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The Role of Co-Operatives in Carbon Trading in Community Managed Carbon Enhancement Activities in Tanzania

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ABSTRACT: *Co-operatives' activities linked to land use, land-use change and forestry generate tradable carbon offsets from community carbon enhancement activities. To this light the major concern of the study on which this paper is based was to examine how the co-operative business model may apply to carbon trading with special emphasis on community carbon enhancement activities. The bulk of the data was generated from semi-structured interviews, focus group discussions and key informant interviews. The results indicated that co-operatives are important for integrating production and marketing of agricultural produce. Services provided by co-operatives range from collection and selling of agricultural produce, extension services, supply of better agricultural inputs to warehousing, grading, and market information. Farmers, through co-operatives' activities generate tradable carbon credits that become a commodity for farmers. The analysis reveals the co-operatives business model offers a framework for smallholder famers to come together as a strong entity to gain collective bargaining power in order to achieve benefits in terms of creating avenues for marketing carbon credits generated through activities with co-operative actions. The study recommends that co-operatives need additional support to effectively engage in carbon trading in terms of technical experts in carbon trade and calls for awareness creation for smallholder farmers to recognize new opportunities for a second commodity (carbon credits).*

KEYWORDS: co-operatives, co-operative business model, carbon enhancement activities, carbon credits, carbon trading

INTRODUCTION

Growing international concerns about climate change have led companies across the globe to reduce their GHG emissions. Among the popular ways to reduce GHG emissions is by purchasing carbon offsets (Adams and Jones, 2009). Carbon trading allows farmers and investors to generate tradable carbon offsets from farmlands and forestry projects through carbon trading. Carbon trading is pertinent to climate negotiations by decelerating the climate change phenomenon. It involves

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implementing practices that are known to improve the rate at which CO_2 is removed from the atmosphere and converted into biomass or soil organic matter (Spash and Theine, 2016). Carbon trading is successful when carbon gains resulting from enhanced land use and land use change practices exceed carbon losses (IPCC, 2007; Smith *et al*., 2014). Carbon trading, as described in the Kyoto Protocol, is a voluntary and mandatory emission trading markets for GHGs (Smith *et al*., 2014). Among the land use practices agroforestry, conservation of natural forests, afforestation programmes and restoration of cultivated and degraded lands have been given priority for carbon trading based on the efficiency of reducing emissions or capturing carbon by storing it (IPCC, 2007).

To-date, co-operatives' activities linked to LULUCF that reduce GHG emissions and enhance carbon stock have been recognized. Certain co-operatives' practices remove carbon from the atmosphere and store it in vegetation and soil organic matter (Nadeau and Nadeau, 2016). Farmer co-operatives' carbon enhancement activities include agroforestry practices, restoration of degraded natural forests, afforestation programmes, land fallow and promotion of the use of energy saving stoves/kilns. Carbon captured from co-operatives' carbon enhancement activities may be qualified to receive carbon credits. Agroforestry cropping systems are said to have a higher potential to sequester carbon than single-species crop or pasture systems because of their perceived ability for greater capture and utilization of growth resources (light, nutrients, and water) (Murthy *et al*., 2013; Tiwari *et al*., 2017). The estimates of carbon stored in agroforestry cropping systems range from 0.29 to 15.21 Mg ha^{-1} yr^{-1} aboveground, and 30 to 300 Mg C ha^{-1} up to 1-m depth in the soil (Nair *et al.*, 2010).

Furthermore, co-operatives are known for high productivity (Hunter and Wu, 2002), which has created an increasing interest of scientific communities in studying the role of co-operatives activities in carbon storage, and ecosystem services (Innocent and Adefila, 2014). Co-operatives are local institutions that address local needs, employing local talents, and led by local leaders (Dubey *et al*., 2016). They are considered to have enormous potential to deliver goods and services in areas where the public and private sectors have failed (Das *et al*., 2006). Co-operatives, agricultural marketing co-operatives in particular, occupy a key position in agricultural development with support in resource and input use, harvesting, marketing channels, storage facilities, distribution channels, value addition, market information and a regular monitoring network system (Kumar *et al*., 2015). In Tanzania, since 1925 when some of the early co-operative societies such as the Kilimanjaro Native Planters Association were formed, the co-operative movement has grown to be one of the formidable sectors of Tanzania's economy. As a rural based economy with agriculture significantly contributing to GDP, any strategy to promote rural development has not and cannot succeed without the co-operative movement (Sizya, 2001).

Although the primary objective of forming co-operatives is to increase agricultural outputs, and marketing of agricultural produce, and because farmers are the single largest group of users and managers of land, water, and other ecological resources throughout the world, little attention has been drawn to agricultural marketing co-operatives' influence on ecosystems services, specifically on how co-operative business model may apply to carbon trading. This is the gap in knowledge that this paper intended to fill. Hence the objective of this paper was to specifically examine how the co-operative business model may apply to carbon trading with special emphasis on community carbon enhancement activities. The principle research questions examined in this study is whether the co-operative marketing approach applies to the carbon trading and what are the research and managerial implications of this.

