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Small-Scale farmers' Integration in Agricultural Value Chains: The Role for Food Security in Rural Tanzania

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1. Introduction

Smallholder agriculture, in most developing countries, is an important driver of food security, employment and poverty reduction for rural households (IFAD and UNEP 2013). This is especially the case in most countries in sub Saharan Africa such as Tanzania. Various efforts have, therefore, been promoted to enhance integration of small-scale farmers in agricultural value chains (AVCs) through input and output markets. Small-scale farmers' integration in AVCs is considered an integral pathway to raising farmers' welfare, including food security through increased productivity, market access, and reduced transaction costs, among other factors (von Braun and Kennedy 1994; Mitchell et al. 2009; Barrett et al. 2010). However, risks such as exclusion from the value chains and exploitative relationships among smallholder farmers and other participants in the value chain may undermine smallholders' welfare (Sivramkrishna and Jyotishi 2008; Wiggins et al. 2010).

Recent studies have mainly dwelt on welfare effects including household food security of smallholders being integrated in modern AVCs and largely concentrating on high value and export-oriented crops while giving little attention to majority of smallholders integrated in traditional AVCs. By focusing on traditional AVCs, the objectives of the paper are, therefore (1) to explore the nature and extent of smallholders' participation in traditional AVCs in rural Tanzania, (2) to empirically analyze the impact of traditional AVC activities on household food security, and (3) to compare the impact of different AVC activities, and combinations of such, on household food security.

2. Data

Data used in this study was collected through a household survey in January and February 2014 from six villages (Changarawe, Nyali and Ilakala in Kilosa district and Ilolo, Ndebwe and Idifu in Chamwino district) in rural Tanzania. Apart from representing majority of the farming systems undertaken in Tanzania, the study villages offer comparable but yet diverse agro-ecological and socio-economic conditions, ideal for analysis of smallholder integration in AVCs and the associated welfare outcomes (Graef et al. 2014).

The survey covered 900 households, with 150 households randomly selected from each of the six villages, proportional to sub-village sizes. The structured questionnaire covered a wide range of

questions aimed at collecting detailed information on households' income generating activities and food security, among others.

3. Results and Discussion

3.1 Smallholder participation in various AVC aspects

Descriptive summary in Table 1 show significant differences between the two study districts (Kilosa and Chamwino) with respect to the integration in traditional AVCs. This suggests a considerable influence of agro-ecological and socio-economic differences, among other factors. Despite cultivating various crops, smallholders' participation in input markets is very low. While, on average, about 21% of the households use improved inputs, only 8% use improved inputs in Chamwino and 34% in Kilosa. With regard to post-harvest handling activities, 36% of households in Kilosa undertake initial processing, as compared to only 16% in Chamwino. For storage, 54% of households store for selling with the length of storage averaging 2.2 months in Kilosa, compared to 49% who store for an average of 1.2 months in Chamwino. Likewise, households' subsistence share is significantly lower for Kilosa (45%) compared to Chamwino (68%). With respect to horizontal integration in traditional AVCs through collective action, around 18% of the households pursue some of their agricultural activities in groups. Smallholders in Kilosa have more collective action (29%) as compared to Chamwino where only 8% of households participate in collective action. Collective action is undertaken for purchase of inputs, producing, processing and selling, though mainly in small and informal groups.

Table 1 Smallholders' integration in various traditional AVC aspects.

Variable	Kilosa (*n*=500)		Chamwino (*n*=499)		*T* statistics	Sample mean *n*=899
	Mean	SD	Mean	SD		
AVCs aspects						
Household uses improved inputs (1=yes)	0.34	0.47	0.08	0.27	-10.17***	0.21
Number of crops cultivated (n)	2.03	0.97	3.67	1.67	16.27***	2.85
Household undertakes initial processing (1=yes)	0.36	0.48	0.16	0.37	-6.86***	0.26
Household's average months of storage (n)	2.20	2.70	1.19	1.76	-5.56***	1.70
Household stores for selling (1=yes)	0.54	0.49	0.39	0.49	-4.35***	0.47
Household participates in collective action (1=yes)	0.29	0.45	0.08	0.27	-8.28***	0.18
Household's subsistence share (%)	0.45	0.38	0.68	0.42	8.39***	0.57

[1] *, **, ***: significant at 10, 5 and 1% respectively.
[3] *T* statistics: Wilcoxon-Mann-Whitney and Chi square tests used to assess significant differences.

