Design Principles of Common Property Institutions: The Case of Farmer Cooperatives in the Upper West Region of Ghana

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ABSTRACT

Common property institutions in natural resource management are often analysed by means of Ostrom's framework of design principles. Recently, the design principles have been generalised to study human groups in other collective action scenarios, including farm producers who collectively buy inputs or sell outputs. Several case studies have conceptualised farmer cooperatives as common property institutions to study how various collective action scenarios have been approached. We contribute to the scarce literature with a field study in the Upper West Region of Ghana, using Ostrom's framework to compare the design principles of active and inactive farmer cooperatives. Using the mean group comparison method, we find numerous significant differences as active farmer cooperatives have clearer boundaries, require more capital investments, have more active board directors and managers, receive more governmental support, and have more locations. However, not all design principles are significantly different for active and inactive cooperatives (e.g. sanctions, legal rights). Considering our results, we perceive opportunities to formalise the conceptualisation of farmer cooperatives as common property institutions with both internal and external design principles. Our results also have policy implications in terms of top-down initiatives to spur collective action by Ghanaian farm producers.

1. INTRODUCTION

Based on numerous case studies of forests, rivers, and other natural resources, Ostrom (1990) argued common property institutions can become robust if certain conditions are met. The conditions are often summarised in the form of eight design principles: (1) clear boundaries, (2) congruent rules, (3) collective choice mechanisms, (4) peer monitoring, (5) graduated sanctions, (6) conflict resolution mechanisms, (7) legal rights, and (8) nested enterprises. Although the design principles are not without critique, both individually and collectively (e.g. Araral, 2014; Undargaa and McCarthy, 2016; Gari et al., 2017), the explanatory power of the analytical framework has been verified in meta-analyses of case studies of common property institutions (Cox et al., 2010; Baggio et al., 2016).

While the design principles relate originally to common property institutions in the arena of natural resources, it is logical to extend analysis to any human group whose members must work together to pursue a common interest (Wilson et al., 2013). The generalisation of the design principles for successful group action in any setting is facilitated by the foundation of biology and political science, which provides a multidisciplinary perspective of the nature of the resource and the behaviour of its users and providers. Examples of applications of Ostrom's analytical framework in collective action situations with non-natural resources relate to carbon emission (Lacroix and Richards, 2015), product origin certification (Quiñones-Ruiz et al., 2015), energy consumption (Melville et al., 2017), and bank financial stability (Salter and Tarko, 2018).

Hagedorn (2013) considered the applicability of Ostrom's analytical framework to common property institutions in the overall economy, particularly in relation to hybrid organisations in which people collectively use non-natural resources. A prominent example of such economic organisations are farmer cooperatives, which are owned and controlled by organised farm producers who collectively sell farm outputs (e.g. corn, milk) or buy farm inputs (e.g. animal feed, fertiliser). Indeed, Ostrom's analytical framework has been applied in recent case studies of farmer cooperatives in Greece (Iliopoulos and Theodorakopoulou, 2014), Indonesia (Jelsma et al., 2017), and Bolivia (Tschopp et al., 2018). The studies used Ostrom's analytical framework to facilitate the description and comparison of the institutional designs of farmer cooperatives in the context of various collective action problems.

Our study contributes to the recent literature with an application of Ostrom's analytical framework to farmer cooperatives in the Upper West region of Ghana. In contrast to prior studies, we survey both active and inactive farmer cooperatives to inform survival or robustness. In addition, we use a relatively large sample of 73 farmer cooperatives in various segments of the agricultural sector. The objective of our field study is to determine why farmer cooperatives are active or inactive, and Ostrom's analytical framework is used because of its explicit intention to explain the long-term robustness (or lack thereof) of common property institutions. Specifically, we attempt to discover significant differences in the presence of Ostrom's design principles of active and inactive farmer cooperatives in the Upper West Region of Ghana. In doing so, we extend the work of Iliopoulos and Theodorakopoulou (2014), Jelsma et al. (2017), and Tschopp et al. (2018), who first applied the design principles to farmer cooperatives in case study settings. Our study also contributes to the scarce academic literature on Ghanaian cooperatives (Calkins and Ngo, 2010; Cazzuffi and Moradi, 2012; Francesconi and Wouterse, 2015).

We proceed as follows. In Section 2, we provide a brief summary of the eight design principles by drawing primarily from Ostrom (1990) and Cox et al. (2010). Section 3 details our methodology, including our data collection and analytical techniques. We present the results of our data analysis in Section 4, after which we summarise and conclude in Section 5 with implications and recommendations for various stakeholders.

