ROLE OF AGRICULTURAL COOPERATIVES IN POVERTY REDUCTION IN NEPAL: AN EMPIRICAL ANALYSIS

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and hereby certify that, in their opinion, it is worthy of acceptance

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DEDICATION

This dissertation is dedicated to my respectful parents,

Rupa Dhakal and Prof. Durga Datta Dhakal,

who have deep respect for the academic profession and always dreamed for me to join the academic profession and work on policy evaluation and improvement that eventually help to reduce the misery of the poor and voiceless.

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ABSTRACT

Cooperatives refer to producer-owned and controlled organizations that improve farmers' livelihoods by correcting market failure. Policy makers consider cooperatives as an appropriate development approach for poverty alleviation of poor farmers for developing economies; therefore, the government of Nepal has been investing economic resources in this sector, prioritizing it as part of a strategy for poverty reduction. The number of coopertives have been increased substantially since 2007 and almost half of the coopertives are involved in agricultural sector. This dissertation research examines poor farmers' access to agricultural cooperatives and the impact of membership on their crop income in Nepal. This study is based on a household survey of 573 rural farm families and Key Informant Interviews of 37 managers of agricultural cooperatives. In order to make the inferences on access and income gain, probit regression, matching, ordinary least square and two-stage least squares techniques are identified as appropriate identification strategies for a cross-sectional data. This study predicts cooperative membership with household characteristics (including demographic and geographic information) and village characteristics. In addition, some of our models use village location dummies rather than village characteristics. The analysis identifies some key determinants that influence

cooperative membership. Those determinants are the ethnicity of a family, the ethnicity of a neighborhood, smallholder land size, distance to agricultural cooperatives, distance to the nearest local market, and distance to a motorable road. For the second research question, our estimates imply that cooperative membership may significantly impact family net crop income but not the rotal family income. Indeed, currently, agricultural cooperatives appear to be focused on financial services like savings and credit activities but are less concerned with agricultural production, and engage in almost no marketing activities. In addition to analyses based on our sample, this study weights the sample to adjust our survey to reflect population estimates; however, there were no important changes in the direction or significance of the variables in weighted specifications compared to unweighted sample specifications. Finally, we conclude it will take some years for members to understand the cooperative guidelines thoroughly and the potential of the cooperative approach to improve economic conditions. Also, there should be a serious attempt from the government to develop the agricultural infrastructure and industry, and to execute a cooperative policy to reduce smallholders' poverty.

Keywords: collective action, cooperatives, poverty reduction, net farm income

CHAPTER 1

INTRODUCTION

Cooperative Context in Nepal

Nepal is a small landlocked country in South Asia that lies in between two giant economies, China and India. The country is divided into three geographic regions and those regions are Terai, Hill and Himalayan. The low-land Terai region, which has a maximum altitude of 305 meters, occupies only 17 percent total land area of the country (Visitnepal, 2019). Nepal became a federal democratic republic country in 2015 (Ministry of Federal Affairs and General Administration, 2018). One fourth of the Nepalese people still lives below the international poverty line, with GDP per capita is $1071 (World Bank [WB], 2019). The annual Gross Domestic Product (GDP) growth rate averaged 3.8 percent, while the population growth rate averaged 1.15 percent from 2010 to 2016 (WB, 2018). Agriculture is a main economic activity of the country, although its contribution to the national GDP was only 27 percent in 2017 (WB, 2019). According to the Central Bureau of Statistics [CBS] (2011) there are 3.7 million agricultural holdings and half of the farmers own only 15 percent of the total arable land. The Nepalese government has been investing in cooperative development for poverty alleviation, and recently the national government announced cooperative development as a key pillar of the economy. Cooperatives or more

generally producer organizations[1] are common in developing countries, particularly in agriculture (Mujawamariya et al., 2013; Simkhada, 2013)

Recently, the Nepalese government said it has taken a number of measures to make the development process inclusive and people-centric so that even the poorest people will benefit from the development. The strategy for this initiative has been the evolution of a three-pillar economy comprised of the state, cooperatives and the private sector. Moreover, the recently passed new constitution says Nepal is to move forward to a socialist economy through partnership with cooperatives, government and business in maximizing proper utilization of human and natural resources (Nepal Gazette, 2015).

Policymakers and development scholars say that the cooperative approach allows agricultural smallholders and wage labor to increase their living standards (Birchall, 2004; Bernard & Spielman, 2009). The majority of the people in Nepal involved in agriculture are smallholders and/or wage laborers. Wage labor may get more employment opportunities in agriculture if the agriculture sector flourished through the cooperative movement. Currently, unskilled wage labor is the second largest source of income in Nepal (International Labor Organization [ILO], 2014). It was reported that cooperatives offer direct employment wage-employment opportunities to approximately sixty thousand people while providing indirect employment benefits like education, transportation, etc. to

[1] A producer organization is defined as a voluntary organization with a democratic decision-making structure, such as cooperatives, producer associations, producer groups and other structures with the goal of obtaining economic gains through shared objectives and activities (Bijaman, 2007).

more than a seven thousand people (Neupane, 2013). Overall, the cooperative sector contributes 3 percent to the national GDP (National Planning Commission, 2013).

There are studies related to smallholder cooperatives and poverty in South Asia and Africa, but, to date, no empirical studies are available that quantitatively examine access to and the impact of agricultural cooperatives on family income in Nepal.

Cooperative History

Cooperatives began in England in the late 18th and early 19th centuries. Over the past 200 years, cooperatives in developed countries have experienced both successes and failures. The producer cooperatives that exist today in developed countries are those that have been successful in terms of member income gain. In particular, cooperatives in developed countries provide an opportunity for producers of all sizes to obtain lower input prices and higher output prices through a cooperative that can bargain with input producers and output buyers. It is common for local agricultural cooperatives to work at all levels of the food value chain. Those levels are input supply, production, processing, and marketing (O'Brien, D. J., and Cook, 2016; O'Brien et al, 2013; Birchall 2004). The cooperative can access the advantages of collective action due to the size of the group, whereas close relationships within the group provide a self-monitoring device to keep them pointed toward their collective goals (Olson, 1971).

In a developed country like the US, Canada, and Europe, cooperatives compete with other firms in the marketplace or can be part of joint ventures with other cooperatives

or firms (Cook & Plunkett, 2006). Members of cooperatives may own and manage processing plants, food manufacturing facilities, wholesale groceries, and so forth. When cooperatives generate margins from efficient operations and add value to the products, these earning are returned to members in proportion to the business they do with the cooperative, partly in the form of cash and the remainder as member's equity held by the cooperative. This equity fund helps to finance additional income-generating activities of the cooperative. If cooperatives need additional working capital to expand their business, the members may make a financial contribution in proportion to the business/transactions they do with the cooperatives (Cook, 1995; Royer, 1992). If members do not have enough income to invest in the project, cooperatives have other ways to invest in new ventures. Cooperatives can merge with other cooperatives or can issue equity capital in the stock market for outsiders, who generally do not have voting rights (United States Department of Agriculture Rural Development, 1994). However, the kind of investment arrangments may vary from country to country based on cooperative rules and regulations passed by the country.

Cooperative members get benefits at two levels from the cooperatives. They earn income at a household level by selling their produce to the cooperative. Further, they also receive dividends at the cooperative level if their cooperative is adding value to their produce and sells it (Cook and Plunkett, 2006). Apart from increased income to the members, there are other factors such as fair payment by the cooperative, availability of

credit from cooperatives, etc., that provide value to a member of a cooperative (O'Brien & Cook, 2016). There is one vote per member irrespective of their use and shares held in the cooperatives. Members can buy more than one share of the cooperatives and may sell shares to members or non-members in a public market (if permitted). Shares sold in the public market do not have voting rights. Any dividends paid to members are based on the number or volume of transactions of the member with cooperatives, dividends are paid based on shares held by shareholders. (Ebbes, 2017). Cooperatives in general offer insurance, supply agricultural inputs in a timely manner, provide access to credit and technical services on production.

Using democratic procedures to run the cooperative allows all members, no matter their size, to have a voice, so they can address their common needs, which is the reason to become a member of the cooperative. Indeed, if small producers are aware of opportunities to exercise their rights in a collective way, they might join the cooperatives in order to address their needs (O'Brien et al., 2013; Francesconi et al., 2015).

Basics of Cooperative

Cooperatives are independent of government and owned by the members. Cooperatives have principles of voluntarism, open membership, democratic member control, economic participation, and common objectives of improving the status and livelihoods of members (Birchall, 2003; International Cooperative Alliance, 2012). The International Cooperative Alliance [ICA] (2012), the apex organization that represents

cooperatives worldwide, defines a cooperatives as "[a]n autonomous association of persons united voluntarily to meet their common economic, social and cultural needs and aspirations through a jointly owned and democratically controlled enterprise" (p. 3). These principles are common to all forms of cooperatives and serve as a foundation for cooperative structure and process.

An agricultural cooperative is a means of collective action; a group of people takes action to enhance their livelihood options through increasing their access to a market at a lower cost (Bijaman, 2007; Valentinov, 2007; Markelova et al., 2009). The role of agricultural cooperatives to minimize transaction cost is crucial (Valentinov, 2007). Transactions costs are the costs for making any economic trade. It includes costs of information and search costs to determine the price of the product and appropriate product characteristics, demand for the product, etc., bargaining to reach an agreement with the other party and policing and enforcing the agreement (North, 1992). These costs are in addition to the cost of goods or services. Agricultural cooperatives lower transactions costs for the individual farmer because each farmer no longer needs to search for marketing information and negotiate the sale. Once the information is known, it can be given to all members. In addition, collective action in cooperatives may increase members' bargaining power in input and output markets to obtain lower costs and higher prices, timely delivery of inputs, etc. (Abate et al., 2014). Thus, in developing countries cooperatives are an institutional device for smallholders to have better market access through breaking up the

local monopolies of traders and intermediaries (Bernard &Spielman, 2009; Poole & de France, 2010).

Agricultural Cooperatives in the US

Many US agricultural cooperatives came into existence in the early 1900s due to the combination of economics, farm organization and policies (Cook, 1995). Farmers needed an organization to act collectively to increase their economic benefits by gaining economies of scale. Further, such an organizations were able to reduce transaction cost for individuals.

At the same time, it is equally important to have a policy that allows cooperatives to grow and evolve. In this context, US agricultural cooperatives have received support from the federal and state legislation, such as exemptions to anti-trust laws, securities waivers, and single taxation provisions (Cook, 1995; Schneiberg, King, & Smith, 2008). Each of these is discussed below.

The US Government passed an anti-trust law in 1890 to maintain a competitive business climate. An exemption for agricultural cooperatives allows them to gain market power. In a sense, farmer's cooperatives may acquire monopoly power by having an unlimited number of farmers who can produce a large volume of the product, which may provide a dominant position and allow the cooperative to set a price. Cooperatives can also threaten to stop providing products to customers who buy products from competitors. Further, a cooperative may agree with other cooperatives on prices and allocate sales

territories and customers among themselves (Smith, 2011). Indeed, anti-trust laws forbid others business types from combining in a similar manner to set prices and sales territories.

The US Government established the Bank of Cooperatives (BOCs) in 1993 to provide credit to cooperatives to support their growth and to establish a well-functioning food value chain. In particular, agricultural cooperatives need to finance both long-term assets and working capital. Cooperative banks can give both secured and unsecured loans to cooperatives (securities waiver) (Cook, 1995). Banks may hold the working capital of the cooperatives as security for financing. Cooperative banks also offer seasonal loans that generally mature within 18 months. A seasonal loan may be secured or unsecured depending on the purpose of the loan (Webb, 1980). The interest rate charged by the banks is below market rate. The interest rate policies vary among the cooperative banks, but, in general, cooperative banks rarely charge variable interest rates[2] that may fluctuate over the time (Webb, 1998).

Further, members' earnings from cooperatives are taxed once (single taxation), either as income of the cooperative when earned or as income of the members when they receive it. In other words, the net income of farmer cooperatives is taxed at either the cooperative level or at the member level but not both (Frederick, 1997).

[2] Variable interest rate varies with the change in the market interest rate over a time, it depends on market interest rate and the principle amount. If customers borrow loan with variable interest rate, their interest payment varies accordingly (Lee, 2018).

These types of policies and institutional arrangments help the agricultural cooperatives to grow as business-oriented entities owned and controlled by users (Royer, 1995; Schneiberg et al., 2008). The institutional support and the business approach taken by the agricultural cooperatives contribute to the successful cooperatives with profitable brand names such as Land O'Lakes, Ocean Spray, United Suppliers, Prairie Farms Dairy Inc. (Hardesty, 2005). Further, the success of US agricultural cooperatives depends on a good understanding of the present situation by its members and projected future operations compatible with rules and regulations. In addition, cooperatives members must understand the rules and regulations that affect the how they may grow and market their goods (Dunn et al., 2002).

Agricultural Cooperative in Nepal

Nepal in General

Table 1. Development indicators of Nepal

Indicators	**Nepal**
Total Population	29 Million[1]
Total Area	147,180 Square Km[2]
Rural Population	80 %[1]
GDP Per Capita Per Annum	$1071[2]
Population Below Poverty line	25 %[2]
Employment in Agriculture	55 %[2]
The share of Agriculture to GDP	27 %[2]
Average Land Holdings	0.9 Hectare[3]
Arable Land (% of land area)	14.74[2]
Agricultural Land (% of land area)	28.74[2]
Human Development Index (HDI) value	0.602[4]
Human Development Index Rank	142[4]

[1] Asian Development Bank, 2017 [2] World Bank, 2019
[3]Central Bureau of Statistics, 2011 [4]United Nations Development Programme, 2020

The majority of the Nepalese population lives in rural areas. Almost one quarter of the population lives below the poverty line based on the international poverty standard of $1.90 per person per day (WB, 2019). Nepal falls into the medium human development

category, ranked in 142th position in HDI[3] indicator in 2019 among 189 countries (United Nations Development Programme, 2020). The proportion of the population engaged in agriculture is around 70 percent and this sector contributes 27 percent of the national GDP in 2018 (WB, 2019), indicating agriculture is a low-income sector. Agricultural land covers approximately 28 percent of total land area of the country but half of that is suitable for growing food crops, so only 14 percent of total land area is arable (WB, 2018). The average farm size in Nepal is only 0.9 hectares, and half of the farmers own only 15 percent of the total arable land (CBS, 2011). The indicators in agriculture and farm size suggest that people involved in agriculture are smallholders and poor, and the agriculture sector is still subsistence oriented and not commercialized. Therefore, the national government may have a high priority for cooperative development as noted above in order to reduce poverty among smallholders.

History of Agricultural Cooperatives in Nepal

In Nepal, there is a history of agricultural cooperative development to improve the livelihood of smallholders. The Government of Nepal established the Department of Cooperatives under the Ministry of Agriculture in 1953. Nepal adopted development initiatives in a policy document in fiscal year 1956/57 in order to ensure the development of cooperatives. Cooperatives and supporting institutions appear in various national plans

[3] It is an index of life expectancy, education, and per capita income. Its value ranges from 0 to 1. Based on the index value, countries are classified in four human development tiers in order, very high, high, medium and low in human development (United Nations Development Programme, 2018)

and the policy on cooperative development and economic prosperity of the nation has changed over the time. These changes in the national policy, including cooperative policy, influenced the growth of cooperatives at the farmer's level. .

Nepal prepared the First Five-Year Plan in 1956 and passed the Cooperative Societies Act in 1959 and the Cooperative Societies Rules in 1961. The first act and rules established the basic structure of cooperatives and how to form and register a cooperative legally (Poudel and Mamoru, 2015). Over time the Nepal government initiated several different programs and approaches for cooperative development in the Second Plan (1962-1965) through the Seventh Plan (1986-1991). The Government frequently moved oversight of cooperatives among ministries and renamed these organizations during this period (Ojha, 2014). This might be due to the confusion among policymakers of how to execute cooperative development at the community level. Moreover, the Government set rules that did not conform to cooperative principles and gave government employees substantial authority, making them more powerful than members; in essence, the government managed the cooperatives (Poudel and Mamoru, 2015). The cooperative movement was weak due to the legal provisions and administrative rules following from the 1961 act that did not recognized cooperatives as autonomous organizations owned by the members and

responsive to their needs (Simkhada, 2013). These cooperatives were not true cooperatives but quasi-cooperatives.[4]

The government established the National Cooperative Development Board (NCDB) in 1991 with the objective of revising the cooperative legislation and formulating member-friendly cooperative policies when the first elected government, after the restoration of a multiparty system, came into power in 1991 (NCDB, 2018). The government launched the Eighth Five-Year Plan (1992-1997) prioritizing poverty reduction with the introduction of a number of policies, including cooperative development (NPC, 1992). In that context, the government passed the Cooperative Act of 1992 and Cooperative Regulations in 1993 to achieve the objectives set in the plan. These acts and regulations, implemented by the Department of Cooperatives, identify cooperatives as member-owned and controlled organizations (Bharadwaj, 2012). Cooperatives began to function in a broader array of activities based on members' needs, including marketing of products, supplying agricultural inputs and providing credit to members (Poudel and Mamoru, 2015).

The cooperative act of 1992, regulations of 1993 and the first amendment to the act in 2000 specify that a cooperative must have at least 25 members to be registered as a

[4] These cooperatives are termed quasi-cooperatives rather than cooperatives because they are controlled by the government not by the users or members.

cooperative society. Cooperatives must have an open membership policy. An individual can buy a share of the cooperative to become a member. The value of the share must be included in the by-laws of the cooperatives. Individual members can leave the cooperative at any time taking their savings after meeting their personal liabilities to the cooperatives, such as loans, equipment, etc. The cooperative must convene the preliminary general meetings within three months of its registration and must regularly organize annual general meetings within 6 months after the expiration of fiscal year (Department of Cooperatives [DOC], 2017).

The cooperative act 1992 requires an elected seven- to the fifteen-member board of directors and a three-member account-supervisory committee with three- to five-year terms for members. The supervisory committee provides for proper checks and balances to avoid any mishandling of capital. It can review all the decisions made by the board and other committees that are formed per the provision of bye-laws. The board of directors is accountable to the general assembly of the cooperative and is responsible for hiring the manager and staff for the operation of the cooperative (DOC, 2017). The presence of at least 50 percent of the general members is needed to conduct a meeting and pass the bye-laws of the cooperative.

The Cooperative Act 1992 provides ways for cooperatives to raise money. Cooperatives can acquire equity capital by selling shares to its members, other cooperatives or foreign cooperatives, which are members of the international cooperative alliance.

Cooperative can sell up to 20 percent of the total shares to an individual member or to member cooperatives. Each member has a single voting right regardless of the number shares owned. With permission from the government, cooperatives can borrow from national and international financial institutions or any other formal institution in order to increase equity capital and issue debentures[5] (DOC, 2017). Likewise, there is a provision that at least one-fourth of the net earnings of the cooperative in any year should be retained or reserved by the cooperative. After deducting reserved funds, a cooperative can give dividends or bonuses to the members, not to exceed fifteen percent of the total share value of the cooperative in any year.

Since 2013, the government of Nepal envisions that cooperatives can play a complementary role with the government and the private sector through organizing rural, poor farmers and enhancing their economic opportunities (Ojha, 2015). The new constitution of Nepal, passed in 2015, says Nepal will move forward to a socialist economy with the participation of government, the private sector and cooperatives to maximize proper utilization of human and natural resources (Nepal Gazette, 2015). Moreover, the new constitution emphasizes the role of cooperatives as a key player for the economic prosperity of the country.

[5] A debenture is a debt instrument issued by an organization in order to get cash. Lenders give cash to borrowers based on trustworthiness or credit rating of the organization rather than the securities of physical assets. In general, an instrument based on unsecured debt is commonly called a debenture (Lemke, 2018).

The new constitution creates three levels of administrative divisions: federal government, seven provinces, and 77 districts, which include villages and city municipalities (Ministry of Federal Affairs and Local Development [MoFLAD], 2018) The government of Nepal recently passed the new Cooperative Act of 2017 to execute the cooperative development in the context of the new federal structure, and provincial and local government. This act provides that all the cooperative regulations made by provincial and local government must follow the national act other than subjects not included in the Cooperative Act of 2017 (Ministry of Land Management, Cooperatives and Poverty Alleviation [MoLCPA], 2018a).

Figure 1

Map of Nepal with administrative divisions: federal, seven provinces,[6] and 77 districts.

(Source: Dahal & Bhusal, 2015)

Provisions other than those in the cooperative act 1991 are discussed below in brief. The Cooperative Act of 2017 increased the minimum numbers of members required to register a new cooperative from 25 to 30 (MOLCPA, 2018a). However, the latest act of 2017 does not clearly indicated whether older cooperatives with fewer members can

[6] The permanent name of the provinces have not passed yet by provinces legislature

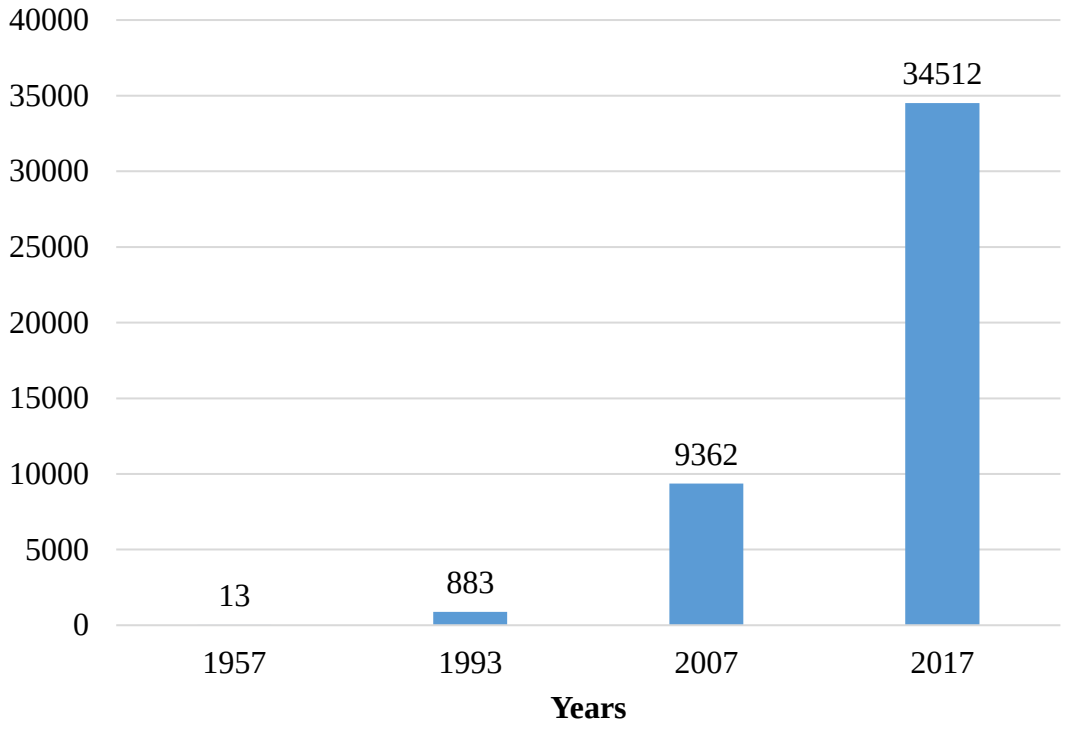
continue to exit. The act sets the value of a cooperative share at 100 NPR[7] and an individual cannot be a member of more than one cooperative. These requirements take some control away from the cooperatives. The cooperatives cannot sell their shares in the open market but can sell to organizations under government control, such as the Nepal Electricity Authority (NEA), Nepal Telecom (NTC), etc. The new act specifies that if a member of the board of directors does business transactions of less than 200,000 NPR with the cooperative, he or she also can be an employee of the cooperative. Cooperatives can offer any type of savings account, but their lending rate must not be more than the 6 percentage points higher than what they pay on savings. Any share dividends or bonuses given to members in any year should not exceed 18 percent of the total share value of the cooperative. Cooperatives must have a Cooperative Promotion Fund and 0.5% of a net income after retained earning must be allocated in that fund. Each cooperative must allocate money from this fund to their federated cooperatives such as the district union, national federation, etc. as per the provision in the bye-laws of federated cooperatives. Federated cooperatives must invest the promotion fund in market infrastructure, education, training or information dissemination for cooperative development.

[7] $1US dollar equivalent to 111.26 NPR, Nepal Rupees(NRB, 2019)

Cooperative Growth

Fig 2.

Growth of Coopearives in Nepal



Source: Poudel & Mamoru, 2015; DOC, 2018

In 1957 the government of Nepal established 13 quasi-cooperatives at the community level to provide credit to flood victims. The number of cooperatives grew slowly for several decades. The number of cooperatives increased from 883 in 1992 to 9,362 in 2007[8] (Poudel and Mamoru, 2015). This growth in cooperative numbers are at least partly be due to changes in the government's cooperative policies and in the political regime. The government policy shifted from allowing only quasi-cooperatives, controlled by the government, to cooperatives with member control. In addition, after the restoration of multiparty democracy, the elected government in 1990 adopted economic liberalization and open market policies (Regmi, 1992). Due to economic liberalization, foreign grants funded many projects and NGOs began to work at the community level, engaging rural people in groups and cooperatives, in order to reduce poverty (Karkee and Comfort, 2016). On the other hand, it seems many cooperatives were created with the support of government and external agencies for channeling grants and funds to the community rather than the needs of the communities.

The number of cooperatives increased from 9,362 in 2007 to 34,512 in 2017 (Department of Cooperatives, 2018a). Approximately 35 percent of cooperatives are involved in agriculture with almost 8 million members (Department of Cooperatives, 2018a). The growth in cooperative number might be due to continuity of the approach to

[8] The year 2007 has been taken due to the changes in political regime in 2006 and availability of the data.

cooperatives, economic liberalization policy and important changes in political regime in 2006. In particular, the Comprehensive Peace Agreement (CPA) was signed between the government of Nepal and a Maoist group in 2006. This peace agreement ended 10 years of armed conflict (United States Institute of Peace, 2006). After the restoration of peace across the country, government employees and many NGOs began to work for cooperative development in remote places, which may also have increased the number of cooperatives.

Institutions Related to Agricultural Cooperatives

As noted above, in developed countries like the US, Canada and Europe, cooperatives compete with other firms in the market place and can be a part of a joint venture with other cooperatives or firms and corporations (Cook & Plunkett, 2006). Producer cooperatives in a developed country work at all levels of the food value chain. There is supportive policy and institutions to increase their chances of success (O'Brien, D. J., and Cook, 2016; Birchall 2004). For example, many US agricultural cooperatives were established in the early 1900s supportive cooperative policy and institutional support from the federal and state legislation, such as, exemptions from anti-trust laws, securities waivers and the single taxation provision (Cook, 1995; Schneiberg, King, & Smith, 2008).

Provision of Single Taxation for Cooperatives in Nepal

There is a single taxation policy for cooperatives in Nepal as in developed countries described by Cook (1995). Members' earnings from cooperatives are taxed once (single taxation) as income of the members when they recive it, but savings, institutional and

reserve funds of the cooperative are not taxed. In other words, the net income of farmer cooperatives is not taxed at the coopeative level (MOLCPA, 2018a). The Cooperative Act of 2017 specifies that the governement can waive sales and local taxes on the goods produced and traded by cooperatives. Cooperatives can also be exempted from import tariffs for the machinery, equipment and raw materials. Further, government can waive any kind of taxes for the cooperatives of minority, female or indigenous group members in order to promote their livelihoods through cooperatives.

Cooperative Banks and Grants

The government established the Agricultural Supply Corporation (ASC) in 1964 to provide agriculture inputs, in particular, seeds and fertilizers, to farmers at a fair price through cooperatives (National Planning Commission, 1965). The Government of Nepal established the Agriculture Development Bank (ADB) in 1968 to give financial services to cooperatives as a successor to the cooperative bank. Since 1973, the ADB has been re-established as a public limited company owned by the government and engaged in commercial banking (Agriculture Development Bank, 2018).

Cook (1995) discussed the role of a cooperative bank owned by cooperative members. In 2000 the government amended the Cooperative Act of 1992 and eliminated the provision of a minimum equity capital of NPR 10 million to establish a cooperative bank. In 2003, cooperative members established the National Cooperative Bank Limited (NCBL) to provide banking and financial services under one roof to all member

cooperatives under the guidance of Nepal Rastra Bank (NRB). Currently, there are 10,000 member cooperatives affiliated with the bank, which has 67 branches nationwide (National Cooperative Bank Limited, 2018).

The National Cooperative Bank finances both working capital and long-term assets for individual members or member cooperatives. Interest rates are lowest for agricultural loans and range between 9.25 and 12.25 percent (National Cooperative Bank Limited, 2018). There is no clear information in national acts and regulations on whether the National Cooperative Bank can provide unsecured loans to its members as in the US (Cook 1995).

The Nepalese government also gives grants to enhance cooperative development and promote the business of a cooperative. The government passed cooperative grant guidelines 2016 in order to make the grants accountable and transparent. Government offices give grants to cooperatives under the headings of either seed money or capital money each year if the government approves the planned budget. The government can give the grants for specific activities of cooperatives, including collective farming by minority groups, landless groups and wage laborers. For landless people, the cooperative can provide land to the people as a group to farm collectively. In a similar manner, the government can give grants for agricultural produce collection, storage, processing and marketing technology, etc. The government also can give grants to specialized cooperatives working together on large investments such as wholesale markets, transportation,

hydropower, manufacturing industries, etc. The grant for capital is based on the fixed costs of the cooperatives. The maximum amount of a capital grant given to a cooperative is 80 percent of its total fixed costs for rural areas and 60 percent in other parts of the country (Ministry of Land Management, Cooperatives and Poverty Alleviation, 2018b).

Competition Promotion and Market Promotion Act, 2007

The Competition Promotion and Market Promotion Act, 2007 is an anti-monopoly act that prohibits any trade practices or monopoly act regarding consumption, production and distribution of goods and services across Nepal. This act does not have any special provision for cooperatives. However, the cooperative act 1993 allows cooperatives to be federated into unions, district unions and central unions and then the apex body of cooperatives, the National Cooperative Federation (Simkhada, 2013). As of 2017, there are 321 cooperatives affiliated with the federation, including cooperative unions, district unions, central unions and the National Cooperative Bank Limited (NCF/N, 2018). This might indirectly allow cooperatives to gain market power as discussed by Smith (2011) in the US. The US government exempted anti-trust law for agricultural cooperatives, so that agricultural cooperative may acquire monopoly power, allowing it to set the price and establish exclusive territories in order control the sale of production.

Education, Training and Services

As noted above, the department of cooperatives was established in Nepal during 1950s in order to start the establishment of cooperatives. Later, the Central Coordination

Committee (CCC), at the national level, and District Cooperative Offices (DCO) in all 77 districts, were established under the cooperative department, ministry of agriculture and cooperatives, in order to offer wide range of services to cooperatives. Those services include oversight, promotion and training activities for cooperative development. The usual oversight involves whether the cooperatives are operating in accord with regulations. Promotion involves campaigns on the importance of cooperatives, facilitating grants for cooperatives and recommending tax exemptions based on acts and regulations. The training activities are offered through the support of other government owned institutions, such as the cooperative training centers and cooperative division offices (Department of Cooperatives, 2018b).

The 77 district cooperative offices were merged into 33 division cooperative offices in 2004 in order to reduce the administrative cost. Earlier, the consolidation may not have been possible due to poor communication and transportation facilities. The division offices have the same main functions of overseeing and promoting the cooperatives as the district offices had. The government opened five regional cooperative training offices in 2005, which do cooperative research, training and development of cooperative-related extension materials. These training centers usually do training on cooperative management, Training of the Trainer (TOT) for entrepreneurial skills and cooperative management, and seminars. (Central Cooperative Training Center, 2018). Although the centers have a research provision, it seems research work is limited to publication of training manuals and basic

cooperative related extension materials. Apart from the training for cooperatives, after 2000 the government required cooperative courses as part of technical and vocational training and optional courses for higher education degrees in agriculture, forestry, education and the like in order to produce technical and human resources to serve the cooperatives ((NPC, 2013).

Khatiwada (2014) argues that despite huge investment in cooperatives, the performance of cooperatives in terms of raising the income of smallholders is not satisfactory due to poor management of the cooperatives. Cooperatives suffer from lack of management and lack of entrepreneurial skills among users, making it difficult to compete in the national and global market. (Kwapong & Korugyendo, 2010). For this, the development of human resources is a key factor. Since the Eleventh Three Year Interim Plan (2007-2010), Nepal's government has emphasized the development of entrepreneurial skills to enable members to gain economic benefits from the cooperatives (National Planning Commission, 2007).

CHAPTER 2

THEORETICAL FRAMEWORK

Conceptual Framework/Theory

An agricultural cooperative allows farmers to work together on shared objectives of economic gains. In particular, a cooperative is a joint effort of farmers\ to utilize their resources, such as land, labor, local knowledge and financial capital, in order to improve their socio-economic condition. In some developing countries cooperatives are emerging as an institutional device for poverty reduction of smallholders. Cooperatives can play a complementary role with the government through organizing rural, poor, small farmers and enhancing their economic opportunities.

This study assesses the contribution of agricultural cooperatives in Nepal to poverty reduction based on three theoretical frameworks: organizational theory, collective action and institutional analysis. To begin it is important to understand why farmers may need an organization in addition to their own farm. Hierarchical firms are not feasible in the subsistence agricultural sector due to the nature of the sector. In particular, its dependence on nature does not enable producers to control the process and production results with accuracy. The inability of producer to control the results make planning, monitoring and supervision complex and expensive (Schmitt, 1993). The problem is more acute in the case of hired labor because it is complex to evaluate the performance of the labor due to the uncertainty in production (Pollak, 1985). However, monitoring and supervision costs are

low if workers are loyal to producers. This loyalty is often absent in hierarchical modes of organization but more likely present in family farms. All the family members themselves are the owners of the family resources and family members have a close-knit relationship that limits opportunistic behavior (Pollak, 1985).

Therefore, farmers may be inclined to have an independent farm due to the labor monitoring and supervision problem (Schmitt, 1993). However, these farms may not achieve the efficient size (internal economies of scale) in order to compete with hierarchical organizations that have established market power through upstream and downstream integration (Valentinov, 2007). For instance, dairy farmers are highly dependent on their local milk processors for purchase of their milk, which is highly perishable. Therefore, there is a high probability of market failure due to monopoly power of the local processor who can act as a price maker. In order to avoid market power farmers may take collective action to achieve a sufficient quantity of milk to be able to efficiently process it. The main benefit of such collective action is avoiding market failure (Bonus, 1986). Here, collective action can internalize the dairy processing transaction under farmers' control so that they can avoid the monopoly market failure and achieve higher prices.

A cooperative is a form of institution. Institutionalism explains the origins of collective action in terms of efficiency and members' welfare. Economists hypothesize that collective action arose to provide cheaper alternatives to existing institutions, such as lower transactions costs (North, 1990). Transactions costs include information and search costs

to know the price of the product, appropriate product characteristics, demand for the product, etc., bargaining to reach an agreement with the other party and policing and enforcement to execute the agreement (North, 1990). These costs are in addition to the cost of the good or service.

Staatz (1987) indicates that the specific assets farmers own for production such as land, household labor, farming experience, etc., combined with high risk in the agricultural sector make farmers likely to join in collective action to lower transaction costs. Collective action reduces the transaction costs for individual farmers because each farmer no longer needs to search for information, to bargain and to enforce the agreement. Once the information is known and enforcement ensured, all members have access to it. Thus, collective action lowers the transaction costs of smallholders and thereby increases their net price.

This study follows the conceptual framework of collective action by economist Olson (2009) that gives insights on how and why groups form. Collective action is an activity a group of people to pursue shared objectives by mobilizing their own local resources (Markelova et al., 2009). Thus, agricultural cooperatives, producer organizations, and users' groups are various forms of collective action, each with their own set of institutional rules.

According to Olson (2009), "Unless the number of individuals in a group is quite small, or unless there is a coercion or some other special device to make individuals act in

their common interests, rational, self-interested individuals will not act to achieve their common or group interests" (p. 2). Olson (2009) notes that the provision of clear economic tools like incentives/penalties guide each individual in a collective action. Olson further argues that due to the provision of incentives based on their contribution, individuals will participate in collective action. Collective action has a self monitoring device due to the size of a group, where close relationships within the group keeps the members pointed toward their collective goals (Olson, 1971).

Apart from the incentives, collective action may be influenced by the nature of the resource, community characteristics, the interrelationship between the community and the resource, market access and external agencies (Agrawal, 2001). Ethnic and income heterogeneity have a negative impact on group functioning, including joining, decision making and sharing information (La Ferrara, 2001). Ostrum (1990) found that collective action becomes successful when groups make their own rules and regulations appropriate to the local context and resource use. The group must follow democratic norms in decision-making and must operate as an autonomous body. External organizations can favor collective action by providing related technical, educational and institutional support (Molinas, 1998). It is equally important to have supportive policy for collective action to grow and evolve (Cook, 1995).