3.2 Impact of AVC activities on household food security

To analyze food security effects of smallholder's integration in AVCs, propensity score matching was used to estimate average treatment effect of AVC activities on household food security. From Table 2, both nearest neighbor and kernel matching show relatively similar average treatment effects on the treated (ATTs). Use of improved inputs significantly increases household food security shown by a 3.3 – 3.8 increase in FCS and also associated with a significant reduction in CSI by 4.0 – 7.1 scores. Looking at storage, households who store for selling are significantly food secure compared to those who do not store for selling. Specifically, storage for

selling is associated with 3.6 to 4.2 higher FCS and a substantial 10.8 to 12.0 lower CSI. With respect to collective action, no significant impacts are found for both nearest neighbor and kernel matching.

Table 2 Average treatment effects for household food security: Binary treatment case

	Nearest neighbor matching		Kernel matching	
	ATT	S.E	ATT	S.E
Use of improved inputs				
Food consumption score (FCS)	3.34**	1.98	3.80**	1.61
Coping strategy index (CSI)	-7.08*	4.16	-4.05*	2.45
Store for selling				
Food consumption score (FCS)	4.21***	1.21	3.68***	0.91
Coping strategy index (CSI)	-12.06***	2.67	-10.80***	1.91
Collective action				
Food consumption score (FCS)	0.26	1.72	1.70	1.56
Coping strategy index (CSI)	-1.49	2.72	-2.05	2.39

Note: [1]***, **, *, represent statistical significance at 1%, 5% and 10% level, respectively.
[2]ATT (average treatment effect on the treated), S.E. (bootstrapped standard errors)

3.3 Comparison of household food security impacts of AVC activities

As a further analysis of impacts of AVC activities on household food security, the impacts of using improved inputs, storing for selling and of participating in both improved inputs and storing for selling are compared to households who are involved only in production. This is implemented with inverse probability weighted regression adjustment (IPWRA).

Table 3: Average treatment effects for household food security: Multiple treatment case

	IPWRA	
	ATT	S.E
Use of improved inputs vs involvement only in production		
Food consumption score (FCS)	6.22**	2.39
Coping strategy index (CSI)	-10.23**	5.01
Store for selling vs involvement only in production		
Food consumption score (FCS)	5.75***	1.56
Coping strategy index (CSI)	-14.74***	4.44
Use of improved inputs and Store for selling vs involvement only in production		
Food consumption score (FCS)	6.88***	1.71
Coping strategy index (CSI)	-16.20***	4.79

Note: [1]***, **, *, represent statistical significance at 1%, 5% and 10% level, respectively.
[2]ATT (average treatment effect on the treated), S.E. (bootstrapped standard errors)

Results (Table 3) show that the use of improved inputs alone, without storage for selling is associated by a 6.38 increase in FCS and a -10.23 decrease in CSI. Comparing the effects of storage for selling, results show that households that participate only in store for selling have a higher FCS of 5.73 and a lower CSI of -14.74. Participating in both, use of improved inputs and

storage for selling, raises households' FCS by 6.88 and lowers CSI by -16.20. Interestingly, the results show that, households participating in both activities have higher FCS and lower CSI compared to those participating in only one of the AVC activity. This suggests that integration of smallholders in traditional AVCs in multiple stages/activities has higher welfare effects, than participation in individual aspects of traditional AVCs.

4. Conclusions and Outlook

The papers' objective was to analyze the impacts of smallholders' integration in traditional AVCs on smallholder welfare, most particularly, household food security. In general, integration of smallholders in traditional AVCs is relatively low, as evidenced by poor linkages to input markets, less post-harvest handling activities, low market participation and poor horizontal coordination among smallholders. Regarding the impacts of smallholder participation in different traditional AVC activities, findings demonstrate that integration into input and output markets is associated with improved food security. Households' food security is higher for smallholders using improved inputs or storing for selling than those not undertaking these activities. Also, participating in both, that is, using of improved inputs and storing for selling, translates into relatively higher food security. Additionally, with respect to collective action, informal and less organized farmer groups are less able to deliver the potential benefits associated with effective collective action.

Therefore, policies to address access and uptake of agricultural technologies, institutional and infrastructural limitations and smallholder collective action systems remain crucial. More importantly, designing of policies to effectively integrate smallholders in AVCs need to take into account the overall spectrum of activities in the value chain.

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