2. OSTROM'S DESIGN PRINCIPLES
2.1 DESIGN PRINCIPLE 1: CLEAR BOUNDARIES
The first principle is related to two types of boundaries: (i) the resource, and (ii) the community (Agrawal, 2002). In terms of natural resources, the boundary stipulates what is used and how much is used. For example, herders and farmers in a high-altitude rangeland area in Bhutan use natural landmarks such as mountain passes, mountain ridges, gorges, and footpaths to mark boundaries (Tenzing et al., 2018). However, where necessary they also install barbed wire fences. The boundaries of the community are less rigid and less straightforward (Cox et al., 2010). Discrimination of users and non-users may be decided by any criterion: resource proximity, payment, political status, gender, or otherwise. For example, users of an irrigation system on Mount Kenya need to own land in the area and make monthly payments (Dell'Angelo et al., 2016).

2.2 DESIGN PRINCIPLE 2: CONGRUENCE BETWEEN USE AND PROVISION RULES AND LOCAL CONDITIONS
Similar to the first principle, the second principle has two components: (i) congruence between use and provision rules, and (ii) congruence between rules and local conditions. The first component relates to balancing the

benefit of use and the cost of provision, which is often regulated by local or federal governments, as in the case of aquifers in Australia and Spain (Ross and Martinez-Santos, 2010). The second component emphasises the importance of local knowledge and participation. For example, Deneke et al. (2011) conducted a case study of different common property institutions in Ethiopia and observed how informal and indigenous farmer-initiated organisations are more successful at communal pond management than outsider-initiated institutions.

2.3 DESIGN PRINCIPLE 3: COLLECTIVE CHOICE ARRANGEMENTS

Related to the second principle, the long-term survival probability of a common property institution is likely to be improved by a collective choice arrangement, which ensures "most individuals affected by the operational rules can participate in modifying the operational rules" (Ostrom, 1990, p. 90). With possession of local knowledge, the resource consumers are in the best possible position to ensure use and provision rules and local conditions are balanced for the long-term benefit of the resource and the community. For example, Sarker and Itoh (2001) described how members of an irrigation system in Japan come together at the beginning of each crop season to collectively discuss the water appropriation policy.

2.4 DESIGN PRINCIPLE 4: MONITORING

Trust and reciprocity are not always enough to ensure use and provision rules are followed and enforced. Rule enforcement is further improved if the monitors are also users, which implies the actions of the former have a direct impact on the actions of the latter (Cox et al., 2010). For example, in a comparative study of 100 forests in 14 countries, Coleman and Steed (2009) observed a significant positive impact of member ownership on internal monitoring and sanctioning. In terms of specific mechanisms, Dell'Angelo et al. (2016) provided the example of gauges to measure water consumption by the users of an irrigation system on Mount Kenya.

2.5 DESIGN PRINCIPLE 5: GRADUATED SANCTIONS

For a rule to carry weight, there must be an expectation of punishment if it is broken. When a monitor observes an authorised user overharvesting the common property, there must be an appropriate measure in place to dissuade future infractions. Similar to the second principle, the penalty structure must be characterised by proportionality of violations and sanctions (Ostrom, 1990). In relation to forest management, Ghate and Nagendra (2005, p. 519) observed an example in the Ranvahi community in India,

where "the provision is to pardon the offender on the first and second occasion either with a warning or with a small penalty. But on the third occasion, there is a provision to expel the member from the association."

2.6 DESIGN PRINCIPLE 6: CONFLICT RESOLUTION MECHANISMS

Access to a judicial system is believed to improve the long-term viability of the common property institution. An internal judicial system may suffice for intra-community strife, whereas the public court system is likely more appropriate for conflict between users and non-users. The importance of the first principle (clear boundaries) is obvious to the latter scenario, whereas the third principle (collective choice arrangement) is more applicable to the former. As an example, Gautam and Shivakoti (2005) described how a forest management institution in Nepal had three provisions for conflict resolution: (i) simple internal conflict is handled by the local committee, (ii) complex internal conflict is handled by the assembly, and (iii) external conflict is referred to the district forest office.

2.7 DESIGN PRINCIPLE 7: LEGAL RIGHTS

Relating to the definition and assignment of property rights to the common property, the common property institution is more likely to be robust if its legal existence is acknowledged by the external government. Similar to the second principle, dismissal of local authority and local knowledge may weaken the ability of the institution to create and enforce boundaries, to resolve conflict, or to maintain congruence between rules and local conditions both in the present and the future. For example, Ross and Martinez-Santos (2010) detailed how the Spanish government is involved in the allocation of water entitlements to handle scarcity.