For any group with more than a few members, if there were no clear allocation of costs and benefits based on member contribution, members will not cooperate in group

work due to the free rider problem (Olson, 2009).The free rider problem arises in a cooperative when the costs borne and benefits received by the individual members are not aligned (Cook, 1995). Members who receive the benefit at little or no cost are free riders on those who bear more cost than their benefit. For instance, if a multipurpose cooperative buys a garlic harvester with contributions from all members, costs and benefits are not aligned because only garlic producers use the garlic harvester. In the same vein when a cooperative needs additional investment for a processing plant, small suppliers might reject the investment proposal because they do not have the capacity to increase their production. They see the expansion as benefitting the producers who can expand and do not see they should pay for the benefit of others. They see the other producers as free riders.

In addition to the free rider problem, Iliopoulos and Cook (2013) argue that cooperatives face four additional collective action problems in their operation: horizon, portfolio, control and influence. The time horizon problem occurs when there are disincentives to members to invest in the growth of the cooperative because the member's claim on retained income generated by the investment is shorter than the productive life of that asset (Porter & Scully, 1987). For instance, members approaching retirement age may not want to invest further because they would not get much return on that investment.

The portfolio problem refers to differences in risk preferences for activities and investments among members, and between members and management (Iliopoulos & Cook, 2013). The portfolio problem depends both on the risk attitude of the members and their

level of dependence on the income from the cooperative. For instance, members who largely depend on the cooperative for a regular income for their livelihood and own a relatively small amount of stock/equity may oppose new investment options due to their inability to bear risk.

The control problem refers to differences in interests among members, the board of directors and the management team. The crucial component is differences in utility functions among the members and among the members, the board and the management. For example, members may want to increase regular returns on their product while the board of director may want to reserve a higher proportion of earnings for future investment. There is also the issue of whether the management's contract is structured to align with the members' objectives. If not management may want to run the cooperative for its own economic benefits rather than that of the members. For example if management receives bonuses for certain activities, they are likely to focus on them, perhaps to the detriment of other activities of benefit to the cooperative members or shareholders. Thus, there are monitoring costs for members to make sure the cooperative board and management align with their objectives (Staatz, 1987). Monitoring cost includes the cost to all members to be informed about the operations of the cooperative, communicate with each other to make decisions regarding the operation and to ensure their decisions are rightly executed by cooperative management. In other words, cooperatives bear high monitoring cost if there

is a divergence in the interests among members, directors, and/or management (Cook & Iliopoulos, 2016).

The influence problem exists when there are differences in observed or possible cost and benefit distributions among members of a cooperative because some members are able to influence the outcome of decisions disproportionate to their voting power (Cook & Iliopoulos, 2016). For example, the cooperative is generating income through apple marketing, but some members influence the cooperative to invest in pear processing and marketing because they recently began producing pears.

These five types of collective action problems require different strategies in order for members to achieve their goals of receiving higher benefits from the cooperative than working independently (Cook, 1995). These strategies should be based on clear economic tools like incentives/penalties which guide each individual in a collective action as noted by Olson (1971). Further, members should make their own rules and regulations appropriate to local context aligned with democratic norms and values to become a successful collective action (Ostrom, 1990).

Research Objectives

This study assesses the impact of agricultural cooperatives on smallholders' income and poverty. As noted above, the majority of the farmers in Nepal are smallholders, mainly involved in subsistence agriculture. Their incomes are low due to the absence of improved

production and marketing practices, and also the unavailability of opportunities in other sectors. The literature explores potential factors affecting farmers' decision to join cooperatives in poor and developing economies. An empirical analysis examines the factors that affect farmers' decisions to join agricultural cooperatives and the resulting impact of agricultural cooperative membership on income level of cooperative members. Finally, the study provides policy implications based on the outcomes of the analysis, recognizes research limitations and suggests areas for future research.

CHAPTER 3

LITERATURE REVIEW

Cooperatives Determinants

The literature on cooperatives does not use consistent categories for farmers and farms. Some studies use an income criteria such as poor and better-off farmers; the income categories vary by study. Others use land size, such as small and large farms or smallholders and larger holders; again there is no set land size for each category across countries. Some studies use poor and small interchangeably, as well as large and better off. Given the focus of this study on poverty alleviation, the preferred terms are income-based and those categories are poor and better-off farmers. As noted above, the majority of the population in Nepal are involved in subsistence-based agriculture with a low level of income. Half of the farmers own less than 0.5-hectare of land and there are limited employment opportunities in other sectors. These facts indicate that smallholders in Nepal are poor, but this fact may not hold true elsewhere.

Likewise, some studies use the terms "access to" or "join" a cooperative in an interchangeable manner. Other studies use the word access to cooperatives to assess the existence of cooperatives in a particular locality. In such a case, joining the cooperatives comes after the existence of cooperatives. For this study, the preferred term is "join" rather than access. The literature on membership focuses on land size, education, gender, family size, ethnicity, ethnicity of neighborhood, farming experience, non-farm income,

membership in other organization, position in other organization, availability of cooperative office in a village, distance to the nearest market, distance to the district capital, distance to a collection center, distance to a motorable road, and access to non-cooperative credit institution as factors that may influence small farmer's decision to join the agricultural cooperative.

Land size

Some studies show that agriculture cooperatives have a certain land requirement for membership so that poor and marginal smallholders cannot join agricultural cooperatives. The study by Ito et al. (2012) of watermelon growers in China found that a farmer must have at least 0.20 hectares land under vinyl greenhouse for watermelon production to be a member of the marketing cooperative. The study reported that marketing cooperative do contract with water melon growers to comply with quality standards, but terms are renewed every year. The authors argue that marketing cooperatives avoid smallholders because marketing cooperatives reduce their transaction cost by doing contracts with some large producers rather than many small producers. The authors further argue that cooperatives restricts smallholders because farmers' ability to bear production and marketing risk is proportional to land size. Cooperatives design a strategy in which risks are shared with members if some problem occurs.

Ebrahim (2000) argues, like Ito et al. (2012), that smallholders could not join sugar cooperatives due to the large size of land requirement of sugar cooperatives in southern

Gujarat. It is possible that smallholders are the marginal input demanders and output suppliers, and meeting their needs could increase costs for the cooperatives so that do not achieve economies of scale in production and marketing. The author further argues that if there are differences in income, assets ownership and skills among the members, cooperatives may bear higher managerial and administrative cost due to these differences. Therefore, most of the members involved in the sugar cooperatives are homogenous large farmers. Even if the smallholders had access to cooperatives, the author argues that they could not influence the decision-making process due to those differences noted above.

In a similar manner to Ebrahim (2000) and Ito et al. (2012), Birthal et al. (2007) argue that the cooperatives working with cash crops such as sugarcane, cotton, oilseeds, etc. in south Gujrat, India, are not suited to the smallholders. Smallholders did not grow these cash crops due to the requirement of large land size to get economies of scale in a production. As a result, only large farmers could join and benefit from these cash crop cooperatives. Therefore, most of the farmers involved in cash crop cooperatives are large producers. .

Fafchhamps and Hill (2005), in a survey of the marketing behavior of small coffee producers in Uganda, who own 0.20 hectares of land on average, found that that small coffee producers sell their product at the farm gate due to the low volume and transportation cost. The authors suggest that their low volume, due to small land size, does not justify

travelling to market for sale. Further, they may have urgent needs of cash; thus they sell at farm gate price and avoid waiting for payment if they join agricultural cooperatives.

On the other hand, if the farmers own more than 4 hectares of land in Kenya and Ethiopia, they are less likely to join cooperatives (Bernard & Spielman, 2009; Fischer & Qaim, 2011). Fischer and Qaim (2011) use a cross-sectional survey of 444 banana growers in Kenya to assess the factors affecting whether they join producer organizations. Surveyed growers own 1.3 hectares land on average and were considered small-scale growers. The farmers grow bananas for both home consumption and the domestic market. Their findings suggest that larger farmers (more than 4 hectares of land) have adequate assets and money to farm independently. Larger farmers may be able to achieve production economies of scale due to the size of the land (Bernard & Spielman, 2009), and be in a better bargaining position when dealing with private buyers due to their production volume (Mosheim, 2002). Therefore, it may be beneficial for larger farmers to farm independently rather than using a cooperative.

Bernard and Spielman (2009) in Ethiopia found that middle-size farmers, with landholdings between 1.22 and 4 hectares, have adequate volume and income to join the cooperatives. The authors suggest that middle-size farmers gain from the economies of scale offered by the cooperatives. The cost of marketing their product individually involves getting marketing information, bargaining with buyers, transferring the product, and arranging for delivery to the destination, etc. (Bernard & Spielman, 2009). They bear lower

per unit production and marketing costs through the cooperatives than working alone due to their volume of production.

Our conclusion from the literature is that small farmers are less likely to join agricultural cooperates than medium and large farmers. The volume produced on small land size may not meet the requirement of cooperatives to achieve efficiency in production and marketing. . Further, some cash crop like sugarcane, cotton, coffee, and oilseeds require large land size to get economies of scale in production, so small farmers cannot produce the crops serviced by cash crop cooperatives. In general, large farmers do join cooperatives for some cash crops- sugar, cotton- but not others - coffee and banana. Large farmers may have a higher costs if they join in collective action than if they farm independently, given their farm assets, bargaining capacity, and skills for exploring other economic opportunities. However, middle-size farmers may join agricultural cooperatives because cooperatives offer them efficiency in production and marketing.

Income and membership fees

Some studies suggest that farmer's income is associated with land size and thereby influences their decision to join agricultural cooperatives. Lerman and Ruben (2005) found that land size is key factor for household income and thereby may indirectly influence farmers' decisions to join an agricultural cooperative in Nicaragua. The authors surveyed three groups of farmers: farmers who never joined the production cooperatives, farmers who left the cooperatives to farm independently, and farmers who joined and remained

members of agricultural production cooperatives. The three groups constitute a sample size of 476 and each group included more than 150 households. On average, these three groups own 17.29, 13.28 and 14 hectares respectively. The only pairwise significant difference in land size among these three groups is between those who never joined and those who left the cooperatives. In 1979, the Nicaraguan government allocated lands to rural landless people. They were encouraged to join agricultural production cooperatives supported by the government and farm collectively rather than in individual plots. In particular, the farmers collectively grew cash crops on the majority of land. Members used their remaining land for home consumption. A decade later, another government abandoned the special state support to the cooperatives. Many farmers chose to leave the cooperatives and farm their land independently. Nevertheless, many farmers remained in production cooperatives because they did not have land titles. In addition, they did not have clear ideas about the terms of loans they received from the government through cooperatives. The authors found that total family income ranged from $357.41 for small farmers (up to 1.4 hectares) to more than $1254.08 for large farmers having 42 hectares and more among all surveyed farmers. This study suggests that large farmers may earn sufficient income and thereby have no need to join agricultural cooperatives, while many landless farmers joined production cooperative in order to earn income and improved their livelihood.

Hill et al. (2008) found that marketing cooperatives and producer groups are less likely to exist in communities of high agricultural potential and higher valued land in rural

Uganda. They examined 5,907 agricultural households in a national survey to find the determinants of the numbers of marketing cooperatives and producer groups in rural Uganda. The authors assessed households that reside 31 to 39 km away from the nearest town, similar to the national average for rural agricultural households is 35 km. The authors found that membership in cooperatives and producer organizations significantly increased up to a certain level of wealth in the community, measured as the value of land in terms of agricultural production potential, then beyond a certain point decreased with increasing land value. However, the authors did not provide the turning point in the curve for the value of agricultural land. The authors suggest that the communities located near to town have higher value of land and argue that the observed lesser viability of cooperatives is due to the income and other market outlet options associated with land near town. The average value of the land in the communities with and without cooperatives are $510 and $515 per hectares, respectively. Likewise, the average value of the land in communities with and without producer groups are $450 and $515 per hectares, respectively. .

Ebrahim (2000) argues that smallholder farmers in south Gujrat, India did not join sugar cooperatives because they did not have enough income to buy a share of the cooperative for membership. According to an estimate by Teerink (1995), shares of the sugar factory in Bardoli district subdivision of southern Gujrat were initially issued at approximately $5, but now are sold at approximately $850, beyond the ability of small farmers to buy. Likewise, the study by O'Brien et al. (2013) of smallholder farmers in

Kenya and Uganda finds that about one-fifth of the surveyed non-members said that the membership fee of the cooperative is too expensive but authors did not report what cost was considered too expensive . The authors surveyed farmers whose incomes ranged from $251 to $ 551 per month. Likewise, a study of grain marketing cooperatives in Ethiopia (Bernard & Spielman, 2009) found small, poor farmers having less than 1.22 hectares could not afford to buy a cooperative share that ranged from $5 to $111. The surveyed farmers owned houses worth $835 on average. It is possible that the volume produced and household income due to their small landholdings might not be large enough to pay the membership fee of the cooperatives.

Household income is a key factor to influence farmers' decision either to join (paying membership fees) or to farm independently. Large farmers or farmers who have higher valued land have smaller financial benefits of joining cooperatives. . On the other hand, small farmers can not join cooperatives since they do not have adequate income to pay membership. The low income of small farmers might be due to low production volume or limited income opportunities associated with land size.

Marketing

A bargaining cooperative is a special type of marketing cooperative that is not involved in sales or handling the products. Instead, its only purpose is as the unified negotiator for the members (Iskow & Sexton, 1992). A study by Menash et al. (2012) found that farmers would likely become cooperative members if farmers found that the price

offered by the cooperatives is higher than alterative options in the market. In particular, the authors examined cashew nut farmers involved in bargaining cooperatives in Benin, West Africa. They surveyed 277 farmers, including 168 members and 109 non-members in two major areas of cashew nut farming. Worley et al. (2000) in the case study of the Pacific Northwest asparagus industry also argue that price is the important factor in whether asparagus growers join bargaining cooperatives. The authors find that the price negotiated by the bargaining cooperatives minus the assessment must outweigh the price offered by alternative channels; otherwise, growers do not join the bargaining cooperatives.

Wollni and Zeller (2007) found that larger coffee farmers do not join cooperatives due to the price they get in the specialty market. The authors surveyed coffee growers with coffee plantations of 5.4 *hectares*[9] on average in Costa Rica, where the national average is 3.4 hectares for coffee plantations. Large farmers can sell their coffee to the specialty market based on quality instead of to the coffee processing cooperatives, which market commodity coffee. Land size significantly increases the coffee grower's probability of using the specialty market. Coffee growers who are members of processing cooperatives get a higher price for commodity coffee than in conventional channels and also get cooperative services such as credit, technical assistance, and market information. Over time the growers who have been members of processing cooperatives are more likely to switch

[9] Average landholding size is 0.5 hectares in Costa Rica (NE,2018) whereas the average coffee plantation across the country is 3.42 hectares (ICAFE, 2002)

to the specialty market. The author suggests that through membership in the processing cooperatives these growers learned business skills and gained bargaining capacity due to the quality and volume produced. Small producers can market their coffee through the cooperative without being a member. The authors found that most of the small producers generally sell coffee to processing cooperatives because they get a higher price than in conventional channels (Wollni & Zeller, 2007). The processing cooperative may need higher volumes to achieve economies of scale in marketing, so they buy from non-members. The small scale producers are more likely to become members of coffee cooperatives and choose cooperatives as an outlet for their coffee than the larger producers.

In summary, price offered by the cooperatives is an important factor for farmers because farmers do not join cooperatives if they receive a lower net benefit than from alternative channels. Large farmers, in particular coffee growers, did not join cooperatives because they get a better price in open the market due to their volume, marketing skills and quality of product.

Distance to market

Some studies focus on the influence of distance to market on the farmers' likelihood of joining agricultural cooperatives. Zewald et al. (2012) in the study of agricultural cooperatives in northern Ethiopia find that being close to a market reduces cooperative membership. If there is a main market within 14.5 kilometers of the farm, the probability of joining the cooperative decreased. Abate et al. (2014), in an evaluation of the impact of agricultural cooperatives on small farmers' technical efficiency in Ethiopia, found different results. These Ethiopian farmers are in cereal crop production and own 1.78 hectares on average. The probability of joining a cooperative increased with the farmers being closed to the local market measured in terms of minutes to reach the market, perhaps because the cooperative reduced transportation and transactions cost such as seeking market information, bargaining, etc.

In addition to lack of access to a market, studies suggest that there is a low opportunity cost of labor if farmers live far from the market. Because there are few labor alternatives to farming, farmers are more likely to join the cooperative (Gebremedhin et al, 2003; Haque et al., 2001).

However, Haque et al. (2011), in a study of 44 brackish water shrimp communities in Bangladesh, found that collective shrimp activities decrease with the increase in the distance between the market and the shrimp rearing canal. The authors argue that farmers

residing near the market are more likely to be involved in collective action. In this case, shrimp are a highly perishable commodity, like milk, so being near a market is important.

Findings of market access on cooperative membership appear to be influenced by the product. Members of a cooperative with a perishable product may live closer to the market. However, there is no consistency in measurement unit. Zewald et al. (2012) measured the distance to the market in kilometers while Abate et al. (2014) measured market access in terms of minutes to reach the market. Further, the size of the market might also affect the findings and the studies do not report this. More study is needed in order to explore the details about market access.

Distance to collection center

Studies suggest that a cooperative collection center is a substitute for the market that influences farmer's decision to join a cooperative. Fischer and Qaim (2011) in Kenya found that the distance to a paved road has a positive and significant effect on joining a cooperative, up to 6.1 kilometers, after which the probability of joining decreases with distance. The authors considered distance to the paved road because collection centers are located along the paved road. Beyond some point, the cost of transport to the collection center and the cost of participation in a group meeting might exceed the potential gain in price (Fischer & Qaim, 2011). Likewise, in the survey study by O'Brien et al (2013) of smallholder dairy farmers in Kenya and Uganda, nearly one-fifth of the non-members

mentioned long distance to the milk collection center as the reason for not joining the dairy cooperatives. However, the authors did not report the distance to a collection center.

The above studies show that the role of the market matters, but not always as expected. In some places, collection center works as a substitute for market. These studies did not provide the distance between the collection center and the market. Therefore, more study is needed to explore the details about collection centers.

Farm assets

Basu and Chakraborty (2008) found that assets influence the decision of farmers to join cooperatives. Basu and Chakraborty (2008) use a comparative survey of dairy cooperatives in two villages of Gujrat, India, employing multivariate logistic regression to assess the determinants of participation in a cooperative. The researchers compare the main farm assets of all 277 households in Mahdole and all 469 households in Saundra Villages. Those assets are land size, number of livestock, private irrigation source, tractor ownership, and household labor availability.

The average farm size in the villages of Mahdole and Saudara are 0.70 and 1.3 hectares, respectively. The number of dairy cows, farm size, proportion of females in a household, and family labor for dairying significantly increase the probability of joining the dairy cooperatives in Mahdole village. In fact, the proportion of female household members have the strongest positive influence on dairy cooperative membership. The authors argue that women have a key role in dairy work; therefore, a higher the proportion

of females in a household increases the probability of joining diary cooperatives. Further, labor availability could allow sharing of household and production responsibilities that might increase the probability of joining cooperatives (Wolduet al., 2013). Agricultural crops practices are not related to dairy cooperative membership in Mahdole village because very few dairy farmers own a private irrigation source, bullocks, or tractors. A study by Kumar and Quisumbing (2015) of the policy reform for gender equality in Ethiopia suggests that land ownership by a women increases women's access to economic activities and collective action thereby and would likely increase the probability of joining cooperatives. .

On the other hand, the number of dairy buffalo, a private irrigation source and annual labor hired are key determinants of dairy cooperative membership in Saudara village. The annual labor hired is the most important factor for dairy membership and increasing land size reduces the likelihood of dairy membership. The authors find that dairy is more commercial and developed in Mahdole, whereas Sundhara has more crop agriculture so that larger land size reduces the likelihood of membership in dairy coops.

In the same vein, studies in Kenya, Uganda, and Ethiopia suggest that larger farmers are less likely to join agricultural cooperatives because the opportunity cost of involvement is relatively higher for larger farmers (Fischer & Qaim, 2011; Fafchamps & Hill, 2005; Bernard & Spielman, 2009). It is possible that larger farmers may own various farm assets and skills that would produce economies of scale in production and marketing

if they farm independently (Wollni & Zeller (2007). In other words, the cost of collective action for large farmers might be higher than the benefits they received from the cooperatives. Therefore, large farmers are more likely to farm independently.

Farm assets influence the farmers' decision to join the cooperatives, with medium-sized farmers the most likely to join a cooperative. Farmers are likely to join the type of cooperative that fits their major farming activity. Large farmers are less likely to join cooperatives since the farm assets they own provide opportunities to get economies of scale in production and marketing by farming independently rather than using cooperatives.

Farming risk

The study by Zheng et al. (2012), using a sample size of 819 households of northern China explore factors affecting farmers' participation in agricultural cooperatives. The risk of the farm operation, expansion of a farm, and crop types have a statistically significant and positive effect on joining agricultural cooperatives (Zheng et al., 2012). Risk perception about price and production is measured on an ordinal scale ranging from one to five, low to high risk. Risk can be associated with crop types as in the study of shrimp in Bangladesh, water melons in China and bananas in Kenya, so farmers are more likely to join cooperatives due to the perishability of the crop. However, none of these studies reported risk associated with crop types. Farmers planting cash crops, such as cotton, peanuts, etc., are more likely to join the cooperatives than smallholders with the same cash crop, but the effect of land size for membership is not significant for grain producers. This

could be due to the low risk of grain production because of a national grain subsidy program in China. Further, cash crops mean higher risk because they need greater capital investment, improved technology/knowledge, and adequate land to achieve the scale of economies in production (Birthal et al. (2007).

Lerman and Ruben (2005) studying Nicaraguan farmers' behavior argue that previously landless and poor farmers primarily join the state-supported agricultural production cooperatives in order to improve their livelihood through sharing production risk among members. The authors further argue that the landless poor farmers have a lower ability to absorb farming risk so they are more likely to join production cooperatives. The authors found that landless poor farmers get credit access and better access to cooperative services through their involvement in cooperatives. As a result, landless poor farmers were able to earn the same level of income compared to independent producers who never joined the cooperatives and the independent producers who recently left the cooperatives.

Farmers join the agricultural cooperatives to increase and stabilize the farm income if they perceive there is a high risk in the farm operation. Findings suggest that farmers growing cash crops are more likely to join agricultural cooperatives in order to stabilize their income because cash crops are a risky farm operation. The above-noted study did not provide clear criteria to measure the risk, as crop types might be one of the factors that affect the risk, so further study is needed.

Non-farm Income

Some studies include the effect of alternative employment opportunities for farmers on participation in agricultural cooperatives. People having a special skill such as carpenter, mason, potter, weaver, hairdresser or traditional healer, etc. are less likely to join the cooperatives. People with these skills can earn more income from these activities instead of working with an agricultural cooperative (Wollni& Zeller, 2007; Zewald et al., 2012). In particular, Zewald et al., studying agricultural cooperatives in northern Ethiopia, observe that a farmer with both a special skill and access to a direct market has a significantly lower probability of joining a cooperatives. Zewald et al. (2012) argue that people spend more time in these special skills, leaving less time to join a cooperative, likely because they can earn more from these occupations than from farming and joining cooperatives.

Likewise, Abate et al. (2014), in an impact evaluation study of agricultural cooperatives in Ethiopia, find that farm households that are closer to roads, grow diverse crops, and have non-farm income are less likely to join an agricultural cooperative. However, Fischer and Qaim (2011) in a study of small-scale banana growers in Kenya found that the probability of becoming a member of producer organizations significantly increased if they are engaged in non-farm self-employment activities. Probably they think the cooperative does things that they do not have time to do, so they join in the collective action. There is a growing demand for bananas in Kenya due to urbanization, a growing

middle class and the expansion of supermarkets in the past few years (Fischer &Qaim, 2011). As a result, farmers might join the producer organization in order to get technical knowledge and inputs such as tissue culture seedlings, credit etc.

The overall findings suggest that farmers who are more involved in non-farm employment activities do not join agricultural cooperatives. However, the finding for banana growers does not fit this pattern. It is likely that farmers compare the income and time of joining a cooperative with that of non-farm employment activities before making the decision to join the cooperatives. Further, most of the cited authors did not clearly distinguish between the activities that fall under non-farm self-employment. Some of the non-farm employment categories such as grocery, local service providers, etc. might be promoted by a cooperative, so further study is needed to generalize the findings.

Education and information access

Studies have also pointed to the importance of education. A study by Bernard and Spielman (2009) of grain marketing cooperatives in Ethiopia finds that each additional unit of educational attainment by a household head significantly increases the likelihood of joining an agricultural cooperative. The authors argue that people with more education may understand the benefits of cooperatives and its working approach. Idrisa et al. (2007), in a survey study of the factors affecting women's participation in agricultural cooperatives in Northern Nigeria, find that women's low level of education is one of the most important factors contributing to their low level of participation in cooperatives. Another study of

agricultural cooperatives in northern Ethiopia has similar findings (Zewald et al. 2012). The survey study of 400 households finds that the household head's education significantly increases the probability of joining cooperative. The study also finds information access (TV, mobile phone, and radio) significantly increases the likelihood of the joining a cooperative. It is possible that people having education and information access might understand the value of the agricultural cooperatives through awareness and information sharing.

Using a measure of how families value education, Weinberger (2001) studies women's participation in local associations and groups (i.e., producer organization, club, saving and credit mobilization group, etc.) in Pakistan. The value that households give to education is measured based on if they educate their children. Households that send all children to school are more likely to participate in the local group and association than households who do not. The author argues that a household sending all their children to school is showing they value education and understand the importance of knowledge, so they are likely to join the group. However, the study of Zewald et al. (2012) of agricultural cooperatives in Northern Ethiopia finds that the effect of sending children to a primary school is just the opposite. This may be due to the lack of time for the parents to engage in cooperatives since they have to do the farm work and any household chores the children would have done and look after the children's educational activities as well.

A study by Zheng et al. (2012) using a sample size of 819 households in northern China found that education has a positive and significant effect on understanding the importance of the cooperatives but does not have any significant effect on participation in cooperatives. A study by Fischer and Qaim (2011) of banana growers in Kenya also finds that education does not have any significant effect on joining a producer group.

Similar to the finding by Zewald et al. (2012) in Ethiopia, Fischer and Qaim (2011) found that having a mobile phone is an important determinant for joining a cooperative. It is possible that education and mobile phone use are collinear in their model because the standard errors of both coefficients are relatively high, and education is not statistically significant, whereas having a cell phone is statistically significant. It is possible that people who have an education are more likely to buy and use a mobile phone and understand the importance of the producer group.

In summary, there are mixed findings on education. Some authors find having education significantly increases the probability of joining agricultural cooperatives. They suggest that educated farmers understand the scope of agricultural cooperatives and its contribution to increased economic benefits. Education may enable farmers to access information, using different communication channels that increase their participation in an agricultural cooperative. However, others found that education alone does not ensure participation in agricultural cooperatives. Likewise, whether there is any effect on

cooperative membership based on the value given to education is also inconclusive. Thus, findings on education are inconclusive and further study of this variable is called for.

Gender

Fischer and Qaim (2011) studying banana growers in Kenya, of which 16 percent of the surveyed households are female-headed, found that gender did not have any significant effect on joining the group. The authors argue that because women were involved in banana growing before the formation of the producer organization, women may be equally empowered as men in terms of participation. The study by Weinberger (2001) on women's participation in Pakistan has similar findings. Gender does not have a significant effect on participation in a local association or economic group. Instead, the author argues that there are differences by gender in education, empowerment and mutual respect in the locality, which affect participation (Weinberger, 2001). Poor female farmers lack the education, knowledge, respect, time, and productive assets to engage in a group in comparison to more educated and wealthier male and female farmers (Baden, 2013; Weinberger and Jutting, 2000).

Gender itself does not have a significant influence on participation in collective action activities. Rather differences often associated with gender, such as education, empowerment, knowledge, productive assets and the roles between men and women may influence participation. Thus, education and resource ownership are contributing factors rather than gender itself for the participation in agricultural cooperatives. Lack of

statistically significant findings could potentially be due to multicollinearity among gender, education, and ownership of productive resources. However, none of the studies noted above talked about this.

Credit

Cooperatives often offer services, such as credit, to their members as an inducement to join. Perotin (2006), studying entry and exit among worker cooperatives and conventional firms in France, finds that low savings, high-risk aversion, lack of alternative credit and vulnerability to unemployment motivate people to join cooperatives. Zewald et al. (2012) argue that the likelihood of Ethiopian farmers joining agricultural cooperatives decreased when farmers had easy access to alternative credit through financial institutions. Small and middle-sized farmers, who do not have alternative credit facilities due to their inadequate farm assets, are likely to participate in agricultural cooperatives (Bernard & Spielman, 2009; Fischer & Qaim, 2011). Fischer and Qaim (2011) found that banana growers in Kenya need financial resources to buy tissue culture plantlets and other inputs for banana farming and therefore join the producer organization to get credit. However, large size farmers might not join agricultural cooperatives because of the limited credit in agricultural cooperatives (Cook, 1996; Wollni & Zeller, 2007; Mensah et al., 2012). Many authors suggest that larger farmers may have easier access to alternative credit institutions due to their land holding size and farm assets (Wollni & Zeller, 2007; Bernard & Spielman; 2009; Fischer & Qaim, 2011; Mensah et al., 2012).

Agricultural cooperatives provide credit to their members though the size of the credit varies. Small and middle-sized farmers do not have easy access to credit so that if a cooperative offers credit this increases their likelihood of joining agricultural cooperatives. However, large farmers may get credit through other financial institutions due to their farm assets. Therefore, credit may be less of an incentive to join an agricultural cooperative for them.

Community Trust and Homogeneity

The study by Hill et al. (2008) on marketing cooperatives and producer groups in rural Uganda found that increased levels of trust within the community have a positive and significant effect on participation in producer organizations. The study uses the presence of civil conflict in the last five years to measure the level of trust in a community. The authors argue that there might be a problem of endogeneity in using the trust variable since the existence of collective action might have increased the level of trust in a community, which decreased civil conflict. The authors argue that a multi-ethnic community that recently experienced civil conflict has a lower level of trust that would reduce participation in marketing cooperatives and producer groups.

The study by La Ferrara (2002) on determinants of group membership in rural Tanzania finds that farmers are more likely to be a member of the group/cooperatives if those groups are more homogenous in ethnicity and income. The author suggests that people tend to sort into more homogenous groups when inequality increases, and rich

farmers have less to gain when the rest of the members are poorer. It is arguable that the group/cooperative often adapts to the majority, whether they be small or large farmers. Likewise, poor people believe that that they do not have the same access to resources as well-off people and that well-off persons would receive the benefits produced in a group. Therefore, poor people are reluctant to join groups that are mixed and heterogeneous (Haque et al., 2011). Thus, people, in general, are more likely to join a group/cooperative that is ethnically and income homogenous (Weinberger, 2001; La Ferrera, 2002).

In a similar manner, Ebrahim (2000) in a literature survey of sugar cooperatives in India argues for policies that facilitate the formation of ethnic and income homogeneous cooperatives emphasizing collective farming, so even small holders may form their own sugar cooperatives and also achieve economies of scale in production. Indeed, the author reported that large farmers from the same ethnicity/caste owned sugar-processing cooperatives. Even if smallholders have access to those cooperatives, they are not able to influence the decision-making process either due to their ethnicity or inadequate wealth.

Farmers are less likely to join income and ethnic heterogeneous groups or cooperatives. Group/ cooperatives often are structured to accommodate the majority whether they are large or small farmers. Farmers are more likely to join income and ethnic homogenous group/cooperatives due to level of trust among the members.

Community characteristics

Community characteristics, such as road transportation, access to electricity, extension services provided by the government such as training, field visit, etc.significantly increase the probability of becoming a member of a cooperative in northern Ethiopia (Zewald et al., 2013). Likewise, Hill et al. (2008) in Uganda find that cooperatives are more likely to exist in less remote communities. The authors suggest that farmers are more likely to become a member of a cooperative if they live in an area that has access to the market, road, electricity, government services etc.

Wollni and Zeller (2007) found that coffee growers in Costa Rica who participate in other group/associations, such as agricultural cooperatives or labor union, are more likely to be a member of coffee marketing cooperatives. Perhaps, a farmer who participates in public meetings and is a member of rural associations/unions at the village level may get the opportunity to learn about cooperatives through information sharing among members of other organizations. It is possible that farmers learn how group works in one and then use that knowledge to join other groups. On the other hand, Fischer and Qaim (2011) in a study of banana growers in Kenya find participation in other groups/association does not have any significant effect on membership in the banana producer organization (not a cooperative).

In summary, findings of farmer's participation in cooperatives due to their involvement in unions and associations are inconclusive. This may be due to the

differences in crop types and research design. Some crops may need more information for production and marketing, so farmers join the cooperatives for sharing the information. Thus, careful attention is needed during research design to resolve the matter.

Summary

The previous literature explores land size, household income, membership fees, farm assets, farming risk, market distance, education, non-farm employment, gender, access to credit, community characteristics, and community trust and homogeneity, as factors influencing the smallholder's decision to join agriculture cooperatives. There are mixed findings on some determinants that may be due to the crop types, local context, and differences in research design. Those determinants are small land size, education, market access, non-farm employment and membership in other groups/associations. There are some key determinants such as medium land size, access to credit, community trust and homogeneity and risk in farming that increase the likelihood of joining cooperatives, while variables like large land size and heterogeneity among people have a negative effect on membership of cooperatives.

Small and poor farmers are less likely to join the agricultural cooperatives than middle-size farmers are, but they are more likely than larger farmers, unless it is a cash crop. This could be due to their inabilty to buy a share of a cooperative. Their volume marketed may not be sufficient to pay the membership or to buy the share of the cooperatives. On the other hand, in general, large farmers, except banana and sugarcane

growers, do not join agricultural cooperatives because they may have adequate resources and can generate other opportunities through their own resources and skills. However, middle-size and middle-income farmers may gain economies of scale in production, marketing, and procurement of inputs through cooperatives. Therefore, they are more likely to participate in agricultural cooperatives.

Education is another factor that may influence farmers' participation in agricultural cooperatives. However, findings on education are inconclusive. Some authors find that education has an influence (Bernard & Spielman, 2009; Weinberger, 2001; Idrisa et al., 2007; Zewald et al., 2012) while others find that education alone does not ensure participation in agricultural cooperatives (Fischer & Qaim, 201; Zheng et al. 2012). Education may enable farmers to access the information using communication channels that can increase their participation in an agricultural cooperative, or the access to information may allow them to farm independently.

Gender does not have an influence on participation in collective action activities (Weinberger, 2001; Fischer & Qaim, 2011). Gender may be correlated with other factors, such as education, empowerment, knowledge, productive assets and roles differences between men and women (Weinberger and Jutting, 2000; Baden, 2013), so even in the absence of a direct relationship there may be a correlation between gender and cooperative membership.

Farmers are more likely to join cooperatives if their community has basic infrastructure such as road access and electricity (Hill et al. 2008; Zewald et al., 2013). Farmers likely join agricultural cooperatives to gain higher prices/benefits. They compare the benefits and service offered by the cooperatives with conventional/alternative channels before joining agricultural cooperatives (Worley et al., 2000; Wollni and Zeller, 2007; Menash et al., 2012). The studies show mixed findings on access to markets. Researchers use a variety of proxy variables for market access. Authors like Haque et al. (2011), Zewald et al. (2012) and Abate et al. (2014) use distance to the market as a proxy while other authors, Fischer and Qaim (2011) and O'Brien et al. (2013), use distance to the collection center. Further, the size and types of market such as haat bazar, local market, etc. may influence the findings on membership but none of the studies assessed the market in that way. The likelihood of farmers who are involved in non-farm employment activities joining agricultural cooperatives is mixed and inconclusive. This could be due to the differences in income based on employment types; therefore, further study is needed.

The level of trust among farmers is an important determinant of membership in agricultural cooperatives. People are less likely to join ethnic and income heterogeneous cooperatives (La Ferrara, 2002; Haque et al., 2011). People trust their own peer group more than a different one (Haque et al., 2011). Farmers who are already involved in unions and associations are more likely to join the agricultural cooperatives in a locality (Wollni and Zeller, 2007). It is possible that farmers learn how such groups work and then use that

knowledge to join other groups. However, a study of banana growers in Kenya finds participation in other groups/association does not have an effect on membership in producer organization. Factors such as risk in the farm operation, crop types, credit facilities, farm assets, non-farm income etc. also influence the farmers' participation in agricultural cooperatives.

