-0.010	-0.053	0.003	0.112	0.078	-0.059	-0.067	-14.332***	-14.112**	-6747.135*	-6,819.841	-0.034	0.063
	(0.025)	(0.029)	(0.179)	(0.197)	(0.096)	(0.101)	(0.099)	(0.112)	(5.126)	(5.680)	(3,,873.342)	(4,250.290)	(0.111)	(0.130)
Responsiveness of higher structures at EPA and district levels														
Higher-level structures provide a venue for feedback on and monitoring of service providers (= 1)	0.065**	0.049	-0.163	-0.159	0.267**	0.255**	0.069	0.024	-18.669***	-15.868**	1,445.108	3,508.745	-0.160	-0.154
	(0.030)	(0.032)	(0.216)	(0.214)	(0.116)	(0.110)	(0.120)	(0.122)	(6.228)	(6.254)	(4,670.841)	(4,618.276)	(0.132)	(0.139)
Higher-level structures are active platforms for discussion (= 1)	-0.025	-0.059*	0.486**	0.669***	0.062	0.119	-0.160	-0.145	-1.419	-0.946	-1,077.522	968.956	0.292**	0.326**
	(0.031)	(0.033)	(0.218)	(0.222)	(0.118)	(0.115)	(0.122)	(0.127)	(6.415)	(6.544)	(4,682.943)	(4,731.516)	(0.134)	(0.144)
Higher-level structure are responsive to concerns raised (= 1)	-0.036	-0.066	0.059	-0.291	0.083	0.016	-0.174	-0.237	6.187	-6.919	-2,921.061	-13,393.748	-0.079	0.128
	(0.029)	(0.068)	(0.211)	(0.462)	(0.113)	(0.238)	(0.117)	(0.262)	(5.990)	(13.345)	(4,524.329)	(9,976.281)	(0.129)	(0.302)
Community characteristics														
Majority wear shoes/slippers, neat clothes (= 1)	0.116***	0.143***	0.064	0.075	-0.114	0.037	0.193*	0.089	10.311*	11.946*	-707.121	1,388.600	0.424***	0.462***
	(0.029)	(0.033)	(0.216)	(0.233)	(0.114)	(0.117)	(0.117)	(0.129)	(6.079)	(6.611)	(4,563.744)	(4,868.170)	(0.135)	(0.154)
Most house roofing is made of iron sheet (= 1)	-0.052	-0.067**	-0.194	-0.110	-0.100	-0.127	-0.086	-0.047	13.725**	10.118	-2164.336	528.691	0.357**	0.328**
	(0.032)	(0.034)	(0.231)	(0.231)	(0.124)	(0.118)	(0.128)	(0.131)	(6.700)	(6.749)	(4,955.587)	(4,925.236)	(0.141)	(0.150)
Household asset value (MWK) (2014)	0.000**	0.000*	0.000	0.000	0.000	-0.000	0.000	0.000	0.000*	0.001**	0.019	0.111	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.176)	(0.174)	(0.000)	(0.000)
Total livestock units (2014)	0.002	0.002	0.034**	0.026*	0.028***	0.026***	0.006	0.001	0.231	0.164	-21.524	-474.720	0.037***	0.036***
	(0.002)	(0.002)	(0.015)	(0.015)	(0.008)	(0.008)	(0.009)	(0.009)	(0.434)	(0.441)	(325.056)	(326.165)	(0.009)	(0.010)