2.8 DESIGN PRINCIPLE 8: NESTED ENTERPRISES

In nested enterprises, the governance of the resource is distributed across two or more layers of users, communities, or stakeholders as one group is nested in another to facilitate cross-scale cooperation (Cox et al., 2010). Relating to the first principle of clearly defined boundaries, the concept of nesting is of special importance to common properties with transitory characteristics, such as grass consumption in pastures and water consumption in rivers. For larger institutions, a nested governance system will facilitate intra-community cooperation and may spur external connections as well (Muradian and Rival, 2012). In New Mexico, for example, an irrigation community in the Taos Valley is characterised by two levels of governance: one within each irrigation system to handle appropriation and provision and one between irrigation systems to handle appropriation (Cox, 2014).

3. METHODOLOGY
3.1 STUDY AREA

The Upper West Region is located in the northwestern corner of Ghana, bordered to the north and west by Burkina Faso. It also shares boundaries with the Upper East, Savannah and North-East regions of Ghana. The region has 11 administrative districts with Wa as its capital (see *Figure 1*). The dominant ethnic group is Mole-Dagbani and the main languages spoken are Dagaare, Wale, Sissali and Lobi. The region lies in the Guinea Savannah belt and is largely rural. The vegetation is mainly grassland interspersed with shrubs and drought-resistant trees such as shea, dawadawa and baobab trees. The region experiences two seasons: a short rainy season occurring between May and September and a long dry season with temperatures rising as high as 40 degrees Celsius. The climate constrains year-round agricultural production as irrigation systems are highly limited. Notwithstanding, agriculture is the main economic activity with 80.4% of households owning or operating a farm (Ghana Statistical Service, 2019). The predominant form of agriculture is peasant agriculture. Common cereal and leguminous crops include maize, sorghum/guinea corn, millet, rice, cowpea, soybean, groundnuts and Bambara beans. Yam is the predominant tuber crop in the region. The climate and vegetation are conducive for rearing animals such as cattle, sheep, goats, pigs, chickens, and guinea fowls. The region has the highest incidence of poverty (70.9%) in Ghana (Ghana Statistical Service, 2018). Considering the high incidence of poverty and the importance of agriculture, farmer cooperatives may form a pathway to economic empowerment and poverty alleviation in the region.

3.2 DATA COLLECTION

The population of our study is composed of farmer cooperatives in the Upper West Region of Ghana which are registered with the Department of Cooperatives. The Upper West Region of Ghana is the study site because of the local presence and knowledge of the researchers. The study employed a multi-stage sampling procedure. First, we obtained a list of farmer cooperatives by administrative district from the Upper West Region office of the Department of Cooperatives. We selected three of the eleven districts in the Upper West Region based primarily on proximity to the base of the researchers, as well as accessibility through the Department of Cooperatives. The three selected districts are Wa Municipal, Nadowli-Kaleo and Daffiama-Bussie-Issa (see *Table 1*). Owing to the lower number of farmer cooperatives in Wa Municipal (N = 23) and Daffiama-Bussie-Issa (N = 21), we included all 44 in our study. In Nadowli-
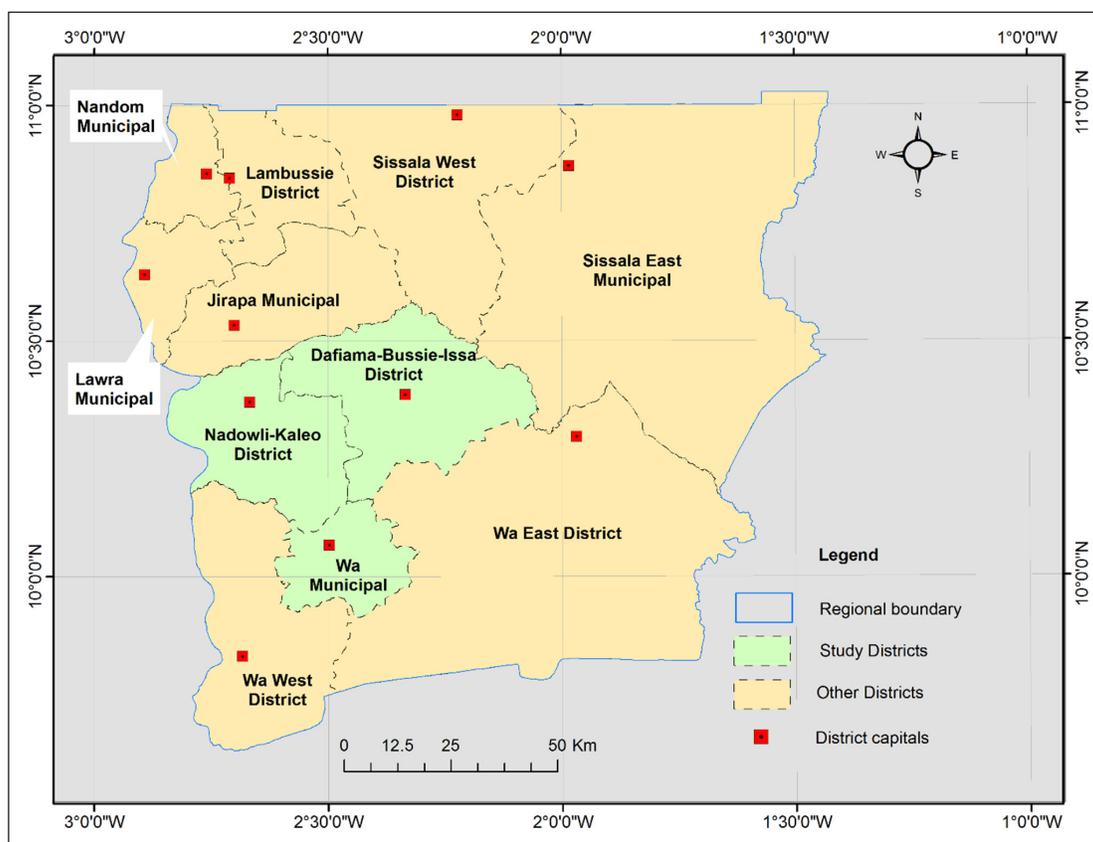