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THEORETICAL FRAMEWORK

A co-operative is an organization or business owned and operated for the benefit of its members. It's a business enterprise where earnings and profits are distributed among its members (Kenkel, 2015). Co-operative enterprises are a unique form of business model based on the principles of collective ownership, voluntary membership, democratic governance, independence and the benefit of its members as the primary purpose (Birchall, 2004). As a business model, the co-operative enterprise has a different strategic purpose to that of an investor owned enterprise; the focus is on the maximization of member benefits rather than the maximization of shareholder returns (Mazzarol, 2009). The co-operative model is a longstanding method by which independent business owners who would otherwise be competitors join forces for their mutual benefit (Goldstein, 2012). The members of these associations believe in the ethical ideals of honesty, openness, social responsibility and caring for others (Wanyama, 2016).

Co-operatives play an important role in linking farmers to markets; markets that farmers could not access individually (Nembhard, 2014). A market oriented co-operative is characterized by a group of individuals who organize themselves into joint undertaking with the aim of delivering benefits for themselves as members (Beucheltzeller, 2012).

The study on which this paper is based was also guided by the Marxist classic theory of co-operation by Jossa (2005), whereby co-ops are necessary for addressing poverty conditions of small farmers and how co-ops can assist them to access market advantages than when they are on their own, especially their protection against price exploitation; and the human development theory advanced by Amartya Sen (1997), which emphasizes that human development should, among other things, be measured by the enhancement of human capabilities through education and training in order to avail themselves with existing opportunities to remove impediments to their own development. One of those impediments was poverty. Entering the carbon industry with small farmers, through co-operative marketing, is a process of competence building and raising the stock of knowledge for small farmers' enhanced capabilities and searching for opportunities to enter competitive markets and address environmental threats. The emphasis here is the fact that going into carbon trading may not be easy and automatic. It needs prepared members as they enter into a new carbon commodity trade in competitive markets.

These theories of co-operation go in line with two important principles of co-operation, namely principle number five putting emphasis on enhancing the stock of knowledge for raising their business capacity through education, training and experimentation and principle number seven, namely concern for the community. It puts emphasis on sustainable development encouraging members of co-operatives to do business which sustains current and future environment.

The co-operatively-owned business strategy is, therefore, but one approach to entrepreneurial development to foster growth and vitality in communities. It is a viable model that capitalizes on the power of people to create their own futures (Crandall, 2014). Co-operative ownership of a business helps to provide essential business services to the community. Furthermore, it serves as a vehicle for community development that can add income to producers who want to access a value-added market. The shared business ownership gives the users control of the business, gives them the benefits that the business provides to their community, and gives a share of ownership in a business which they find important to themselves and their families (Crandall, 2014).

MATERIALS AND METHODS

Study area description

The study was conducted from July 2016 to February 2017 in agroforestry cropping systems in Moshi Rural District and *miombo* woodland agro-ecosystems in Urambo District. In both districts co-

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operatives are dominant drivers of economic activities for a long time: Kilimanjaro Native Co-operative Union (KNCU) for Moshi Rural District and Western Zone Tobacco Growers Co-operative Union (WETCU) for Urambo District. The dominant farming system in Moshi Rural District is a multi-storeyed agro-forestry cropping system which involves the integration of several multi-purpose trees and shrubs with food and cash crops and livestock on the same unit of land. This agroforestry system has a multilayered vegetation structure similar to a tropical mountain forest which maximizes the use of limited land, provides a large variety of foods and provides substantive environmental services beyond the areas where it is practised. Because of the high quantities of biomass it produces and its capacity to recycle organic matter on farms, the agroforestry system contributes significantly to carbon storage. In Urambo District tobacco farming is the dominant farm type. This, for decades, has exerted pressure on *miombo* woodlands, the vegetation which plays an important role as a carbon sink. The two areas of study have significant and historical co-operative activities tied to LULUCF.

Data collection

As the study sought to explore the ability of co-operatives marketing approach to carbon trading, a qualitative research design was chosen. This enabled the study to gain a holistic perspective on each case's approach and capture all of the potentially rich and meaningful characteristics of co-operatives marketing approach. Designed to obtain a quick overview of the co-operative business model, the study relied heavily on qualitative techniques to collect primary data. Consequently, the bulk of the data was generated from semi-structured interviews and focus group discussions (FGDs) with key informants that were purposively sampled on the basis of their leadership positions in co-operative societies. Sixteen (16) FGDs were conducted, one from each co-operative society. Accordingly, twelve interviews were held with key informants. These were from the co-operative Unions (KNCU and WETCU), district agricultural and cooperative extension officers and retired cooperatives leaders. A questionnaire for Smallholders was administered to 297 farmers; it supplemented the qualitative techniques, mainly to capture nature of farming and smallholder farmers' perceptions on co-operatives services to farmers.