Impact of Cooperative Membership on Income Gain and Poverty Reduction

In addition to questions about who joins a cooperative an important question is whether cooperative membership increases incomes. In particular, the second research question is "Do agricultural cooperatives provide income gains for their members?" The literature does not use a common measure for the income gain for cooperative members. Many authors directly measure the income gain from cooperative membership and relate the income gain data to poverty reduction or improvement in the lifestyles of the household. Some authors measure both income and poverty reduction measures on an index or poverty reduction as a percentage. There are also studies that measure the welfare gain of cooperative members in terms of expenditures/consumption per capita, and price and yield gain for members. Whatever the approaches that have been used that are related to income gain are within the scope of the literature review of the second research question.

Many studies have found that being a member of a cooperative has a significant and positive impact on income (Bernard et al., 2008; O'Brien et al., 2013; Verhofstadt & Maertens, 2014; Mojo et al., 2017). Apart from membership, other factors might influence

the income difference between members and non-members, such as land size, market distance, farm assets, education, gender, non-farm employment, household size, credit access. Therefore, previous research commonly uses Propensity Score Matching (PSM) techniques in order to make treatment and comparison groups similar by restricting the observations to a common support region so that there is no there is no significant difference on covariates between treatment and comparison group. In other words, treatment units are matched with their similar counterparts that differ only in the treatment under study (Heinrich et al., 2010). Further, some studies also used endogenous switching regression (ESR) technique along with PSM to check the robustness of the PSM technique. These methods will be explained in the methods chapter.

Qualitative Studies of Income Gain

There are qualitative studies on the role of US agricultural cooperatives in improving incomes of African American smallholders and poor farmers. The qualitative studies have found that cooperatives enhance the income of the smallholder farmers. The Federation of Southern Cooperatives, across ten southern states of the US, includes agricultural and a wide range of other cooperatives as member cooperatives. Most of the members of the agricultural cooperatives are small, African-American landholders, owning about 42 acres (17 hectares) on average (FSC/LAF, 2018). Nembhard (2004) finds that African American sharecroppers in the southern belt lost their jobs and share-cropped land due to their participation in the civil rights movement during the 1970s. According to the

report of the federation, the federation works to acquire land for some people who lost their access to land during the civil rights movement. Small farmers who are members of the cooperatives produce vegetables and fruits and sell their products at a higher price due to the increased bargaining capacity enabled through the cooperatives (FSC/LAF. 2018). Nembhard (2014) summarizes the report of FSC/LAF project about member cooperatives across six states of the US in south. The report estimated sales of $85 million through cooperative marketing and members received dividends earning equivalent to $25 million during the last 45 years. The basis of any dividends paid to members is the volume of transactions of the member with a cooperative. Actual increases in income were not estimated.

There are also qualitative studies of cooperatives in South Asian countries, which conclude that cooperatives generate income and reduce poverty. The Bangladesh Milk Producers' Cooperative Union Limited is an histrical case study examining income gain of small farmers. The Bangladesh Milk Producers' Cooperative is the central unit of of 345 primary milk producer' cooperatives at village level, established by the government in 1973. This cooperative union is the pioneer dairy cooperative in Bangladesh. The union is popular for its brand name, Milk Vita. The primary cooperatives at the community level own milk collection centers, which send the milk to the processing center owned by the union. The milk is processed and distributed throughout the country. The union has a 63 percent share of the liquid milk market in the country. The union provides various services

to dairy farmers, such as loans for cattle purchase and feed, animal nutrition improvement and what farmers perceive as a fair milk price (Zaedi et al, 2009).

Milk Vita was managed by government civil servants and operated at a loss until 1990. In 1991 the managing committee of the union was changed and now eight out of the12 members are representatives of the primary cooperatives, who are farmers at the village level. These changes made the farmers the real owners of the union. Due to management changes, the membership of the dairy cooperatives increased significantly from about 35,000 to 101,000 dairy farmers in 2005 (Zaedi et al, 2009). Farmers' earnings increased ten-fold from 1991 to 2000, lifting the household earnings of about 0.3 million people (including household members) well above the poverty line. Milk Vita also created an additional 2,200 jobs, including 300 for milk distribution in urban areas, and at processing plants and collection centers. In general, these jobs were taken by the poorer people (Birchall, 2003), who are landless.

People who are functionally landless and poorer in a community also are supported by the dairy cooperatives to improve their livelihoods (Birchall, 2003). Farmers who own less than half an acre of land are functionally landless. The land owned by them includes their houses, around which they keep livestock. These functionally landless farmers usually keep one to three small cows that only give 1-3 liters of milk per day. Usually, these farmers feed their livestock household food waste and local rice staw. In fact, their dairy animals are less productive due to poor feed nutrition (Oliver & Mckague, 2012). Initially,

organizations like Care Bangladesh, UNDP and FAO organized these people into user groups and gave technical services and micro-credit loans. Then, indiviudals in the group buy livestock with credit from the user group. Groups purchase bulk feed and obtain veterinary medicines at reduced cost. Feed is also available in 10 kg bags rather than 40 Kg so even poor farmers can afford it. Simple village level technologies for feed preparation and storage had been initiated through the technical support of the NGOs (Mckague, 2012). Later, these users groups formed the primary dairy cooperatives at the village level that supplied the milk to the collection centers under the umbrella of the unionnion. Through this process, almost 4000 functionally landless villagers begun to earn income keeping dairy (Birchall, 2004).

Likewsie, there is the historical case of dairy cooperatives that were successful in generating income for smallholders in Kheda district, Gujarat. The district is well known for milk production across India. Earlier milk producers at the village level sold their milk and processed milk into products like ghee, accessing urban markets through middlmenan or traders. In 1920, a private firm was established to collect milk from the farmers at its collection centers to supply Bombay (now Mumbai). In1945 the governent of India gave this firm monoply rights to collect and distribute milk. Farmers were not satisfied with the price offered by the private firm; therefore, discontented farmers organized themselves and formed central unit at distric level in 1946. Like Milvita in Bangladesh, dairy farmers formed milk producer coooperative societies at the village level and all the socities

federated into district level cooperative named the Kaira District Cooperative Milk Producers Union (Baviskar & Attwood, 1984).

The majority of the farmers involved in producer cooperatives in Kheda district, Gujarat, are smallholders having less then 1 hectre of land (Patel, 1988). Producer cooperative societies collect milk from dariy farmers at village level and then supply their milk to the union that owns the processing plant, now famous by the brand name-- Amul Dairy. The processing plant produces processed products, such as butter, cheese, milk powder, baby food, chocolates, etc. The union pays the dairy societies based on volume and quality, and the village societies pay members on the same basis

Later, the Union became a three tier cooperative called Gujraat Cooperative Milk Marketing Federation Ltd.(GCMMFL) serving member dairy farmers across Gujrat state and becomes the thirteenth largest dairy organization worldwide . Currently, it reports that there are 18,554 village milk cooperative socities, 18 member unions at district level and 3.6 million milk prodcuer members under its umbrella. GCMMFL estimated that its daily milk sales turnover is approximately $ 4.5 billion and milk procurment was 18 million litres in 2017/2018 (Amul, 2018). GCFML raised the income of dairy members four-fold

from 2010 to 2017. In particular, the price paid to member farmers has been increased from IRs[10] 24.30 to IRs 49 per liter of milk during last seven years (Pandit, 2018).

Ebrahim (2000), in a literature survey, finds that sugar cooperatives in south Gujarat of India have been successful for large-scale agricultural production and commercialization. The area of sugar production almost doubled in south Gujarat between the 1980s and the 1990s and the crop gives stable prices. Large and medium farmers established sugar factory cooperatives during the 1990s so that they can receive the margins of intermediaries and private traders. From the income gain they received, the medium-sized farmers have been transformed into big farmers and big farmers into an elite group possessing farm vehicles and cars. However, smallholders do not have access to these sugar processing cooperatives due to the high price of a cooperative shares (Breman, 1978). Furthermore, smallholders in southern Gujrat do not grow cash crops such as sugarcane, cotton, etc. due to the resource constraints such as capital, land, etc. (Birthal et al., 2007).

Studies of agricultural cooperatives in African countries up to the 1990s concluded that cooperatives did not perform well in alleviating the poverty of smallholders (Wanyama et al., 2009). The "cooperatives" were initially established as state entities rather than independent enterprises owned by members (Hussi et al., 1993; Develtere & Pollet, 2008). Many African countries, including Ghana, Keya, Nigeria, Senegal, Uganda, and Rwanda,

[10] IRs: Indian Rupees
$1=70.95 IRs(SBI, 2018)

adopted Structural Adjustment Programs (SAPs) facilitated by the World Bank in order to run the economy on market principles in the early 1990s (Wanyama et al., 2009). At the same time, the governments also enacted pro-democratic political structures in their cooperatives legislation. After the 1990s, members of cooperatives became the real owners of cooperatives. The number of cooperatives and members significantly increased after the adoption of liberalized economic policies. Due to these two effects, the membership of cooperatives even reached 10 percent of the total population in Egypt, Senegal, Ghana, and Rwanda (Wanyama et al., 2009). Cooperatives that are successful in African countries are those that provide significant financial and economic benefits to the members. These cooperatives gradually built up financial resources through membership shares, loans and saving of the members. They work on demand-driven products with a business-oriented approach while following the principles of democratic values (Develtere & Pollet, 2008). A survey study by Verhofstadt and Maertens (2014) examining the impact of agricultural cooperatives on farm income and poverty reduction in Rwanda found agricultural cooperatives have positive and significant impacts on farm income and poverty reduction measured in term of percentage poverty reduction.

Quantitative studies of income gain

The study by Wollni and Zeller (2007) using a survey of coffee growers in Costa Rica found a price gain for cooperative members. The authors collected data from a sample of 216 households in an area that grows more coffee than the national average. Among

sampled households, 84 percent are members of the cooperatives. The authors measured the impact of using different marketing channels by coffee growers on the price they received using Ordinary Least Square (OLS) regression techniques. This study used price gain as the dependent variable, as a function of coffee marketing channels measured by dummy variables and a set of other explanatory variables such as land size, education, etc. The study found that coffee marketed through cooperatives increases the average price for members by US $0.1/kg over conventional channels holding other explanatory variables constant. The price increase relative to conventional channels is not due to the quality of the product but the coffee processing cooperatives bargaining power due to access to world market information. The authors reported that coffee cooperatives have a positive impact on incomes of medium-sized and small farmers. However, large growers did not join the cooperatives due to their access to the premium coffee market. Large growers get a premium price due to the quality of their coffee and their business skills. Because cooperatives are not in the premium coffee market, large farmers do not belong.

O'Brien et al. (2013), using a survey of small-scale dairy farmers in Kenya and Uganda, examine the benefits of membership in dairy cooperatives that includes milk production, collection and processing. The authors surveyed four dairy cooperatives, three in Kenya and one in Uganda. The cooperative in Uganda is in the process of building a processing facility and this cooperative constitutes approximately 30 percent of total sample size. The authors employed Ordinary Least Square (OLS) regression techniques to

compare income between approximately equal numbers of members and non-members, 2246 and 2078 individuals respectively. A descriptive comparison of mean characteristics found that members have significantly more cows, higher production per cow and a higher level of income from dairy than non-members do. The study used OLS regression with monthly dairy income as the dependent variable and cooperative membership as a dummy variable controlling for other relevant factors such as education, number of cows etc. The regression estimates that cooperative members earn statistically significantly higher incomes from dairy than non-members do. Members have $18 per month higher income than non-members holding other explanatory variables constant. The authors argue that the difference in income is due to the cooperatives since there is no statistically significant difference in non-dairy income between members and non-members. However, this study may have biases in the estimation due to observable and unobservable factors. In general, dairy farmers who choose to become the members might have different skills and financial resources than non-members, which could bias the findings.

Using a different approach, Anteneh et al. (2011) investigated the return to different market channels used by coffee growers in Southern Ethiopia. The authors surveyed 1400 smallholder coffee farmers including 700 members of cooperatives. The majority of coffee farmers in the study area have less than 0.5 hectares of coffee and only 3 percent of farmers own more than 2 hectares. On average, coffee growers allocated 45 percent of their land to a coffee plantation. Cooperative regulations do not require members to sell exclusively to

their cooperative and non-members can sell coffee to the cooperatives. The authors categorized coffee growers into three groups based on to whom they sold coffee: only cooperatives, only private traders, and multiple channels (to both cooperatives and traders). The authors reported that 42 percent of members sell their coffee to multiple channels. This study used Tobit regression to assess the determinants of market channels and analysis of variance (ANOVA) to estimate the differences in income and yield between marketing channels. The authors found that coffee income is significantly higher in the group using multiple channels followed by selling only to private traders and the lowest income is those selling only to cooperatives. The differences in income are due to the yield of the coffee and taking advantage of prices in various marketing channels. In particular, the growers who used multiple channels can earn more income by diversifying the risk of getting a low price from only one channel.

The authors reported two regression equations using the proportion of coffee sales by members to private traders and the proportion of coffee sales by non-members to cooperatives as the dependent variables. The authors found that though cooperatives offer a higher price to the members than to non-members, many members sold to private traders due to the upfront cash payments. Cooperatives often do not pay until they have sold the coffee. On the other hand, many non-members sold their coffee to cooperatives for two reasons. First, non-members could receive a higher price from the cooperatives than from

private traders. Second, non-members could also get the dividends through their relatives who are members.

The study by Bernard et al. (2008) of cereals (six cereals crops are considered: teff, sorghum, maize, barley, wheat and millet) production-and-marketing cooperatives for smallholders in rural Ethiopia found that cooperative membership has significant effect on cereals price, members receive a 7.2 to 8.9 percent higher cereals price compared to non-members. The authors suggest this may be due to increased bargaining power of the cooperatives due to the collective volume and market access.

Using nationally representative secondary data, Bernard et al. analyze a sample of 7200 households, including 150 cooperative members. The authors used a probit model to estimate the propensity score as the probability of sampled farmers being a member of a cooperative. Bernard et al. used kernel and five nearest neighbors matching techniques in order to estimate the average treatment effect on the treated (ATT) and found statistically similar results from both approaches. The authors employed both matching techniques in order to test the robustness of the estimator.

The study by Fischer and Qaim (2011) used propensity score matching to measure the impact of being a member of a banana producer's group on household income in Kenya. The authors surveyed 444 banana growers, including 243 nonmembers. The study found that income from banana production is 22.84 to 22.97 percent significantly higher for the producer group members than non-members. The share of banana income to total

household income is 0.08 percent higher for the producer group members than non-members. Although the price for members was higher, the authors reported that the increase in income is not primarily due to the premium price but due to expansion of the crop. The difference in received banana net price between member and non-member is minimal if the opportunity cost of labor to take bananas to the group-run collection center is included. Members expanded their banana area significantly more than non-members did. The authors argue that expansion is possible due to the support provided by the producer organizations: technical knowledge, information sharing, linkages to extension services and financial institutions for banana cultivation. The authors note that some members recently adopted tissue culture technology but the plants from the newly adopted technology have not yet been harvested, so there is no difference in yield.

Fischer and Qaim (2011) used probit regression to estimate the propensity score to measure the effect of group membership on total banana income. In particular, the unmatched sample fails to satisfy balancing properties because three covariates out of 17 are statistically different between control and comparison groups. The authors applied kernel and five nearest neighbor matching to assess the impact of being a member of a producer group on banana income. After applying either matching techniques, none of the variables is significantly different. The author reported that most of the observations overlapped in the common support region, which indicates that the majority of group

members are comparable to the majority of the non-members; therefore, the sample is balanced, and the findings are statistically valid.

The study by Ito et al. (2012) on small watermelon growers in rural *Nanjing*[11], China found that members of a marketing cooperative have significantly higher income compared to non-members. The authors surveyed 318 growers, 160 members and 158 non-members, and measured the impact of membership employing three propensity score matching techniques. The authors used a probit model to estimate the propensity score and restricted the final observations to those within the common support region. The authors employed nearest–neighbor matching, kernel-based matching and local linear regression matching. Local linear matching is similar to kernel matching but includes a linear term in the propensity score of the treatment individuals along with the weight function. This is done by using only those treated observations close to the weighted average of all individuals in the comparison group. Inclusion of a linear term in a kernel function is helpful when comparison group observations are distributed asymmetrically around the participant observations (Smith & Todd, 2005).

Households with less than 0.20 hectares under vinyl greenhouses for watermelon production could not join the cooperatives. The marketing cooperative is a closed member cooperative because members have to maintain quality standards set by the cooperative

[11] Nanjing is the township consists of 24 village committees lies 28 km south from the provincial capital of Jiangsu (Ito et al., 2012)

(Ito et al., 2012). The study reports that farm income from watermelons is US $4.25to $4.57 per day higher for members than non-members. The difference in farm income is due to the price premium rather than yield. The finding of no difference in yield between members and non-members may be due to the spillover effect of the cooperatives. Non-members living near cooperative members may adopt the production technology practiced by the members in order to increase the yield (Ito et al., 2012).

Abate et al. (2014) employed PSM to estimate the average impact of membership on the technical efficiency of smallholder farmers in terms of output gain in Ethiopia. This study used data from 'Ethiopia Agricultural Marketing Household Survey' in order to obtain a sample size of 1638 households, surveyed in accord with a three-stage stratified random sampling plan. In the sample, 34 percent are members of cooperatives while the others are independent farm households having similar socio-economic attributes. The study found that member households have 5.64 to 5.74 percentage points higher output from a given set of inputs than non-members have. Cooperative members gain income from the higher production of cereal (i.e., teff, wheat and finger millet) due to the efficient use of inputs compared to non-members. The authors suggest that higher output for members is possible due to the services provided by agricultural cooperatives. The agricultural cooperatives provide members training, information on production and marketing, extension linkages, etc. The authors suggest that in addition to increased production, the

services offered by the cooperatives reduce transaction cost in marketing and production and push up smallholder's income.

Abate et al. (2014) also employed a probit model to estimate the propensity score and then used kernel and the five nearest neighbors matching techniques to measure the impact of cooperative membership and found statistically similar results from both techniques

A survey study by Verhofstadt and Maertens (2014) measuring the impact of agricultural cooperatives on farm income and poverty reduction found positive and significant results on reduction in poverty in southern Rwanda. The authors employed propensity matching on data from a sample of 389 households including 154 cooperative members from seven cooperatives. The author chose land–and-marketing cooperatives that are actively involved in the maize and horticultural sectors. Land–and–marketing cooperatives are service cooperatives that purchase or rent land and allocate land to members to cultivate. Individual members can also sell to the cooperatives what they produce on their own lands.

In this study, 49 percent of the sampled households: 54 percent of non-members and 34 percent of members, fall under the Rwandan national poverty line. Farm income of cooperative members, US $460, is significantly higher than non-members, US $200. Members own more land than do non-members on average (0.34 vs 0.25 hectare.), although the difference is not statistically significant. The authors employed a probit model to

estimate the probability of sampled farmers being a member of an agricultural cooperative and then applied four different matching techniques to check the robustness of the PSM method: nearest neighbor matching with three neighbors, nearest neighbor matching with one neighbor, kernel matching, and local linear matching.

The authors reported only the kernel matching balancing property did not find any significant differences between treatment and comparison units. However, authors estimated the ATT by using all four matching techniques with similar statistical findings from all the techniques, with some minor differences in magnitude. The results indicate that cooperative members earn 40 to 46 percent higher farm income than non-members. The study finds that cooperative membership reduces the likelihood of being poor by 10 to 14 percentage points.

The study by Mishra et al. (2018) used propensity score matching to investigate the impact of being a cooperative member with a contract in tomatoes with the cooperative on tomato net income in Nepal. The authors surveyed a sample of 602 tomato growers including 341 members who produced tomatoes under a contract with their respective cooperatives. These cooperative members were identified from six cooperatives across the five villages of three central districts of Nepal. Those six cooperatives constitute three types of cooperatives, agriculture, multi-purpose and vegetable cooperatives. These cooperatives have contracts with their members for tomato production. Cooperatives provide technical support for production and inputs such as fertilizer, seed, pesticide, credit

for the production etc., and fix the price in advance for a particular quantity and quality. The authors considered tomato growers as smallholders because they own 0.37 hectares of land on average. Cooperative members (contract farmers) own 0.45 hectares while non-members (independent farmers) own 0.26 hectares.

Mishra et al. (2018) used probit regression to estimate the propensity score of contract adopter and non-adopters in order to match the observations. The authors applied nearest neighbor and kernel matching techniques to examine the impact on tomato net income. After applying matching techniques in order to check for differences in the covariates in two groups, the authors reported that only 30 observation did not overlap in the common support region, which indicates that the majority of the observations are comparable and the inferences drawn are reliable.

The study found that tomato farmers with contracts receives 70 to 76 percent significantly higher net income than independent growers. The authors reported that the increase in net income is not due to the price but due to lower input, labor, and operational cost. Further, tomato farmers with contracts have 27 percent higher yield than independent farmers. The authors suggest that the differences in income and yield are possibly due to the support provided by the cooperatives through contract terms and conditions. The authors also suggest that there might be some unobservable factors that have an effect on outcomes, though the authors did not note the possible unobservable factors. The authors calculated Rosenbaum bounds to check the sensitivity of the treatment effect and

confirmed that the estimated effect will not change even with the presence of unobservable factors.

Mojo et al. (2017) measured the impact of coffee cooperatives on the household income of smallholders in rural Ethiopia using an Endogenous Switching Regression (ESR) model along with three propensity score matching models. The authors argue that the ESR technique addresses the biases that comes from unobservable factors such as farmer's skills, motivation, etc., that PSM does not.

Identification of the ESR model requires at least one additional variable as an instrument in the first stage that is strongly correlated with membership but has no effect on the outcome variable (income) except through cooperative membership. In the second stage, two separate outcome equations (one for members and another for non-members) are estimated using income as the dependent continuous variable as a function of a set of explanatory variables. The income equation is estimated excluding instrumental variables, which removes the bias caused by unobservable variables that affect membership (Negash & Swinnen 2013; Ahmed & Mesfin, 2017; Mojo et al., 2017). This method confirms that the effect of independent variables for the two groups (members and non-members) is significantly different and detects the presence of unobservable biases that are due to unmeasured factors that affect the decision of the people to be a member of the cooperatives. Indeed, the ESR estimation shows both the actual and counterfactual

scenarios of the treatment effect under different regimes (i.e. members or non-members) (Lokshin & Sajata, 2004; Negash & Swinnen 2013).

The authors, (Mojo et al. 2017), surveyed 305 households, of which 44 percent were members of four cooperatives and the rest were independent coffee growers in rural Ethiopia. Coffee cooperatives were selected applying multistage sampling from a region that has a coffee production and geographic accessibility. The authors considered sampled households to be rural smallholders because they own 1.37 hectares of land on average, and the households' median distance to the main marketing town in the region is 21 km. Members own 1.6 hectares while non-members have 1.1 hectares. Likewise, the average total income of members and non-members is US $590 and US $370. Both land size and total income are significantly different between members and non-members.

The authors employed three matching techniques after estimating propensity scores using a probit model: five nearest neighbors, kernel, and radius matching techniques. Radius matching is the technique where the treatment individual is matched with a control individual that has a propensity score within a given radius. Observations that did not fall within common support region were dropped, providing a final sample size of 282 individuals, of which 49 percent were member households. The authors found a balanced sample using all matching techniques; there were no significant difference in any covariate mean between treatment and comparison groups.

The PSM models found that members do not earn significantly higher incomes compared to non-members. However, application of ESR on the same data finds that cooperative membership have a positive and significant impact on the total income of the household. The authors argues that there are some unobservable attributes captured by ESR that were not captured by the PSM. The authors used "distance to Jimma town", the largest city in the region as an instrumental variable for membership and found different results that PSM. But the question can be raised about the validity of the instrumental variable since the "distance to Jimma town" could affect the household income because the town provides famers easy access to agricultural experts and market information as reported by the authors. Further, both approaches have different assumptions so that we can not directly compare the estimates of ESR and PSM.

Cooperative members would have 26 percent less income if they had not been members. Non-members would have earned 152 percent higher income if they had been cooperative members. In addition, if non-members had been members, they would have earned 35 percent more income than actual members. The authors suggest that coffee cooperatives improve farmers' income by increasing their bargaining power and setting coffee prices based on a world market. This study also gives some logic about why the average impact on income is lower for actual members than non-members. First, when the cooperatives started buying coffee, private traders also raised prices to compete with the coffee cooperatives. Thereby, non-members received benefits from the price increases

obtained by the cooperatives. Second, cooperatives offer a supply of agricultural inputs to the non-members in order to gain economies of scale in input supply, thus lowering the costs of non-members.

However, a study by Ahmed and Mesfin (2017) reported that PSM and ERS models had similar statistical findings. The authors measured the impacts of agricultural cooperatives on wellbeing, in terms of consumption expenditures, in eastern Ethiopia. The authors surveyed 250 households, including 129 non-members. On average, cooperative members and non-members own 1.01 and 0.95 hectares of land, respectively. The authors predicted the propensity score using a logit model and reported adequate observations within the common support region. The authors use four matching techniques: radius, kernel, nearest neighbor and stratification matching. In stratification matching the treatment and control observations are grouped into strata based on their propensity scores. The overall impact is based on the weighted average of the stratum effect while each stratum carries the weight based on the number of treated units in each stratum. The study found that per capita consumption expenditure is significantly higher, by 17.6 to 26.5 percent, for members than non-members. The study employed ESR to check the robustness of the results, by controlling for unobservable selection bias. ESR results confirm the findings of PSM techniques.

Wossen et al. (2017) measured the impact of cooperative membership on the household welfare of smallholder farmers in rural Nigeria, employing PSM, inverse

probability weighted adjusted regression (IPWRA) and ESR. However, the authors did not discuss which specific PSM techniques they employed in this study. The authors used household asset ownership (i.e., monetary value of assets such as farm equipment, phone, television, jewelry, household utensils, etc.), per capita consumption expenditure, and the progress out of poverty index (*PPI*)[12] as measures of a household welfare. The Grameen Foundation developed PPI to measure poverty at the household level considering observable household characteristics, asset ownership and access to basic services (Desiere et al., 2015).

IPWR weights each observation of the sample in order to construct a sample in which the distribution of measured baseline covariates is independent of the treatment assignment. In particular, the authors argue that IPWR eliminates bias that arises due to the misspecification of the model through giving weights to each observation. However, Thoemmes and Ong (2016) argue that if there is a presence of *confounders*[13] in the specification of the model due to unobservable factors, neither simple propensity score matching nor IPWR address this issue. In that context, Wossen et al. (2017) argue that ESR controls the bias that arises due to the unobservable factors that affect the treatment and

[12]PPI index value ranges from 0 (most likely to below a poverty line) to 100 (least likely to be below a poverty line). PPI is constructed based on ten questions that are related to poverty and used by many development organizations (Wossen et al., 2017).

[13] If a variable has an effect on both treatment selection and the outcome, that variable is known as confounder (Thoemmes & Ong, 2016)

outcome variables in the model. The authors used three techniques to increase the robustness of the estimator; all three techniques produced similar statistical findings. This findings suggest that there were no biases due to unobservable factors. The study found that members have 4.57 to 9.01 points higher PPI score than non-members; 29 percent to 96 percent higher asset values; and 5.2 to 12.5 percent higher food consumption expenditures.

Wossen et al. (2017) used secondary data from a randomly selected cassava-growing national household survey of Nigeria to compare 602 cooperative members with 1808 non-members. The authors consider them smallholders because they own 3.07 hectares on average. However, land ownership is significantly different between these two groups, as members own 3.34 hectares on average and non-members own 2.8 hectares. This study reported an adequate number of observations within the common support region and then employed PSM and IPWR. Further, the balancing test employing PSM and IPWR confirms no significant difference on a single covariate between treatment and control groups.

CHAPTER 4

METHODOLOGICAL FRAMEWORK

Identification Strategy

This study has addressed the two research questions in two stages. In the first stage, we used a probit model to analyze the probability of being a member of an agricultural cooperative and to calculate the propensity score of treatment and control observations. We then estimated the effect of agricultural cooperatives on net crop income and total family income using different techniques, including matching, ordinary least squares, and two-stage least squares. We estimated the effects of cooperative membership using the unweighted sample and a weighted sample designed to be representative of the population in the covered villages.

First, we employed a binary choice probit model to determine the effects of various factors on the probability of farmers joining a cooperative. We could use the logit model to estimate the effects instead of the probit, as both models essentially give the same predictions of marginal effects and provide a prediction that always lies between 0 and 1 (Berry et al., 2010). Some binary choice studies prefer the probit because it assumes a standard normal distribution in the error term (Wollini & Zeller, 2007; Zewald et al., 2013).

The general specification of the probit model that we used in our study is as follows:

$$\tilde{\boldsymbol{I}}_{\boldsymbol{i}}^{\boldsymbol{treat}} = \boldsymbol{\beta}_{\mathbf{i}}\boldsymbol{X}_{\boldsymbol{i}} + \cdots \ldots \ldots \ldots + \boldsymbol{\epsilon}_{\boldsymbol{i}}$$

$\boldsymbol{I}_{\boldsymbol{i}}^{\boldsymbol{treat}}$ = 1 if $\tilde{\boldsymbol{I}}_{\boldsymbol{i}}^{\boldsymbol{treat}}$ > 0 or 0 if otherwise

$\boldsymbol{I_i}$ denote a dependent variable that indicates the probability of a household becoming a member of an agricultural cooperative. $\boldsymbol{X_i}$ is a vector of exogenous variables and $\boldsymbol{\beta_i}$ is a vector coefficients and $\boldsymbol{\epsilon_i}$ is an error term associated with unobservable factors. The error term is assumed to be normally distributed and independent. The farmer's choice of whether to join the cooperative is a function of demographic, geographic and village characteristics, variables be taken as exogenous.

We calculated propensity score by using the same probit model that we had used to estimate the factors affecting cooperative membership.

$$\boldsymbol{P}(\boldsymbol{X_i}) = \boldsymbol{P_r}\{Ii = 1|\boldsymbol{X_i}\} = \mathrm{E}\{Ii|\boldsymbol{X_i}\}$$

Where, $\boldsymbol{P}(\boldsymbol{X_i})$ is propensity score of every sampled observation and $\boldsymbol{I_i}$ is a treatment variable and $\boldsymbol{X_i}$ represent explanatory variables or pre-treatment variables, given that $\boldsymbol{P}(\boldsymbol{X_i})$ is similar in both groups. We calculated the propensity score, that is the probability of receiving treatment (i.e., cooperative membership), conditional on pre-treatment characteristics (such as education, gender, main occupation, family size, ethnicity, ethnicity of neighborhood, household land size, and so on), to measure the effects of cooperative membership on income (Stuart, 2010; Wossen et al., 2017).

We employed propensity score matching (PSM), after calculating propensity score with the probit model, to estimate average treatment effects of agricultural cooperatives on net crop income and total family income. In particular, we computed the difference in income between farmers in the treatment group (i.e., members of agricultural cooperatives)

and the control group (i.e., non-members) to estimate the average treatment effect. The control group, in this study, provides the counterfactual by demonstrating what would have happened to the treatment group in absence of treatment. In reality, it is infeasible to do an ideal experiment due to the nature of the treatment, and budget and time constraints, so we assessed the income effects by finding similar counterfactuals (i.e., non-members) assuming selection is based on observable factors (Gibson-Davis and Foster, 2006; Heinrich et al., 2010; Mojo et al., 2017; Liu, 2018). This study employed propensity score matching techniques to account for differences in observed covariates between members and non-members (Bernard et al., 2008; Francesconi & Heerink, 2010; Godtland et al., 2004). PSM assumes there are no systematic differences in unobservables between control and treatment groups that are associated with the dependent variables when both groups are matched on observable variables. If the matching methods work properly, theory tells us that the distribution of observed covariates is the same in the treated and control groups at each value of the propensity score (Becker & Ichino, 2002; Gibson-Davis and Foster, 2006; Abate et al., 2014; Morgan, 2017).

We then defined the common support region where distributions of the propensity scores for treatment and comparison groups overlap. In other words, there should be enough observations that overlap between cooperative members and non-members so that the average treatment effect on the treated (ATT) can be measured with robustness. If the propensity score of most of the comparison observations are smaller than the minimum of

the treated group, there must be enough comparison cases within the range of treated individuals (Bernard et al., 2008). After defining the common support region, we needed to identify an appropriate matching technique to estimates the effects of agricultural cooperatives on net crop income and total family income. Several matching techniques were frequently used in order to estimate the effects. In particular, there is no rule-of-thumb to determine which technique is appropriate in each context (Heinrich et al., 2010).

There is a trade-off between bias and efficiency in using each technique. For example, the nearest neighbor minimizes bias because it compares treatment and control individuals that have similar propensity scores, but this technique reduces the efficiency of the estimator because it does not use multiple comparisons for each individual for the estimation. On the other hand, the estimator is more efficient if observations are matched with more neighbors but at the price of using poorer matches, thereby increasing bias (Heinrich et al., 2010). The matching technique's main objective is to aid in achieving balance between the treatment and comparison group on all the covariates using a single dimension variable that is a function of the covariates (Caliendo & Kopeing, 2008; Mueser et al., 2007). Matching techniques differ in the way the neighborhood for each individual is defined based on the propensity score, how the common support region is handled and how the weights are assigned to these neighbors (Becker & Ichino, 2002; Heinrich et al., 2010). The most important component is whether the propensity score model is adequately specified or not.

We employed caliper matching to estimate the effect of agricultural cooperative membership on net crop income and total family income. We initially applied the nearest neighbor (NN) matching with replacement and without replacement. We found significant differences in averages of some variables between the weighted treatment and comparison groups when we used NN with replacement and without replacement, so we finally adopted caliper matching with caliper of 0.6 (radius matching) to reduce the biases. The basic idea of caliper matching is that it uses all the comparison group members within the caliper, as many comparison cases as are available within the caliper, and avoids poor matches based on the specified caliper (Heinrich et al., 2010; Mojo et al., 2017). We performed a balancing test after caliper matching with caliper of 0.6 to ensure matching on covariates between cooperative members and non-member families. The averages for all the covariates between members and non-members were not significantly different when we applied caliper matching. The balancing test indicates that the method is successful in controlling independent variables. In particular, the matching techniques ensures the matching of the observations withing common support region to assure the balanced sample. (Austin, 2011; Ito et al., 2012).

In our study, ATT is the differences in net crop income and total family income between cooperative members and non-members within common support region which are matched by the propensity score (Heckman & Vytlacil, 2001; Heinrich, 2010; Fischer & Qaim, 2012; Liu, 2018). Where, ***Y(1)*** and ***Y(0)*** are outcome indicators (Net crop income)

with and without treatment denoted by $\boldsymbol{I_i}$ (1) or (0) while , $\boldsymbol{P(X_i)}$ indicates the propensity score associated with explanatory variables. The propensity score creates comparable counterfactual households for cooperative members so that ATT is estimated controlling differences in observables. We estimated the effect of agricultural cooperatives on net crop income and total family income using PSM and other regression techniques such as *OLS* with village dummies/without village dummies, zero-order regression and compared the estimates from these techniques to verify the robustness of the estimates. ATT is estimated as:

$$\boldsymbol{ATT = E\{E\,\langle Y(1)|I_i = 1, P(X_i)\rangle - \; E\,\langle Y(0)|I_i = 0, P(X_i)\rangle|I_i = 1\}}$$

There is some controversy regarding the error variance when we estimate treatment effects applying propensity score matching. Studies suggest that simple formula used for estimation of error variance suffers from biases due to the estimation of the propensity score, the requirement of a common support region, and the way samples are matched (Austin & Small, 2014; Caliendo & Kopeing, 2005). But these authors suggest that the error variance that comes from matching techniques would be negligible when we used PSM techniques without replacement. We applied psmatch2 Stata tools to calculate treatment effects that claim to calculate approximate standard error assuming independent observations, fixed sampling weights, and homoskedasticity of the income variable in the

sample (Leuven & Sianesi, 2003). We also applied bootstrap methods to confirm our estimate's sampling variability (Efron et al., 1994) and found the simple analytical standard errors are not seriously biased in our case.

Like ordinary regression, propensity score techniques do not control the bias that arises from unobservable factors (Jensen, 2002; Currie 2003; Gibson-Davis & Foster, 2006). In this study, this bias may occur due to differences between members and non-members in the distribution of their unobserved characteristics, such as ability, risk preference, motivation, etc. In other words, if there are unobserved variables that affect the treatment assignment and the outcome variable simultaneously even after matching, there may be a hidden bias or inconsistency (Heckman et al., 1997; Rosenbaum, 2002; Mueser et al., 2007). Controlling for such biases requires a suitable instrument that explains the probability of participation in agricultural cooperatives but does not affect the families' net crop income other than its effect through cooperative membership (Bernard et al., 2008; Caliendo & Kopeing, 2008).