Figure 1 Map of Upper West Region, Ghana.

Kaleo District, however, we employed a simple random sampling technique to select a representative sample of 31 farmer cooperatives from a population of 70. The size of our sample is thus 75. However, because of incomplete information we dropped two responses. Hence, our analysis is based on the sample of 73 farmer cooperatives. Of the 73 farmer cooperatives, 59 indicated to be active at the moment of the study. The remaining 14 farmer cooperatives had ceased operations at some point during the past five-year period. All 59 active farmer cooperatives are owned and governed by organised farm producers who collectively sell outputs. In terms of farm production, 53 of the 73 farmer cooperatives sell maize, 30 sell soybeans, and 18 sell groundnuts. Other commodities are also sold (e.g. yam, poultry). The average age is under 10 years in each of the

three districts. The average membership size ranges from 32 in Daffiama-Bussie-Issa to 50 in Nadowli-Kaleo.

Our survey instrument is a semi-structured questionnaire which is in part based on Ostrom's analytical framework (see Appendix A). We developed the survey instrument in collaboration with representatives from the Department of Cooperatives for input on the appropriateness of the content and the structure. The questionnaire addressed six of the eight design principles (i.e. boundaries, use and provision rules, collective choice arrangements, sanctions, legal rights, nested enterprises). The sampling unit is the farmer cooperative. Before the collection of the field data in April 2020, the researcher trained the interviewers on the interpretation and the translation of the questions into the local Dagaare language to elicit proper responses from less educated respondents. Under the supervision of the researcher, the local staff of the Department of Cooperatives administered the questionnaire to the chairman, the vice chairman, or the secretary of each farmer cooperative.

3.3 DATA ANALYSIS

Most of the design principles and their related variables have been measured in binary dimensions. To explore differences between active and inactive farmer cooperatives, we primarily used the two-sample proportions test (i.e. Pearson's Chi-squared test). In several instances, we used T-tests and Kruskal-Wallis tests to test differences in the means of continuous and ordinal variables, respectively. We used Stata 16 to conduct our data analysis.

4. RESULTS
4.1 BOUNDARIES

There exist significant differences in terms of the boundaries of active and inactive farmer cooperatives (see *Table 2*).

DISTRICT	WA MUNICIPAL	DAFFIAMA-BUSSIE-ISSA	NADOWLI-KALEO
Active			
Yes	14	15	30
No	9	4	1
Members	34.17	31.63	49.94
Age (years)	7.73	8.78	9.32
Commodity			
Maize	13	15	25
Groundnuts	4	0	14
Soybean	1	9	20
Other	5	10	7

Table 1 Overview of Sample Characteristics by Region.