The sampling technique was purposive—that is, co-operatives were selected based on the likelihood that they would provide useful findings. Given the focus of the study, primary agricultural marketing co-operatives that were engaged in agricultural crops marketing businesses were sampled. A total of16 farmers' primary co-operatives were sampled, eight from each district. In order to enhance validity and reliability, a standard set of questions were used for each interview. The topics for discussion centred around five key categories: carbon enhancement activities, co-operative services, market environment, networks and general performance. This interview protocol only formed a guide for each interview, as new issues emerged in each case that required further investigation. The interviews were supplemented with focus group discussions and desk based analysis.

RESULTS

The findings are presented around two key themes. First, the study identified the co-operative model and explored their characteristics and services offered to members. Second, building on this first section, the study explored the replication of co-operative marketing approach to carbon trading.

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Farmers' Socio-demographic characteristics

Of the 297 respondents involved in the study, 148 were from Moshi District and 149 were from Urambo District. The respondents from the two districts were predominantly males. The number of males from Urambo district (133) was significantly higher than that for Moshi District (110). There was no significant difference between the age distributions of the respondents from the two districts although those from Moshi appeared to be older than their counterparts in Urambo District. The mean age for all of them (297) was 52.7 years (minimum 22, maximum 94, range 72, sd 14.67). With regard to education, standard VII (primary education) was the highest education level for majority of the respondents from the two districts 50.7% for Moshi district and 63.8% for Urambo District. The major income generating activity was farming, followed by animal husbandry and business.

Size and structure of smallholders farms

With regard to land size, there was a great variation between the two ecosystems. In the agroforestry cropping system the mean total land size was 3.05 ha (minimum 0.5 ha, maximum 7.0 ha, range 6.5 and standard deviation 1.07). The mean land size for land under coffee banana agroforestry was 0.8 ha (min 0.5 and max 2 ha). The land under agroforestry system covers 62,432.45 hectares which is 44.66% of the total land area of Moshi district (Bamanyisa *et al*., 2017).

In the *miombo* woodland aagro-ecosystem the mean total land size for smallholders' farmers was 8.25 ha (min 2.5 and max 22 ha, range 6.5 and standard deviation1.07). The mean land size for land under restored forests was 1.7 ha (min 1.0 and max 8 ha); woodlots 1.6 ha (min 0.5 and max 4 ha), fallow land 1.3 ha (min 0.5 and max 3 ha). Land under woodlots, fallow fields and restored forests roughly covers 196,161.41 (32.09%) of the total land area in Urambo district.

Carbon enhancement activities

The study revealed that smallholder farmers were involved in some activities that enhance carbon stock in both districts. When ranked from most to least farmers' carbon enhancement activities, tree planting (88.6%), soil management (76.4%), watershed management (74.1%), agroforestry (66.4%), protecting trees from fires (60.6%) and use of energy saving stoves (59.6%) scored high compared to other factors (Table 1). Very few farmers reported to practice of organic farming (22.1%), zero grazing (23.1%) and planting fodder (42.0%). Observations revealed that in Urambo District where tobacco farming poses threat to *miombo* woodlands, tree planting was one condition for tobacco farmers to enter into contract with tobacco buying companies. Other conditions were switching from traditional kilns used for tobacco curing to modern kilns which use fewer firewood and restoration of degraded natural forests. Furthermore, the study observed some farmers practising organic farming and zero grazing in Moshi Rural District. Interviews with primary co-operative leaders showed that these practices are promoted and/or coordinated by farmers' primary co-operatives.

Table 1 : Carbon enhancement activities by smallholder farmers under cooperative action

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Activity	Per cent
Tree planting	88.6
Soil conservation	76.4
Water shed management	74.1
Use of energy saving stoves	59.6
Protecting trees from fires	60.6
Restoration of degraded natural forests	44.7
Planting fodder	42.0
Crop rotation	53.5
Zero grazing	23
Agroforestry practices	66.4
Organic farming	22.1

Percentage do not total 100 because of multiple responses

Services provided by primary co-operatives

It was observed that farmers' primary co-operatives are central for integrating production and marketing. Farmers were asked to list services they got from co-operatives; as illustrated in Figure 1, the overwhelming majority (87.9%) listed collection and selling of agricultural produce, 72.4% extension services, 68.7% and supply of better seeds, 70.7% of the respondents reported that they got education, training or information given by their co-operatives, 49.5% supply of agricultural inputs, 32.7% agro credit and 27.9% certification of crops. Interviews with co-operative leaders indicated that agricultural marketing co-operatives provide other post-harvest services to their members, which include warehousing, grading, packaging, transport and market information.