Table A.4 continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	% of HHs accessing advice		Average number of technologies known		Average number of technologies tried out		Average number of technologies adopted		Average quantity of chemical fertilizer applied (kg)		Average value of production per hectare		Average HDDS	
Distance to tar/asphalt road (km)	-0.001	-0.001	0.008	0.011**	0.001	0.004	0.000	-0.000	0.205	0.276*	29.760	150.044	0.004	0.002
	(0.001)	(0.001)	(0.005)	(0.005)	(0.003)	(0.003)	(0.003)	(0.003)	(0.140)	(0.145)	(105.093)	(107.397)	(0.003)	(0.003)
Community population	0.000***	0.000***	-0.000	-0.000	0.000	0.000	0.000	0.000	-0.000	0.001	-0.392	-0.520	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.604)	(0.629)	(0.000)	(0.000)
Number of abnormal weather months in 2015	-0.001	0.009	0.399***	0.500***	0.097	0.127**	0.132**	0.114	14.415***	12.875***	12,528.333***	13,573.053***	0.089	0.039
	(0.016)	(0.018)	(0.113)	(0.119)	(0.062)	(0.063)	(0.064)	(0.071)	(3.493)	(3.753)	(2,505.620)	(2,644.297)	(0.073)	(0.083)
Distance to nearest city (km)	-0.000	-0.000*	-0.000	0.000	-0.000**	-0.000	0.000	0.000	-0.000	-0.000	-0.058	0.015	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.082)	(0.088)	(0.000)	(0.000)
Number of associations in the community (= 1)	0.004	0.006	-0.070	-0.072	-0.077***	-0.082***	0.048*	0.063**	0.920	0.744	-1,315.510	-1,075.195	-0.059*	-0.083**
	(0.007)	(0.007)	(0.049)	(0.049)	(0.026)	(0.025)	(0.028)	(0.029)	(1.402)	(1.441)	(1,044.954)	(1,057.953)	(0.030)	(0.032)
Farming is main use of land (= 1)	0.152***	0.235***	0.357	-0.337	0.241	0.183	0.227	0.122	-17.799*	-14.966	-2,777.825	-8711.365	0.445**	0.189
	(0.050)	(0.057)	(0.363)	(0.394)	(0.194)	(0.197)	(0.201)	(0.220)	(10.189)	(10.976)	(7,708.822)	(8,209.490)	(0.222)	(0.254)
Number of major nonagricultural sources of employment	0.012	0.007	0.040	0.110	-0.018	-0.056	-0.057	-0.037	0.670	0.606	2,223.586	2,629.920	-0.015	0.027
	(0.010)	(0.011)	(0.074)	(0.076)	(0.040)	(0.039)	(0.041)	(0.043)	(2.102)	(2.207)	(1,576.547)	(1,619.001)	(0.045)	(0.050)
Community has development projects (= 1)	-0.123**	-0.176***	0.016	0.094	0.420*	0.335	-0.015	-0.095	-18.424	-19.368	13,144.613	15,865.868*	-0.020	0.030
	(0.060)	(0.065)	(0.430)	(0.447)	(0.230)	(0.227)	(0.238)	(0.252)	(12.345)	(12.886)	(9,159.584)	(9,463.755)	(0.263)	(0.289)
Distance to nearest govt extension agent (km)	-0.001	-0.003	-0.005	-0.006	-0.011*	-0.013**	-0.001	0.002	0.195	0.214	1.993	-98.949	-0.010	-0.009
	(0.002)	(0.002)	(0.011)	(0.011)	(0.006)	(0.006)	(0.006)	(0.007)	(0.315)	(0.328)	(236.564)	(243.066)	(0.007)	(0.007)
Number of different extension agents in community	0.039**	0.035*	-0.357***	-0.304**	-0.120*	-0.127**	-0.024	-0.047	2.309	3.117	-778.750	-1,126.428	-0.070	-0.091
	(0.017)	(0.018)	(0.122)	(0.123)	(0.066)	(0.063)	(0.068)	(0.070)	(3.489)	(3.559)	(2,601.674)	(2,629.317)	(0.074)	(0.080)
Number of lead farmers in the community	-0.003	-0.002	0.019	0.036	0.008	0.013	-0.025	-0.041**	-0.752	-0.749	-828.439	-260.386	-0.029	-0.022
	(0.004)	(0.004)	(0.029)	(0.030)	(0.016)	(0.015)	(0.018)	(0.018)	(0.838)	(0.851)	(631.341)	(637.212)	(0.018)	(0.019)
Number of times in last 2 years that Parliament visited community	-0.005**	-0.004**	0.004	0.006	0.003	0.005	0.003	0.004	0.059	0.080	498.350*	425.955	-0.002	-0.001
	(0.002)	(0.002)	(0.014)	(0.013)	(0.007)	(0.007)	(0.008)	(0.008)	(0.393)	(0.384)	(294.900)	(285.282)	(0.009)	(0.009)
% of households receiving health advice													0.547**	0.635**
													(0.254)	(0.269)