CHARACTERISTIC		INACTIVE	ACTIVE	TEST STATISTIC	p-VALUE
Geographic Boundaries	No	8	10	9.297	0.002
	Yes	5	42		
Minimum Volume Restrictions	No	11	20	8.217	0.004
	Yes	2	30		
Maximum Volume Restrictions	No	12	25	7.619	0.006
	Yes	1	25		
Non-Member Transactions	No	4	2	9.511	0.002
	Yes	10	57		
Quality Standards	No	5	1	17.359	0.000
	Yes	9	58		

Table 2 Design Principles of Active and Inactive Farmer Cooperatives – Boundaries.

Differences in the proportions of user residencies, minimum and maximum volume restrictions, quality standards, and non-member transactions are all significant at the 99% confidence level. Active farmer cooperatives have a higher proportion of resource boundaries (i.e. minimum and maximum volume restrictions, quality standards) and community boundaries (i.e. member residencies). For active farmer cooperatives, it is thus clearer who can deliver and how much. The only contrary evidence is in the form of non-member transactions, which constitute deliveries from farm producers who are not members of the cooperative. For instance, Te-sagelawulubu Co-operative Farming and Marketing Society in the Daffiama-Issa-Bussie District owns and operates a shea butter processing facility that allows non-members in and around the community to deliver and process shea butter. Non-members are also allowed to sell shea butter through the cooperative. However, non-members are charged a higher processing and service fee relative to members. According to the mean group comparison, active farmer cooperatives have a higher proportion of non-member transactions, which are normally not conducive to the performance of common property institutions (e.g. Ross and Martinez-Santos, 2010). The situation is ambiguous in the case of farmer cooperatives. While contributing to scale efficiency and bargaining power, case study work highlights how non-member deliveries may prove challenging in terms of quality and governance (Mujawamariya et al., 2013; Hooks et al., 2017). As such, we cannot conclude definitively if the exclusion of non-members, which would conform to the interpretation of the design principle, is positive or negative in the case of farmer cooperatives in general or farmer cooperatives in our sample in particular.

4.2 USE AND PROVISION RULES

While not emphasised in Ostrom's analytical framework, Wiederkehr et al. (2019) argued the provision of equity or capital is of strong importance to the performance of common property institutions. The same is true of farmer cooperatives, as suggested by the vast literature on the relationship of finance to member behaviour and firm performance (e.g. Barton et al., 2011). In our sample, members of active farmer cooperatives pay a membership fee more frequently than members of inactive farmer cooperatives (see *Table 3*). The difference in the proportions is statistically significant. Active farmer cooperatives also display a higher proportion of member capital investments, which is again significantly different from inactive farmer cooperatives. Thus, as compared to inactive farmer cooperatives, active farmer cooperatives on average have more rules to balance use and provision. In farmer cooperatives in general, the balance of the collective good is determined by the desire to patronise and the obligation to capitalise (Puusa et al., 2016). Having "skin in the game" may facilitate a better alignment of common and private objectives. Of course, member equity is also needed to fund assets and resources to avoid dependence on external financiers. We do not observe a significant difference in the proportions of the equity investment method. Few farmer cooperatives, whether active or inactive, use the proportional investment method to balance use and provision. Instead, the one-time investment method is the standard among farmer cooperatives in the Upper West Region of Ghana. As such, the dominant investment method is a divergence from common observations in Europe and North America, where investment is often proportional to use (Chaddad and Cook, 2004; Grashuis and Cook, 2017).

4.3 COLLECTIVE CHOICE ARRANGEMENTS

The one-member, one-vote system, which is characteristic of traditional farmer cooperatives in Europe and North America (Chaddad and Cook, 2004), is the most common collective choice arrangement in our sample (see *Table 4*). The one-member, one-vote system facilitates an emphasis on equality and democracy as opposed to proportionality, which may cause problems in case of member heterogeneity in production size (Höhler and Kühl, 2018). If so, relatively large members would prefer control to be proportional to production. The proportions are almost identical in

CHARACTERISTIC		ACTIVE		TEST STATISTIC	p–VALUE
Membership Fees	No	2	0	8.666	0.003
	Yes	12	59		
Equity Investments	No	6	9	5.281	0.022
	Yes	8	50		
Proportional Equity Investments	No	6	44	0.030	0.863
	Yes	1	6		

Table 3 Design Principles of Active and Inactive Cooperatives – Use and Provision Rules.

active and inactive farmer cooperatives. In all farmer cooperatives in Upper West Region, Ghana, control is to some extent delegated to board directors and managers. Ranging from five to seven, the number of board directors and managers is stipulated by the local government, which reveals a strong interrelationship with the design principle of legal rights.[1] The number of meetings by members, board directors, and managers is more variable and informative. In active farmer cooperatives, the number of meetings for each group is high relative to inactive farmer cooperatives. In the case of board directors and managers, the differences are statistically significant. In general, members meet more frequently than board directors and managers. Member participation in the democratic

governance of the cooperative is important to its overall performance (Österberg and Nilsson, 2009; Grashuis and Cook, 2019). However, we do not observe a significant difference in the attendance rate at member meetings for active and inactive farmer cooperatives.