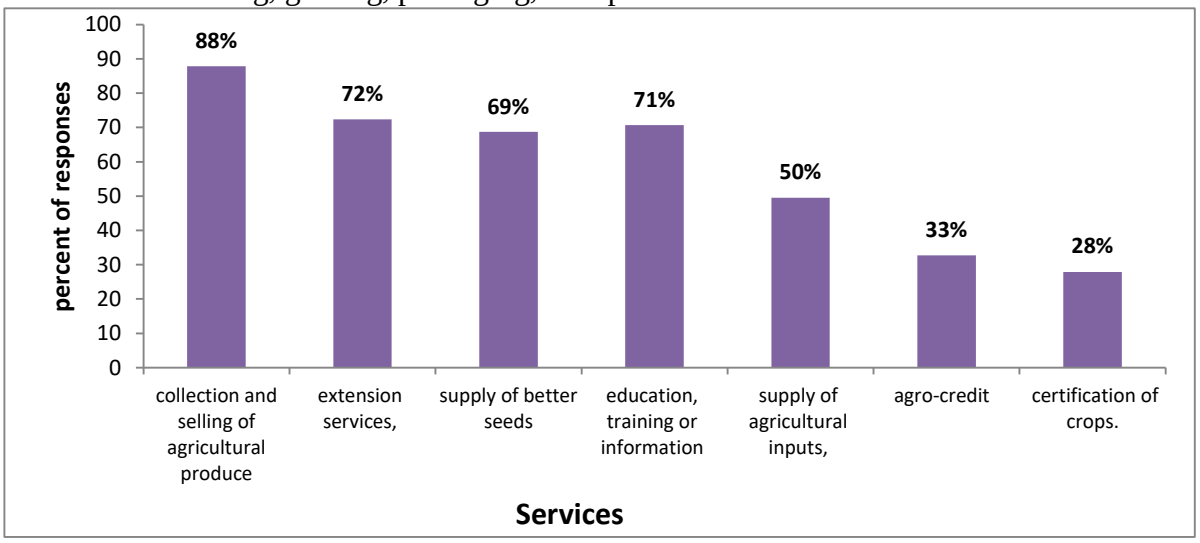

Figure 1: Services provided by primary co-operatives to members

Members who got education, training or information from co-operatives reported that education focused on better farm management, mainly production skills (88%), post-harvest management and

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storage (78%), tree planting (78%), soil conservation (76.1%), water shed management (74.1%), use of energy saving stoves (59.6%) and protecting trees from fires (60.6%).

Participation of co-operatives in environmental services

The study also sought to know the participation of co-operative societies in ecosystem services. Fig. 2 is a summary of respondents' responses on the participation of co-operatives in environmental services. The majority of the respondents agreed that co-operatives were highly involved in environmental services.

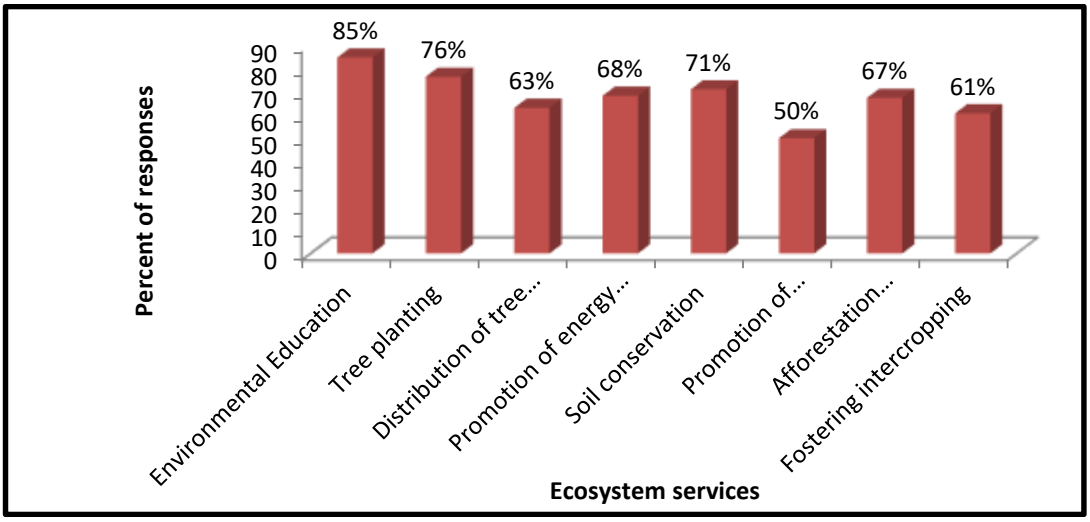

Figure 2 : Participation of co-operatives in environmental services

Information gathered from farmers through focus group discussion revealed that agroforestry cropping system involves the integration of several multi-purpose trees and shrubs with food and cash crops and livestock on the same unit of land. Furthermore, the results showed that the agroforestry practices apart from providing shade to coffee, fodder and mulch production exhibit considerable capacity to accumulate biomass and nutrients. The results in chapter four showed that in the agroforestry cropping systems the amount of carbon was higher compared to other cropping systems. Carbon stock ranged from 29.94 t C ha^{-1} in coffee banana dominated agroforestry to 96.52 t C ha^{-1} in coffee agroforestry plantations.