Given this background, we estimated the effect of cooperative membership on our measures of income using instrumental variables regression to estimate the average effect of cooperative membership (ATE) on income and examine the robustness of our results. The most frequently used and popular instrumental variable estimator is two-stage least squares (2SLS) (Murray, 2006; Wooldridge, 2016). The two-stage least squares technique involves two stages in the estimation. In the first stage, we estimated the predicted value

of cooperative membership for each observation by regressing the cooperative membership on the instrumental variables and other explanatory variables using ordinary least squares. This first stage regression is a "reduced form equation". We then estimated our measure of income in the next stage by regressing income on the predicted value of cooperative membership and the other explanatory variables but omitting the instruments. We substituted the predicted value of cooperative membership into the second stage equation, based on the calculation in the first stage. The second stage coefficient estimates are called the two-stage least squares estimate. We can describe the whole process of two-stage least squares through following equations;

In an OLS regression equation

$$\boldsymbol{Y = \beta_0 + \beta_1 X_i + \beta_2 M + \epsilon}$$

$\boldsymbol{Y}$ denotes net crop income or total family income of the farmers. $\boldsymbol{M}$ denotes cooperative membership = 1, 0 (1 if a farmer is cooperative membership and 0 if otherwise) and $\boldsymbol{X_i}$ represents explanatory variables or control variables.

As we noted above, there are unobserved variables that may affect a farmer's decision to become a cooperative member. In such a case, the OLS estimator may suffer from bias, The problem is the correlation between unobserved factors which are associated with the error term and cooperative membership. Therefore, we employed an instrumental variable (Z) that influence cooperative membership but is not correlated with error and

does not directly affect net crop income or total family income other than its effect through cooperative membership.

Stage 1: Regress the endogenous variable $\boldsymbol{M}$ on the instrumental variable $\boldsymbol{Z}$ and other exogenous variables (X), which is also known as the reduced form equation:

$$\boldsymbol{M = \delta_0 + \delta_1 X_i + \delta_2 Z + \varepsilon}$$

Stage 2: Regress $\boldsymbol{Y}$ on the predicted variable $\boldsymbol{\widehat{M}}$ and the other exogenous variables, two-stage least square estimates

$$\boldsymbol{y = \beta_0 + \beta_1 X_i + \beta_2 \widehat{M} + \epsilon}$$

The instrumental variable estimator can avoid the bias that ordinary least squares suffer when an explanatory variable in a regression is correlated with the regression's error term and simultaneous causality bias occurs (Murray, 2006). Further, there are variables that we do not observe and cannot measure, and they are not included in the model. Those unobserved variables may cause bias because they may have a direct/indirect influence on income measures. In the same vein, OLS estimates may suffer from simultaneous causality bias in our case because families' income may induce families to be cooperative memberships. Indeed, both PSM and OLS estimate can suffer from omitted variable bias due to tainted and unmeasured variables (Zanutto,2006).

In our context, tainted variables are those determinants of income that are influenced by cooperative membership but may also influence income. We avoided such tainted variables in our OLS estimate. However, there may be biases due to unmeasured or unobservable variables. Hence, we employed instrumental variable regression to avoid these biases embedded in OLS and PSM estimates. There are many observational studies that used OLS techniques to infer causal effects. Research like ours that does not use random assignment, quasi-experimental research, may suffer from hidden biases due to unmeasured variables. Hence, we compare OLS and PS estimates to test the assumption of linearity and additivity inherent in the OLS application. In contrast, we check whether there may be biases due to relevant unmeasured variables comparing the OLS and 2SLS estimates.

In our case, either the OLS or PSM may suffer from omitted variable bias, along with biases due to simultaneity. In particular, there may be misspecification problems in OLS, which, in turn, are associated with lack of overlap between treated and non-treated cases (i.e., cooperative members vs. non-members). Our estimates show that the magnitude of income differences was comparatively higher in OLS estimates than PSM estimates. Alhough standard errors were similar for our income measures in both PSM and OLS estimates, estimates of effects on net income were statistically significant in the OLS model. Likewise, estimates of effects on net crop income and total family income were not significant in 2SLS estimates. This considerable variation in OLS estimates may be caused

by misspecification problems, due to unobservable or simultaneous causality bias, in OLS estimates.

Hausman (1978) suggests that variables are not exogenous if we find inconsistent estimates and differences in significance level when we compare OLS and 2SLS estimates. We performed Durbin (1954) and Wu-Hausman (Wu 1974; Hausman 1978) endogeneity tests to determine whether regressors in the estimation are endogenous or exogenous. Both of the tests assume that the instruments we used are valid, which means they do not directly affect the income (i.e., dependent variable). The only source of association with income is its impact on the variables being instrumented, in our case cooperative membership. These tools then test whether the variables being instrumented actually need to be instrumented, in which case they are endogenous. We found the coefficient was different when we use the instrumental variables, i.e., the endogeneity test indicates significance when we compare 2SLS and OLS estimates, so we reject the hypothesis that the OLS estimates are not biased.

We can say that the OLS estimates was rejected as valid because the estimates of the effect on the net crop income are statistically different from the OLS estimates when we instrument, assuming the instruments are valid. Our 2SLS estimates have standard errors that are similar to OLS standard error estimates, which indicates the quality of instrumental variables in our model. Murray (2006) suggests that 2SLS estimators usually have larger standard errors than the OLS estimators because 2SLS uses only that part of

the variation in the "troublesome explanator" (i.e., cooperative membership) that appears as variation in the predicted value of cooperative membership. Finally, we estimated income effects using all the regression techniques that we mentioned above both for the surveyed cases and for the survey sample as weighted to reflect population estimates in the sample villages. We observed there were no meaningful changes in the direction and significance of the variables in the weighted specifications compared to unweighted sample specifications.

CHAPTER 5

DATA CHARACTERISTICS

Collection Strategy

Sample size identification

This research uses primary data to address research questions and to test the hypotheses of this research. The primary data are collected using a household survey and key informants' interview (KII) methods. There are three geographic regions in Nepal – mountain, hill, and plain comprising 77 districts (MOFALD, 2018). This study employs multistage random sampling to choose the sample. First, districts that have agricultural cooperatives started between 1992 to 2014 are grouped for sampling because the government shifted the legal structure governing cooperatives through the cooperative act 1991 (Regmi, 1992). In addition, Nepal adopted economic liberalization policies advocated by the World Bank and western countries in 1992 and began many grant-funded projects to work at the community level through cooperatives (Karkee & Comfort, 2016). These districts are grouped by climate into 77 districts of the nation. Climate and topography are related so that the one implies the other. Also, they are a determinate of the types of agriculture. This study surveys in the Chitwan district due to its plain topography, the number of functional cooperatives, and easy road access. Further, Chitwan is a typical district representing the plain region in terms of agricultural practices, ethnicity, and proximity to Nepal's southern border.

After the selection of the district, the study identified only 27 villages out of 36 villages for the survey. Those nine villages were excluded because they differed in topography, cropping patterns, ethnicity, or development indicators from the others of the 27 villages. Those nine villages are most rural villages of the Chitwan district (ODCC, 2020). All the identified 27 villages represent a typical plain region of Nepal, like many other districts of the plain region, have a similar topography, cropping pattern, and ethnicity (DADO, 2019). This study ranked these 27 villages in quintiles based on the proportion of cooperative members relative to the total population. Then, I choose an initial sample frame consisting of 269 cooperative member households from all quintiles, 282 non-member households from the bottom two quintiles, and 289 non-member households from the upper three quintiles. The process of choosing individuals that constitute a sample is described below in detail.

Table 2. Distribution of the proportion of cooperative members and the total population for each village

SN	Villages	No. of Cooperatives[1]	Coop. members[1]	Total population[2]	Proportion
1	Kumrose	5	1780	8082	0.220
2	Birendranagar	3	3071	14934	0.206
3	Sibanagar	1	1486	7674	0.194
4	Kathar	7	1627	9696	0.168
5	Sukranagar	2	1210	8057	0.150

6	Bachhauli	4	1490	10905	0.137
7	Patihani	4	1460	11500	0.127
8	Pithuwa	4	1559	12579	0.124
9	Piple	3	1866	15455	0.121
10	Gitanagar	4	1543	13929	0.111
11	Bagoda	3	1058	10913	0.097
12	Khairahani	3	1975	21530	0.092
13	Meghauli	1	1001	14149	0.071
14	Ayodhyapuri	4	743	10693	0.069
15	Bhandra	4	1048	16121	0.065
16	Jutpani	2	881	14324	0.062
17	Gunjanagar	3	903	15071	0.060
18	Padampur	1	881	14924	0.059
19	Gardi	2	476	9241	0.052
20	Kalyanpur	2	326	6836	0.048
21	Chainpur	3	750	16786	0.045
22	Jagatpur	4	434	11195	0.039
23	Parbatipur	2	127	6506	0.020
24	Fulbari	1	30	3862	0.008
25	Sardanagar	1	26	11508	0.002
26	Mangalpur	1	30	19066	0.002
27	Dibyanagar	0	0	8334	0.000

[1] Cooperative Training and Division Office, 2017; Cooperative Training and Division Office, 2016
[2]Central Bureau of Statistics. 2012

Table 3. Quintiles ranking and sampling distribution with an expected response rate in each village

SN	Quintiles	Villages	Final sample		expected respond rate 0.70	Effective sample	
			Non-members	members		Non-members	Members
1		Kumrose	17	10	0.7	12	7
2		Birendranagar	17	10	0.7	12	7
3	I	Sibanagar	17	10	0.7	12	7
4		Kathar	17	10	0.7	12	7
5		Sukranagar	17	10	0.7	12	7
6		Bachhauli	17	10	0.7	12	7
7		Patihani	17	10	0.7	12	7
8	II	Pithuwa	17	10	0.7	12	7
9		Piple	17	10	0.7	12	7
10		Gitanagar	17	10	0.7	12	7
11		Bagoda	17	10	0.7	12	7
12		Khairahani	17	10	0.7	12	7
13		Meghauli	17	10	0.7	12	7
14	III	Ayodhyapuri	17	10	0.7	12	7
15		Bhandra	17	10	0.7	12	7
16		Jutpani	17	10	0.7	12	7
17		Gunjanagar	17	10	0.7	12	7

18	IV	Padampur	28	11	0.7	20	8
19		Gardi	28	11	0.7	20	8
20		Kalyanpur	28	11	0.7	20	8
21		Chainpur	28	11	0.7	20	8
22		Jagatpur	28	11	0.7	20	8
23	V	Parbatipur	28	11	0.7	20	8
24		Fulbari	30	11	0.7	20	8
25		Sardanagar	28	11	0.7	20	8
26		Mangalpur	28	11	0.7	20	8
27		Dibyanagar	28	0	0.7	20	0
Total			571	269		404	191

There may have been a problem of overrepresentation and selection bias in the sample determination since each village has a different population and a different proportion of cooperative members. For instance, villages with more people and cooperative members may have a proportionately higher chance of membership in the sample. Villages were grouped into quintiles based on the proportion of cooperative members and the total population to minimize the noted biases. Afterward, the sample size from each quintile was determined in a way that allows the comparison of member and non-member in a village. The sample size for members and non-members from each village within the upper three quintiles and lower two quintiles are equal. The allocation of a

sample size of non-members for each village of the lower two quintiles was comparatively higher than the upper three quintiles to make a comparison of members with two non-member groups. This study identified an effective/target sample size of 191 members of households from all quintiles, 200 non-member households from the bottom two quintiles, and 204 non-member households from the upper three quintiles.

This study anticipated a maximum of 30 percent non-response for the survey due to the area's plain topography, easy road access, availability of mobile phones (most of the families had cell phones), and the time duration for the questionnaire interview. In particular, household visits were planned during a slack farming period to ensure a higher response rate. The initial sample size was adjusted by adding a 30 percent non-response rate to an effective/target sample size. Also, the minimum sample size to be surveyed from each village was determined, for instance, at least seven members from each village of the upper three quintiles to make an actual sample size near to the target sample size. When there was a non-response from the target households, at least one revisit was made to make the actual sample size near to the effective/target sample size. Another household was approached when we did not meet in two visits. This process was continued until the target sample reached in each village among members and non-members. The actual sample size for non-members in few villages was not close to the target sample size, even approaching all the sampled lists. In such a case, we did not add a new sample; instead, we adjusted by approaching all samples of other villages. So a low response rate in few villages did not

make a difference in the target sample size within quintiles for comparison purposes, as noted above. We approached all the samples in an equal number of villages for members and non-members to see any differences in response rate. Also, the low response rate for non-members in few villages compelled us to approach all the samples in some of those villages.

Table 4. Actual sampling distribution among members and non-members in each village

SN	Quintiles	Villages	Initial sample			Approach sample		
			Non-member	Member	Total	Non-members	Member	Total
1	I	Kumrose	17	10	27	17	10	27
2		Birendranagar	17	10	27	17	9	26
3		Sibanagar	17	10	27	16	8	24
4		Kathar	17	10	27	17	10	27
5		Sukranagar	17	10	27	16	10	26
6	II	Bachhauli	17	10	27	17	9	26
7		Patihani	17	10	27	15	8	23
8		Pithuwa	17	10	27	16	9	25
9		Piple	17	10	27	15	8	23
10		Gitanagar	17	10	27	16	9	25
11	III	Bagoda	17	10	27	17	10	27
12		Khairahani	17	10	27	16	9	25

13		Meghauli	17	10	27	15	10	25
14		Ayodhyapuri	17	10	27	17	9	26
15		Bhandra	17	10	27	17	8	25
16		Jutpani	17	10	27	16	9	25
17		Gunjanagar	17	10	27	17	10	27
18	IV	Padampur	28	11	39	26	9	35
19		Gardi	28	11	39	27	10	37
20		Kalyanpur	28	11	39	28	9	37
21		Chainpur	28	11	39	26	10	36
22		Jagatpur	28	11	39	25	9	34
23	V	Parbatipur	28	11	39	27	11	38
24		Fulbari	30	11	41	29	11	40
25		Sardanagar	28	11	39	27	11	38
26		Mangalpur	28	11	39	24	11	35
27		Dibyanagar	28	0	28	27	0	27
Total			571	269	840	543	246	789

Table 5. Actual sampling distribution with the response rate

SN	Quintiles	Villages	Approach sample			Actual sample		
			Non-member	Member	Total	Non-members	Member	Total
1	I	Kumrose	17	10	27	7	7	14
2		Birendranagar	17	9	26	9	7	16

3		Sibanagar	16	8	24	12	7	19
4		Kathar	17	10	27	2	8	10
5		Sukranagar	16	10	26	12	9	21
6	II	Bachhauli	17	9	26	0	7	7
7		Patihani	15	8	23	12	7	19
8		Pithuwa	16	9	25	12	7	19
9		Piple	15	8	23	12	7	19
10		Gitanagar	16	9	25	12	7	19
11	III	Bagoda	17	10	27	12	7	19
12		Khairahani	16	9	25	12	7	19
13		Meghauli	15	10	25	12	8	20
14		Ayodhyapuri	17	9	26	12	7	19
15		Bhandra	17	8	25	11	7	18
16		Jutpani	16	9	25	12	7	19
17		Gunjanagar	17	10	27	11	8	19
18	IV	Padampur	26	9	35	20	8	28
19		Gardi	27	10	37	20	8	28
20		Kalyanpur	28	9	37	20	8	28
21		Chainpur	26	10	36	20	8	28
22		Jagatpur	25	9	34	20	8	28
23	V	Parbatipur	27	11	38	20	9	29
24		Fulbari	29	11	40	20	9	29

25		Sardanagar	27	11	38	20	9	29
26		Mangalpur	24	11	35	20	9	29
27		Dibyanagar	27	0	27	20	0	20
Total			543	246	789	372	200	572
Respond rate						68.7	81.3	72.5

Overall, the response rate is 72.5 percent, which is more than what the study expected earlier. The response rate for non-members, 68.7 percent, is relatively lower compared to members, 81.3 percent. Many non-member families did plant crops compared to members, which is the most common reason for the low response rate for non-members. Indeed, this study did not interview those families who did not plant crops. Some non-member families are landless, but they were involved in planting renting the land; therefore, this study took their interview. Many non-member families were migrated elsewhere than members, which may be another reason for the low response rate for non-members. This study finally interviewed 172 non-members from the upper three quintiles, 200 non-members from bottom two quintiles, and 200 non-members from all quintiles. In this way, this study has an actual sample size of 573 households, including 372 non-members and 200 members with a response rate of 73 percent. This study is able to compare 200 members from all quintiles with 172 non-member households from the upper three quintiles. Then, again, re-estimate the model by comparing 200 members from all

quintiles with 200 non-members from the bottom two quintiles to get results that better reflect population-level effects.

The records of the National Federation of Cooperatives, Division Cooperative Offices, District Cooperative Federation, District Agricultural Cooperative Association, and Agricultural Cooperatives were used to prepare a sampling frame and to document the relevant data. There are 74 functional agricultural cooperatives, including 28,000 members across the villages registered between 1992 to 2014 (CTA DO, 2018). I randomly sampled households from functional cooperatives based on cooperative membership lists in each village. Each village in our sample has at least one functional agricultural cooperative except Divyanagar Village. Non- members were randomly selected from those villages using the sampling frame provided by the Office of Election Commission, excluding the list of the member.

Apart from the household survey, this study purposively identified 37 agricultural cooperatives, for Key Informants Interview (KII) purpose. This study purposively chose these cooperatives keeping at least one cooperative from the village and based on the number of functional cooperatives relative to other villages. Most importantly, the chosen cooperatives must have as many as of our sampled members. In this way, this study interviewed 37 chairpersons/managers of these agricultural cooperatives to add to and validate the information collected through a household survey. This study with chairpersons/managers is able to consider the structure of services provided by the

cooperatives and the role they serve as viewed by both chairpersons/managers and the members.

The choice of sample size is a function of three factors: significance level, power[14], and the effect size (the effect of the program, we wish to detect or expect) (Devane et al., 2004). Typically, the researcher chooses a power level of 0.8, which means that 80 percent of the time, the analysis detects a difference between the control and treatment groups if a difference of a given size exists. This study used a significance level at 5 percent (p-value = 0.5) as the threshold for accepting that a variable has an impact. In general, researchers use 5 percent in social science research. It also means that we are 95 percent confident that the results we observe are not due to chance. This research assumed a moderate standardized effect size of 0.1 to 0.3, where the standardized effect size is the difference in the outcome of two groups divided by the standard deviation (Coe, 2002). For example, an effect size of 0.3 means that in a random assignment experiment, the score of the average person in the treatment group is 0.3 standard deviations above the average person in the

[14] Power is the probability of rejecting the null hypothesis when the alternative hypothesis is correct. The power of a test has a monotonic relationship with the sample size at a given level of significance. The 80 percent power of test means that there is an eight out of ten chance of detecting a difference at a given level statistical significance (McCrum-Gardner, 2010).

control group. Therefore, the mean of the treatment group exceeds the mean of the control groups by 30 percent of a standard deviation.

If we use the formula to determine sample sizes for two independent samples considering the tentative standard deviation of the outcome variable and effect size, the sample of each group should be at least 177 to detect an effect size of 0.3 at 80 percent statistical power and 95 percent significance level. According to Vanvoorhis and Morgan (2007), to fit a regression model, the sample size should be at least 10 times the number of predictors. We have 25 predictor variables, so the sample size should be at least 250. We took a sample size of 572, which is sufficient for making statistical inferences.

Table 6. Distribution of total population and sample weight for members and non-members in each village

Villages	Total population		Actual sample		Selection likelihood (%)		Weight sample for unit	
	Non-member	member	Non-member	Member	Non-member	Member	Non-member	Member
Kumrose	6302	1780	7	7	0.1	0.4	900.3	254.3
Birendranagar	11863	3071	9	7	0.1	0.2	1318.1	438.7
Sibanagar	6188	1486	12	7	0.2	0.5	515.7	212.3
Kathar	8069	1627	2	8	0.0	0.5	4034.5	203.4
Sukranagar	6847	1210	12	9	0.2	0.7	570.6	134.4

Bachhauli	9415	1490	0	7		0.5		212.9
Patihani	10040	1460	12	7	0.1	0.5	836.7	208.6
Pithuwa	11020	1559	12	7	0.1	0.4	918.3	222.7
Piple	13589	1866	12	7	0.1	0.4	1132.4	266.6
Gitanagar	12386	1543	12	7	0.1	0.5	1032.2	220.4
Bagoda	9855	1058	12	7	0.1	0.7	821.3	151.1
Khairahani	19555	1975	12	7	0.1	0.4	1629.6	282.1
Meghauli	13148	1001	12	8	0.1	0.8	1095.7	125.1
Ayodhyapuri	9950	743	12	7	0.1	0.9	829.2	106.1
Bhandra	15073	1048	11	7	0.1	0.7	1370.3	149.7
Jutpani	13443	881	12	7	0.1	0.8	1120.3	125.9
Gunjanagar	14168	903	11	8	0.1	0.9	1288.0	112.9
Padampur	14043	881	20	8	0.1	0.9	702.2	110.1
Gardi	8765	476	20	8	0.2	1.7	438.3	59.5
Kalyanpur	6510	326	20	8	0.3	2.5	325.5	40.8
Chainpur	16036	750	20	8	0.1	1.1	801.8	93.8
Jagatpur	10761	434	20	8	0.2	1.8	538.1	54.3
Parbatipur	6379	127	20	9	0.3	7.1	319.0	14.1
Fulbari	3832	30	20	9	0.5	30.0	191.6	3.3
Sardanagar	11482	26	20	9	0.2	34.6	574.1	2.9
Mangalpur	19036	30	20	9	0.1	30.0	951.8	3.3
Dibyanagar	8334	0	20	0	0.2		416.7	

In addition, this study calculates weights to reflect the selection of cases with unequal selection probabilities associated with each village. Sampling weights allow us to yield accurate population estimates for the parameter of interest (Ciol et al., 20006). I used sample weights calculated as inverse probabilities of selection for each unit, also known as design weights, that corresponds to the total population of members and non-members in each village. In particular, design weights are used to adjust unequal probabilities of sampling units being sampled, which are not equal due to the various stages of sampling and different stratum sizes associated with a total population of cooperative members and non-members (Lavallée and Beaumont, 2015). The last two columns present the weight of each sampled unit corresponding to their total population. The weighted sample for members is lower than non-members for all the villages, meaning that members are overrepresented in the sample relative non-members. The assigned weight sample for members for the villages was substantially lower in the bottom two quintiles than the upper three quintiles, while there was not such a difference for non-members among quintiles.

C**haracteristics of the sample**

Nepal is a multi-ethnic, multi-cultural and multi-religious, and multi-lingual country. Caste/ethnicity captures traditional status within Nepal and is strongly associated with cultural assets and the economic position of the Nepalese population (Gurung, 2014). Caste/ethnicity has been a controversial political issue in Nepal since 1991, the year

democracy was restored. This awareness of caste and ethnic identity has grown because some caste/ethnic groups did not have access to mainstream politics in the past (Gurung, 2014).

In general, a person is assigned his/her caste or ethnic status by birth. The last name or family name indicates caste and ethnicity or the distinct cultural identity of a person. In Nepal, caste also refers to the distinct identity of the people based on the hierarchal system rooted in the Hindu religious values of purity. The Brahman caste is placed at the top and then the Chhetri caste in the hierarchical structure based on Hindu religious myth. Brahmans are those from which society draws Hindu priests responsible for teaching and maintaining sacred knowledge (Gurung, 2014). In contrast, "Dalit" is the untouchable caste, and members are considered suited for low- grade jobs such as sewer cleaner, blacksmith, tailor, etc.

Table 7. Social background among the surveyed families

Background	Frequency	Percent
Hill Brahman	260	45.5
Chhetri	89	15.6
Indigenous/Ethnic group	140	24.5
Dalit (Untouchable)	76	13.3
Madhesi	1	0.2

Mixed	6	1.0
Total	572	100.0

Ethnicity refers to a specific kind of cultural identity associated with a territory based on a common name, culture, language, and origin (Smith, 1986). Madhesi people are a separate ethnic group residing mainly in the southern plains of Nepal, close to the border. There are altogether 126 caste or ethnic groups and 123 local spoken languages reported across the country in the 2011 census. Nevertheless, there are only nine groups that have more than one million population, and those groups in descending order of size are Chhetri, Hill Brahman, Magar, Tharu, Tamang, Newar, Kami, Musalman, and Yadav (CBS, 2012). The castes Magar, Tamang, Newar, and Tharu fall under the category of indigenous/ethnic groups, the Yadav caste belongs to the Madhesi ethnic people, and the Musalman is a separate group following the Islam religion. Likewise, the Kami caste falls under the category of Dalit (Gurung, 2014). Chhetri was the largest caste having 16.6 percent of the total population, followed by Brahman hill with 12 percent (CBS, 2012).

The ethnicity/caste composition of the surveyed families is roughly similar to that of Nepal, except for the Madhesi people. Madhesi people mainly live in the southern plain region of Nepal but not in the Chitwan District. Hill Brahmin is the dominant caste among surveyed families, with 46 percent, which is followed by the Indigenous/ethnic group (24.5). Chhetri and Dalit are almost in the same proportion.

Table 8. Family size of the surveyed families

Family size	Frequency	Percent
1 to 3	85	14.9
4 to 5	339	59.3
6 to 9	148	25.8
Total	572	100.0
Mean	4.8	
Median	5	

Table 8 gives the distribution of the family size of the surveyed families. The largest group of families are in the 4 to 5 size category, corresponding to the national average at 4.8 (CBS, 2012). The median value is slightly higher than the mean; thus, most of the surveyed families have a slightly higher number of family members compared to the national average.

In general, the primary source of income for a household determines the socio-economic status of a family. By design, agriculture – crop farming and livestock farming, is the main economic activity of the surveyed families. Approximately 32 percent of the families reported agriculture as the main occupation, which is followed by jobs abroad with 25 percent. Families received remittances as family members are working abroad in unskilled employment, particularly in gulf countries, Korea, and Malaysia. These families

may be engaged in low skilled jobs overseas due to a low levels of education or limited employment opportunities within the country.

Table 9. The main occupation or source of income of the families

Occupation	Frequency	Percent
Crop farming	116	20.3
Livestock farming	66	11.5
Poultry	5	0.9
Own a business	76	13.3
Regular job	130	22.7
Wage daily	34	5.9
Jobs abroad (remittance)	142	24.8
Others	3	0.5
Total	572	100.0

The engagement of the substantial number of families in jobs abroad may signify the lower socio-economic status of the families. A regular job at 22.7 percent follows jobs overseas, and then self-employed business, such as a grocery shop, restaurant, cafeteria, or tea/coffee shop. Wage employment is the main occupation of a very few families indicating the lowest socio-economic status in Nepalese society. Table 9 indicates that a substantial number of families reported that agriculture is their secondary occupation. The percentage

of the families that reported crop or livestock farming as their secondary profession is 51.4 and 30.6, respectively.

Table 10. Secondary occupation of the families

Occupation	Frequency	Percent
Crop farming	294	51.4
Livestock farming	175	30.6
Poultry	7	1.2
Own a business	30	5.2
Regular jobs	34	5.9
Wage daily	17	3.0
Job abroad (Remittance)	10	1.7
No secondary occupation	5	0.9
Total	572	100.0

As noted above, Nepalese farmers are smallholders, and the situation is associated with land holdings because the land is inherited from family and is precious due to its economic and social value. Most of the surveyed families reported they own less than 0.4 hectares of land, which is lower than the national average at 0.7 hectares (CBS, 2013) and district average at 0.46 (DADO, 2019).

Table 11. Land ownership among surveyed families

land size in hectares	Frequency	Percent
No land	4	0.7
0.1 to 0.49	446	78.0
0.50 to 1	96	16.8
1.1 to 2.7	26	4.5
Total	572	100.0
Mean	0.4	
Median	0.3	

The majority of the families grow at least three crops in a year, which is a common practice across the district due to the availability of three crop seasons – spring, summer, and winter (DADO, 2019). Rice, wheat, maize, potato, and vegetables are the primary crops grown by the families. The cropping patterns differ accordingly to the land types and irrigation facilities available. Families generally follow cereal crop-based farming practices, and vegetables are grown in small areas, mainly for household consumption.

Table 12. Number of crops grown by the families during one year

Crop	Frequency	Percent
0	1	0.2
1	10	1.7
2	50	8.8
3	268	46.9
4	130	22.7
5	43	7.5
6	34	5.9
7	33	5.8
8	3	0.5
Total	572	100.0
Mean	3.6	
Median	3	

Livestock farming is an integral component of an agricultural system in the country. Farmers engage in crop and livestock farming as a supplementary enterprise across the country where both sectors contribute to each other to produce output up to a certain level without competing for the available resources. For instance, livestock supports crop farming by providing Farmyard Manure (FYM) to the crop, while crops offer fodder to the livestock. Such a combination is profitable and may be relevant for Nepalese farmers due to resource constraints such as land size, capital, etc. Like Nepalese farmers, the majority

of the surveyed families in the Chitwan district are involved in crop farming along with livestock farming.

Table 13. Livestock farming by the families during one year

Numbers	Cows	Buffalo	Goat	Pig
1	142 (58.9)	135 (78.5)	19 (7.1)	3 (50)
2	66 (27.4	31 (18)	54 (20.2)	3 (50)
3	18 (7.5	3 (0.5)	49 (18.4)	0
4	6 (2.5)	3 (0.5)	42 (15.7)	0
5 to 8	7 (1.2)	0	89 (13.3)	0
> 8	2 (0.4)	0	14 (5.2)	0
Total	241 (100)	172 (100)	267 (100)	6 (100)
Mean	1.8	1.2	4.4	1.5
Median	1	1	4	1.5

The national average of livestock numbers (cattle, buffaloes, yak, sheep, goats, and pigs) per household is 5.84. Number of livestock are converted into single unit - liestock unit (LSU) -as using the conversion coefficient for each types of livestock as given in FAO (2020) for the analysis puropsoed below. The most common livestock in the plain region or lower belt of Nepal is buffalo, goats, sheep, pigs, and poultry (CBS, 2012). Almost all farm families keep some livestock in Nepal, although the types of livestock raising vary from caste to caste. For instance, milk cows and buffalo are common among Brahmin and

Chhetri caste across the country, and they do not keep pigs but do keep goats for meat purposes for religious and cultural reasons (Pokhrel, 2014). In the same vein, surveyed families keep livestock at their farm, and cows are more common for milk as cows give more milk than buffalo.

Local indigenous buffalo are also common for butter production and home consumption. Many families suggested to the interviewer that buffalo milk is beneficial and nutritious for children. Though nearly 12 percent of families reported livestock farming as their primary occupation, none of the families keep more than ten cows, three buffalo, and 15 goats. The majority of the families keep more cows than buffaloes, as they earn income by selling the milk on the market.

Table 14. Gender of the respondents in the surveyed families

Sex	Frequency	Percent
Female	328	57.3
Male	244	42.7
Total	572	100.0

Table 15. Gender of the family head who makes the major farm decision

Sex	Frequency	Percent
Female	251	43.9

Male	321	56.1
Total	572	100.0

Most of the respondents, 57.3 percent, are female. However, not all of them are not decision-makers for farm activities in their family. Only 43.9 percent of respondents reported that their family was headed by the female who made farm decisions, decisions such as choosing the crop for cultivation, time for cultivation and harvesting, location for produce sale, etc. Males are more likely to be the economic decision-makers in Nepal due to the patriarchal society; therefore, the male might dominate in household decisions irrespective of their knowledge, experience, and educational level. Females are responsible for childcare and household work.

Table 16. Education of the family- head (in Years) who made the major farm decisions

Education	Frequency	Percent
Illiterate	63	11.0
1	119	20.8
2 to 4	27	4.7
5	53	9.3
6 to 9	82	14.4
10 to 11	133	23.3
12	62	10.8

13 to 18	33	5.7
Total	572	100.0
Mean	6.5	
Median	7	

Nearly half of the familyheads did not attend the middle school. Generally, the literacy status of the people is a tool to analyze the development status of a family. The capability and ability of the families to make an informed decision may be severely constrained by illiteracy.

Table 17. Family representation in the number of community-based organizations

Organization	Frequency	Percent
None	20	3.5
1	96	16.8
2	178	31.1
3	143	25.0
4 to 6	125	21.9
7 to 9	10	1.7
Total	572	100.0
mean	2.7	
Median	2	

The majority of the surveyed families reported that they are members of at least two community-based organizations such as cooperatives, irrigation users' groups, community forestry users' groups, women clubs, producer groups, and saving and credit mobilization groups. As noted above, various community mobilization groups were formed after 1992, in accord with economic liberalization policies advocated by the World Bank and western countries. Due to the beginning of a new era, many projects funded by grants began to work at the community level, engaging rural people in groups and cooperatives. There may be duplication of many activities due to the execution of many projects at the community level. This duplication of the activities might facilitate families to get membership of more than one organization without genuinely understanding the objectives of the program.

Comparison of members and non-members

Table 18. The social background of the families among members and non-members

Ethnicity	non-member	percent	member	percent	total	percent
Hill Brahmin	140	37.6	120	60.0	260	45.5
Chhetri	60	16.1	29	14.5	89	15.6
Indigenous/ethnic	94	25.3	46	23.0	140	24.5
Dalit	72	19.4	4	2.0	76	13.3
Madhesi	0	0.0	1	0.5	1	0.2
Mixed	6	1.6	0	0.0	6	1.0

Total	372	100.0	200	100.0	572	100.0

Hill Brahman is the most common caste, for cooperative members and others, but they are overrepresented among members relative to nonmembers. Indigenous/ethnic groups are similarly represented among both members and nonmembers.. Dalit with 19.4 percent is the third-largest group among non-members, while the Chhetri caste is the third largest group among members. The proportion of Dalit is comparatively higher among non-members than members. Dalit were previously excluded from main-stream politics, possibly limiting access to agricultural cooperatives. Hence, the number of Dalit among cooperative members is comparatively lower.

Table 19 provides information identifying each household's immediate neighborhood. The mixed group, more than one caste/ethnicity, is the most substantial proportion for immediate neighborhood among non-members. The Hill Brahman and Chhetri castes are the largest groups among members. The study by La Ferrara (2002) found that families are more likely to be a member of cooperatives if they live in a homogenous group. Homogeneity may be the reason behind the highest proportion of Hill Brahman/ Chhetri among members as these two castes have many commonalities and are commonly known as the Khas ethnic groups (Gurung, 2014).

Table 19. The ethnicity of the immediate neighborhood by the member and non member category

Ethnicity	Non-member	Percent	Member	percent	Total	Percent
The majority are Hill Brahman/Chhetri	103	27.7	112	56.0	215	37.6
The majority are Indigenous/ethnic	63	16.9	59	29.5	122	21.3
Majority are Dalit	46	12.4	5	2.5	51	8.9
Mixed	160	43.0	24	12.0	184	32.2
Total	372	100.0	200	100.0	572	100.0

Table 19 describes the main occupation in each household. Members are more likely to be in farming crops and livestock. The proportion of families reporting jobs abroad as the main occupation is comparatively higher among non-members than members. Jobs abroad is the largest category among non-members. The jobs abroad may be the only option among many non-members, possible due to small land size.

Table 20. Distribution of the main occupation among members and non-members

Occupation	Non-member	Percent	Member	Percent	Total	Percent
Crop farming	64	17.2	52	26.0	116	20.3
Livestock farming	37	9.9	29	14.5	66	11.5
Poultry	5	1.3	0	0.0	5	0.9

Own a business	43	11.6	33	16.5	76	13.3
Regular Jobs	92	24.7	38	19.0	130	22.7
Daily wages	32	8.6	2	1.0	34	5.9
Job abroad	97	26.1	45	22.5	142	24.8
Others	2	0.5	1	0.5	3	0.5
Total	372	100.0	200	100.0	572	100.0

As noted above, the land size of the surveyed families is nearly equal to the district average at 0.46[15]. However, the average figure for members at 0.48 is higher than the district average. Further, land size is comparatively larger for members than non-members. Four non-members even do not own any land. However, they previously grew crops through the contract agreement with the landlord. In general, the annual sharecropping agreement locally knows as the "Adhiya system" among farmers is common in the Chitwan district. In this system, farmers produce the crops with their resources, and the type of crop to be grown is fixed through an agreement between farmers and landlord. Farmers must give half of the total produce to the landlord as rent. Farmers generally prefer a cash land lease, but they need to pay at least one year's rent at the beginning.

[15] DADO, 2019

Table 21. Distribution of land ownership among members and non-members

Land size	Non-member	Percent	Member	Percent	Total	Percent
No land	4	1.1	0	0	4	0.7
0.1 - 0.49	318	85.5	128	64	446	78.0
0.50 - 1	46	12.4	50	25	96	16.8
1.1 to 2.7	4	1.1	22	11	26	4.5
Total	372	100.0	200	100	572	100.0
Mean	0.3		0.48		0.4	
Median	0.2		0.33		0.3	

The cost of cash renting is lower than sharecropping. However, poor farmers prefer sharecropping as they do not have cash at hand to pay rent before cultivation. Members are slightly more likely to plant more than three crops per year (52.5 percent versus 37.1 percent), and their mean number of crops is higher.