4.4 SANCTIONS

Based on the outcomes of the mean group comparisons for the various types of sanctions, we do not find much support in Ostrom's analytical framework (see *Table 5*). Differences in terms of the proportions of defection penalties, quality penalties, excess volume penalties, other fines, or suspensions are not significant. Also, contrary to expectations, the proportion of warnings is lower and the

CHARACTERISTIC		INACTIVE	ACTIVE	TEST STATISTIC	p-VALUE
One Vote System	No	1	3	0.093	0.761
	Yes	13	56		
Board Directors		6.57	5.58	2.978	0.008
Managers		4.64	4.90	1.429	0.172
Board Director Meetings		1.79	2.63	5.171	0.023
Manager Meetings		2.29	3.12	4.042	0.044
Member Meetings		3.57	4.24	2.599	0.107

Table 4 Design Principles of Active and Inactive Farmer Cooperatives – Choice Arrangements.

CHARACTERISTIC		INACTIVE	ACTIVE	TEST STATISTIC	p-VALUE
Non-delivery Penalties	No	3	12	0.008	0.928
	Yes	11	47		
Quality Penalties	No	2	8	0.005	0.943
	Yes	12	51		
Quantity Penalties	No	6	38	2.195	0.139
	Yes	8	21		
Warnings	No	5	41	6.462	0.011
	Yes	9	16		
Fines	No	1	6	0.132	0.717
	Yes	13	52		
Suspensions	No	13	52	0.132	0.717
	Yes	1	6		
Expulsions	No	2	25	3.996	0.046
	Yes	12	33		
Graduated Sanctions	No	1	25	6.124	0.013
	Yes	13	34		

Table 5 Design Principles of Active and Inactive Cooperatives – Sanctions.

proportion of graduated sanctions is higher for inactive farmer cooperatives as compared to active farmer cooperatives. According to Ostrom's analytical framework, robust common property institutions use harsher sanctions (e.g. fines, suspensions) for repeat offenders to dissuade deviations from cooperation. Our result is in direct contrast to Sarker and Itoh (2001), Ghate and Nagendra (2005), and others who described the use of graduated sanctions in robust common property institutions. Overall, whether individually or collectively, sanctions do not appear to matter much when separating the active and inactive farmer cooperatives in our sample. One possible explanation is provided by Jussila et al. (2012), who considered the dual perception of negative reinforcement: (i) dissuasion to breach the supply agreement, but also (ii) dissuasion to patronise the cooperative. In a case study of coffee cooperatives in Rwanda, Mujawamariya et al. (2013) also noted how sanctions and other general procedures by cooperatives may increase the cost of transacting to members and non-members. As such, it is perhaps necessary to make adjustments to Ostrom's analytical framework in reference to farmer cooperatives to facilitate more realistic expectations of the presence and effect of sanctions.

4.5 LEGAL RIGHTS

Ghana has a strong support system for farmer cooperatives, which are important for attaining agricultural and rural development in Ghana (Salifu et al., 2010; Asibey-Bonsu, 2012). There are numerous governmental and non-governmental institutions which promote the development and performance of farmer cooperatives, particularly the Ghana Cooperatives Council and the Department of Cooperatives, both housed at the Ministry of Employment and Labour Relations. Farmer cooperatives

are considered to have better access to inputs at reduced cost, greater bargaining power in the marketplace, and influence on policies with bearing on their livelihood (Salifu et al., 2012). As such, the government defines and secures the legal rights of farmer cooperatives. Furthermore, the government also assumes an active role in the governance of many farmer cooperatives (see *Table 6*).[2] When comparing active and inactive farmer cooperatives, there is a significant difference in the proportions of government involvement, which is manifested by the interaction of district directors and field officers from the Department of Cooperatives with members, board directors, and managers. The involvement of the government in the governance of active farmer cooperatives is higher as compared to inactive farmer cooperatives. Our finding relates to common critiques of top-down initiatives to force collective action by farm producers (e.g. Golovina and Nilsson, 2011; Gezahegn et al., 2020). In the context of Ghana, the involvement of the government is perhaps necessary to address the apparent lack of formal education and experience of board directors and managers. Financial and technical support, whether from the government or other organisations, do not significantly differ for active and inactive farmer cooperatives. Most farmer cooperatives in our sample receive technical support but not financial support. Francesconi and Wouterse (2015) detailed some of the support provided by the government, noting how access to cash, fertiliser, and other inputs seemed conditional on the formation of farmer cooperatives.