In Urambo District, the study revealed that co-operatives in addition to coordinating marketing and storage of agricultural produce (tobacco) were also involved in carbon enhancement activities. These activities include tree planting, conservation of natural forests, land fallow and promotion of the use of energy efficient kilns (modern kilns). Interviews with farmers and co-operative leaders revealed that tree planting and/or restoration of degraded natural forest was mandatory for all tobacco farmers. These practices reduce GHG emissions due to forest loss and enhance carbon stock through conservation of forests and afforestation programmes. The study results showed that, for every one bag of fertilizer, a farmer was supplied with 50 tree seedlings for afforestation programme. The purpose of tree planting was to combat environmental degradation mainly deforestation caused by

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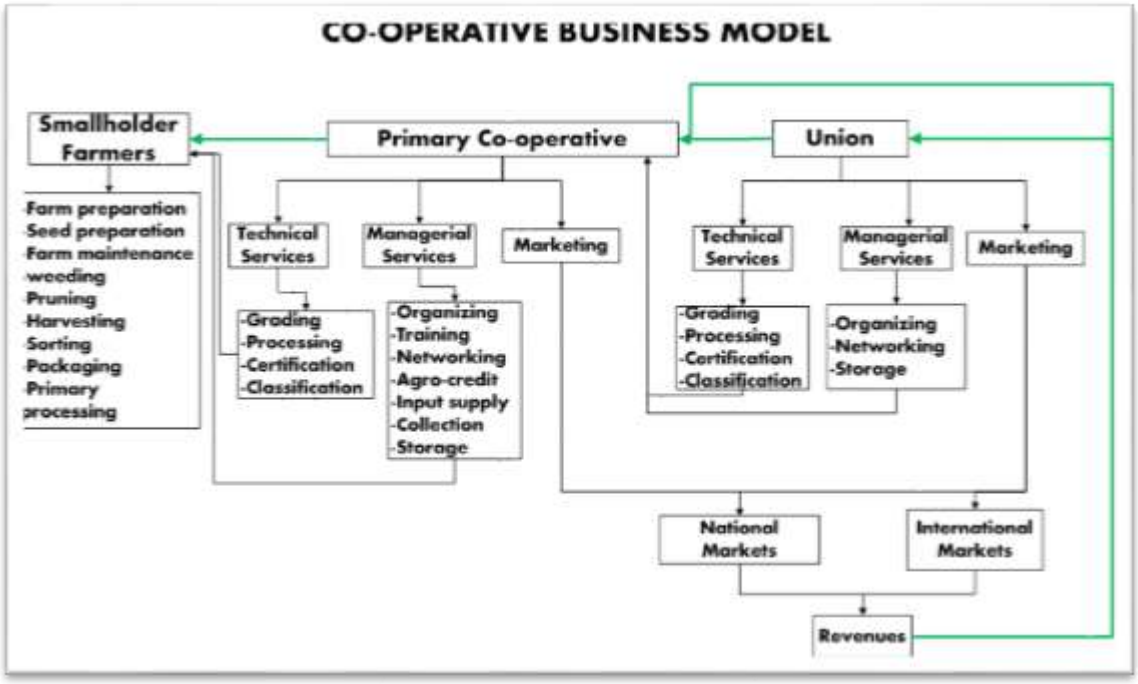
tobacco farming. Interviews with co-operative leaders showed that modern kilns for tobacco curing cut fuel wood use by 50% compared to conventional kilns. With conventional kilns, a farmer used 14 tons of wood for an acre of tobacco compared to modern ones where he used 7 tons of fuel wood for curing tobacco from an acre. Interviews with co-operative leaders showed that the modern kilns use tree branches and not logs as traditional ones. Farmers associate these practices with reduced pressure on *miombo* woodlands and therefore enhanced carbon stock.

Business Model of the sampled co-operative societies

This analysis describes the basic co-operative business models of 16 primary agricultural marketing co-



operatives (8 coffee farming and 8 tobacco farming). An overview of the co-operatives' business models, their characteristics and services offered is presented in Fig. 3. Farmers' primary co-operatives in the two districts coordinate farming of the two main cash crops, coffee in Moshi Rural District and tobacco in Urambo District. The findings showed that co-operatives offer several well-known technical, managerial and marketing services to small farmers. These technical services include processing, grading, certification and classification. Managerial services include organizing, networking, training, input supply and agro-credit collection and selling of agricultural produces.