Table 22. Number of crops planted by the members and non-members during one year

Crops	Non-member	Percent	Member	Percent	Total	Percent
up to 2	45	12.1	16	8	61	10.7
3	189	50.8	79	39.5	268	46.9
4	79	21.2	51	25.5	130	22.8
5 to 8	59	15.9	54	27	113	19.8

Total	372	100.0	200	100	572	100.0
Mean	3.5		3.9		3.6	0.6
Median	3		4		3	0.5

Table 23. Education of family-head who made farm decisions among members and non-members.

Education	Non-member	Percent	Member	Percent	Total	Percent
Illiterate	51	13.7	12	6.0	63	11.0
1	83	22.3	36	18.0	119	20.8
2 to 4	25	6.7	2	1.0	27	4.7
5	38	10.2	15	7.5	53	9.3
6 to 9	53	14.2	29	14.5	82	14.3
10 to 11	72	19.4	61	30.5	133	23.3
12	33	8.9	29	14.5	62	10.8
13 to 18	17	4.6	16	8.0	33	5.8
Total	372	100.0	200	100.0	572	100.0
Mean	5.8		7.8		6.5	
Median	5		10		7	

Education may be a prime factor for the growth and development of a human being. The average level of education is comparatively lower for non-members than members. Almost 14 percent of non-members are illiterate in comparison to 6 percent of members.

More than half of the members at least attended grade 10, and grade 10 is the highest school level of local education in Nepal, providing a "school level certificate." In contrast, only 33 percent of non-members obtained that level of education. The majority of the members at least completed two more years of education than the average for non-members.

Table 24. Family representation in the number of community-based organizations by member and non-member category

Organization	Non-member	Percent	Member	Percent	Total	Percent
None	20	5.4	None	0.0	20.0	3.5
1	85	22.8	11	5.5	96.0	16.8
2	130	34.9	48	24.0	178.0	31.1
3	93	25.0	50	25.0	143.0	25.0
4 to 6	44	11.8	81	40.5	125.0	21.9
7 to 9	0	0.0	10	5.0	10.0	1.7
Total	372	100.0	200	100.0	572.0	100.0
Mean	2.2		3.6			
Median	2		3			

More than 5 percent of non-member families did not join any community-based organizations. Most of the member families, around 70 percent, are involved in at least three community-based organizations while the number is only 37 percent for non-member families. Overall, member families belong to 3.6 community-based organizations

compared to 2.2 to non-members. This difference is partly a reflection of selection, since members belong to at least one organization. But it also suggests that members have more connections to other organizations.

Table 25. Family representation in organization membership and executives in the number of community-based organizations other than agricultural cooperatives

Executives	Non-member	percent	Member	Percent	Total	Percent
None	20	5.4	0	0.0	20	3.5
General members	292	78.5	167	83.5	459	80.2
1 to 2	53	14.2	31	15.5	84	14.7
3 to 4	3	0.8	2	1.0	5	0.9
5 to 6	4	1.1	0	0.0	4	0.7
Total	372	100.0	200	100.0	572	100.0
Mean	0.29		0.22		0.26	
Median	0.00		0.00		0.00	

Very few and almost equal numbers of cooperative members and non-member families represent other community-based organizations as executives. Most of those families in both categories are the executive members of only one community-based organization. Only 1.1 percent of non-member families are executive members of 5 or 6 community-based organizations, while none of the cooperative member families were found to be the executives of more than 4 community-based organizations.

As noted above in the literature review, if families are involved in other organizations as executives, they are less likely to join the cooperatives as they do not have time to be involved in cooperative activities. However, the observation of this study is different from previous studies. Some cooperative members as well as non-members were executives of more than one community-based organization. Their multiple involvement as executives indicates either they are more active with leadership squills compared to other general members, or, most of the general members did not want to lead the community-based organizations.

Table 26. Economically active labor force (age between 15 – 59 years) in the family of the surveyed households

Economically Active Members	Non-members	Percent	Members	Percent	Total	Percent
1 to 3	202	54.3	74	37.0	276	48.3
4 to 5	147	39.5	115	57.5	262	45.8
6 to 8	22	5.9	11	5.5	33	5.8
> 8	1	0.3	0	0	1	0.2
Total	372	100.0	200	100	572	100.0
Mean	3.4		3.9		3.6	
Median	3		4		4	

Table 26 gives the distribution of the economically active labor force of the surveyed families. The government of Nepal categorizes the population that falls between the age of 15- and 59-years as the labor force of the country (CBS, 2012). Among cooperative members, the largest group of families have fewer than four members while it is four or more among non-member families. Overall, member families have 3.4 active members compared to 3.9 for non-members. This difference may partly reflect their participation in community-based organizations.

Table 27. Number of families taking credit/loan last year

Loan	non-member	percent	member	percent	total	percent
No	177	47.6	70	35.0	247	43.2
Yes	195	52.4	130	65.0	325	56.8
Total	372	100.0	200	100.0	572	100.0

Table 27 describes whether households took out a loan in the last year. Members are more likely to take a loan than non-members (65 percent versus 52.4 percent). This difference may be because cooperatives provide credit only to their members. As noted above, members do have more land and education, which may motivate them to initiate income-generating options by taking a loan. Members were using more loans than non-members, as further described in table 28. Most of the members owed more than 100,000

Nepalese rupees[16] at the end of the cropping year. In contrast, only 39 percent of non-member owed more than 100,000 rupees. Overall, the amount owed is substantially higher for members in comparison to non-members.

Table 28. The total amount of loan owed by members and non-members at the end of a cropping year

Loan owed	Non-member	Percent	Member	Percent	Total	Percent
1000 - 50000	70	40.7	29	24.2	99	33.9
50001 - 100000	35	20.3	23	19.2	58	19.9
100001 - 300000	40	23.3	22	18.3	62	21.2
300001 - 100000	20	11.6	33	27.5	53	18.2
100001 - 200000	7	4.1	13	10.8	20	6.8
Total	172	100.0	120	100.0	292	100.0
Mean	200,913		402,250		283,654	
Median	80,000		195,000		100,000	

Table 29. The annual household income other than crops and vegetables

Income	Non-member	Percent	Member	Percent	Total	Percent
up to 200,000	90	24.2	53	26.5	143	25.0
200,001 to 300,000	66	17.7	20	10.0	86	15.0
300,001 to 400,000	86	23.1	35	17.5	121	21.2

[16] $1US dollar equivalent to 111.26 NPR, Nepal Rupees (NRB, 2019)

400,001 to 550,000	54	14.5	46	23.0	100	17.5
550,001 to 1000,000	67	18.0	38	19.0	105	18.4
1000,001 to 3700,000	9	2.4	8	4.0	17	3.0
Total	372	100.0	200	100.0	572	100.0
Mean	387,355.7		394,435.6		389,831.2	
Median	332,950.0		371,750.0		338,200.0	

Table 29 describes the annual income of the families, excluding crop income. In particular, the annual household income includes income from livestock farming, business, daily wages, job abroad (remittances), regular jobs, pension, and cooperative dividends. There was only a small difference in mean annual income, excluding crop income between members and non-members. This indicates that the per capita income of both categories, members and non-members, are similar if both groups have identical crop income. As noted above, there are differences in landholdings, and numbers of crops grown during the year between members and non-members, which may contribute to the differences in crop income between members and non-members.

Table 30. Annual household income of the families from crop and livestock farming (In Nepalese Rupees)

Income	Non-member	Percent	Member	Percent	Total	Percent
5,000 to 100,000	131	35.2	30	15.0	161	28.1
100,001 to 200,000	115	30.9	67	33.5	182	31.8

200,001 to 350000	90	24.2	55	27.5	145	25.3
350,001 to 500,000	29	7.8	25	12.5	54	9.4
500,001 to 1400,000	7	1.9	19	9.5	26	4.5
1400,001 to 3500,000	0	0.0	4	2.0	4	0.7
Total	372	100.0	200	100.0	572	100.0
Mean	191,043		301,593		229,697	
Median	152,500		240,000		180,000	

Table 30 describes the annual agricultural income of the families. Most of the members earned more than 200,000 Nepalese rupees per year from crop and livestock farming. In contrast, only 34 percent of non-member families earned more than 200,000 Nepalese rupees. Overall, members earned an average of 301,593 Nepalese rupees compare to 191,043 to non-members. As noted above, the income difference may be due to the differences in landholdings, the number of livestock, and numbers of crops grown during the year between members and non-members. Cooperative members are from families with more workers, which may have increased the earnings of the member families. This study revealed that cooperative members do have more education and more loans than non-members. Members may use their higher loan amounts to increase income generation options, inducing observed differences in earnings.

Table 31. Percent of families buying new assets from crop and livesock earnings

Buying new assests	Non-member	Percent	Member	Percent	Total	Percent
No	169	45.4	64	32.0	233	40.7
Yes	203	54.6	136	68.0	339	59.3
Total	372	100.0	200	100.0	572	100.0

Table 31 describes whether families bought any new assets through the income earned from crop and livestock farming in last year. Those assets include land, house maintenance tools /expenses, property, cash savings, livestock, and items such as television, radio, mobile, bike, etc. About 68 percent of member families reported that they bought such assets. The proportion of families reported buying the assets is slightly higher for members compared to nonmember families. Although members are earning much higher revenue from crop and livestock farming compared to non-members, the difference in proportion buying such assets between members and non-members families is minimal. This negligible difference may be due to more loan repayment obligations of the members compared to non-members. As noted above, more members are taking and using loans than non-members families.

Table 32. The annual farm revenue from crop and vegetables for the families in Nepalese Rupees.

Income	Non-member	Percent	Member	Percent	Total	Percent

up to 50,000	122	32.8	35	17.5	157	27.4
50,001 to 100,000	144	38.7	60	30.0	204	35.7
100,001 to 150,000	63	16.9	36	18.0	99	17.3
150,001 to 200,000	20	5.4	21	10.5	41	7.2
200,001 to 350,000	18	4.8	25	12.5	43	7.5
350,001 to 1,000,000	5	1.3	19	9.5	24	4.2
1,000,001 to 2,300,000	0	0.0	4	2.0	4	0.7
Total	372	100.0	200	100.0	572	100.0
Mean	88,577.7		189,476.8		123,857.1	
Median	65,000.0		109,100.0		81,450.0	

Table 32 tabulates the annual household farm revenue of the surveyed families. Most of the members earned more than 100,000 Nepalese rupees per year from crop farming. In the same vein, the majority of the non-members earn less than 100,001 Nepalese rupees per year from farming. In contrast, only 28 percent of non-member families received more than 100,000 Nepalese rupees. Overall, members earned an average of 189,476 Nepalese rupees compared to 88,577 for non-members. The crop income difference may be due to differences in the scale of crop production and sale revenue between members and non-members. As noted above, there are differences in landholdings, the number of crops grown, working members, education, and loan amount

between members and non-members. These factors may induce higher production and, thereby, more farm income for members compared to non-members.

Table 33. The annual cost of crop farming for the families in Nepalese Rupees

Cost	Non-member	Percent	Member	Percent	Total	Percent
up to 25,000	37	9.9	8	4.0	45	7.9
25,001 to 50,000	101	27.2	32	16.0	133	23.3
50,001 to 100,000	162	43.5	70	35.0	232	40.6
100,001 to 200,000	59	15.9	53	26.5	112	19.6
200,001 to 650,000	10	2.7	35	17.5	45	7.9
650,001 to 1600,000	3	0.8	2	1.0	5	0.9
Total	372	100.0	200	100.0	572	100.0
Mean	78,240.59		147,726.9		102,536.5	
Median	65,000.0		100,000.0		75,000.0	

Table 33 presents the annual cost of agricultural services, inputs, and the imputed cost for crop farming of the surveyed families. In particular, those cost includes, land rented in, plowing and manure, seeds and pesticides, labor hired, marketing, transportation, miscellaneous and the imputed value of household labr. Nearly 45 percent of cooperative members have more than 100,000 Nepalese rupees in costs per year. Only 20 percent of non-members have that level of cost. Overall, members have an average cost of 147,726 Nepalese rupees compared to 78,240 for non-members. The difference in farm cost may

be due to the differences in landholdings and the number of farming crops between members and non-members. IF we compare the median annual farm revenue and cost for both members (109,100 Vs. 100,000) and non-members (65000 Vs. 65000), there was almost no profit at the end. In other words, the profit left to the farm families is almost equal to the imputed value of household labor. We did not include the cost of capital and imputed value of land in the calculation, which could make the loss to the families if included. The loss indicates farmers may not achieve economies of scale in input use and production, or farmers may not receive a fair price margin in the crop supply chain. It is possible that traders or intermediaries could get the most profit margin in the crop supply chain because farmers were compelled to sell their produce whatever price traders offer. Despite the loss in crop farming, many families still engaged in crop farming because there may be limited opportunities in other sectors. As noted above, The proportion of job abroad as the main occupation surpasses the other sectors for non-members, and the second-largest for members may reflect the higher opportunity cost of crop farming. There is an increasing trend of going abroad for jobs among many family members across the villages. This may be because of the high opportunity cost of household labor in crop farming.

Role of cooperatives

As noted above, only 43.9 percent of respondents reported that they belong to a female-headed family. However, in 59 percent of the households, females are the members of the agricultural cooperatives representing their family. The proportion male at 37 percent

is comparatively lower than female involvement in agricultural cooperatives. There might be several reasons for lower male participation in agricultural cooperatives. For instance, the male might prefer to be engaged in other cooperatives other than agricultural cooperatives, such as dairy, saving and credit, multi-purpose, etc. Males may delegate responsibility for selected agricultural activities, so the male arranges for the female of their household to become a member of an agricultural cooperative.

Table 34. Gender of the families who represent the agricultural cooperatives

Gender	Frequency	percent
Female	118	59
Male	73	36.5
Both sex	9	4.5
Total	200	100

The duration of membership varies from 2 to 20 years. Some families, 4 percent, have been members of the agricultural cooperatives for 16 to 20 years, and the same proportion has been members for only two years. Most of the families have been members of agricultural cooperatives for at least six years. Families joined agricultural cooperatives to get the services given by the cooperatives, and such services are credit, agricultural inputs, technical training, etc. Households do not need to become members of agricultural

cooperatives to get agricultural inputs such as seed, fertilizer, etc. Any farmers living within the coverage area of agricultural cooperatives can buy the subsidized inputs from agricultural cooperatives. However, once a household gets services such as those listed from the cooperatives, the service receivers are socially obliged to become a member of that cooperatives.

Table 35. Duration of membership in agricultural cooperatives

Years	Frequency	Percent
Only 2	8	4
3 to 5	66	33
6 to 10	84	42
11 to 15	34	17
16 to 20	8	4
Total	200	100
Mean	7.8	
Median	6	

Credit and input availability are the most common reason for members to participate in agricultural cooperatives. People, in general, would like to be involved in their community or group activities; therefore, group bonding is another reason for membership. Technical training is also one of the reasons for membership, which is the fourth-ranked reason for being a member and is the most common third reason for joining

a cooperative. Marketing service is the lowest ranked reasons for most of the members reflecting the fact that most members do not sell their produce through cooperatives.

Table 36. The first reason for being a member of cooperatives

Reasons	Frequency	Percent
Credit provision	80	40
Inputs availability	82	41
Technical training	7	3.5
Group bonding	16	8
Milling services	3	1.5
Extension and linkages	1	0.5
savings	8	4
marketing services	3	1.5
Total	200	100

Table 37. The second reason for being a member of cooperatives

Reasons	Frequency	Percent
Credit provision	34	17
Inputs availability	63	31.5
Technical training	28	14
Group bonding	23	11.5
Milling services	2	1
Savings	23	11.5

Marketing services	24	12
Irrigation support	3	1.5
Total	200	100

Table 38. The third reason for being a member of cooperatives

Reasons	Frequency	Percent
Credit provision	23	11.5
Inputs availability	23	11.5
Technical training	58	29
Group bonding	36	18
Milling services	4	2
Extension and linkages	2	1
Savings	25	12.5
Marketing services	10	5
Irrigation support	19	9.5
Total	200	100

Community characteristics

Table 39. Distance to agricultural cooperatives from the residence of the families in kilometers

Distance	Non-member	Percent	Member	Percent	Total	Percent
up to 0.1	6	1.6	32	16.0	38	6.6

0.2 to 0.5	33	8.9	76	38.0	109	19.1
0.6 to 1	104	28.0	62	31.0	166	29.0
1.1 to 2	161	43.3	20	10.0	181	31.6
2.1 to 4	68	18.2	10	5.0	78	13.6
Total	372	100.0	200	100.0	572	100.0
Mean	1.7		0.8		1.3	
Median	1.5		0.5		1	

Members live closer to the office of agricultural cooperatives than non-members. Almost 85 percent of members reported that their residences are within 1 kilometer of cooperatives. In contrast, only 39 percent of non-members lives within the same periphery. Overall, non-members' houses are an additional 1 kilometer farther away from an agricultural cooperative than members. This membership differences may reflect selection since families near to the cooperatives are more likely to be members. It also suggests that families forming a cooperative may establish the office of the cooperative in their area.

Table 40. Distance to agrovets from the residence of the families in kilometers

Distance	Non-member	Percent	Member	Percent	Total	Percent
Up to 1	19	5.1	39	19.5	58	10.1
1.1 to 3	113	30.4	83	41.5	196	34.3
3.1 to 5	167	44.9	67	33.5	234	40.9
5.1 to 6.4	47	12.6	11	5.5	58	10.1

6.5 to 9	26	7.0	0	0	26	4.5
Total	372	100.0	200	100	572	100.0
Mean	3.9		2.8		3.4	
Median	4		2.5		3.5	

Entrepreneurs who sells agricultural inputs, including pesticides, seeds, fertilizers, animal medicine, vaccination, etc. are commonly known as agrovets. Agrovets also provide technical guidance to buyers/farmers on how to use particular inputs. Agrovets are common across the villages of Nepal. Table 40 describes the distance farmers travel to agrovets from their residences. The agrovets were within 4 kilometers for most non-member families but only 2.8 kilometers for most member families. The distance to agrovets for members is comparatively shorter than non-members. This difference in length is obviously due to the location of agrovets in an area where most of the member families reside. Any member or outsider may establish an agrovet in response to the demand for its services. The market for agrovets may be logical as most member families were involved in agriculture as the main occupation.

Table 41. Distance to agricultural development Bank from the residence of the families

Distance	Non-member	Percent	Member	Percent	Total	Percent
Up to 1	13	3.5	7	3.5	20	3.5

1.1 to 3	42	11.3	28	14	70	12.2
3.1 to 5	89	23.9	48	24	137	24.0
5.1 to 8	132	35.5	71	35.5	203	35.5
8.1 to 16	96	25.8	46	23	142	24.8
Total	372	100.0	200	100	572	100.0
Mean	6.4		6.3		6.3	
Median	6		5.8		6	

The Government of Nepal established the Agriculture Development Bank (ADB) in 1968 to give financial services to cooperatives as a successor to a national cooperative bank. Since 1973, the ADB has been engaged in commercial banking and was established as a public limited company owned by the government. In Chitwan district, there are five branches of ADB in the area of the 27 villages (Agricultural Development Bank, 2018). Farmers suggested that this bank has offered agricultural product loans to farmers, and the interest rate is lower than other commercial banks. In general, most of the commercial banks are unwilling to give agricultural product loan to farmers due to the risk involved in the agricultural sector. There was no difference between members and non-members concerning distance to an ADB branch from their residences. This may be due to its population-specific establishment of branches irrespective of the location of agricultural cooperatives.

Table 42. Using loan services of the ADB by member and non-member categories

Use	Non-member	Percent	Member	Percent	Total	Percent
No	356	95.7	177	88.5	533	93.2
Yes	16	4.3	23	11.5	39	6.8
Total	372	100.0	200	100.0	572	100.0

As noted above, although the interest rate of ADB is comparatively lower than other commercial banks and ADB also offers agricultural loans to the needy families, only approximately 7 percent of surveyed families received a loan from the ADB. This low number of loans may be due to the availability of formal and informal financial institutions such as rural banks, cooperative banks, saving and credit cooperatives, agricultural cooperatives, credit and saving mobilization groups, etc. in the area. Many families, including key informants, suggested that these institutions offer loans at a lower interest rate compared to commercial banks and the ADB. Cooperatives provide credit up to 100,000 Nepalese rupees without collateral, keeping the group as collateral. In addition, most of the community-based organizations offer loan services to their members, and the size of the loan amount depends on their savings and capital investment. As noted above, credit availability is the most common reason to become a member of agricultural cooperatives. Most key informants, chairpersons/managers of agricultural cooperatives, suggested that agricultural cooperatives are currently mainly working in savings and credit

mobilizations. All cooperatives are offering loans at a lower interest rate than other institutions though loan size differs from cooperatives to cooperatives. If cooperative members do not get desired loans at the market interest rate from their own cooperative, then only they seek loans from other financial institutions.

Table 43. Distance to the motorable road from the residence of the families in Kilometers

Distance	Non-member	Percent	Member	Percent	Total	Percent
up to 0.05	66	17.7	111	55.5	177	30.9
0.06 to 0.1	24	6.4	36	18	60	10.5
0.11 to 0.49	124	33.4	37	18.5	161	28.1
0.50 to 1	151	40.6	16	8	167	29.2
1.1 to 3	7	1.9	0	0	7	1.2
Total	372	100	200	100	572	100.0
Mean	0.5		0.15		0.33	
Median	0.4		0.05		0.4	

Table 43 shows that distance to a motorable road has a strong relationship with cooperative membership. More than half of members are within 0.05 kilometers from a road (essentially on directly accessible to a road), whereas fewer than a fifth of nonmembers are this close. Still most household have easy access to the motorable way, although a few households have to travel more than one kilometer to a motorable road.

Overall, member families have to go 0.33 kilometers to reach a motorable road compare to 0.5 kilometers to non-members.

Table 44. Distance to the district capital from the residence of the families in kilometers

Distance	Non-member	Percent	Member	Percent	Total	Percent
5 to 10	80	21.5	38	19	118	20.6
10.1 to 16.9	88	23.7	67	33.5	155	27.1
17 to 25	98	26.3	37	18.5	135	23.6
25.1 to 40	54	14.5	40	20	94	16.4
40.1 to 51	52	14.0	18	9	70	12.2
Total	372	100.0	200	100	572	100.0
Mean	20.7		20.4		20.6	
Median	17		17		17	

"Bharatpur" is the administrative center or capital town of the Chitwan district and belongs to a separate municipality authority from the villages. Bharatpur is the fifth largest city of Nepal, with a population of 199,867 (CBS, 2012). The government's many divisions and branch offices, as well as offices of NGOs and CBOs, are located at Bharatpur. These include the Cooperative Training and Division Office (CTDO), District Cooperative Association, District Agriculture Cooperative Association, Cooperative Bank, farmers market, and Agriculture Collection Center. Table 44 presents the distances of residences

of families from district headquarters. Overall, members average 20.4 kilometers from district capital compared to 20.7 kilometers for non-members. This slight difference suggests that the district capital may not have any influence on joining agricultural cooperatives.

Table 45. Distance to farmers' market from the residence of the families in kilometers

Distance	Non-member	Percent	Member	Percent	Total	Percent
up to 3	70	18.8	49	24.5	119	20.8
3.1 to 5	97	26.1	53	26.5	150	26.2
5.1 to 8	91	24.5	47	23.5	138	24.1
8.1 to 25	50	13.4	22	11	72	12.6
25.1 to 45	64	17.2	29	14.5	93	16.3
Total	372	100.0	200	100	572	100.0
Mean	10.8		9.6		10.3	
Median	5.5		5		5.5	

The Farmers' markets are temporary markets managed and operated by farmers themselves to sell their fresh products under a temporary shelter. In Chitwan, most of the farmers' markets operate twice a week for limited hours targeting nearby customers. Farmers mostly sell vegetables, milk, ghee, eggs, and locally made handicrafts in the market. Farmers generally practice this mode of marketing to increase their profit margin.

Table 45 describes the distance surveyed families have to travel to reach a farmers' market from their residences. The farmers' markets were within 8 kilometers for 59 percent of non-members and 75 percent of members. Overall, members have to travel an average of 2.8 kilometers compare to 3.9 kilometers for non-members. Members may have decided the location for the market to sell their agricultural produce since more member families were involved in agriculture as their primary occupation.

Table 46. Distance to the nearest local market from the residence of the families

Distance	Non-member	Percent	Member	Percent	Total	Percent
Up to 1	19	5.1	39	19.5	58	10.1
1.1 to 3	113	30.4	83	41.5	196	34.2
3.1 to 5	167	44.9	67	33.5	234	41.0
5.1 to 6.4	47	12.6	11	5.5	58	10.1
6.5 to 9	26	7	0	0	26	4.5
Total	372	100	200	100	572	100
Mean	3.9		2.8		3.4	
Median	4		2.5		3.5	

As noted above, cooperative membership appears to be influenced by the type of agricultural products and the marketing services offered by the cooperatives. Members of a cooperative with a perishable product may live closer to the market. However, the prior literature is difficult to interpret because of a lack of consistency in the measurement unit.

Some authors measured the distance to the market in kilometers while others measured market access in terms of time to reach the market. None of the studies address the issue of market size that may also affect the probability of farmers becoming a member of an agricultural cooperative. Table 46 describes the distance between farmers' residences and the nearest local market. Each village has a local market, where villagers visit to buy essential goods such as salt, sugar, or pulses in minimal amounts. In general, villagers purchase those products in large quantities from the regional market due to the price differences. Most local traders of cereal crops locate in the local market and buy the product from farmers and either sell to district traders or sell directly to wholesalers of the regional market after milling/processing the product.

The local market is a popular meeting place for villagers to share information about daily affairs. The distance to the nearest market for members and non-members is the same as the distance to an agrovets since the latter usually reside in the local market. Overall, the distance to the nearest market is an average of 3.9 kilometers for non-members compared to 2.8 kilometers for members. Farmers living near to markets may be aware of the importance of agricultural cooperatives, which induces their membership.

Table 47. Availability of agricultural cooperative collection center in the village

Availability	Non-member	Percent	Member	Percent	Total	Percent
No	170	45.7	84	42.0	254	44.4
Yes	202	54.3	116	58.0	318	55.6

Total	372	100.0	200	100.0	572	100.0

As noted above, a cooperative collection center is a substitute for the market, and this may influence farmers' decisions regarding whether to join a cooperative. In general, the nearer the distance to the collection center, the higher the probability of people joining an agricultural cooperative. As we expected, Fischer and Qaim (2011) found that the distance to the collection center in Kenya has a positive and significant effect on joining a cooperative up to the length of 6.1 kilometers, after which the probability of joining decreases with the distance. Farmers are more likely to join agricultural cooperatives when the potential gain in price through the services of collection centers exceeds their marketing cost through selling by themselves. In contrast, marketing cost exceeds price gain if they live away from collection centers. This is possible because farmers have to bear high transfer costs to deliver their produce to the collection center if they live far away from the collection center. Therefore, the distance may be inversely proportional to the likelihood of joining the cooperatives. However, distance to the collection center does not influence the membership across the villages because the collection center is not offering the exact marketing services as described in Kenya, so very few members use the collection center across the villages. What are the services offered by the collection center and why very few members used it are described below.

Table 48. Using the services offered by the agricultural cooperative collection center in the villages

Use of services	Non-member	Percent	Member	Percent	Total	Percent
No	361	97.0	191	95.5	552	96.5
Yes	11	3.0	9	4.5	20	3.5
Total	372	100.0	200	100.0	572	100.0

There are collection centers established by agricultural cooperatives across the villages. Most of the cooperative members and non-member families reported the availability of collection centers in their villages. But, approximately 97 percent of families said that they are not using the service of the collection center because collection centers were not buying their produce. Many key informants and household survey respondents suggested that the collection centers were established to buy the product of members and sell the product so that they need not depend on whatever price offered by the local traders. But, the collection centers of agricultural cooperatives fail to deliver these marketing services, which the members earlier expected. They thought they do not have managerial capacity to offer the marketing services since it is the most challenging job due to many internal and external obstacles. Many agricultural cooperatives established collection centers at their locality because government/donor agencies provide cash support to establish a collection center. However, many collection centers closed later due to the

inability of cooperatives to operate/handle it. There are a few collection centers near to district headquarters that are operating, and they are just providing vegetable selling stalls on cash rent to individual members. Members who rent booths could collect the produce from anywhere and offer the price to consumers as an independent trader.

Table 49. Availability of any industry/factory in the village

Availability	Non-member	Percent	Member	Percent	Total	Percent
No	249	66.9	126	63.0	375	65.6
Yes	123	33.1	74	37.0	197	34.4
Total	372	100.0	200	100.0	572	100.0

As noted above in the literature review, some studies suggest that if families have alternative employment opportunities near to their residences and earn more income from those employment opportunities than existing farm practices, families are less likely to join in agricultural cooperatives. Table 49 tabulates the availability of industry/factory in the village of surveyed families. Those industries are grain processing/milling, mineral water, cooking - gas filling, plastic appliances, etc. Many surveyed families suggest that these factories/industries offer daily wages to approximately 10 to 15 persons of the surrounding area of 2 to 3 villages. The proportion of families reporting availability of industry or factory is slightly higher for members compared to non-members. This slight difference may reflect the engagement of more member families in alternative employment

opportunities compared to non-members, although these industries offer very few job opportunities at the locality.

Key Informants Interview (KII)

Background of KII

This study interviewed 37 chairpersons/managers of the agricultural cooperatives to add to and validate the information collected through a household survey. These agricultural cooperatives were purposively selected to include at least one functional cooperative from each village in our household survey sample. Each village has at least one functional agricultural cooperative except Divyanagar village. In other words, this KII study identified those agricultural cooperatives whose members constitute the sample of the household survey. In this way, this study is able to explore the structure of services provided by the cooperatives and the role cooperatives serve as viewed by their chairpersons/managers.

Table 50. Respondent position in the agricultural cooperatives

Designation	Frequency	Percent
Chairpersons	14	37.8
Managers	23	62.2
Total	37	100

This study interviewed 23 managers and 14 chairpersons of the agricultural cooperatives. In particular, interviews with only managers were originally planned, but in 14 cooperatives, there was no full-time manager; therefore, I interviewed the chairpersons. When chairpersons of those cooperatives were asked the reason for not recruiting separate managers, they reported they currently do not need separate managers due to low transaction numbers. The 23 managers who were interviewed are not outsiders but are members of the respective agricultural cooperatives. As noted above in the literature, as per existing rules and regulations, if they do business transactions of less than 200,000 Nepalese rupees (NPR) with the cooperative, members can also be an employee of the cooperative. However, the act does not describe the types of business transactions that are counted toward this limit.

Background of chairpersons/managers

Table 51. Duration served as the chairperson/manager in their respective cooperatives since the appointment

Years	Frequency	Percent
up to 3	6	16.2
4 to 6	17	45.9
7 to 10	6	16.2
11 to 15	5	13.5
16 to 22	3	8.1

Total	37	100.0
Mean	7.7	
Median	6	

Table 51 provides information about the duration of respondents' role as chairperson/manager in their cooperatives since their appointment. Chairpersons/managers had been working in their cooperatives an average of more than 7 years. If the cooperatives had hired outsiders as the managers for specified periods, the average duration of service would probably have been much lower. Cooperative members working as employees with their cooperatives may reflect a lack of favorable policy and possible inefficiency of cooperative members in operating the cooperatives. As noted above in the literature review, the institutional support and the business approach taken by agricultural cooperatives contribute to the successful cooperatives in terms of income gain to the members.

Table 52 indicates whether the respondents had managerial experience before being appointed as chairpersons/managers in the cooperatives. Almost one half of the chairpersons/managers reported that they did not have any prior managerial experience. Other chairpersons/managers reported only experience working as board members of high school and secondary school management committees, board members of community-based organizations such as Community Forestry User Groups (CFUGs), Irrigation Users

Group (IUG), etc. They did not work for a private company or community-based organizations as a management staff.

Table 52. Prior managerial experience of chairpersons/managers before joining the cooperatives

Experience	Frequency	Percent
No	17	45.9
Yes	20	54.1
Total	37	100

Table 53 provides information about the gender of the interviewed respondents. More than two-thirds of the respondents are male. Only around 30 percent of the total respondents are female. Most of the cooperatives in which women held positions are established as women's cooperatives, and some of those cooperatives only allow females to be the members. Those only female membership cooperatives were formed through the facilitation and financial support of NGOs and INGOs, which work for women empowerment. Those only female membership cooperatives generally offered fewer services to members than mixed cooperatives. Female chairpersons/managers were asked why their performance was lower compared to mixed cooperatives. Most of them suggested that females were responsible for childcare and household work, so they are not able to give the required time to the cooperatives. Males are more likely to be the economic

decision-makers and have central roles in informal institutions in Nepal due to the patriarchal society; therefore, the males may be appointed to lead the organization irrespective of their knowledge, experience, and educational level.

Table 53. Gender of the chairpersons/managers in the cooperatives

Gender	Frequency	Percent
Female	11	29.7
Male	26	70.3
Total	37	100

Objectives of the cooperatives

Income generation and financial services are the most common primary goal stated by chairpersons/managers for agricultural cooperatives in their community. Chairpersons/managers would like to increase member's income by increasing agricultural production; therefore, an increase in agricultural production is another goal behind the establishment of the cooperatives. An increase in savings behavior is also one of the goals, which is the second-ranked second primary goal of the cooperatives. As noted above, most of the members are poor and are smallholders. An increase in saving behavior of the members may be the entry point to increase equity capital, thereby to initiate income-generating options. Hence, chairpersons/managers reported saving behavior as one of the primary goals of the cooperatives. Marketing service is the lowest-ranked goal, reflecting

the fact that cooperatives do not buy the product of the members and sell their products. Most chairpersons/managers reported that members are only now aware the importance of cooperative savings for reducing their dependency on outside lenders. Chairpersons/managers suggest it takes time for members to develop an understanding of how to best use the cooperative structures to improve their marketing of their goods. In particular, it would take time for producer families to work with cooperatives to obtain lower input costs and higher output prices. As noted above in the literature review, cooperatives have economic advantages of lower input cost and higher output price due to the cooperative approach in production and sale.

Table 54. The first primary goal of the cooperatives

Goals	Frequency	Percent
Income generation	16	43.2
Financial services (savings & loan lending)	9	24.3
Increase Agri-production	7	18.9
Receive grant and services	3	8.1
group marketing	2	5.4
Total	37	100.0

Table 55. The second primary goal of the cooperatives

Goals	Frequency	Percent
Financial services (Savings & loan lending)	10	27.0
Increase savings behavior	8	21.6
Increase ag production	2	5.4
Income generation	10	27.0
Group marketing	4	10.8
Women empowerment	2	5.4
Receive grant & subsidies	1	2.7
Total	37	100.0

Structure of the cooperatives

Table 56 describes the information about the size of the cooperatives, membership numbers in the initial year of registration. More than half of the cooperatives had fewer than 51 members in the year they registered the cooperatives. More than 16 percent of the cooperatives had only 25 members. The minimum number of members to register the group as a new cooperative is 25 under the old cooperative act, whereas the new cooperative act of 2017 increased the minimum numbers of members required to register a new cooperative from 25 to 30 (MOLCPA, 2018a). Overall, the agricultural cooperatives have an average of 182 members who joined the cooperatives during the establishment year.

Table 56. Cooperatives membership during their first year of registration

Size	Frequency	Percent
Only 25	6	16.2
26 to 50	16	43.2
51 to 150	4	10.8
151 to 500	6	16.2
501 to 1000	4	10.8
1001 to 1300	1	2.7
Total	37	100.0
Mean	182	
Median	38	

Table 57. Duration of the establishment of agricultural cooperatives

Years	Frequency	Percent
6 to 7	13	35.1
8 to 9	7	18.9
10 to 15	10	27.0
16 t0 20	3	8.1
21 to 22	4	10.8
Total	37	100.0
Mean	11	
Median	9	

Table 57 provides the information about the age of the cooperatives the study had chosen. Approximately two-thirds of the cooperatives was registered 8 years prior to the survey. Overall, surveyed cooperatives were an average of 11 years old. All cooperatives were more than 6 years old, due to the selection criteria of this study. As noted above, this study purposively chose those functional agricultural cooperatives which were registered between 1992 and 2014. In particular, the government shifted the legal structure governing cooperatives, transferring ownership of the cooperatives from the government to cooperative members through legislation in 1991 (Regmi, 1992). How the cooperative act of 1991 converted quasi-cooperatives to cooperatives is described in detail in the literature review section above. The benchmark of 2014, limiting cooperatives to those 5 years old or older, was purposively determined due to the research objectives. The researcher assumes that the cooperatives should be at least 5 years old to analyze the impact of cooperatives on members' farm income. In other words, it may several years for the cooperatives to develop their structures and to offer the services to its members.