4.6 NESTED ENTERPRISES

About 50% of the farmer cooperatives in our sample report to be members of other farmer cooperatives (see *Table 7*). However, active and inactive farmer cooperatives do not differ significantly in the proportions of nested enterprises.

CHARACTERISTIC		INACTIVE	ACTIVE	TEST STATISTIC	p-VALUE
Government Involvement	No	9	12	10.643	0.001
	Yes	5	47		
Financial Support from Government	No	12	43	1.003	0.317
	Yes	2	16		
Technical Support from Government	No	1	2	0.404	0.525
	Yes	13	57		
Financial Support from NGOs	No	11	34	2.099	0.147
	Yes	3	25		
Technical Support from NGOs	No	3	6	1.327	0.249
	Yes	11	53		

Table 6 Design Principles of Active and Inactive Cooperatives – Legal Rights.

CHARACTERISTIC		INACTIVE	ACTIVE	TEST STATISTIC	p-VALUE
Member of Another Cooperative	No	8	26	0.686	0.407
	Yes	6	32		
Operation of Multiple Locations	No	3	6	9.182	0.002
	Yes	11	53		

Table 7 Design Principles of Active and Inactive Cooperatives – Nested Enterprises.

We find more support for Ostrom's analytical framework in another variable, which indicates if the subject operates two or more locations (i.e. one or more locations in addition to headquarters). For example, Nadowli District Multi-Farmers Union, located in Sombo in the Nadowli-Kaleo District with a membership size of 490, is a typical example of a nested (i.e. federated) cooperative. The members of the Nadowli District Multi-Farmers Union are referred to as primary cooperatives, which formed the cooperative union to facilitate access to key inputs as well as marketing opportunities as they operate in the same sectors. Active farmer cooperatives have a higher proportion of multiple locations than inactive farmer cooperatives, and the difference is statistically significant. The operation of multiple locations is perhaps indicative of control delegation to local consumers in order to facilitate a better alignment of use and provision conditions. However, it is also possible to apply an economic interpretation in terms of cost efficiency, which concerns the ability to decrease the average cost of production by increasing size. There is ample evidence in the empirical literature of farmer cooperatives having access to scale economies (e.g. Thomsen and Eidman, 2004; Grashuis, 2020).

5. SUMMARY AND CONCLUSION

Ostrom's analytical framework of design principles is arguably the go-to diagnostic tool to measure the robustness of user-owned natural resource management institutions. Recently, the design principles have been generalised to facilitate the study of human groups in other collective action scenarios. One such scenario is the collective sale of outputs by organised farm producers. In the recent literature, several case studies have used Ostrom's analytical framework to conceptualise farmer cooperatives as common property institutions in collective action scenarios.

Considering its general applicability and overall emphasis on robustness, we used Ostrom's analytical framework to study active and inactive farmer cooperatives in the Upper West Region of Ghana, an area which is characterised by poverty and heavy dependence on agriculture. Specifically,

we endeavoured to find significant differences in the design principles of active and inactive cooperatives. As expected, we found numerous significant differences via the mean group comparison method. Active farmer cooperatives have clearer boundaries, require more capital investments, have more active board directors and managers, receive more governmental support, and operate more locations. Put differently, active farmer cooperatives have more of Ostrom's design principles than inactive cooperatives, which corresponds to most of the existing evidence in relation to common property institutions in general. However, some of the observed differences in the design principles lacked statistical significance, which we attribute to the unique characteristics of farmer cooperatives in general as well as the unique circumstances of farmer cooperatives in the Upper West Region of Ghana in particular.