Figure 3: Business Model of the sampled Co-operative societies

With regard to marketing approaches, the study noted two different marketing channels: farmers' primary co-operatives selling agricultural produce through the co-operative union (2nd tier) and direct selling to the open market without passing through the co-operative union. The former is the traditional/conventional marketing channel. Under this model the role of primary co-operatives is

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collection and processing then handing the crop/produce to the union, the union sets the market on behalf of the members. The union then looks for the best buyer who offers the best price. The latter approach is that where some primary co-operatives in Moshi Rural District declined from selling coffee through the union and formed a network through which they market/carry out the auction of their crop products. According to interviews with primary co-operative leaders, the motive to withdraw from the union network was to seek an alternative marketing system free from bureaucracy and high coordination costs inherent in the union structure that further reduced prices. Under this marketing channel primary co-operative societies do the collection, bulk storage and handling, grading, transport and marketing directly the farmers' crops at the coffee auction. The latter marketing approach was also observed in tobacco marketing in Urambo District, where tobacco farmers sell their produce directly to the open market through their primary co-operatives. Interviews with co-operative leaders showed that the second marketing model reduces operation costs compared to the conventional one; as a result the farmers enjoy financial benefits arising from economies of scale, thus achieving higher prices for equal or better quality services.

Linking Carbon trading to Co-operative Business Models: application of the co-operative business model to carbon trading

With regard to the application of co-operative business model to carbon trading, the study focused on two actors in the value chain; the smallholder farmers and the primary co-operative societies. The analysis based on the second co-operative marketing channel described in section 4.4 above, and is presented from two points of view: the farmers are in charge of implementing activities that result in reduction of carbon emissions (generating carbon credits) and primary co-operatives whose role is to coordinate generation and selling of the resultant carbon credits. Carbon trading widens the number of commodities to two (coffee and carbon for coffee farming communities or tobacco and carbon for tobacco farming communities) instead of the tradition of atomized co-operatives where there is a single crop demanded by external markets. In the widened commodity perspective, co-operatives are able to deal with other types of commodities including carbon credits. Based on the carbon production chain the following applies to the Cooperative Business Model as regards carbon trading

Smallholder farmers: Farmers in both districts through co-operatives' activities linked to carbon emissions reduction and carbon enhancement activities generate carbon credits. These activities include improved soil management techniques, agroforestry practices, and management of perennial shade trees in coffee agroforestry cropping systems, land fallow practices, afforestation programmes and conservation of natural forests/restoration of degraded natural forests in miombo woodland agro-ecosystems. Carbon credits generated at the household level now become a commodity for farmers. The carbon now becomes a second commodity

Primary Co-operatives: The primary co-operatives farmers' organizations ought to be responsible for promoting sustainable forest management by capitalizing on activities that reduce pressure from forests products. Carbon is a stock commodity, because it is stock, primary co-operatives must be active to look for assessment, measurement, evaluation and markets. Key activities by primary co-operatives for carbon enhancement activities include organizing and documenting the progress of participating farmers, administrating contracts and monitoring, communicating with farmers about

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tasks, obligations and rights along with buyers, attending the third party verification, and paying visits to all participating farmers. In terms of carbon credits marketing, although credits are created at the farm level, the commodification and trading process will take place off the farm through primary co-operatives. The primary societies will bundle/stack and channel carbon credits created and act as a focal contact points for buyers or international carbon markets. Once sales of credits take off, primary co-operatives will be selling credits in the name of the farmers and also be responsible for fund management and equitable sharing of the benefits. Figure 4 illustrated how the co-operative business model applies to carbon trading.