Table 58. Cooperatives membership

Size	Frequency	Percent
up to 100	6	16.2
101 to 250	8	21.6
251 to 600	5	13.5
601 to 1000	6	16.2

1001 to 1500	9	24.3
1501 to 2200	3	8.1
Total	37	100.0
Mean	673	
Median	563	

Table 58 tabulates the number of families currently involved in the cooperatives. Approximately half of the cooperatives have more than 600 members. Nearly one-third of the cooperatives have more than 1000 members. All cooperatives have an open membership policy, and managers had no knowledge of the closed membership approach to assure quality control and supply control of the product, as discussed in the literature review above. Respondents suggest that cooperatives could increase the equity capital if more members joined the cooperatives by membership fees, membership savings, and selling share to members. Overall, agricultural cooperatives have an average of 673 members. The average cooperative membership is almost three times higher than in the beginning year.

As noted above, changes in government cooperative policies, including economic policies adopted after 1990, and changes in the political regime in 1991 and 2006 may have induced a rapid growth in cooperative membership. Many respondents suggested that some of the individuals joined more than one agricultural cooperative, which may also add to membership growth. Most members did not know that rules prohibited membership in

more than one agricultural cooperatives; therefore, it would take some years to follow the cooperative guidelines strictly, respondents suggested. The Cooperative act 2017 mentions that an individual can not be a member of more than one agriculture cooperative (MOLCPA, 2018a).

Table 59. Regular monthly savings required to maintain membership in the cooperatives

Savings	Frequency	Percent
50	2	5.9
100	12	35.3
200	10	29.4
500	8	23.5
1000	2	5.9
Total	34	100.0
Mean	274	
Median	200	

Table 59 provides information about how much money members have to save per month in their respective cooperatives to maintain membership. More than 70 percent of cooperatives have a provision of up to 200 Nepalese Rupees (NPR) monthly savings to maintain membership. Overall, members have to save an average of 274 NPR in the cooperatives. Regular savings is one of the ways mentioned in the cooperative legislation

to raise the equity capital of the cooperatives. In the beginning, regular savings and selling the minimum number of shares to members are the most commonly adopted ways by the cooperatives to raise the equity capital. Cooperatives legislation sets the value of the cooperative share at 100 NPR, and the value of the share must be specified in a cooperative's by-laws. Cooperatives can sell up to 20 percent of total share to individual members (DOC, 2017).

Respondents suggest that cooperatives could not force individuals to buy many shares, say 15 or 20 shares. Nobody would purchase so many shares without knowing much about the cooperative approach and looking at the cooperative performance. In addition, families involved in agriculture are poor and smallholders, who did not have enough income to buy many shares at a time. Therefore, mandatory regular savings may be the best option to raise the money in the cooperatives. Most chairpersons/managers suggest that very few members left the cooperatives due to the inability to continue regular savings. Cooperatives are offering various types of saving accounts, such as regular/fixed membership savings, children, senior citizens, etc., at varying interest rates ranging from 7 to 11 percent. Individual members can leave the cooperatives at any time taking their savings with interest, after meeting their personal liabilities to the cooperatives, such as loans, equipment, etc. if they have any. Many cooperatives would deduct 1 percent of savings when their members leave the cooperative, while relatively new cooperatives, which are few in numbers, deduct 2 percent from departing members.

Table 60. Maximum loan size to members without a mortgage in Nepalese Rupees

Loan size	Frequency	Percent
up to 5000	7	18.9
5001 to 10,000	5	13.5
10,001 to 50,000	4	10.8
50,001 to 100,000	19	51.4
100,001 to 200,000	1	2.7
200,001 to 500,000	1	2.7
Total	37	100.0
Mean	75,676	
Median	100,000	

Table 60 indicates the maximum loan size offered to members by the cooperatives without a mortgage. As noted above, loan availability is the most common reason for members to join the cooperatives. In particular, farmers' have easy access to cooperative credit, and it reduces their dependency on outside lenders. Members can get a certain amount of loans from their cooperatives at a minimal interest rate without a mortgage. In particular, cooperatives provide loans at a lower interest rates compared to other formal financial institutions, although loan size is smaller. Only 2 cooperatives provide loans of more than 100,000 Nepalese Rupees (NPR) to their members. All other cooperatives offer maximum loan amounts of l00,000 NPR or less. Chairpersons/managers suggested that

cooperatives which have lower equity capital provide loan amounts of less than 100,000 NPR. There are few cooperatives that have enough equity capital, approximately 10 million equity capital, offering up to 1,500,000 NPR with a mortgage. Cooperatives offer loans in crop farming and livestock farming at 9 percent interest rate, and 14 percent interest for education and 15 percent for a job abroad and real estate business purpose. The lending rate must not be more than the 6 percentage points higher than what they pay on savings ((MOLCPA, 2018a).

Table 61. Maximum loan size to members with a mortgage in Nepalese Rupees

Maximum loan size	Frequency	Percent
No provision	14	37.8
20,000	1	2.7
100,000	2	5.4
500,000	1	2.7
1,000,000	17	45.9
1,500,000	2	5.4
Total	37	100.0
Mean	900,870	
Median	1,000,000	

Table 62. Initiatives taken by chairpersons/managers

Outcomes	Frequency	Percent
Regularize and increment in savings	26	70.3
Distribution of subsidized fertilizers and seeds	27	73.0
Increment in the capital share	10	27.0
Increment in savings and loan investment	1	2.7
Promote organic production	1	2.7

When chairpersons/managers were asked their initiatives towards the outcomes achieved by the cooperatives, most of them reported increased membership savings and distribution of subsidized fertilizers and seeds to members. Half of the cooperatives have membership savings of around 100 million Nepalese Rupees (NPR) due to the increased membership by inviting families of other locations within village and some cooperatives even approached to border villages. Some cooperatives even borrowed funds from government-supported financial institutions at a 5 percent interest rate and lend to members in different sectors. Agricultural cooperatives appear to be focused on financial services like saving and credit activities instead of agriculture production and marketing. When the reasons behind it were asked to them, most of them said the Nepalese government has not focused on the development of the agricultural sector through cooperatives. There are many problems in the agricultural sector; therefore, as noted above, it takes time for cooperatives to engage in agricultural production and marketing commercially.

They further reported they could not cover overhead office costs if they did not focus on financial services. They indicated that financial services subsidized any development expenditures on agricultural technology and infrastructure development, such as improved variety of cereals and vegetables, collection centers, storage house, tractor, irrigation canal, market information system, etc. Cooperatives are just lending the agricultural loans to members, and very few members are taking agricultural loans. Some of the cooperatives were even thinking of converting their cooperatives into saving and credit cooperatives if the government would not support and execute the development of agricultural cooperatives. We heard that the government is amending the cooperative regulation, agricultural cooperatives must do at least 30 percent of their total business transactions in agriculture. If the government does so without prior investigation and allowing for public comment, it will hinder the development of agricultural cooperatives and the agriculture sector rather than their development.

Respondents reported they build up linkages to various government and non-government agencies to receive grants and subsidies. More than half of the cooperatives are retailing subsidized fertilizers to farmers. Indeed, Nepal does not have mineral fertilizer production, and its demand is met by import. Krishi Samagri Company Limited (KSCL), the government-owned company, handles the procurement and distribution of the subsidized fertilizers. After the reestablishment of subsidy policy in 2009, KSCL only met 20 percent of national fertilizer demand (NEAT, 2012). KSCL administers cooperatives

for retailing fertilizers, and currently, 13,175 cooperatives are involved in retailing fertilizer across the country (KSCL, 2020). Many cooperatives receive a one-time grant up to 500,000 NPR from central and local government agencies under the headings of institutional development. Most cooperatives receive free seed for vegetables and rice, although the amount is small compared to its demand. Likewise, cooperatives would get a 70 percent cost subsidy to buy threshing machines, rice harvesters, grinding mills, etc., - up to 300,000 NPR if they need and approach to the providers – GOs/N. Most of the cooperatives utilize this cost subsidy scheme.

Use of weight sample to compare members and non-members

This study interviewed 573 households, including 200 cooperative members and 372 non-members from 27 villages of the Chitwan district on Nepal. Apart from the household survey, this study purposively carried out a Key Informants Interview (KII) with 37 chairpersons/managers of agricultural cooperatives to validate the information collected through the household survey. This study uses the weighted sample for 26 villages to reflect population estimates and allows us to compare them with estimates from our samples. We could not get responses for non-members from one village, so this study excludes that village, so that the weighted sample reflects the population-level more precisely.

Table 63. The social background of the families in the total population represented by the sample weight

Ethnicity	non-member	percent	member	percent	total	percent
Hill Brahman	106623	37.2	16209	61.7	122832	39.2
Chhetri	45906	16.1	3176	12.1	49081	15.7
Indigenous/ethnic	74813	26.1	6368	24.2	81181	25.9
Dalit	54549	19.0	318	1.2	54867	17.5
Madhesi	0	0	220	0.8	220	0.1
Mixed	4791	1.6	0	0.0	4791	1.5
Total	286681	100	26291	100.0	312972	100.0

Table 63 describes the social background of the families in the total population represented by the sample. Hill Brahman is the most common caste in the overall population represented by the sample, and their proportion among members is almost double of non-members. Indigenous/ethnic groups are similarly represented among both members and non-members. Dalit is the third largest group among non- members, but the Chhetri caste is the third largest group in members. Dalits were previously excluded from mainstream politics, as noted above, limiting access to agricultural cooperatives. Overall, the proportion of social background for members and non-members is similar for the sampled families and the total population represented by the sample.

Table 64. The main occupation of the surveyed families in total population

Main occupation	Non-member	Percent	Member	Percent	Total	Percent
Crop farming	47517	16.6	7623	29.0	55140	17.6
Livestock farming	25806	9.0	3041	11.6	28847	9.2
Poultry	3438	1.2	0	0.0	3438	1.1
Own a business	34376	12.0	3485	13.3	37861	12.1
Regular Jobs	65908	23.0	5077	19.3	70985	22.7
Daily wages	31329	10.9	364	1.4	31693	10.1
Job abroad	77160	26.9	6647	25.3	83807	26.8
Others	1147	0.4	54	0.2	1201	0.38
Total	286681	100.0	26291	100.0	312972	100.0

Table 64 describes the distribution of the main occupation among the total population represented by the sample. The proportion of the total population involved in crop farming is the largest category for members, while a job abroad is the most common category for non-members. The proportion of the total population with jobs abroad is comparatively higher among non-members than members. Overall, the proportion in different occupation categories for members and non-members is similar between the sampled families (unweighted) and the total population represented by those sampled families (weighted).

Table 65. Education of the family-head who made farm decisions in total population

Education	Non-member	Percent	Member	Percent	Total	Percent
Illiterate	46471	16.2	2048	7.8	48519	15.5
1	69375	24.2	4876	18.5	74251	23.7
2 to 4	22490	7.8	109	0.4	22599	7.2
5	23761	8.3	1966	7.5	25727	8.2
6 to 9	38590	13.5	3490	13.3	42080	13.4
10 to 11	50214	17.5	8183	31.1	58397	18.7
12	22802	8.0	3411	13.0	26213	8.4
13 to 18	12978	4.5	2208	8.4	15186	4.9
Total	286681	100.0	26291	100.0	312972	100.0
Mean	5.4		7.6		5.6	
Sd	4.8		4.7		4.8	

Table 65 tabulates the educational attainment of the family head among the total population. Education is a prime factor for the overall growth and development of a human being. The capability and ability of the families to make an informed decision may be severely constrained by education. The average level of education is comparatively lower for non-members than members as in the surveyed families. Almost 17 percent of non-members are illiterate in comparison to 8 percent of members. The illiterate proportion for non-members and members among the total population is slightly higher than the surveyed families. Still, the average years of education differ by less than one year between surveyed

families and the total population. Overall, the difference in the level of education for members and non-members (averaging over two years) is very similar for the sampled families and the population represented by those sampled families.

Table 66. Land distribution among total population in hectares

Land size	Non-member	Percent	Member	Percent	Total	Percent
No land	5807	2.0	0	0.0	5807	1.9
0.1 - 0.49	244664	85.3	15881	60.4	260545	83.2
0.50 - 1	33472	11.7	6884	26.2	40356	12.9
1.1 to 2.7	2738	1.0	3526	13.4	6264	2.0
Total	286681	100.0	26291	100.0	312972	100.0
Mean	0.3		0.5		0.3	
Sd	0.2		0.5		0.3	

The land size reflects the status differentials of the families due to the value and opportunities associated with it. Table 66 describes the land distribution in the total population (weighted sample). The average land size for non-members is the same for the weighted and unweighted samples. Although the average land size for members is slightly bigger for weighted than the unweighted sample (0.5 Vs. 0.4), the overall land size for the weighted sample at 0.3 is smaller than the unweighted sample at 0.4. This could be due to variation in landholdings among members, and most of the member families have smaller landholdings than members' average holdings. The table shows the average land size for

non-members is comparatively smaller than members, even though a few members do not own any land.

Table 67. Economically active labor force (age between 15 – 59 years) in total population

Economically active members	Non-members	Percent	Members	Percent	Total	Percent
1 to 3	155262	54.2	9463	36.0	164725	52.6
4 to 5	112532	39.3	15742	59.9	128274	41.0
6 to 8	17754	6.2	1086	4.1	18840	6.0
> 8	1132	0.4	0	0.0	1132	0.4
Total	286,681	100.0	26291	100.0	312972	100.0
Mean	3.4		3.8		3.5	
Sd	1.3		1.03		1.3	

Table 67 describes the active labor force in a household of the population represented by the sampled families. As noted above, the active labor force is the population of the country aged between 15 and 59 years. Overall, the economically active labor force for members and non-members is very similar for the weighted and unweighted sample. As in the unweighted sample, the largest group of families have fewer than four labor force members in the sample of cooperative non-member, which possibly limits their participation in agricultural cooperatives or community-based organizations. Few families

among cooperative non-members have six or more members of labor force members, and this proportion is comparatively higher for non-members than members. The distribution of active labor force members is more varied for cooperative non-members than members, which can be further verified by the higher standard deviation for non-members than members.

Table 68. The annual household revenue from different sources and the cost of crop farming in total population (in Nepalese Rupees)

Revenue/cost	Non-member		Member		Total	
	Mean	Sd	Mean	Sd	Mean	Sd
HH revenue other than crops/veg	386,844.4	367,106.0	429,796.6	352,999.1	390,452.6	365,932.2
Crop and livestock revenue	187,812.3	139,278.4	336,857.7	392,216.6	200,332.6	179,842.6
Crop and vegetable revenue	90,626.3	99,662.4	223,501.0	323,352.6	101,788.2	138,578.2
Cost of crop farming	84,697.8	96,918.4	168,352.1	196,117.3	91,725.1	111,155.4

Table 68 presents the total annual household earnings from different sources, including farm revenue (crops and vegetables) and the cost for these crops in the overall population represented by the sample. The non-farm household income for non-member

and combined sample are very similar for the unweighted sample and weighted sample. In contrast, the average non-farm income s for members is comparatively higher for the weighted than the unweighted sample (429,796.7 Vs. 394,435.6). In the same way, the average earnings from crop and livestock for members and non-members for weighted and unweighted samples follow the same patterns. Although members have much higher revenue from crop and livestock for the weighted sample than the unweighted sample, the average earnings for the combined sample is lower in the weighted than the unweighted sample (200,332 Vs. 229,697). The cooperative members are weighted relatively less than in the unweighted sample, which could bring down the average in the weighted sample. The crop and vegetable revenue and cost of crop farming for weighted and unweighted samples follow the same pattern as for crop and livestock revenue.

Table 69. Distance to various offered services from the residences in kilometers in total population

Services	Non-member		Member		Total	
	Mean	Sd	Mean	Sd	Mean	Sd
District capital	20.9	11.8	21.9	10.9	21.0	11.7
Motorable road	0.4	0.3	0.1	0.2	0.4	0.3
Agriculture Development Bank	6.4	3.2	6.3	3.4	6.3	3.2
Ag. Cooperatives	1.6	0.8	1.0	0.8	1.5	0.8
Farmers' market	9.2	10.9	8.3	10.0	9.2	10.9

Nearest local market	3.6	1.5	2.8	1.6	3.5	1.5

Table 69 describes how far each household has to travel in kilometers to receive the various services in the total population represented by the sample. The average distance to reach the district capital for non-members is very similar for the weighted and the unweighted samples. In contrast, members' houses for the weighted sample are an additional 1.5 km away from district capital than the unweighted sample. Overall, the distance to a motorable road and a branch of the Agricultural Development Bank (ADB) from the families' residences are very similar for the unweighted and weighted samples. The average distance to agricultural cooperatives and the nearest local market also follows the same pattern as in district capital. But the average distance to a farmers' market from the residence for members and non-members is relatively shorter for the weighted sample than the unweighted sample. The distance differences for members and non-members are nearly 1.5 kilometers between weighted and unweighted samples. Overall, the distance indicators discussed above are similar for the unweighted and weighted samples, albeit with minor differences in some services. These minor differences could be due to differences in sample weight for members and non-members compared to the unweighted sample.

CHAPTER 6

COOPERATIVE DETERMINANTS

Results and Discussion

Table 70. The difference in means of covariates for unweighted and weighted sample

Variables	Unweighted			Weighted		
	Non-member	Member	Difference (P >t)	Non-member	Member	Difference (P >t)
Years of education of family head	5.8	7.8	**0.000**	5.4	7.6	**0.000**
Gender of the family head (1= M)	0.5	0.6	0.401	0.5	0.6	0.131
Main income source (1 = farming)	0.2	0.3	**0.013**	0.2	0.3	**0.035**
Household family size (number)	4.7	4.9	0.019	4.6	5.0	0.023
Active labor force (number)	3.4	3.9	**0.000**	3.4	3.8	**0.002**
Land size in hectares	0.3	0.5	**0.000**	0.3	0.5	**0.001**
Livestock value index (number)	1.4	2.3	**0.049**	1.3	3.2	0.121
Ethnicity of the family (1=general)	0.5	0.7	**0.000**	0.5	0.7	**0.000**
Ethnicity of Neighborhood (1 = Homo)	0.6	0.9	**0.000**	0.6	0.9	**0.000**
Distance to the nearest local market (km)	3.9	2.8	**0.000**	3.6	2.8	**0.003**
Distance to agricultural cooperatives (km)	1.7	0.8	**0.000**	1.6	1.0	**0.007**
Distance to district capital (km)	20.7	20.4	0.736	20.9	21.9	0.577

Agrovets in the village (1=yes)	1.0	1.0	**0.043**	1.0	1.0	0.594
Cooperative collection center in village (1=yes)	0.5	0.6	0.397	0.6	0.5	0.516
Distance to motorable road (km)	0.5	0.1	**0.000**	0.4	0.1	**0.000**
Distance to farmers' market (km)	10.8	9.6	0.323	9.2	8.3	0.310
Any factory/industry in village (1=availability)	0.3	0.4	0.346	0.5	0.4	0.397
Observations	372	200		286,681	26,291	

Note: bold p-value indicates significant differences at a 5 % level

Table 70 describes the mean differences in explanatory variables between cooperative members and non-members in weighted and unweighted samples. The averages of members and non-members are significantly different for nine variables out of seventeen variables in both samples. Two more variables, livestock value index and agrovets in the village, are significantly different in the unweighted sample but not significant in the weighted sample. These differences in the two variables could be due to the differences in sample weight for members and non-members compared to the unweighted sample, as noted above. Overall, the comparison of covariate averages for members and non-members are similar for weighted and unweighted samples, although significance differs for two variables.

Table 71. Correlation matrix among explanatory variables

Variables	EF	GF	MO	HF	AL	EO	EO	LS	LV
Years of education of family head	1.00								
Gender of the family head (1= M)	0.11	1.00							
main occupation (1=farming)	0.00	0.13	1.00						
Household family size (number)	-0.03	0.15	-0.09	1.00					
Active labor force (number)	-0.03	0.13	-0.01	**0.68**	1.00				
Ethnicity of the family (1=general)	0.31	0.09	-0.01	-0.06	-0.02	1.00			
Ethnicity of Neighborhood (1 = Homo)	0.03	0.08	-0.07	0.16	0.20	0.06	1.00		
Land size in hectares	0.20	0.17	0.25	0.21	0.14	0.11	0.20	1.00	
Livestock value index (number)	0.08	0.02	0.07	0.08	0.05	0.05	0.02	0.11	1.00
Distance to agricultural cooperatives (km)	-0.08	-0.01	0.09	-0.04	-0.09	-0.11	-0.08	-0.10	-0.05

Distance to the nearest local market (km)	-0.14	-0.03	0.00	-0.16	-0.17	-0.12	-0.28	-0.14	-0.03
Distance to district capital (km)	-0.06	0.09	-0.02	0.11	0.12	-0.12	0.12	0.05	0.01
Agrovets in the village (1=yes)	0.06	-0.06	0.03	-0.08	-0.02	0.05	-0.07	0.06	0.04
Cooperative collection center in village (1=yes)	0.05	-0.13	0.07	-0.19	-0.10	0.02	-0.42	0.04	0.01
Distance to motorable road (km)	-0.16	-0.05	-0.01	-0.07	-0.09	-0.17	-0.11	0.09	-0.06
Distance to farmers' market (km)	-0.07	0.18	-0.02	0.14	0.10	-0.15	0.19	0.05	-0.02
Any factory/industry in village (1=availability)	0.02	-0.14	-0.01	-0.02	0.01	0.11	0.03	0.03	-0.02
Use of ADB service (yes=1)	0.11	0.03	0.00	0.13	0.11	0.12	0.07	0.17	0.09

Table 72. Correlation matrix among explanatory variables (continue table 71)

Variables	DA	DL	DD	AI	CC	DM	DF	AF	UA
Distance to agricultural cooperatives (km)	1.00								

Distance to the nearest local market (km)	0.15	1.00							
Distance to district capital (km)	0.09	-0.05	1.00						
Agrovets in the village (1=yes)	-0.27	0.02	-0.28	1.00					
Cooperative collection center in village (1=yes)	-0.05	0.27	-0.22	0.21	1.00				
Distance to motorable road (km)	0.17	0.15	0.11	-0.01	-0.06	1.00			
Distance to farmers' market (km)	0.16	-0.03	**0.84**	-0.36	**-0.46**	0.17	1.00		
Any factory/industry in village (1=availability)	0.02	-0.18	-0.13	0.14	0.19	-0.13	0.29	1.00	
Use of ADB service (yes=1)	-0.09	-0.11	-0.06	0.02	-0.19	-0.01	0.05	0.02	1.00

Note: bold correlation coefficient value indicates a correlation between the variables of at least 0.4 in absolute value.

: capital letter in the first row indicates an abbreviated form of variables name, like EF= years of education of family head)

Tables 70 and 71 describe the degree of association among all the explanatory variables that we include in our estimation of cooperative membership and its impact on farm revenue. In general, a correlation coefficient below 0.4 is considered a weak correlation.

However, according to Kozak et al. (2012), we should interpret a correlation coefficient based on the research context rather than its magnitude alone. In some cases, even a small coefficient may reflect an important association between variables. In this study, the correlations between variables measuring active labor force and household family size, between distance to farmers' market and distance to the district capital, and between the farmers' market and having a cooperative collection center in the village are more than 0.4. There is a particularly strong correlation between distance to a farmers' market and distance to the district capital, with a value of 0.84. This relationship is expected as we found that most of the farmers' markets operated within the district capital.

Table 73. An extended model of probit estimation of cooperative membership with all independent variables

Covariates	Coefficient	SE[a]	Marginal effect
Years of education of family head	0.007	0.016	0.001
Gender of the family head (1= M)	-0.268*	0.151	-0.048*
Main occupation (1=farming)	0.473**	0.189	0.084**
Household family size (number)	-0.033	0.080	-0.006
Active labor force (number)	0.060	0.086	0.011
Ethnicity of the family (1=general)	0.339**	0.160	0.060**
Ethnicity of Neighborhood (1 = Homo)	1.222***	0.190	0.217***
Land size in hectares	0.960***	0.288	0.171***

Livestock value index (number)	0.000	0.011	0.000
Distance to agricultural cooperatives (km)	-0.778***	0.106	-0.138***
Distance to the nearest local market (km)	-0.255***	0.052	-0.045***
Distance to district capital (km)	-0.022*	0.012	-0.004*
Agrovets in the village (1=yes)	0.025	0.553	0.005
Cooperative collection center in village (1=yes)	0.935***	0.207	0.166***
Distance to motorable road (km)	-2.939***	0.416	-0.522***
Distance to farmers' market (km)	0.025	0.015	0.004*
Any factory/industry in village (1=availability)	-0.302*	0.171	-0.054*
Use of ADB service (yes=1)	0.481	0.355	0.086
Constant	0.366	0.736	
Observation	572		
Pseudo R-Squared	0.511		

**Denotes significance at 10 %level*
***Denotes significance at 5 % level*
****Denotes significance at 1 % level*
[a] *Standard errors are robust and corrected*

Table 73 presents results from the probit estimation predicting cooperative membership, including all the explanatory variables, 17 variables as noted above in the research design. We have included many explanatory variables to predict the cooperative membership in order to minimize the biases due to unobservable factors that may affect membership. In the initial probit estimation equation, we included four quadratic terms for active labor force, land size, livestock value index, and distance to the nearest local market.

We found none of these squared terms were significant when we ran the probit model, so we dropped all squared terms in the model. Hence, we estimate the probit model of cooperative membership with 18 explanatory variables and report the average marginal effects. Main occupation, the ethnicity of the family, ethnicity of neighborhood, land size, and having a cooperative collection center in the villages each have a positive and significant effect on the probability of becoming cooperative member. For example, on average a one-hectare increase in land ownership increases the likelihood of cooperative membership by 17.1 percentage points. Likewise, families living in homogenous communities are more likely to become cooperative members than families residing in mixed communities, with an increment of 21.7 percentage points. In contrast, distance to an agricultural cooperative, distance to the nearest local market, and distance to a motorable road have negative and significant effects on the probability of cooperative membership.

Table 74. A restrictive model of probit estimation of cooperative membership with limited set of independent variables

Covariates	Coefficient	SE[a]	Marginal effect
Years of education of family head	0.009	0.016	0.002
Gender of the family head (1= M)	-0.189	0.148	-0.034
Household family size (number)	0.002	0.056	0.000
Ethnicity of the family (1=general)	0.338**	0.157	0.062**

Ethnicity of Neighborhood (1 = Homo)	1.102***	0.188	0.201***
Land size in hectares	1.138***	0.263	0.208***
Distance to agricultural cooperatives (km)	-0.765***	0.105	-0.140***
Distance to the nearest local market (km)	-0.254***	0.051	-0.046***
Distance to district capital (km)	-0.005	0.007	-0.001
Agrovets in the village (1=yes)	-0.053	0.547	-0.010
Cooperative collection center in village (1=yes)	0.746***	0.184	0.136***
Distance to motorable road (km)	-2.863***	0.393	-0.522***
Any factory/industry in village (1=availability)	-0.357**	0.169	-0.065**
Constant	0.553	0.737	
Observation	572		
Pseudo R-Squared	0.496		

**Denotes significance at 10 %level*
***Denotes significance at 5 % level*
****Denotes significance at 1 % level*
[a] *Standard errors are robust and corrected*

The inclusion of many variables may cause multicollinearity in the model, which can make it very difficult to get reliable estimates of the coefficients as we get inflated standard errors. Similarly, endogeneity is another concern in causal inference based on regression analysis. We expect that there may be problems associated with unmeasured variables that predict membership, or for variables where the membership influences the variables in question. Variables, active labor force, and distance to farmers' market may have issues due to multicollinearity since they are strongly correlation with other variables,

as we noted above. Whereas the variables, main occupation, livestock value index, distance to farmers' market, and use of ADB services, may suffer from endogeneity in the estimation. We therefore dropped all those variables and estimated the model to compare the results with the earlier specification. Table 74 describes this alternative specification of the model on those independent sets of variables - assuming they are exogenous. We found no changes in the direction and significance of the exogenous variables compared to the earlier model, although there were some minor changes in the standard errors and average marginal effects. The household family size has a positive effect while it is negative in the earlier model, but it was not statistically significant in either case. The value of standard errors and average marginal effects for having a cooperative collection center in the village and the distance to the district capital decreased slightly relative to the previous model. In contrast, the average marginal effect of land size and distance to agricultural cooperatives increased somewhat along with a reduction in standard error. Most of the variables had slightly lower standard errors than the earlier model.

Table 75. A probit estimation predicting cooperative membership with location dummy variables

Covariates	Coefficient	SE[a]	Marginal effect
Years of education of family head	0.015	0.017	0.003
Gender of the family head (1= M)	-0.090	0.169	-0.015
Household family size (number)	0.008	0.065	0.001
Ethnicity of the family (1=general)	0.372**	0.175	0.063**
Ethnicity of Neighborhood (1 = Homo)	1.065***	0.238	0.179***
Land size in hectares	0.983***	0.263	0.166***
Distance to agricultural cooperatives (km)	-0.809***	0.133	-0.136***
Distance to the nearest local market (km)	-0.382***	0.071	-0.064***
Distance to motorable road (km)	-3.197***	0.393	-0.538***
Gardi (omitted dummy)	-	-	-
Piple (1=yes)	0.464	0.525	0.081
Bhandra (1=yes)	0.380	0.445	0.066
Birendranagar (1=yes)	1.085**	0.455	0.197**
Kathar (1=yes)	1.942***	0.697	0.362***
Kumrose (1=yes)	1.271**	0.504	0.234**
Chainpur (1=yes)	1.293***	0.422	0.236***
Khairahani (1=yes)	1.148**	0.500	0.208**
Pithuwa (1=yes)	-0.013	0.487	-0.002

Padampur (1=yes)	1.116***	0.410	0.200***
Jutpani (1=yes)	0.135	0.475	0.023
Mangalpur (1=yes)	0.715	0.489	0.127
Fulbari (1=yes)	1.375**	0.571	0.251**
Sardanagar (1=yes)	0.868*	0.505	0.155*
Gunjanagar (1=yes)	1.246**	0.502	0.227**
Meghauli (1=yes)	1.342***	0.464	0.246***
Sukranagar (1=yes)	2.499***	0.536	0.439***
Parbatipur (1=yes)	1.895***	0.560	0.341***
Jagatpur (1=yes)	0.183	0.486	0.031
Patihani (1=yes)	-0.049	0.522	-0.008
Sibanagar (1=yes)	-0.160	0.424	-0.026
Gitanagar (1=yes)	-0.333	0.387	-0.054
Ayodhyapuri (1=yes)	1.071**	0.461	0.195**
Kalyanpur (1=yes)	1.377***	0.484	0.249***
Bagoda (1=yes)	-0.256	0.648	-0.042
constant	0.391	0.605	
Observation	545		
Pseudo R-Squared	0.534		

**Denotes significance at 10 %level*
***Denotes significance at 5 % level*
****Denotes significance at 1 % level*
[a] *Standard errors are robust and corrected*

Table 75 presents the probit estimation predicting cooperative membership with independent variables, controlling 24 village dummy variables representing 25 villages. As noted above, this study surveyed families from 27 villages of the Chitwan district, but we estimated the prediction of cooperative membership with only 25 villages. We dropped two villages, Bachhauli and Dibyanagar, because the Bachhauli and Dibyanagar village sample do not have any observations of cooperative non-member and members respectively. The model still showed collinearity when we ran the model dropping Bachhauli and Dibyanagar villages. We expect the problem of collinearity to be due to the four variables: availability of a cooperative collection center in the village, availability of agrovets in the village, distance to district capital from families' residence, and availability of industry in the village. The services attributed in these variables are commonly shared by the families in a given village, as noted above, which causes collinearity in the estimation when village dummies are included.

Therefore, we estimated the model dropping those four variables, which finally produced the results without collinearity in estimation. We found no observed changes in the direction and significance of the variables specified in the restrictive model. There were some minor changes in the standard errors and average marginal effects for most of the variables, although the average marginal effects for land size decreased substantially. The average marginal value for the household’s land holdings decreased by almost 5 percentage points relative to the previous specification. Village is important as a predictor of

cooperative membership, and it turns out that land size differs across villages. The results imply that, to some degree even a small landholder is likely to join a cooperative along with big landholders in locations with mostly large landholders. Most of the location dummy variables had a positive and statistically significant effect on cooperative membership compared to the Gardi village. In particular, families living in 11 villages are more likely to become members of cooperatives by more than 20 percentage points than the Gardi village. In contrast, families residing in five villages are less likely to become members of a cooperative, but the difference is less than 6 percentage points compared to Gardi village.

Table 76. A extended model of probit estimation of cooperative membership with all independent variables in the weighted sample

Covariates	Coefficient	SE[b]	Marginal effect
Years of education of family head	0.017	0.019	0.002
Gender of the family head (1= M)	-0.062	0.163	-0.006
Main occupation (1=farming)	0.638***	0.135	0.060***
Household family size (number)	-0.056	0.087	-0.005
Active labor force (number)	0.118	0.096	0.011
Ethnicity of the family (1=general)	0.206	0.244	0.019
Ethnicity of Neighborhood (1 = Homo)	1.063***	0.242	0.100***

Land size in hectares	1.079***	0.378	0.102***
Livestock value index (number)	0.014	0.012	0.001
Distance to agricultural cooperatives (km)	-0.578**	0.262	-0.054**
Distance to the nearest local market (km)	-0.200***	0.061	-0.019***
Distance to district capital (km)	0.003	0.017	0.000
Agrovets in the village (1=yes)	-0.523	0.760	-0.049
Cooperative collection center in village (1=yes)	0.544*	0.279	0.051*
Distance to motorable road (km)	-2.927***	0.426	-0.276***
Distance to farmers' market (km)	-0.020	0.021	-0.002
Any factory/industry in village (1=availability)	-0.431***	0.153	-0.041**
Use of ADB service (yes=1)	0.419	0.346	0.039
Constant	-0.543	0.900	
Observation	565		
Population size	312972		

**Denotes significance at 10 %level*
***Denotes significance at 5 % level*
****Denotes significance at 1 % level*
[b] *Standard errors are linearized and corrected*

Table 76 presents results for the probit estimation model predicting cooperative membership with all explanatory variables in the weighted sample, which we compare with the same specification estimated for the unweighted sample (Table 73). We found no observed changes in the direction and significance of the variables compared to unweighted specifications. However, we observe changes in the average marginal value of some

variables and we note that standard errors have increased slightly for most of the variables. Average marginal effects decreased for most of the variables, and the reduction is substantial for five variables compared to the specification of the unweighted sample. Those five variables are land size in hectares, distance to a agriculture cooperative from familiy's residence, the ethnicity of the neighborhood, availability of a cooperative collection center in the village, and distance to a motorable road from the family's residence. The average marginal effects for an additional hectare in land size decreased from 17.1 percentage points in the unweighted sample to 10.2 in the weighted sample. Likewise, the effect for distance to a motorable road from a family's residence decreased from 52.2 to 27.6 percentage points; this was the largest reduction in terms of percentage points. However, the largest proportional reduction was in the availability of a cooperative collection center, which decreased from 16.6 to 5.1 (almost 70 percent). A decline in the marginal propensity is expected in the weighted sample because the proportion of cooperative members is substantially lower in the weighted sample compared to the unweighted sample. This is because we have oversampled cooperative members in the weighted sample compared to the unweighted sample.

Table 77. A restrictive model of probit estimation of cooperative membership with a limited set of independent variables

Covariates	Coefficient	SE[b]	Marginal effect

Years of education of family head	0.017	0.018	0.002
Gender of the family head (1= M)	-0.044	0.157	-0.004
Household family size (number)	0.025	0.040	0.002
Ethnicity of the family (1=general)	0.188	0.270	0.019
Ethnicity of Neighborhood (1 = Homo)	0.912***	0.239	0.090***
Land size in hectares	1.249***	0.324	0.123***
Distance to agricultural cooperatives (km)	-0.593**	0.263	-0.058**
Distance to the nearest local market (km)	-0.188***	0.065	-0.019***
Distance to district capital (km)	-0.007	0.008	-0.001
Agrovets in the village (1=yes)	-0.185	0.697	-0.018
Cooperative collection center in village (1=yes)	0.582***	0.187	0.057**
Distance to motorable road (km)	-2.564***	0.390	-0.253***
Any factory/industry in village (1=availability)	-0.371**	0.173	-0.037**
Constant	-0.680	0.870	
Observation	565		
Population size	312972		

**Denotes significance at 10 %level*
***Denotes significance at 5 % level*
****Denotes significance at 1 % level*
[b]*Standard errors are linearized and corrected*

Table 77 presents results from the probit estimation predicting cooperative membership on a more limited set of independent variables allowing comparison with the earlier model fitted on the unweighted sample (Table 74). As in the case of Table 76, Table

77 follows the same pattern as the earlier table. Variable coefficients display substantial reductions in just the same way as we observed in the previous Table 76.