Table A.4 continued

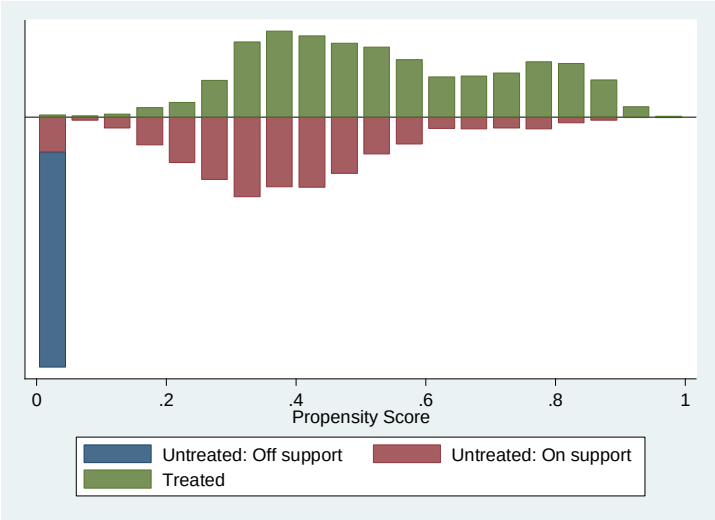
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	% of HHs accessing advice		Average number of technologies known		Average number of technologies tried out		Average number of technologies adopted		Average quantity of chemical fertilizer applied (kg)		Average value of production per hectare		Average HDDS	
Health facility in community (= 1)													0.249**	0.234*
													(0.124)	(0.132)
Other controls in the stepwise process														
% of households received advice (= 1)			3.320***	3.510***										
			(0.435)	(0.434)										
Average number of technologies known					0.465***	0.456***			4.345***	4.799***				
					(0.029)	(0.029)			(1.529)	(1.593)				
Average number of technologies tried out							0.196***	0.213***						
							(0.044)	(0.049)						
% of households receiving fertilizer subsidy									61.186***	62.385***				
									(13.018)	(13.494)				
Average number of technologies adopted											2,161.228	1,290.657		
											(2,396.186)	(2,431.391)		
Average fertilizer quantity applied (kg)											283.747***	265.162***		
											(45.513)	(47.239)		
Average % of area planted with modern varieties											1,780.612	-274.054		
											(13,175.299)	(13,381.791)		
Average value of production (MWK/ha)													0.000***	0.000***
													(0.000)	(0.000)
Constant	0.354***	0.196	1.908***	0.754	-0.205	-0.477	0.076	-0.298	6.429	-8.202	5,398.212	-20,461.168	2.696***	3.171***
	(0.096)	(0.139)	(0.706)	(0.946)	(0.381)	(0.487)	(0.388)	(0.535)	(21.660)	(27.966)	(20,969.649)	(24,255.702)	(0.428)	(0.616)
Sigma														
Constant	0.197***	0.198***	1.413***	1.343***	0.761***	0.692***	0.779***	0.758***	39.879***	38.354***	30,229.236***	28,740.962***	0.866***	0.874***
	(0.008)	(0.009)	(0.059)	(0.059)	(0.032)	(0.030)	(0.035)	(0.036)	(1.763)	(1.790)	(1,261.712)	(1,257.953)	(0.036)	(0.038)
Observations	287	261	287	261	287	261	287	261	287	261	287	261	287	261
Log likelihood	43.534	38.416	-506.517	-447.335	-329.128	-274.451	-336.880	-299.805	-1375.283	-1233.488	-3,368.089	-3,049.789	-365.785	-335.211
Chi-squared	93.466	94.882	122.340	140.912	284.998	287.976	65.381	76.191	87.778	92.100	115.739	123.229	143.863	140.666

Source: International Food Policy Research Institute household and community surveys (2016).

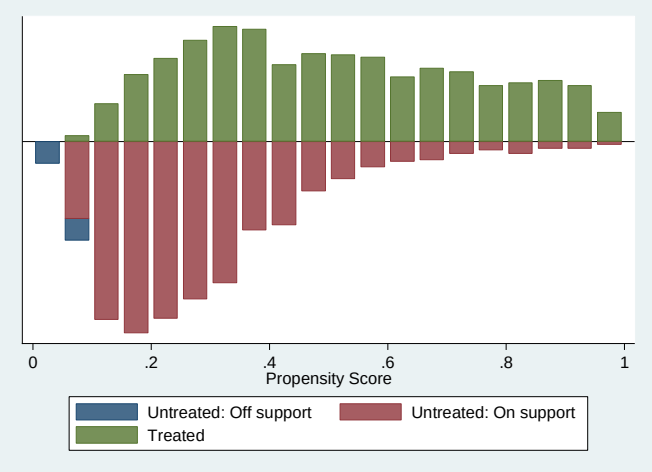
Note: Figures are the marginal effects from Tobit models. Standard errors in parentheses. The figures for those variables designated as "(= 1)" represent the discrete change of the dummy variable from 0 to 1. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. ASP = area stakeholder panel; EPA = extension planning area; HDDS = household dietary diversity score; HH = household; MWK = Malawian kwachas; VDC/VAC = village development committee or village agriculture committee.