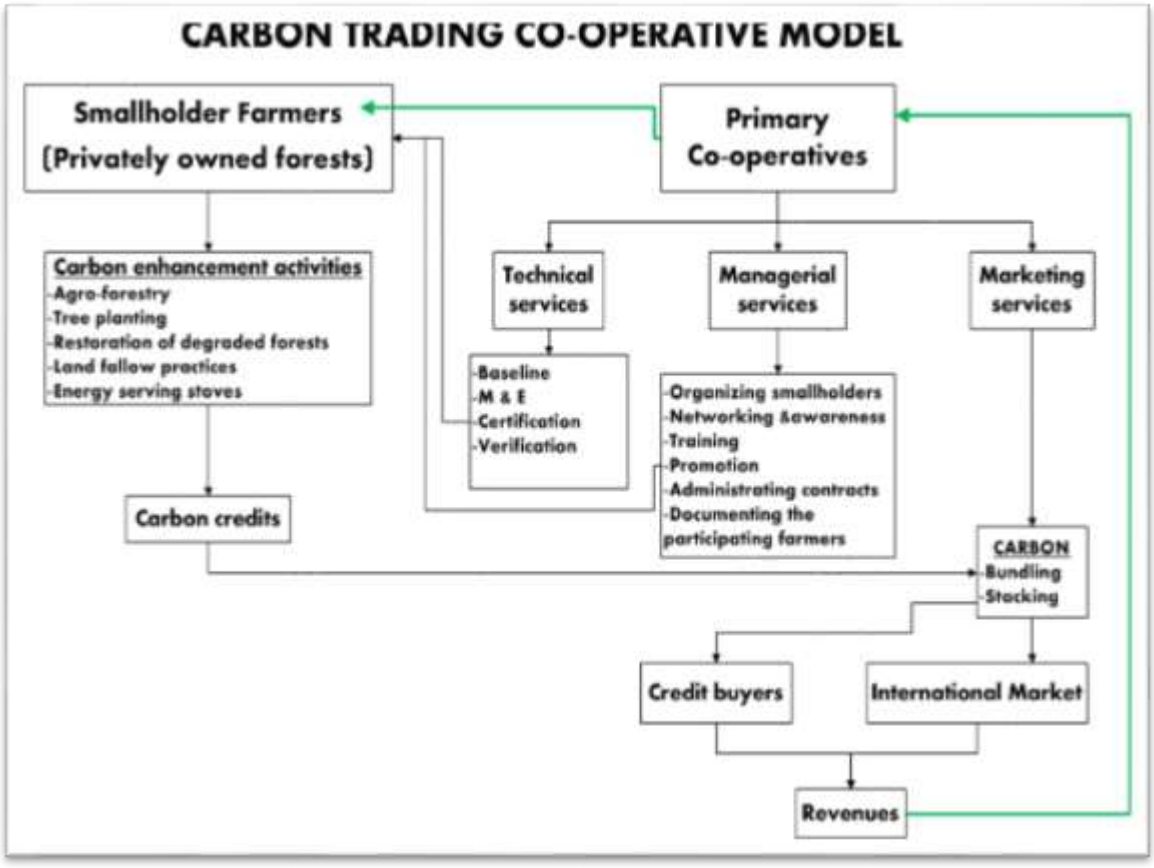

Figure 4:Co-operative carbon credit trading model

The key resources needed are the internal control systems and project technicians that provide technical assistance on how to implement mitigation activities. The primary co-operatives will recruit or hire extension personnel for baseline, monitoring and reporting, land use planning, verification and measurements as they do for crop production and marketing.

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DISCUSSION

The underlying contention of the study is that co-operatives have a unique ability to efficiently aggregate and mobilize large numbers of people and resources at the community level in order to increase crop productivity and overall income by generating support in various activities related to agriculture. Suitable farming systems to generate income through crops marketing have been achieved by members of the co-operatives. Focusing on ecosystem services, a comprehensive set of activities related to LULUCF have been integrated in order to develop resilience towards climate change. The activities as mentioned earlier include agroforestry, restoration of degraded forests, tree planting, land fallow and intensive farming. These activities increase net forest carbon sequestration, thereby generating carbon credits, another commodity that can be traded through the co-operative approach.

The importance of engaging in meaningful action to reduce GHG emissions and enhance carbon stock is recognized in the United Nations Framework Convention on Climate Change (UNFCCC) through various mitigation options mainly the Clean Development Mechanism(CDM) and reducing emissions from deforestation and forest degradation, and enhancing forest carbon stocks in developing countries (REDD+) (Rahman *et al*., 2015). These are intended to engage multi-scale stakeholders in conservation and sustainable management of forest resources for enhancing carbon sequestration in developing countries with incentives as a reward for mitigating global climate change (Gardner *et al*., 2012).

The results suggest that the general characteristic of the co-operative marketing model fits nicely in carbon trading. Co-operatives have the potential to chip in to organize the smallholder farmers to take advantage of the carbon market, both voluntary and/or compliance markets. Smallholder farmers do not know how to access carbon markets because of small scale production. The study showed potentials of co-operative societies bundling or stacking carbon credits into bigger volumes that fits the requirement of the market. Thus co-operatives act as aggregators who collect carbon credits from smallholders before selling at the international markets or private buyers through the voluntary market. Organizing communities into groups (co-operatives) addresses the long lasting challenges of rewarding climate services by smallholders without which they could not meet the minimum volume/quantity required by the international markets (Deal *et al*., 2012). Carbon credits are traded only in large bundles (more than 10,000 metric tons per year), so "aggregators" bundle together the offsets from numerous smallholders to sell them at the carbon market (Adams and Jones, 2009). On their own, individual smallholder farmers may not be generating sufficient carbon credits in a cost effective manner but their co-operatives by bundling and/or stacking climate services enable individual smallholders not only to effectively participate in carbon trading but also provides an improved method for integrating markets (Deal *et al*., (2012). Bundling or stacking of climate services for payments could both increase forestland value and encourage farmers to consider their land as natural assets that provide a set of different ecosystem services (Collins and Larry, 2008; Farley and Costanza, 2010; LaRocco and Deal, 2011).