Table 78. A probit estimation of cooperative membership with location dummy variables in the weighted sample

Covariates	Coefficient	Std. Err.	Marginal
Years of education of family head	0.020	0.020	0.002
Gender of the family head (1= M)	0.143	0.165	0.013
Household family size (number)	0.049	0.045	0.004
Ethnicity of the family (1=general)	0.338	0.354	0.031
Ethnicity of Neighborhood (1 = Homo)	0.870*	0.429	0.079*
Land size in hectares	1.239***	0.352	0.112***
Distance to agricultural cooperatives (km)	-0.677	0.431	-0.061*
Distance to the nearest local market (km)	-0.352***	0.102	-0.032***
Distance to motorable road (km)	-3.020***	0.481	-0.274***
Gardi (omitted dummy)			
Piple (1=yes)	0.525	0.476	0.056
Bhandra (1=yes)	0.369	0.485	0.038
Birendranagar (1=yes)	1.537***	0.474	0.219**
Kathar (1=yes)	1.232**	0.591	0.167
Kumrose (1=yes)	1.576***	0.461	0.234**

Chainpur (1=yes)	1.316***	0.337	0.183***
Khairahani (1=yes)	0.885***	0.191	0.106***
Pithuwa (1=yes)	0.106	0.450	0.010
Padampur (1=yes)	1.240***	0.317	0.166***
Jutpani (1=yes)	0.096	0.436	0.009
Mangalpur (1=yes)	-1.070**	0.487	-0.063***
Fulbari (1=yes)	0.184	0.624	0.018
Sardanagar (1=yes)	-0.688	0.751	-0.047
Gunjanagar (1=yes)	0.892	0.662	0.109
Meghauli (1=yes)	1.392**	0.650	0.195
Sukranagar (1=yes)	2.630***	0.779	0.458**
Parbatipur (1=yes)	1.493**	0.633	0.220*
Jagatpur (1=yes)	-0.001	0.704	0.000
Patihani (1=yes)	0.110	0.364	0.010
Sibanagar (1=yes)	0.342	0.367	0.035
Gitanagar (1=yes)	-0.048	0.182	-0.004
Ayodhyapuri (1=yes)	1.038**	0.452	0.134*
Kalyanpur (1=yes)	1.298***	0.357	0.182**
Bagoda (1=yes)	-0.839**	0.348	-0.054***
constant	-1.124	1.100	

Observation	545		
Population size	304638		

**Denotes significance at 10 %level*
***Denotes significance at 5 % level*
****Denotes significance at 1 % level*
[b] *Standard errors are linearized and corrected*

Table 78 presents results from the probit estimation predicting cooperative membership with village dummy variables in the weighted sample, allowing comparison with the same specification of the unweighted sample (Table 75). As in Tables 76 and 77, this specification follows the same pattern for the independent variable coefficients, with two exceptions. First, the coefficient for gender of the family head changed from negative to positive, although it is not statistically significant in either table. Dummy variables for village do appear to change somewhat. Standard errors increased in half of the village dummies, and there were changes in the direction and significance level of average marginal effects. Five village dummies changed signs while seven village dummies changed significance levels. Among seven village dummies, five village coefficients changed from significant in the unweighted sample to insignificant in the weighted sample. This variation in coefficients of village dummies compare to unweighted sample may be the result of differences in sample weightage among villages. We observed reduced average marginal effects for most of the village dummies, though some of the coefficients increased, and few remain the same. The largest reduction was found in the Mangalpur dummy, which decreased from 0.127 to – 0.063.

Discussion of determinants of cooperative membership

The literature identifies some key factors, such as land size, market access, education, gender, non-farm income, access to credit, ethnicity/race of the community, and membership in other groups/organizations, which influence cooperative membership. There are mixed findings on some of those determinants: land size, education, gender, market access, non-farm income, and membership in other groups/associations. Some studies find these factors increased the likelihood of being members of cooperatives while others identified the opposite. This mixed finding may be due to the crop types, local context, types of cooperatives, and research design differences.

This study presents results predicting cooperative membership with all the variables noted above except membership in other organizations, position in other organizations, and non-farm income. We omitted these measures because we were concerned that the measures could be influenced by cooperative membership, causing coefficients to be biased. For example, differences in membership in other organizations between cooperative members and non-members could partly be a reflection of selection, as could executive positions in other organizations. We are also concerned about similar problems for non-farm income, as it may be influenced by cooperative membership. Therefore, we did not include these variables in the probit estimation. We added other variables due to their applicability in the Nepalese context. These additional variables are the main occupation of the household head, active labor force size, an index of livestock value,

availability of an agrovet in the village, distance to a farmers' market, availability of any industry in the village, and 24 village dummies.

Land size

Our results from the probit estimation predicting the effect of land size on cooperative membership are different from the findings of Fischer and Qaim (2011) in Kenya, and Bernard and Spielman (2009) in Ethiopia. In their work, like ours, smallholders are less likely to join the agricultural cooperatives than middle-size farmers, but, in contrast to our results, large landholders are also less likely to join cooperatives. The exception is that larger farmers are likely to join cooperatives if they are involved in cash crops like watermelon, sugarcane, cotton, oilseeds, etc. In general, cash crops are agricultural crops grown for direct sale – easily marketable, rather than household consumption and livestock feed. Studies by Ebrahim (2000) and Birthal et al. (2007) in south Gujrat, India and Ito et al. (2012) in China argue that the cooperatives that focus on cash crops are not suited to the smallholders since these cash crops require large land size to get economies of scale in production. Hence, large farmers are more likely to join cash crop cooperatives.

Contrary to the findings in Kenya and Ethiopia, we found that smallholders are less likely to be the members of agricultural cooperatives than middle-sized and large farmers. On average, a one-hectare increase in land ownership increases the likelihood of cooperative membership by 16.4 percentage points (Table 75). We found no deviation for linearity when we ran the probit estimation with the squared term for land size. This

contrast may be due to the differences in land holdings, crop types, and cooperatives' role in the production and marketing of agricultural produce. Studies in Kenya and Ethiopia consider smallholders to have land around 1.5 hectares, but, in our research, on average, surveyed families own only 0.4 hectares of land, close to the district and national average in Nepal. The cooperatives in the Kenyan study involved banana crops and working on production-related services rather than marketing, whereas in the Ethiopian study, the cooperatives are engaged in the marketing of cereal crops produced by their members.

The literature suggests that cooperative membership is influenced by the type of agricultural products, local context, and the cooperatives' services. The majority of the families in our study area have the same cropping pattern, at least three crops a year, consistent with cereal crop-based farming practices in Nepal. In general, families did not grow cash crops (sugarcane, cotton, sunflower) due to small land size and the relatively low prevailing prices for these crops. It seems agricultural cooperatives in our study area provided fewer services compared to Kenya and Ethiopia. Agricultural cooperatives in Nepal did not even provide marketing services, although marketing service appear to be valued by households. Credit and input distribution are the most common services offered by the agricultural cooperatives in Nepal. Hence, differences in the local context, crops, and efficiency of agricultural cooperatives may influence the differences between our findings for the effects of land size and those found in the literature.

Market access

Market access is another key factor that may influence cooperative membership. The literature on market access is mixed, although the literature is not consistent in defining the market and in the way market access is measured. Our results predicting cooperative membership for the nearest local market are the opposite of those of Abate et al. (2014) in Ethiopia and somewhat similar to Zewald et al. (2012) in northern Ethiopia. Abate et al. (2014) found that the likelihood of joining a cooperative increased with the farmers' distance from the local market measured in terms of minutes to reach the market. These farmers are in cereal crop production and own 1.78 hectares on average. The increased probability of membership with the distance to the local market may be because the cooperative reduced their transportation and transaction costs, cost of seeking market information, bargaining, etc.

In Zewald et al. (2012) have a sample of smallholders having an average land area of 0.63 hectares, similar to ours, the probability of joining cooperatives decreases with the distance to the market, but in contrast to our results, the probability increases after a certain distance. In our results, an increase of one kilometer distance to the nearest local market reduces the likelihood of cooperative membership by 6.4 percentage points. We did not find a curvilinear relationship for the nearest local market (Table 75). This contrary result may be due to the difference in defining the market. Unlike our study, Zewald et al. (2012) did not appear to include distance to the local market, and their measure of distance applies

to the main market in the region. In our analysis for Nepal, we also included distance to the main market, the district capital, in the estimation. The district capital does not directly influence the marketing of cereal crops produced by the Nepalese farmers, but it may influence cooperative membership due to its role as an administrative headquarters. In particular, farmers sell mostly cereal crops to the nearest local market. Then, the local trader may sell those products to traders who reside at the district capital. We found there was no significant effect of distance to the district capital in predicting cooperative membership.

Haque et al. (2011) studied 44 brackish water shrimp communities in Bangladesh and found similar findings to ours. The collective shrimp activities decrease with the increase in the distance between the market and the shrimp rearing canal. The authors argue that farmers residing near the market are more likely to be involved in collective action, results similar to ours. In this case, shrimp are a highly perishable commodity, like milk, so being near a market is important. In our case, farmers mainly grow cereal and sell it to traders in the local market. Further, the local market is a meeting and information-sharing point for the farmers, so farmers living nearby local markets are more likely to become members of agricultural cooperatives. Hence, the effect of distance to market on cooperative membership may be influenced by the product and types of market.

Distance to a motorable road

Distance to a motorable road influences cooperative membership because the road provides farmers easy access to the nearest market, collection center, or office of an agricultural cooperative. Some authors, therefore, estimate the effect of road availability in a community on cooperative membership. Zewald et al. (2012) in northern Ethiopia found that the availability of roads in their area increases the likelihood of becoming a member of an agricultural cooperative. Hill et al. (2008) in Uganda found that cooperatives are more likely to exist in less remote communities with road access. In our study, we estimated the effect of distance to the road on membership rather than availability, because the motorable way is available in every village and neighborhood, so the distance is what matters.

Our finding regarding the distance to a motorable road is similar to the study of Abate et al. (2014) involving agricultural marketing cooperatives, although the effect is not statistically significant in their research. We found that distance to a motorable road has a negative and significant effect on cooperative membership. On average, an additional one km increase in distance to the motorable road reduces the likelihood of cooperative membership by 53.8 percentage points. In contrast, in Kenya, Fischer and Qaim (2011) found distance to the paved road has a significant and curvilinear effect on group membership. The probability increases up to a certain distance (6.1 kilometers), then decreases with the distance. The authors studied banana smallholders having 1.5 hectares of land on average and estimated the distance to the paved road because banana collection

centers are located along the paved road. The authors argue that beyond 6.1 kilometers, the cost of transport to the collection center run by cooperatives may exceed the potential gain in price; therefore, it would reduce the probability of joining the cooperative.

Distance to the collection center and to agricultural cooperatives

Distance to the collection center may not influence the membership across the villages in our cases because very few cooperatives established collection centers, and they were not able to offer marketing services. These collection centers closed later due to the inability of cooperatives to operate them. There are a few collection centers near to district headquarters that are operating, and they are providing only vegetable selling stalls on cash rent to individual members. Members who rent booths can collect the produce from anywhere and offer it to consumers as an independent trader. In our studies, only 4 percent of families said that they were using the services of the collection center established by agricultural cooperatives. In our estimation of results presented above, the availability of a collection center has a significant effect on cooperative membership. This measure is collinear with village dummies, so we dropped it in our final estimation predicting cooperative membership controlling 25 village dummies.

Distance to agricultural cooperatives is a key factor in influencing cooperative membership in Nepal. A Nepalese household is less likely to join cooperative by 13.6 percentage points for each additional one kilometer to an agricultural cooperative (Table 75). We found credit availability and subsidized input distribution are the most common

reasons to be members of cooperatives. As we already mentioned, there are very few collection centers established by agricultural cooperatives, and the cooperatives did not provide marketing services. Therefore, distance to an agricultural cooperative may matter significantly in our study. But in the literature, distance to a collection center matters because agricultural cooperatives offer marketing services through collection centers. The collection centers and cooperative offices are operated from the same location/premises.

It appears in the study of Fischer and Qaim (2011) in Kenya that the producer group's collection center and office were in the same place, so the authors did not include cooperative office in their estimation. O'Brien et al. (2013) studied smallholder dairy farmers in Kenya and Uganda and observed milk collection centers and offices were on the same premises. One-fifth of the non-members reported long distance to the milk collection center run by the cooperatives as a reason for not joining the dairy cooperatives. Cooperative may establish collection centers around or at the office to reduce the transaction cost associated with collective meetings, collective marketing, etc. In the literature, collection centers work as a substitute for agricultural cooperatives and even proxy for market access, but our study's case is different.

The ethnicity of the family

In Nepal, the ethnicity of the family and ethnicity of the immediate neighborhood are key determinants that influence cooperative membership. Ethnicity refers to a specific

kind of cultural identity associated with a territory based on a common name, culture, language, and origin (Smith, 1986). There are altogether 126 caste or ethnic groups across the country based on the 2011 census. Chhetri was the largest caste having 16.6 percent of the total population, followed by Hill Brahman with 12 percent, and then followed by other indigenous/ethnic and Dalit castes (CBS, 2012). Hill Brahmin and Chhetri castes are the most dominating castes due to the hierarchal system rooted in the Hindu religious values of purity. Indigenous\Ethnic and Dalit caste were previously excluded from mainstream politics in Nepal so that they may have limited access to agricultural cooperatives.

The ethnicity/caste composition of the surveyed families is roughly similar to that of Nepal. We included the ethnicity of the family as a dummy variable in our estimation and found that the family's ethnicity has significant effect on cooperative membership. Families belonging to Hill Brahmin and the Chhetri castes are 6.3 percentage points more likely to be cooperative members than other castes. Similarly, Ebrahim (2000), in a literature survey of sugar cooperatives in India, argues for policies that facilitate the formation of ethnic homogeneous cooperatives for lower castes focusing collective farming. Indeed, the author reported that large farmers from the dominant castes were members of sugar-processing cooperatives and limited the access of lower castes to these cooperatives. The people from lower castes are poor and smallholders. Even if smallholders have access to those cooperatives, they could not influence the decision-making process either due to their status associated with caste or inadequate wealth.

The ethnicity of the immediate neighborhood

Like the study of La Ferrara (2002) on determinants of group membership in rural Tanzania and the study by Haque et al. (2011) on determinants of collective action in 44 brackish water shrimp communities in Bangladesh, we found a significant effect of homogeneity of ethnicity of the immediate neighborhood on cooperative membership. Farmers living in a homogeneous community are more likely to be members by 17.9 percentage points than mixed (heterogeneity) community. People are more likely to join a group/cooperative that is homogenous because they may have trust with their peer group or caste. Indeed, income inequality and social status are associated with the caste system in Nepal, so we may be observing an effect of economic inequality.

La Ferrara (2002) suggests that people tend to sort into more homogenous groups when income inequality increases. It is arguable that group/cooperatives fit well with ethnic homogeneity because homogeneity increases the level of participation, resolving issues due to their common culture, beliefs, and traditions. Further, Hill Brahman and Chhetri are economically better off than other castes in Nepal. Perhaps, people in other castes believe that they do not have the same access to resources, and the more advantaged members would be likely to benefit through collective action. Therefore, farmers living in mixed communities are less likely to be members of agricultural cooperatives. As we observed in

our study area, Hill Brahman and Chhetri constitute more than half sampled cooperative members.

Education

Education of a family head may influence cooperative membership. Education may enable farmers to access information using different means that would increase their participation in an agricultural cooperative or to access information that allows them to farm independently. Our analysis found that education does not have any significant effect on cooperative membership (Table 14). Overall, results in the literature are inconclusive. Bernard and Spielman (2009) studied grain marketing cooperatives using nationally representative secondary data in Ethiopia and found education significantly increases the likelihood of joining an agricultural cooperative. In this study, farmers were smallholders having an average land of 1.5 hectares. A study by Zewald et al. (2012) in agricultural production cooperatives with a sample of smallholders with an average land of 0.63 hectares also found the same education results in northern Ethiopia. They argue that people having education may understand the benefits of cooperative membership, and therefore they were more likely to join cooperatives.

In contrast, Zheng et al. (2012), in a study of agricultural cooperatives – production and marketing cooperatives – in northern China, found that education has a positive and significant effect on understanding cooperatives' benefits, but that education does not have any significant effect on participation in cooperatives. The authors used a sample size of

819 smallholders having an average land of 1.8 hectares. Likewise, a study by Fischer and Qaim (2011) with a sample of 444 banana growers in Kenya found education does not have any significant effect on joining a producer group. The contrary results of Zheng et al. and Fischer and Qaim may be due to the differences in defining education variables. The authors who found significant effect measured education as a dummy variable - illiterate or literate. Whereas the authors who did not find a significant effect measured education on a one-to-five Likert scale in China, and with a dummy variable in Kenya, with education above primary school identified as literate.

None of the authors measured education as a continuous variable as we did in our study in Nepal as exact grade attended or passed. Similarly, there were differences in the educational level of families involved in these studies. In the study of Zheng et al. (2012) in China, 90 percent of family heads have an educational level of junior middle school or higher, whereas in the study of Fischer and Qaim (2011) in Kenya, 74 percent of family heads finished at least primary school or above. In our study in Nepal, nearly half of the family heads attended middle school, and only 11 percent of family heads were illiterate. Families may have a good understanding of the services provided by the cooperatives due to the level of literacy in Nepal. As mentioned above, the agricultural cooperatives in Nepal did not provide marketing services to the families, though marketing services appear to be valued by households. The widespread knowledge about the shortcomings of cooperatives

to provide marketing services to families may result in an insignificant effect for education in our study in Nepal.

Hence, differences in educational level, the role of the cooperatives, and variable measurement may influence the differences between our findings for the effects of education and those findings in the literature, particularly in China and Kenya.

Gender of the family head

Our analysis in Nepal found that gender of the family head does not have any significant effect on cooperative membership. Similar to our findings in Nepal, Fischer and Qaim (2011) in Kenya found that gender of the family head did not have any significant effect on joining a producer group. The authors argue that banana is women's crop in Kenya, and women were involved in banana growing before the formation of the producer group. Therefore, group membership is not influenced by gender. Likewise, a study by Weinberger (2001) on women's participation in Pakistan found that, although women were less likely to participate in a local association or economic group, gender does not have a significant effect on participation once other factors were controlled. Instead, the author argues that differences by gender in education, empowerment and mutual respect in the locality affect participation. Many female farmers lack the education, knowledge, respect, time, and productive assets to engage in a group in comparison to more educated and wealthier male and female farmers (Baden, 2013; Weinberger and Jutting, 2000).

Similar to the arguments of Weinberger (2001), we found gender is not a contributing factor for joining agricultural cooperatives, once other factors like education, land size, etc. were controlled. We found that females were more likely to be the household representative to the agricultural cooperatives, although males are more likely to be the economic decision-makers in Nepal due to the patriarchal society. Indeed, we found, similar to Fischer and Qaim (2011), that females were engaged in agricultural practices before the formation of agricultural cooperatives, and males may delegate responsibility for selected agricultural activities, so the male may arrange for the female of their household to become a member of an agricultural cooperative. . Therefore, in our study in Nepal, similar to the study of Fischer and Qaim (2011) in Keny, Gender of the household itself is not a key contributing factor influencing the membership.

Household family size

Our results in Nepal predicting the effect of household family size on cooperative membership are similar to findings from Fischer and Qaim (2011) in Kenya, Zheng et al. (2012) in China, Zewald et al. (2012) in northern Ethiopia and Bernard and Spielman (2009) in Ethiopia. We found household family size does not have any significant influence on cooperative membership. In the initial estimation, we included active labor force and a squared term for active labor force along with household family size. We did not find any deviation in linearity for the active labor force, so we dropped the squared variable. When we ran the model with active labor force and household farm size along with other variables

(Table 73), neither variables significantly influence cooperative membership. We were concerned about collinear relationship between the active labor force and household family size, so we dropped the variable active labor force (Table 75). There was a change in the sign of the household size coefficient when we dropped the active labor force measure, although the magnitude of the coefficient in both models is very small and not statistically significant.

Fischer and Qaim (2011) in Kenya and Bernard and Spielman (2009) in Ethiopia estimate a probit model similar to ours with household family size. In contrast, the other two studies estimate and present a model with both variables household family size and a number working in the labor market in a household, and find that both variables did not have any significant influence on cooperative membership. We are concerned that the labor force in the household may reflect participation in a community-based organizations. Therefore the size of the household may influence the membership. But we found that no effects of family size and active labor force on cooperative membership, consistent with the literature.

Credit access

Credit access may be a key factor in influencing cooperative membership because small and poor farmers need continued access to credit for farming and some funds to join cooperatives as a membership fee. In our survey in Nepal, credit provision by cooperatives is the most common reason for joining cooperatives, though the amount of credit provided

varies from cooperative to cooperative. Perotin (2006) studied entry and exit among worker cooperatives and conventional firms in France and found, similar to findings in Nepal, that credit access is a key factor causing people to form/join a cooperative. In Nepal, cooperatives provide credit up to 100,000 Nepalese rupees without collateral, keeping a farmer group at neighborhood level, consisting of 5 – 10 members, as collateral. The Government of Nepal established the Agriculture Development Bank (ADB) to give financial services to cooperatives as a successor to a national cooperative bank. In our study area, there are five branches of ADB. Farmers suggested that this bank has offered agricultural product loans to farmers, and the interest rate is lower than other commercial banks. Most commercial banks are unwilling to give agricultural produce loans to farmers due to the risk involved in the agricultural sector.

We are concerned that the variable identifying use of ADB credit may suffer from endogenity problems in estimation. So, in our final estimation, we dropped this variable (Table 75). We estimated the effect of the use of ADB service on cooperative membership in earlier estimation and found that the use of ADB service did not have a significant influence on cooperative membership. This insignificant effect may be due to the low number of surveyed people using ADB loans. Only 7 percent of surveyed families used ADB loans. This low rate of borrowing may be due to the availability of several formal and informal financial institutions such as rural banks, cooperative banks, saving and credit cooperatives, agricultural cooperatives, credit and saving mobilization groups, etc. in the

area. Many families, including key informants, suggested that these institutions were offering loans at lower interest rates compared to commercial banks and the ADB.

Zewald et al. (2012) in northern Ethiopia found that the likelihood of Ethiopian farmers joining agricultural cooperatives decreased when farmers had easy access to alternative credit through financial institutions, although the authors did not discuss the credit limits and interest rates of cooperatives and alternative institutions. Many authors argue that large farmers might not join agricultural cooperatives because of the low level of credit available through agricultural cooperatives (Cook, 1996; Wollni& Zeller, 2007; Mensah et al., 2012). In contrast to the findings of Zewlad et al. (2012), Fischer and Qaim (2011) in Kenya found that availability of alternative credit significantly increases a membership in a group. The authors argue that small and poor farmers need higher investment in banana cultivation due to the cost of tissue culture plantlets. Producer group in Kenya did not have a provision of credit to their members. So, if they have access to alternative credit, they are more likely to join the banana producer groups.

Agricultural cooperatives provide credit to their members though the amount of credit varies. The literature has different findings than our results in Nepal. This difference may be due to the credit services provided by agricultural cooperatives in Nepal.

Availability of factory/ industry in villages

Farmers who are engaged in other non-farm employment activities may be less likely to join agricultural cooperatives. It is likely that farmers would assess the time and price gain in agricultural cooperatives compared to other employment opportunities when they decide to join cooperatives. Zewald et al. (2012) and Abate et al. (2014), studying agricultural cooperatives in Ethiopia, find that farmers engaged in alternative employment are less likely to join cooperatives. They argue that farmers were earning more income than what they would gain from cooperative membership, and they have less time for cooperatives due to their engagement in non-farm employment activities.

Our analysis in Nepal, similar to their results, finds that the availability of any factory/industry in a village significantly reduces the likelihood of being a cooperative member by 6.5 percentage points (Table 13). In Nepal, approximately 35 percent of surveyed families report a factory/industry's availability in their villages. Those industries include grain processing/milling, mineral water processing, cooking-gas distribution, plastic appliance manufacture, etc. These factories/industries offer daily wages to approximately 10 to 15 persons in the surrounding area of 2 to 3 villages.

The proportion of families reporting availability of an industry or factory is slightly higher for members compared to non-members (37 Vs. 33.1). This slight difference may reflect the engagement of more member families from some particular villages closer to a farmers' market in alternative employment opportunities compared to non-members. We

found a correlation value of 0.29 between availability of any industry/factory and farmers' market, a greater correlation than between industry/factory and any other variable. We expected this higher value because most industries/factories and the farmers' markets operated closer to the district capital. This correlation was further verified in our restrictive model estimated with a subset of independent variables. When we dropped farmers' market along with other problematic variables in our restrictive model, the coefficient for the availability of industry/factory changed from -0.054 to -0.065 and is statistically significant at the 5 percent level, as compared to 10 percent in the earlier model.

As we discussed above, the proportion of families reporting the availability of industry/ factory is slightly higher for members compared to non-members. This higher proportion among members implies that the availability of any industry or factory in a village could *increase* the probability of cooperative membership, though we found the opposite finding in our models. To identify the zero-order relationship be ran the model with one independent variable, the availability of any factory/ industry in a village. As expected, the availability of any industry or factory in a village increases the probability of cooperative membership, and the difference is 3.9 percentage points, although it is not statistically significant.

We ran various models to determine which control variables cause the coefficient of industry/factory predicting cooperative membership to switch from positive to negative in our final specification. We found that two control variables, the distance to the nearest

local market and the distance to a motorable road, switch the coefficient from positive to negative. When we estimated the effect controlling distance to the nearest local market, the coefficient for the availability of any industry/factory changed from 0.039 to – 0.014 and when we controlled for the distance to a motorable road, the coefficient changed from 0.039 to – 0.012. When both are controlled, the coefficient is -0.054. This indicates that families living in a village with any factory/industry and living in equal distances to the nearest local market and a motorable road, were less likely to be a member of agricultural cooperatives.

Indeed, we included the availability of any factory/industry in the village in our earlier models (extended and restrictive), but the variable's coefficient was not identified when we ran the model with village dummies. In our study area in Nepal, the availability of factory/industry in a village was shared by the families in a village, which causes collinearity in the estimation with village dummies. In contrast, Fischer and Qaim (2011), studying small-scale banana growers in Kenya, found that the probability of becoming a member of producer organizations increased significantly if they were engaged in non-farm self-employment activities. Probably they were earning less than what they would gain from collective action. There is a growing demand for bananas in Kenya due to urbanization, a growing middle class, and supermarkets' expansion in the past few years (Fischer & Qaim, 2011). Due to that, farmers might join the producer organization to get technical knowledge and inputs such as tissue culture seedlings, fertilizers, etc.

Overall findings suggest that the effect of alternative employment opportunities on cooperative membership is significant and negative, although the pattern may differ if farmers involved in collective action could earn more through their farming than their through involvement in alternative employment opportunities.

Distance to a farmers' market

The literature uses a variety of proxy variables for market access. Authors like Haque et al. (2011) in Bangladesh, Zewald et al. (2012) in northern Ethiopia, and Abate et al. (2014) in Ethiopia use distance to the market as a proxy while other authors, Fischer and Qaim (2011) in Kenya and O'Brien et al. (2013) in Kenya and Uganda, use distance to the collection center. Distance to farmers' markets may influence membership, but none of the studies discussed farmers' markets. In their studies, farmers' markets may not exist, but they could be a proxy for market access in Nepal, and could influence cooperative membership. We included this variable along with the distance to the district capital and to the nearest local market in our models.

The Farmers' markets are temporary markets managed and operated by farmers themselves to sell their fresh products under a temporary shelter. In Chitwan, most farmers' markets operate twice a week for limited hours targeting nearby customers. Farmers mostly sell vegetables, milk, ghee, eggs, and locally made handicrafts in the market. Farmers generally practice this mode of marketing to increase their profit margins. In our initial estimation in Nepal, we found no significant effect of distance to farmers' markets in

predicting cooperative membership (Table 73). Overall, surveyed families have to travel an average of 10.3 kilometers to reach a farmers' market.

This failure to find an effect of distance to a farmers' market may be due to the operation of farmers' markets close to the district capital. We were concerned about the collinear relationship between distance to a farmers' market and distance to the district capital. We estimated the correlation between those two variables and found a strong correlation with a value of 0.84. Therefore, we dropped distance to a farmers' market in our restrictive model (Table 74) and found minor changes in the marginal effects for distance to the district capital from 0.004 to 0.001, but no changes in the coefficient's direction or significance level. In our final estimation (Table 75), we also dropped the variable distance to the district capital because this variable was collinear with the village dummies.

Our conclusion is that there is no significant influence of distance to a farmers' market on cooperative membership. Farmers mainly sell fresh vegetable produce at farmers' markets, and most farmers' markets are near the district capital. Therefore, farmers' markets may not influence the cooperative membership.

Total Livestock Units (TLU)

The number of livestock owned by the household may influence cooperative membership. If farmers raise more livestock, including milk cows and buffalos, they may

have higher opportunity costs of participating in an agricultural crop cooperative, or they may join dairy cooperatives, rather than agricultural crop cooperatives (the focus of our study), due to dairy cooperatives' services. Basu and Chakrabotry (2008), in a survey study of dairy cooperatives in Gujrat, India, found that the number of dairy cows and buffalos significantly increased the probability of joining dairy cooperatives. As we discussed in detail earlier, almost all farm families keep some livestock in Nepal, but the types and numbers of livestock vary from family to family.

We converted the number of livestock raised by a family into a single unit for estimation purposes – using the conversion coefficient for each type of livestock as given in FAO (2020). Similar to the findings of Zewald et al. (2012) in northern Ethiopia and Abate et al. (2014) in Ethiopia, we found total livestock units did not have any significant effect on cooperative membership (Table 12). We found no deviation from linearity when we ran the model with a squared term for a TLU, so we estimated the model dropping the squared term (Table 73). We, however, were concerned with endogeneity problems for TLU in estimation because cooperative membership may influence the decision to raise livestock for a member through collective activities. Therefore, in our final specification, we dropped the variable TLU and estimated the model with a limited set of independent variables (Table 74).

The two Ethiopian studies referenced above both used the number of oxen and the total livestock unit (TLU) because oxen power is a key resource for plowing agricultural

land in Ethiopia (Chanie et al., 2012). They found the number of oxen significantly increased the probability of cooperative membership, though it was significant only at the 10 percent level in the study of Zewald et al. (2012). Zewald et al. (2012) also discussed the endogeneity problems associated with the number of livestock, but Abate et al. (2014) did not discuss it. In our study area in Nepal, animal power is not used to plow fields. Farmers usually use a rented tractor to plow the field due to cost instead of oxen. The most common livestock in our study area in Nepal are cows, buffalos, goats, sheep, pigs, and poultry. The majority of the families keep more cows than buffaloes, as they earn income by selling the milk on the market.

In our study, though nearly 12 percent of surveyed families reported livestock farming as their primary occupation, none of them keep more than ten cows, three buffalo, or 15 goats. This small number of livestock owned by surveyed families may be the reason there are no significant effects of the TLU on cooperative membership.

Main occupation

We may expect that farmers engaging in farming as the main occupation and experienced farmers are more likely to join agricultural cooperatives. Experienced farmers have experienced the risk associated with the production and marketing of agricultural produce and thereby may be more likely to join an agricultural cooperative. However, in our study in Nepal, only one-third of the surveyed families reported agriculture as their main occupation. Most of the surveyed families had been engaged in subsistence

agriculture for a long time due to inheritance of the land. Therefore, we included the variable main occupation instead of farm experience in our models.

We found that the main occupation (coded as a dummy for farming as the main occupation) has significantly increased the likelihood of being a cooperative membership by 8.4 percentage points (Table 73). After agriculture, jobs abroad was the largest main occupation, with 25 percent of surveyed families. Job abroad may be only option among these families due to small land size otherwise many families could be engaged in agriculture as a main occupation. We were concerned that the variable main occupation may suffer from endogeneity problems in the estimation, so we dropped this variable in our restrictive model, which we fitted with a limited set of independent variables (Table 74).

There are no studies in the literature that use a variable identifying farming as the main occupation in their estimation. It appears in the literature that most of the surveyed farmers had agriculture as their main occupation. Furthermore, in most studies, farmers were engaged in cash crops like banana, watermelon, coffee, etc. and were more likely to be tied to commercial activities than our farmers. Some studies included farming experience in their estimation, but none of the studies discussed the problem of endogeneity and collinearity. The variable farming experience may have collinear with the education and age of the farmers. Findings suggest that there was a significant effect of the main

occupation as farming in predicting cooperative membership, although the variable may suffer from endogeneity problems.

Availability of agrovets in the village

The availability of agrovets in a village may influence cooperative membership in Nepal. Agrovets are common across the villages of Nepal. Agrovets are private shops that sell agricultural inputs, including pesticides, seeds, fertilizers, animal medicine, vaccinations, etc. Agrovets also provide technical guidance to buyers/farmers on how to use particular inputs. But we found no significant effect of the availability of agrovets in a village in predicting cooperative membership. The presence of agrovets may reflect families' involvement in agricultural practice. Therefore, any cooperative member or outsider may have established agrovets in a village, but it did not have any effect on membership since it is available in almost every village. Hence, the distance to either a nearest local market or an agrovets may matter more than the availability of agrovets in the village. But, in our study area in Nepal, the distance to the nearest market for members and non-members is the same as the distance to an agrovets since the latter usually reside in the local market. So, we included the availability of agrovets in a village instead the distance to an agrovets from a residence of a family.

When we ran the model with twenty-five village dummies, we dropped the variable agrovets because, like any village characteristic, it is be capture by village dummies. The literature did not discuss agrovets. It appears in other studies that cooperatives either

provided the services that the agrovets in Nepal offered, or cooperatives and nearby farmers bought the agricultural inputs from the same market. In practice, distance to the nearest market, distance to a collection center, etc. may have captured the potential effects of Nepal's agrovets.

The effect of the availability of an agrovets in a village did not have any significant effect in predicting cooperative membership. This may be due to its availability in almost every village and its services to everyone on a cost basis.

Summary and Conclusion

In the analysis above, we have identified some key determinants that influence cooperative membership in Nepal, and those determinants are the ethnicity of a family, the ethnicity of a neighborhood, land size, distance to agricultural cooperatives, distance to the nearest local market, and distance to a motorable road. Furthermore, we also have found the availability of a collection center in a village (coded as a dummy for the availability of collection center in a village) and main occupation (coded as a dummy for farming as the main occupation) significantly influence cooperative membership. But we dropped these two variables along with the seven other variables in our final specification because we were concerned that these variables may suffer from endogeneity and collinearity problems, causing coefficients to be biased.

We added some variables in our estimation that were not discussed in the prior literature, the availability of agrovets in the village, distance to a farmers' market, and

availability of any industry/factory in a household's village. Indeed, the literature is not consistent in defining and measuring market access, so we included all the possible proxies that could capture market access, such as distance to the nearest local market, distance to a farmers' market, distance to the district capital, distance to a motorable road, availability of any factory/industry in the village, availability of a collection center in the village, etc. Our results differ from those in the literature in our findings on land size, education, and credit access.

We found, similar to the results of Fischer and Qaim (2011) in Kenya, and Bernard and Spielman (2009) in Ethiopia, that smallholders are less likely to join agricultural cooperatives than middle-size farmers, but, in contrast to their results, we found large landholders are more likely to join cooperatives. In the literature, the exception is that larger farmers are likely to join cooperatives if they are involved in cash crops like watermelon, sugarcane, cotton, etc. (Ebrahim, 2000; Birthal et al., 2007; Ito et al., 2012). These just-referenced studies in India and China argued that cash crop cooperatives are not suited to smallholders since these cash crops require large land size to get economies of scale in production. Studies in Kenya and Ethiopia consider smallholders to have land around 1.5 hectares, but, in our study, surveyed families, on average, own only 0.4 hectares. Surveyed families in our study area did not grow cash crops due to small land size and relatively low prevailing prices for these crops. It seems cooperatives offered fewer services in Nepal compared to Kenya and Ethiopia.

In our study in Nepal, the ethnicity of the family and ethnicity of the immediate neighborhood are key determinants that influence cooperative membership. Hill Brahmin and Chhetri castes are the socially dominant castes in Nepal, and they are more likely to become cooperative members. Ebrahim (2000) in India, reporting results similar to ours, found that lower castes have limited access to cooperatives because they were previously excluded from mainstream development. Even if they have formal access to cooperative membership, they could not influence the decision-making process either due to the status associated with their caste or inadequate wealth. Indeed, income inequality and social status are associated with the caste system in Nepal, so that we may be observing the effect of economic inequality. Consistent our findings, La Ferrara (2002) in rural Tanzania and Haque et al. (2011) in Bangladesh suggested that people are more likely to join a group/cooperative that is homogenous because they may have greater trust in members of their peer group or caste. It is possible that ethnic homogeneity increases the ability to resolve conflict due to common culture and tradition

Distance to the nearest local market, to agricultural cooperatives, and to a motorable road are key factors influencing cooperative membership in Nepal. We tried to include as many proxy variables as possible to capture market access. Similar to our results, Zewald et al. (2012) in Ethiopia and Haque et al. (2011) in Bangladesh, found the probability of joining cooperatives decreases with distance to a market, but we did not find a curvilinear relationship for the nearest local market as in the study of Zewald et al. (2012). One

important difference between our analyses and these studies is that we included three measures of market distance, distance to a farmers' market, distance to a local market, and distance to the main market, whereas other studies only identified distance to the main market. Furthermore, Zewald et al. (2012) studied the cooperatives involved in marketing, while in the study of Bangladesh, families were involved in shrimp collection in a group, and sell the collected product to nearby market independently. Our findings for the effect of the nearest local market is the opposite of Abate et al. (2014) in Ethiopia, although, in their studies, families were larger landholders than ours. Indeed, land size may be associated with household income, so this may cause differences in findings.