Figure A.1 Results of the propensity score matching

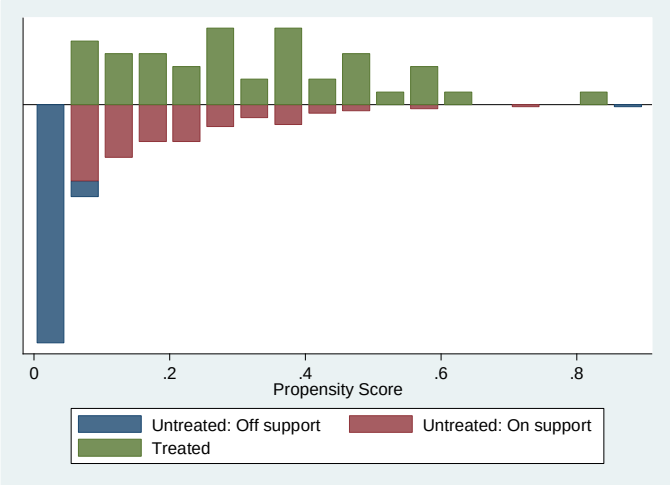
a. Household participation in VDC



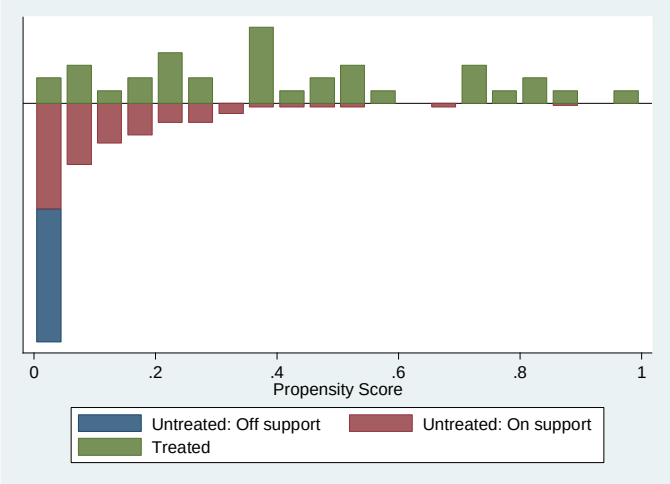
b. Household participation in VAC



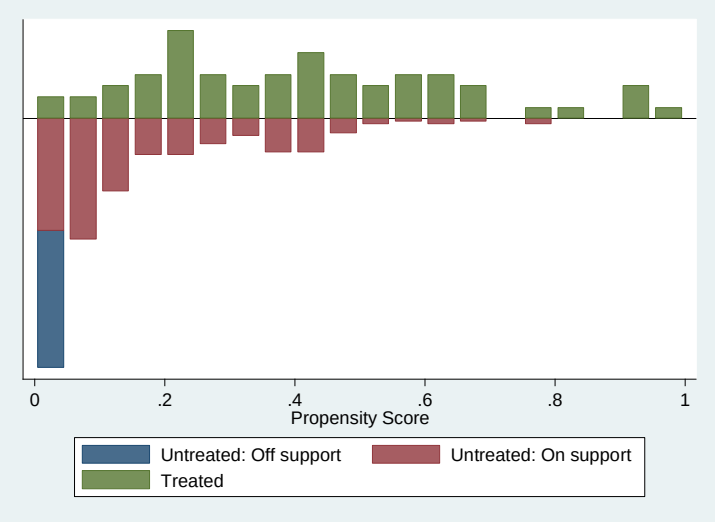
c. Presence of active VDC/VAC in the community



d. Presence of responsive VDC/VAC (conditional on being active)



e. Model village concept implemented



Source of raw data: International Food Policy Research Institute household and community surveys (2016). Results using Stata software.
Note: VAC = village agriculture committee; VDC = village development committee.

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