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The results show that co-operatives hire or recruit extension officers to assist the farmers in better crop production; similarly carbon trading need accurate information on carbon stocks, biodiversity and the socioeconomic status of the communities (van der Gaast *et al*., 2018). Co-operatives may engage extension personnel for baseline, monitoring, verification and measurements to carry out the function. Furthermore, co-operatives may organize training and awareness campaign on carbon trade benefits (Liebrand and Ling 2009)· Similarly as verification of the land use practices impact on greenhouse gas reduction is usually required, a co-operative may engage verifiers, or have verifiers on its field service staff to carry out the function. Thus, a co-operative could help its members maximize the benefit available from the sale of carbon credits by negotiating the highest prices possible for the credits and minimizing the costs associated with selling carbon credits. Combined with other revenue streams associated with sales of coffee/tobacco, carbon credits could contribute additional cash flow to enhance the economic welfare of the members.

It is undisputable that LULUCF has the potential to contribute considerably to reducing net emissions by sequestering carbon dioxide from the atmosphere (Rose *et al*., 2012). The uptake of these opportunities, however, has been slow, particularly in regulating carbon markets (Cacho *et al*., 2013); because of high carbon transaction costs, the property right to be exchanged is fragmented, difficult to measure and its exact size is subject to uncertainty. Stacking of carbon credits by co-operatives could reduce transaction costs, specifically costs related to organizational aspects of the bundle and running costs related to verification and certification of credits generated (LaRocco and Deal, 2011; Deal *et al*., (2012). Both collective selling provide co-operative members with an opportunity to access multiple sources of revenue (LaRocco and Deal, 2011).

With regard to marketing, a co-operative does bargain for lower marketing fees and/or higher returns. Similarly, co-operatives may play these roles in carbon trading; a co-operative may engage a broker(s) to negotiate with carbon credit purchasers on prices and terms of trade or may act as a broker to negotiate with carbon credit purchasers, may engage an aggregator(s) to trade carbon credits for members and/or may act as an aggregator if there is enough volume of carbon credits generated by members ((Liebrand and Ling 2009)). In essence, the function of a carbon credit aggregator is similar to that of primary co-operative society.

Thus, a co-operative could help its members maximize the benefit available from the sale of carbon credits by negotiating the highest prices possible for the credits and minimizing the costs associated with selling carbon credits. Co-operatives can work to ensure monitoring, benefit transfer and reporting. There is potential to reap additional dividends if conservation of one ecosystem service leads to the conservation of other services including biodiversity (Venter *et al*., 2009).

Two key limiting factors in collective carbon trading are shared knowledge of how the business works and political will. Both of these can be overcome with targeted educational campaigns, clear dissemination of success and failures directed at both the co-operatives members and the general public.

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CONCLUSION, RECOMMENDATIONS AND POLICY IMPLICATIONS

The study examined how the co-operative business approach may apply to carbon trading with special emphasis on community carbon enhancement activities. Co-operatives play a major role in uniting their members to address common purpose. The study effectively demonstrated the potential and efficacy of co-operatives in mobilizing their members to undertake carbon enhancement activities, generate carbon credits and participate in carbon trading. Thus co-operatives apply not only to crop production, but can be used in a wide range of other commodities. The co-operative marketing approach, through stacking carbon credits, makes smallholder farmers eligible for carbon projects and therefore smallholder farmers can earn revenue from both carbon credits and agricultural produce. The concept of co-operatives business model as a tool for carbon trading leaves much to be desired in the area of climate change services. It offers a framework for small-holder famers to come together as a strong entity to gain collective bargaining power and by so doing, the groups can achieve considerable benefits in terms of creating avenues for the marketing of carbon credits generated through activities with co-operative actions.

However, co-operatives need additional support to effectively engage in carbon trading in terms of technical experts in carbon trading. There is also a need to look at the rules and regulations of carbon trading to facilitate flexibility to suit the carbon trading requirements and promote various activities required for enhancing carbon stock.

This paper has stresses the role of co-operatives and similar organizations as the best means to carry out local carbon projects. Therefore, co-operatives need to be given much more attention by researchers and policy makers as a delivery mechanism for carbon-related services in local communities. Meaningful change often takes place based on learning from pilot projects. The community of co-operative researchers and developers can play a very important role in propagating an agenda in which co-operatives can become a major part of climate change mitigation. They can do this through identifying examples of co-operatives that are carrying out carbon enhancement activities, to broaden their activities into the area of climate services, including carbon trading.

Carbon is a new commodity smallholder farmers need to be introduced to. Therefore, awareness creation for members to recognize new opportunities for a second commodity (coffee/tobacco + carbon credits) is required. Finally, participation of co-operatives in climate services is an opportunity for training institutions, Moshi Co-operative University in particular to organize seminars and workshops on climate services and/or develop climate change related courses for co-operative extension officers and co-operatives stakeholders.

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