The application of Ostrom's analytical framework in case study settings in Greece, Indonesia, Bolivia, and now Ghana has proven to be insightful in terms of how organised farm producers behave in collective action scenarios. However, we see several weaknesses and limitations to be addressed in future research endeavours. First, we observe an obvious need to formalise the conceptualisation of farmer cooperatives as common property institutions. While generalisable, we do not know precisely how each design principle is manifested by the various policies and procedures of farmer cooperatives. It is also unknown how the design principles relate to one another, either conceptually or practically, in the context of farmer cooperatives. A formal framework may inform better survey instruments or other field study methods and thus facilitate opportunities to yield reproducible and comparative data. Second, like Jelsma et al. (2017) in the context of farmer cooperatives, we argue Ostrom's analytical framework ought to be refined or extended to consider more relevant variables. For example, both active and inactive farmer cooperatives list leadership, member commitment, external support, and market access as common obstacles to success (Dary and Grashuis, 2020). There is much research, empirical as well as theoretical, on the importance of managers to the performance of farmer cooperatives (e.g. Fulton and Hueth, 2009; Liang and Hendrikse, 2013). While scarcer, there is also research highlighting market access as the main motivation behind collective action of small-scale producers (Markelova

and Mwangi, 2010; Gouet and Van Paassen, 2012). Third, to facilitate a better framework to explain the robustness of farmer cooperatives as common property institutions, it may prove helpful to consider the correlation of Ostrom's design principles with other frameworks of cooperative values and principles. The most prominent framework is formed by the Rochdale Principles, which have been updated over time to reflect the evolution of cooperatives as socio-economic organisations (International Cooperative Alliance, 1995). However, other values and principles also appear throughout the literature (Spear, 2000; Novkovic, 2008; Puusa et al., 2016).

Our results have policy implications as well. For many years, the Ghanaian government has promoted the formation and development of farmer cooperatives. Through district officers and field workers, the government is also involved in the governance of farmer cooperatives, likely because most board directors and managers are volunteers with little formal education. However, it is unclear if governmental support in fact increases the ability of farmer cooperatives to become or remain robust. Many Ghanaian farm producers are poor and do not have a large asset portfolio, which is reflected by the inability of farmer cooperatives to build capital. Some farmer cooperatives have been formed with an intrinsic objective to obtain financial and technical support from governmental and non-governmental organisations, which often grant supplies on the condition of group formation or membership. Another part of the puzzle relates to the outdated character of the Co-operative Societies Act of 1968, which arguably facilitates too little autonomy for the farmer cooperatives. However, more research is needed to consider the local conditions to better inform the causal relationship of governmental policy to the performance of Ghanaian farmer cooperatives.

APPENDIX A QUESTIONNAIRE

Q. Is your cooperative active or inactive?

BOUNDARIES
Q. Must members come from a certain geographic area?
Q. Must members do a mimum volume of business with your cooperative?
Q. Are there maximum volume restrictions?
Q. Are non-members allowed to do business with your cooperative?
Q. Does your cooperative have quality standards?

USE AND PROVISION RULES
Q. Do your members pay membership fees or dues?
Q. Do members have equity in your cooperative?

Q. Is member equity invested in proportion to patronage in your cooperative?

COLLECTIVE CHOICE ARRANGEMENTS
Q. How many board directors does your cooperative have?
Q. How many managers does your cooperative have?
Q. Does each member receive one vote?
Q. How often do board directors meet?
Q. How often do managers meet?
Q. How often do members meet?

SANCTIONS
Q. Are there non-delivery penalties?
Q. Are there quality penalties?
Q. Are there excess quantity penalties?
Q. Does your cooperative use warnings?
Q. Does your cooperative use suspensions?
Q. Does your cooperative use expulsions?

LEGAL RIGHTS
Q. Is the government involved in the governance of your cooperative?
Q. Does your cooperative receive financial support from the government?
Q. Does your cooperative receive technical support from the government?
Q. Does your cooperative receive financial support from an NGO?
Q. Does your cooperative receive technical support from an NGO?

NESTED ENTERPRISES
Q. Is your cooperative a member of another cooperative?
Q. How many locations does your cooperative have?

NOTES

1 The significant difference in the number of board directors for active and inactive farmer cooperatives is attributable to geographical heterogeneity. Many of the inactive farmer cooperatives in our sample come from Wa Municipal, where the standard number of board directors is higher as compared to the other two districts. We therefore do not associate an increase in board size with an increase in inactivity.

2 The frequent involvement of the government in the governance of the farmer cooperatives in our sample is in part explained by the nature of our sample. We sampled from farmer cooperatives which are registered with the Department of Cooperatives. There is no doubt other farmer cooperatives which are not registered with the Department of Cooperatives do not feature as much government involvement.

COMPETING INTERESTS

The authors have no competing interests to declare.

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