Some of the studies estimated the effect of availability of a motorable road on cooperative membership instead of distance to a motorable road, but we ran the model with the distance to a motorable road because the motorable way is available in every village and almost all neighborhoods. Similar to Abate et al. (2014), we found distance to a motorable road has a negative and significant effect on cooperative membership, the opposite conclusion of Fischer and Qaim (2011) in Kenya. However, Fischer and Qaim used distance to the paved road as a proxy variable to measure the service of collection centers since collection centers were located along the paved road. The distance to a collection center may not influence cooperative membership in our case because very few collection centers existed, and cooperatives did not offer marketing services.

We included the availability of a collection center in a village since 5 percent of members used the services of collection centers. We found the availability of a collection center in a village has a positive and significant effect on cooperative membership. Most members who used the collection centers operated vegetable selling booths provided by collection centers on cash rent but members do get some discount on cash rent and provision differs from a cooperative to a cooperative, acting as independent traders, not as cooperative members. In the literature, collection centers work as a substitute for agricultural cooperatives, both operated from the same location and even proxy for market access, but our study's case is different. In our study area in Nepal, distance to an agricultural cooperative matters because collection centers were not established and operated as in the literature, and cooperative members reported credit services are the most common reason to join cooperatives.

We also included distance to a farmers' market, availability of any industry/factory or agrovets in the village as proxy variables to capture market access; none of these variables were discussed in the literature. These three variables did not significantly influence cooperative membership, although we dropped these variables in our final specification with village dummies, since they are collinear with village fixed effects.

We found that have farming as the main occupation has a positive and significant effect in predicting cooperative membership, although we dropped this variable in our final specification due to endogenity concern as cooperative membership may influence family

head's primary occupation. The literature did not discuss this variable. It appears in the literature that most of the surveyed farmers had agriculture as their main occupation and were more likely to be tied to commercial agriculture than our farmers. Some studies included farming experience in their estimation, but none of the studies discussed the problem of endogeneity and collinearity. The variable farming experience may be collinear with the education and age of the farmers. We found, similar to Fischer and Qaim (2011) in Kenya and Zheng et al. (2012) in China, and opposite of Bernard and Spielman (2009) and Zewald et al. (2012) in Ethiopia, that education did not have any significant effect on cooperative membership. None of the studies measured education as a continuous variable, as we did in our study in Nepal. Furthermore, there are differences in educational level.

In our study area, the ability to obtain credit from a cooperative is the most common reason for joining cooperatives, though the amount of credit provided varies from cooperative to cooperative. In Nepal, cooperatives provide credit up to 100,000 Nepalese rupees without collateral, keeping a farmer group at a neighborhood level, consisting of 5 – 10 members, as collateral. The literature found inconclusive and inconsistent results on credit access, although none of the studies discussed details regarding interest rate, loan size, and available alternative credit institutions. That our results are different than theirs may be due to credit services offered by an agricultural cooperative and Agricultural Development Bank (ADB) in Nepal. The use of agricultural development bank loan, as proxy for alternative credit access, did not have a significant effect on cooperative

membership. This insignificant effect may be due to the low number of surveyed people using ADB loans.

In our analysis, we have identified that there are some key determinant such as the ethnicity of a family, the ethnicity of neighborhood, land size, availability of a collection center in the village, and farming as a main occupation that increase the likelihood of joining cooperatives, while variables like distance to an agricultural cooperative, distance to the nearest local market, and distance to a motorable road have negative effects on cooperative membership. Prior literature has mixed findings on land size, education, market access and non-farm employment. We found education did not have any effect on cooperative membership. None of the studies mentioned in the prior literature measured education as a continuous variable as we did in our study in Nepal. There are also differences in the educational level of the families involved in the studies between our study in Nepal and the prior literature. In our study, most families were literate and about half of the family heads attended middle school. Families may have a good understanding of the shortcomings of agricultural cooperatives to offer marketing services to their members due to the level of literacy in Nepal. It appears marketing services are the most demanded services among families due to the inability of farmers to compete with the produce that comes from abroad, particularly from India. This widespread knowledge among families about the shortcomings of cooperatives in marketing services may result in insignificant effects for education in our study in Nepal.

The literature found inconclusive and inconsistent results on credit access, although none of the studies discussed details regarding interest rate, loan size, and available alternative credit institutions. In our study in Nepal, the use of an agricultural development bank loan, as a proxy for alternative credit access, did not have a significant effect on cooperative membership. This insignificant effect may be due to the low number of surveyed people using ADB loans. Furthermore, in our study area, the ability to obtain credit from a cooperative is the most common reason for joining cooperatives, though the amount of credit provided varies from cooperative to cooperative. That our results are not comparable or different than those in the literature may be due to the important role of credit services offered by an agricultural cooperative in Nepal and minimum number of families using Agricultural Development Bank (ADB) loans.

We included three measures of market access, distance to a farmers' market, distance to a local market, and distance to the main market in our analysis, whereas prior studies only identified distance to the main market. In our study, the distance to the nearest local market has negative and significant impact on cooperative membership and the two other measures of market access, distance to a farmers' market and a main market, did not have significant effects on cooperative membership. In our study area, the main market (district capital) does not directly influence the marketing of cereal crops. Farmers usually sell cereal crops and vegetables to the nearest local market; then, the local trader may sell those products to district traders at the main market. There are few farmers' market in our

study area and most of those are near the main market. Therefore, access to farmers' markets or the main market may not influence farm sales or cooperative membership. Determinants such as gender of the family heads, total livestock units (TLU), household family size, and the number of household members active in the labor force did not affect cooperative membership. These findings of no effects are consistent with the literature.

CHAPTER 7

COOPERATIVE MEMBRSHP IMPACT ON INCOME

Results and Discussion

Many studies have found that being a member of a cooperative has a significant and positive impact on income (Bernard et al., 2008; O'Brien et al., 2013; Verhofstadt & Maertens, 2014; Mojo et al., 2017), although prior literature did not use a common measure for the income gain for cooperative members. Many authors directly measure the specific crop-based income gain from cooperative membership and relate the income gain data to poverty reduction or improvement in the lifestyles of households. Some authors measured household income and poverty reduction using an index or poverty reduction percentage. In our study, we measured the impact of agricultural cooperatives on gross income and net income from cereal and vegetable crops because cereal and vegetable crops were the focus of the agricultural cooperatives we studied in Nepal.

Agricultural cooperative membership may have caused the income difference between cooperative members and non-members. In addition, there were other key factors that may have influenced the income difference, such as education of the family head, gender of the family head, family size of the household, ethnicity of the family, ethnicity of the neighborhood, land ownership, and location of the villages. We, therefore, used Propensity Score Matching (PSM) techniques in order to make cooperative members and non-members similar as prior literature used in such a case.

Propensity score is used to matches the cooperative member and nonmember samples, so that there is no significant difference on covariates between matched cooperative members and non-members (Heinrich et al., 2010). In other words, cooperative member families are matched with their similar families that differ only in not being cooperative members.

Table 79. Average propensity score in three models

Category	Extended model				Restrictive model				With village dummies			
	Mean	SD	Max	Min	Mean	SD	Max	Min	Mean	SD	Max	Min
Members	0.71	0.27	0.99	.011	0.70	0.27	1.00	.013	0.73	0.28	1.00	0.017
Non-members	0.15	0.21	0.99	$8.73e^{-24}$	0.16	0.21	0.99	$6.54e^{-24}$	0.15	0.21	0.98	$1.36e^{-30}$
Samples	572 (200 + 372)				572 (200 + 372)				545 (193 + 352)			

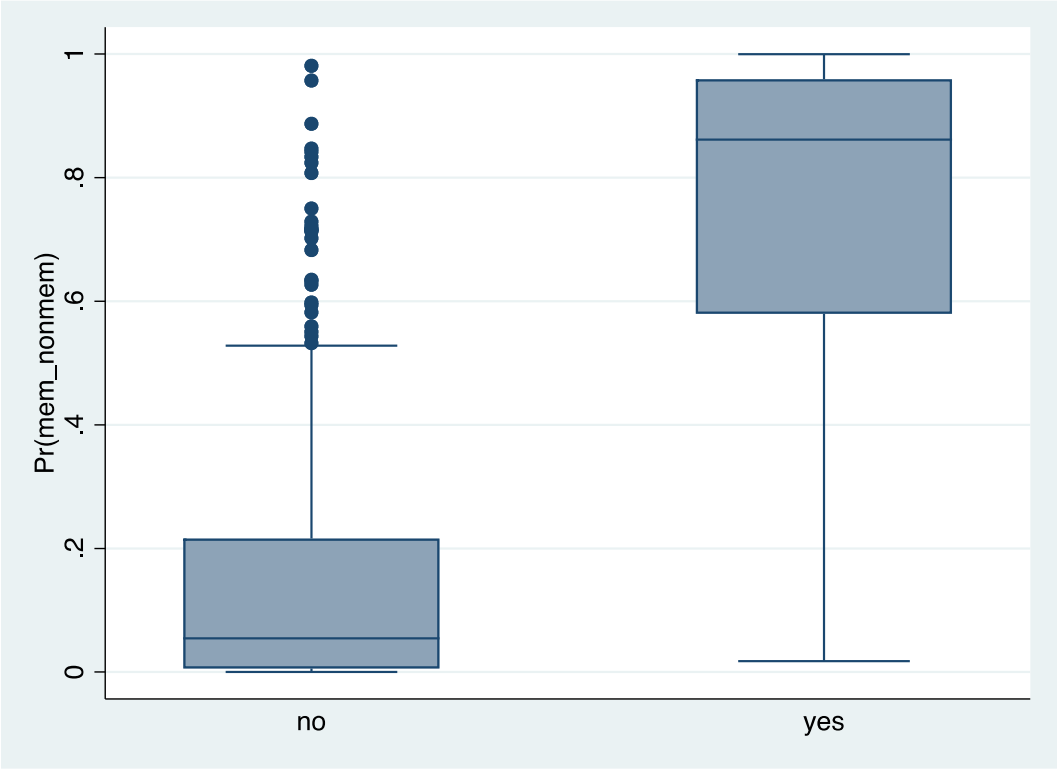
Note: Parenthesis shows sample size of members and non-members respectively

Table 79 presents three propensity score estimation models using three different sets of covariates. These sets of covariates are the same as in earlier probit estimation models, one with all extended variables, a second with a limited set of independent variables and a third with location village dummies. Following the procedure outlined above, we estimated propensity score using these three different sets of variables and we

found similar average propensity score value for cooperative members and similar averages for non-members. The average propensity score value for cooperative members ranges from 0.70 to 0.73 while it ranges from 0.15 to 0.16 for cooperative non-members (Table 79). We observe that the average value for members is much higher than for cooperative non-members. This reflects the difference in covariate values between cooperative members and non-members. Notwithstanding the difference in average propensity score between cooperative members and non-members, the box plot (figure 1) shows that there were many cooperative members and non-members that have similar propensity scores, facilitating matching.

Fig 3.

Box plot of PS score comparing cooperative members and non-members with village dummies



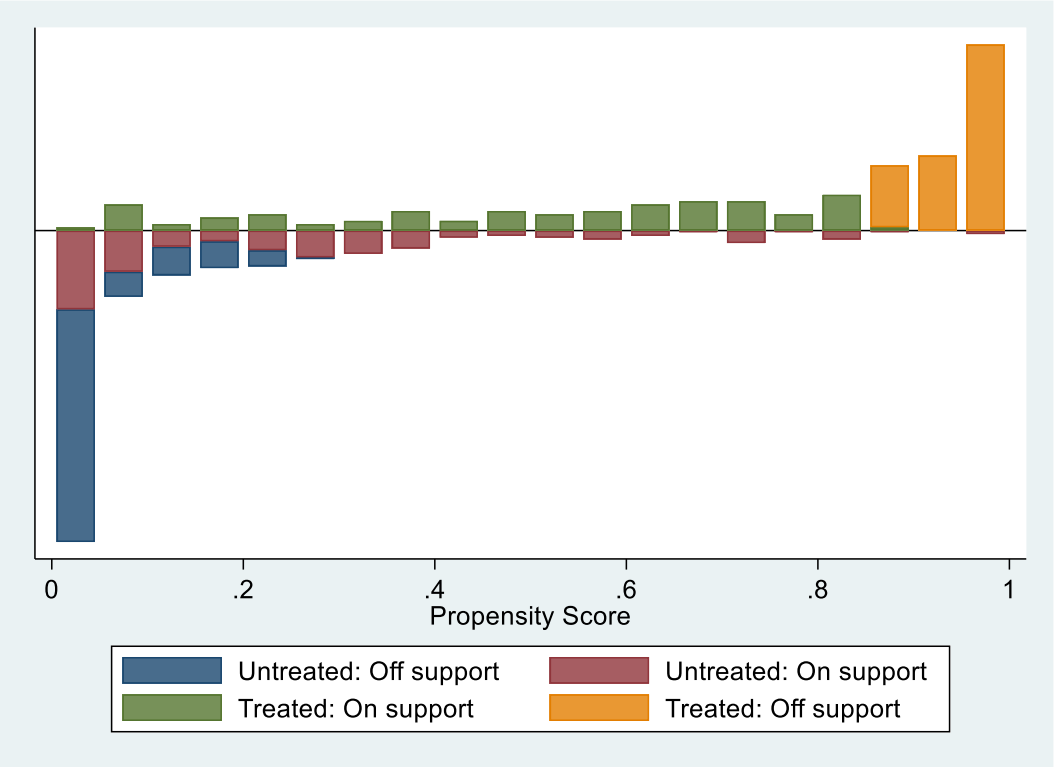
The box plot presented in figure 3 is also called the whisker plot. Two lines outside the box that extends to the highest and lowest observations are called whiskers and the data beyond the whiskers are considered as outliers. Indeed, an outlier is a point, which falls

more than 1.5 times the interquartile range above the third quartile or below the first quartile (Galarnyk, 2018).

This box plot splits the distribution of the propensity score into quartiles. The box's bottom line identifies the first quartile, the middle line of the box is the median value, and the top line of the box is the third quartile. The dotted circles in the figure (above the top whisker) are outliers in the distribution. The variability in the Propensity Score (PS) distribution is relatively lower for cooperative members than non-members since we observed a number of outliers in cooperative non-members. However, the box plot shows that the interquartile range is higher for cooperative members than non-members. The distribution of PS for cooperative members is skewed right while the distribution is skewed left for non-members. We observed that the distribution of PS for cooperative members within the first quartile overlaps the PS value of cooperative non-members, which facilitate matching. Also, those outliers in the distribution of cooperative non-members can be matched with cooperative members. Hence, we are sure that there are enough observations within cooperative members and non-members to proceed with the matching analysis.

Fig 4.

Common support region for cooperative members and non-members in caliper matching with 0.6 wide



The propensity score estimates based on the village dummies model were then used to match members and non-members. Indeed, we expect matching estimation with

independent variables controlling 24 village dummies would give the most precise estimates of the three models, as we discussed above in the section on the determinants of cooperative membership. We then applied caliper matching with width 0.6. There are several matching techniques, but no clear criteria for determining which technique is appropriate in each context (Heinrich et al., 2010; Mueser et al., 2007). For instance, caliper matching minimizes bias, excluding the poorly matched cases but reduces precision in estimates omitting poorly matched treated cases, so there is always a tradeoff between efficiency and bias (Mueser et al., 2007; Smith & Todd, 2005).

Figure 4 presents the common support region for cooperative members and non-members. The propensity score distributions largely overlap, so the analysis can consider a large share of the cases. This figure also indicates that the majority of cooperative members can be matched with non-members. In other words, there are enough observations that overlap between control and treatment groups so that ATT can be measured with robustness. We dropped 284 observations, 99 of the cooperative members, and 185 non-members, which fall outside the common support region. The proportion of members in the common support region is comparatively higher than for non-members.

The matching technique's main objective is to aid in achieving balance on all the covariates using a single dimension variable that is a function of the covariates (Caliendo & Kopeing, 2008; Mueser et al., 2007). In this context, we initially applied the nearest neighbor (NN) matching with replacement and without replacement. We found significant

differences in averages of two variables when we matched using NN with replacement, and we found significant differences in averages for seven variables when we matched using NN without replacement. Though NN with replacement only dropped fewer observations (154, including 24 members and 130 non-members) compared to caliper matching, we adopted caliper matching to reduce biases. There are significant differences in averages of the two key variables, the ethnicity of the family (1 = general) and distance to a motorable road (kilometers) when we employed a balancing test in covariates using NN with replacement.

Mueser et al. (2007) mention that an appropriate matching technique depends on matching variables for the treatment and comparison samples, the relative sample size, and the data's quality. Therefore, we performed a balancing test after caliper matching with caliper of 0.6 to ensure similar characteristics for cooperative members and non-member families.

Table 80. Balancing test results with unmatched and matching techniques

Covariates	Unmatched			Caliper matching		
	Member	Non-member	Difference (P >t)	Member	Non-member	Difference (P >t)
Years of education of family head	7.84	5.64	**0.000**	7.13	6.29	0.245
Gender of the family head (1= M)	0.58	0.55	0.472	0.55	0.55	0.933
Household family size (number)	4.94	4.67	0.035	4.82	4.88	0.818

Ethnicity of the family (1=general)	0.74	0.53	**0.000**	0.79	0.76	0.742
Ethnicity of Neighborhood (1 = Homo)	0.88	0.60	**0.000**	0.79	0.76	0.565
Land size in hectares	0.50	0.28	**0.000**	0.32	0.33	0.777
Distance to agricultural cooperatives (km)	0.77	1.64	**0.000**	1.07	1.20	0.271
Distance to the nearest local market (km)	2.73	3.77	**0.000**	2.97	3.09	0.603
Distance to motorable road (km)	0.14	0.42	**0.000**	0.20	0.18	0.571
Gardi (omitted dummy)						
Piple (1=yes)	0.03	0.03	0.895	0.06	0.08	0.620
Bhandra (1=yes)	0.03	0.03	0.754	0.03	0.03	0.889
Birendranagar (1=yes)	0.03	0.02	0.480	0.04	0.05	0.608
Kathar (1=yes)	0.04	0.01	**0.003**	0.03	0.01	0.371
Kumrose (1=yes)	0.03	0.01	0.248	0.03	0.02	1.746
Chainpur (1=yes)	0.04	0.06	0.438	0.02	0.02	0.910
Khairahani (1=yes)	0.04	0.03	0.895	0.05	0.05	1.856
Pithuwa (1=yes)	0.04	0.03	0.895	0.05	0.08	0.426
Padampur (1=yes)	0.04	0.06	0.438	0.05	0.04	0.866
Jutpani (1=yes)	0.04	0.03	0.895	0.06	0.04	0.641
Mangalpur (1=yes)	0.05	0.06	0.613	0.04	0.05	0.608
Fulbari (1=yes)	0.05	0.06	0.613	0.05	0.03	0.577
Sardanagar (1=yes)	0.05	0.06	0.613	0.05	0.05	0.856

Gunjanagar (1=yes)	0.04	0.03	0.536	0.05	0.04	0.866
Meghauli (1=yes)	0.04	0.03	0.663	0.03	0.03	0.889
Sukranagar (1=yes)	0.05	0.03	0.468	0.04	0.02	0.492
Parbatipur (1=yes)	0.05	0.06	0.613	0.01	0.01	0.937
Jagatpur (1=yes)	0.04	0.06	0.438	0.04	0.04	0.872
Patihani (1=yes)	0.04	0.03	0.895	0.02	0.02	0.910
Sibanagar (1=yes)	0.03	0.03	0.895	0.03	0.04	0.593
Gitanagar (1=yes)	0.03	0.03	0.895	0.06	0.03	0.396
Ayodhyapuri (1=yes)	0.03	0.03	0.895	0.01	0.01	0.937
Kalyanpur (1=yes)	0.04	0.05	0.438	0.01	0.02	0.498
Bagoda (1=yes)	0.03	0.04	0.895	0.05	0.34	0.866
Observation	545.00			545.00		
Median bias	6.20			10.70		
Mean bias	19.10			17.00		
Pseudo R-Squared	0.535			0.041		
P-value of LR	**0.000**			1.000		

Note: Bold P-value indicates a significant difference at a 5% level

Table 80 present the result of the balancing test after matching and provides a comparison with the unmatched samples. This table reports the mean of all covariates for cooperative members and non-member families before and after matching. The averages of members and non-members were not significantly different when we applied caliper matching. The balancing test indicates that the estimates we obtain applying the caliper

matching are robust. We also estimated using a caliper of 0.7, but we found three variables were significantly different in the matched samples. Furthermore, when we decreased caliper from 0.6 to 0.2, we observed fewer case were matched. So, we finally estimated ATT using a caliper of 0.6.

Table 81. Estimation of the effects of cooperative membership on income using caliper matching at 0.6 width

Outcome	Averages		Caliper matching			Bootstrapping with 100 reps	
	Member	Non-member	ATT	SE	T-stat	SE	P-value
Net crop income	41749.9	10337.01	37327.98	19747.68	1.89	21637.15	0.08
Total family income	436185.00	397692.80	44024.79	46564.68	0.95	54919.11	0.42
Observations	572		545			545	

Note: Bold P-value indicates a significant difference at a 5% level

Table 81 presents an estimate of ATT using a caliper of 0.6, with standard error estimated by bootstrapping. The results indicate that total annual family income was 44,025 Nepalese rupees higher for cooperative members than matched non-members, but this difference in income is not statistically significant. The yearly total family income includes net income from crops and vegetables, income from livestock farming, business, daily wages, jobs abroad (remittances), regular jobs, pensions, and cooperative dividends. Likewise, the magnitude of the difference in net crop income was 37,328 Nepalese rupees, which was slightly lower than the difference in total family income. The effect of

cooperative membership on net crop income was closer to significant (p=.08) than the effect on total yearly family income. The magnitude of the net crop income difference was less than 9% of surveyed families' average total income (411,152 Nepalese rupees). If we had calculated total family income using gross crop income rather than net crop income, the magnitude of the difference would have been much lower than 9%. Overall, we can say that cooperative membership may have had a modest effect on either the family income or net crop income. Effects on net crop income may be a reflection of production activities for cereals and vegetables, which are the focus of the agricultural cooperatives; agricultural cooperatives mainly provide production services such as seeds, credit for production, training and extension services, subsidized fertilizers, etc. to cooperative members.

There is some controversy regarding the error variance when we estimate treatment effects applying propensity score matching. Studies suggest that simple formula used for estimation of error variance suffers from biases due to the estimation of the propensity score, the requirement of a common support region, and the way samples are matched (Austin & Small, 2014; Caliendo & Kopeing, 2005). But these authors suggest that the error variance that comes from matching techniques would be negligible when we used PS matching techniques without replacement. We applied psmatch2 Stata tools to calculate treatment effects that claim to calculate approximate standard error assuming independent observations, fixed sampling weights, and homoskedasticity of the income variable in the sample (Leuven & Sianesi, 2003). However, we apply bootstrap methods using 100

bootstrap samples to confirm ATT's sampling variability. The bootstrap is a resampling method to estimate the standard error of estimated statistics and to construct confidence intervals (Efron et al., 1994). We found bootstrap standard errors of the ATT for both outcomes, net crop income and total family income are similar to the standard errors produced by simple analytical methods. These similar standard errors and non-significant p-value of estimates using the bootstrapped standard error indicate the simple analytical standard errors are not seriously biases in our case.

Table 82. Estimation of the effects of cooperative membership on income using different regression techniques

Outcome	Zero-order regression		OLS with village dummies		2SLS	
	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
Net income	32398.95 (10620.43)	**0.00**	46746.3 (22005.44)	**0.03**	-23043 (22291.62)	0.30
Total family income	37640.22 (30239.87)	0.21	45164.31 (43619.22)	0.30	80186.78 (81431.52)	0.33
Observation	545		545		545	
Instruments	None		None		2 variables	

Note: Figures in parentheses indicates Standard Error of the estimates
: Bold P-value indicates a significant difference at a 5% level

Table 82 presents the results of income differences between cooperative members and non-members using different regression techniques. Like ordinary regression, propensity score techniques do not control the bias that arises from unobservable factors

(Currie 2003; Gibson-Davis and Foster, 2006; Jensen, 2002). In this study, this bias may occur due to differences between members and non-members in the distribution of their unobserved characteristics, such as ability, risk preference, motivation, etc. In other words, if there are unobserved variables that affect the treatment assignment and the outcome variable simultaneously even after matching, there may be a hidden bias or inconsistency (Mueser et al., 2007; Rosenbaum, 2002). Controlling for such biases requires a suitable instrument that explains the probability of participation in agricultural cooperatives but does not affect the families' net crop income (Bernard et al., 2008; Caliendo & Kopeing, 2008).

Given this background, we estimated the effect of cooperative membership on our measures of income using instrumental an variables regression (2SLS) to examine the robustness of our results. We used two instrumental variables in our model, the ethnicity of the neighborhood and distance between an agricultural cooperative and the family's residence, to estimate the average effect of cooperative membership (ATE) on income. We assume the ethnicity of the neighborhood and distance to an agricultural cooperative from the residence of a family may affect the membership, but these variables do not directly affect the income of the family other than through its effect on membership. The most frequently used and popular instrumental variable estimator is two-stage least squares (Murray, 2006; Wooldridge, 2016).

The two-stage least squares technique involves two stages in the estimation. In the first stage, we estimate the predicted value of cooperative membership for each observation by regressing the cooperative membership on the instrumental variables, the ethnicity of the neighborhood and distance to an agricultural cooperative from the residence of a family and other explanatory variables, using ordinary lest squares. This first stage regression is a "reduced form equation". We then estimate our measure of income (ATE) in the next stage by regressing income on the predicted value of cooperative membership and the other explanatory variables in the second stage but omitting the instruments. We substitute the predicted value of cooperative membership into the second stage equation, based on the calculation in the first stage. The second stage coefficient estimates are called the two-stage least squares estimate.

The instrumental variable estimator can avoid the bias that ordinary least squares suffer when an explanatory variable in a regression is correlated with the regression's error term and simultaneous causality bias occurs (Murray, 2006). Further, there are variables that we do not observe and cannot measure, and they are not included in the model. Those unobserved variables may cause bias because they may have a direct/indirect influence on income measures. In the same vein, OLS estimates may suffer from simultaneous causality bias in our case because families' income may induce families to be cooperative memberships. Indeed, both PS matching and OLS estimate can suffer from omitted variable bias due to tainted and unmeasured variables (Zanutto,2006).

In our context, tainted variables are those determinants of income that are influenced by cooperative membership but may also influence income. We avoided such tainted variables in our OLS estimate. However, there may be biases due to unmeasured or unobservable variables. Hence, we employed instrumental variable regression to avoid these biases embedded in OLS and PS estimates. There are many observational studies that used OLS techniques to infer causal effects. Research like ours that does not use random assignment, quasi-experimental research, may suffer from hidden biases due to unmeasured variables. Hence, we compare OLS and PS estimates to test the assumption of linearity and additivity inherent in the OLS application. In contrast, we check whether there may be biases due to relevant unmeasured variables comparing the OLS and 2SLS estimates.

In our case, either the OLS or PS matching may suffer from omitted variable bias, along with biases due to simultaneity. In particular, there may be misspecification problems in OLS, which, in turn, are often associated with a lack of overlap between treated and non-treated cases (i.e., cooperative members vs. non-members). Our estimates show that the magnitude of effects on net crop income was relatively higher in OLS estimates than PS estimates, but standard errors were similar for net crop income measures in both PS and OLS estimates. The effects on net crop income were statistically significant in the OLS model and close to significant in the PS model. This considerable similarity between OLS and PS estimates suggests that our estimates do not suffer from misspecification or biases

due to failure of overlap. Further, if we consider the effect of cooperative membership on total yearly family income, we observe that OLS and PS estimates are very similar. Estimates of effects on total yearly family income were significant in neither OLS nor PS models. The magnitude of estimated effects of cooperative membership on the total yearly family income was also similar in both estimates. These similarities in effects on total yearly family income effects may further confirm that both PS and OLS estimates did not suffer from serious biases due to misspecificaton.

The results (Table 82) indicate that the total yearly family income was 80,186.78 Nepalese rupees higher for cooperative members than non-members when we use two-stage least squares. This effect estimate on total family income was not significant, consistent with the results of the the OLS. In contrast to the yearly total family income, the magnitude of the difference in net crop income was lower in 2SLS estimates than OLS estimates (23,043 versus 46,746). The difference was not statistically significant in the 2SLS estimates but was significant in OLS estimates. The significant result in the effect on net crop income indicates either the OLS or 2SLS may suffer from biases. The OLS estimates may have unobservable or simultaneous causality bias which may induce an upward bias in the OLS estimates, resulting in a significant estimate for the effect of cooperative membership on net crop income. In contrast, 2SLS estimates may have biases due to weak or inappropriate instruments that cause bias in estimates of effects on net crop income.

Hausman (1978) suggests that variables are not exogenous if we find inconsistent estimates and differences in significance level when we compare OLS and 2SLS estimates. We performed Durbin (1954) and Wu-Hausman (Hausman 1978; Wu 1974) endogeneity tests to determine whether regressors in the estimation are endogenous or exogenous. Both of the tests assume that the instruments we used are valid, which means they do not directly affect the income (i.e. dependent variable). The only source of association with income is its impact on the variables being instrumented, in our case cooperative membership. These tools then test whether the variables being instrumented actually needs to be instrumented, in which case it is endogenous. We found the coefficient was different when we use the instrumental variables, i.e., the endogeneity test indicates significance when we compare 2SLS and OLS estimates, so we reject the hypothesis that the OLS estimates are not biased. We can say that the OLS estimates was statistically rejected as valid because the estimates of the effect on the net crop income are different from the OLS estimates when we instrument, assuming the instruments are valid.

We previously estimated many possible 2SLS income models with one, two, and even three instrumental variables. We found all previously estimated 2SLS models differed substantially from OLS estimates in terms of the standard error, the magnitude of the difference, and the endogeneity tests with the restriction imposed. Therefore, we ultimately estimated 2SLS coefficients with those noted two instrumental variables assuming the instruments are valid. In our study in Nepal, the mixed group, more than one

caste/ethnicity, was the highest proportion with 43 percent of the families in the immediate neighborhood among non-members. In contrast, among members, the immediate neighborhood has the Hill Brahman and Chhetri castes as the largest groups, at 56 percent.

Ethnicity/caste refers to the distinct identity of the people based on the hierarchal system rooted in the Hindu religious values of purity. The Hill Brahman and Chhetri castes are placed at the top in the hierarchical structure based on Hindu religious myth, and we can see their dominance in mainstream politics in Nepal. The study by La Ferrara (2002) found that families are more likely to be a member of cooperatives if they live in a homogenous group. People are more likely to join a group/cooperative that is homogenous because they may have greater trust with their own peer group or caste. It appears income inequality and social status are associated with the caste system in Nepal, so we may be observing an effect of economic inequality. Homogeneity may be the reason behind the highest proportion of Hill Brahman/ Chhetri among members as these two castes, which have many commonalities and are commonly known as the Khas ethnic groups (Gurung, 2014). We found a significant effect of homogeneity of the ethnicity of the immediate neighborhood on cooperative membership (Table 75). Given this background, it is logical to assume that the ethnicity of the immediate neighborhood is strongly associated with cooperative membership, and this variable does not influence a family's income other than its effect on income mediated through cooperative membership.

In the same vein, members live closer to the office of agricultural cooperatives than non-members. Almost 85 percent of members reported that their residences are within 1 kilometer of cooperatives. In contrast, only 39 percent of non-members live within the same periphery. Overall, non-members' houses are an additional 1 kilometer farther away from an agricultural cooperative than members. Also, when we controlled for other factors, we found that distance to agricultural cooperatives from the families' residences significantly influenced the cooperative membership (Table 75). This membership differences may reflect decisions by families near to the cooperatives to become members. It also may be because families forming a cooperative may establish the office of the cooperative in their area. Our assumption is that any factor that induces families to form such a cooperative is not directly related to our dependent variables.

As in the literature, in our study, many agricultural cooperatives established collection centers at their locality to buy the product of the members and sell the product to aid members in obtaining a reasonable profit margin. In contrast to the members' expectations, the collection centers of agricultural cooperatives fail to deliver these marketing services, which was the service most sought by cooperative members. Many collection centers closed in recent years due to the inability of cooperatives to operate/handle the collection centers as per their objectives of providing marketing services. There are a few collection centers near to district government administrative headquarters that are operating, but they are only providing vegetable selling stalls on cash

rent to individual members. Members who rent booths may collect produce from anywhere and offer the produce to consumers as independent traders. Given this background, distance to an agricultural cooperative matter significantly in our study. But in the literature focusing on cooperatives outside Nepal, distance to a collection center matters because agricultural cooperatives offer marketing services through collection centers. Hence, it is not surprising that distance to an agricultural cooperative from a families' residence is what is important, not distance to a collection center.

Our 2SLS estimates of net crop income have standard error estimates similar those in OLS, but the standard errors for the effects on total yearly family income differ, which indicates our instruments may be week. Our 2SLS standard errors for the effects on total yearly family income was higher than the OLS standard error estimate. Murray (2006) suggests that 2SLS estimators have larger standard errors that the OLS estimators because 2SLS uses only that part of the variation in the "troublesome explanator" (i.e., cooperative membership) that appears as variation in the predicted value of cooperative membership. But we observed inconsistent standard error estimates between OLS and 2SLS estimates when we compared effects on net crop income and total yearly family income. Further, our 2SLS result indicating much lower effects of cooperative membership on net crop income as compared to the OLS and PS, and insignificant effects on net crop income, contradict the view that Nepal's cooperative services focused on credit and crop production activities provided benefits. Indeed, we found similarity in income effects between PS and OLS

estimates in terms of magnitude of the income difference and standard errors and these results were consistent with Nepal's the view that benefits occurred. We consider it possible that PS and OLS estimates do not suffer from model specification biases and the instrument that we assumed valid may be weak.

Table 83. Estimation of the effects of cooperative membership on income using different regression techniques in the weighted sample

Outcome	Zero-order regression		OLS with village dummies		2SLS	
	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
Net income	43230.89 (18685.89)	**0.03**	50116.39 (21576.84)	**0.02**	-31840 (53374.45)	0.55
Total family income	86126.74 (52997.74)	0.11	70403.75 (69901.34)	0.32	-71428.9 (356173.5)	0.84
Observation	545		545		545	
Population	304638		304638		304638	
Instruments	None		None		2 variables	

Note: Figures in parentheses indicates Standard Error of the estimates
: Bold P-value indicates a significant difference at a 5% level

Table 83 presents the income estimation results using different regression techniques in the weighted sample, which we compare with the same specifications estimated for the unweighted sample (Table 82). We found no changes in the direction and significance of the income estimates compared to unweighted specifications except for the 2SLS estimates of the effects on yearly total family income. In the weighted analyses, we

found slightly higher net crop income and standard errors in all net crop income estimates than in the unweighted specifications. This slight variation in the net crop income and standard errors compared to the unweighted sample may result from differences in sample weighting among villages. However, the effect estimate was substantial (almost double) for the effect on yearly total family income in OLS and zero-order regression estimates. We also observed changes in the direction (i.e., from positive to negative sign) in yearly total family income in 2SLS estimates though the magnitude is similar (80186 versus –71428 in weighted).

Table 84. Estimation of the effects of cooperative membership on income using matching techniques in the weighted sample

Outcome	Averages		OLS with village dummies		Caliper matching
	Members	Non-members	Coefficient	P-value	Coefficient
Net income	55175.32	**11918.43**	50116.39(21576.84)	**0.02**	49227
Total family income	485067.50	398815.10	70403.75(69901.34)	0.32	41928
Observation	545		545		545
Population	304638		304638		304638
Instruments	None		None		2 variables

Note: Figures in parentheses indicates Standard Error of the estimates
: Bold P-value indicates a significant difference at a 5% level

Notwithstanding these differences, we note that standard errors have increased greatly for yearly total family income in the 2SLS estimates compared to unweighted specification. As a result, differences between weighted and unweighted results are not

likely to be meaningful. The proportion of cooperative members is substantially lower in the weighted sample than the unweighted sample. This substantial reduction is because we have oversampled cooperative members in our survey. In a similar vein, table 84 presents the income estimation results using caliper matching in the weighted sample. We found changes in the significance of the income estimates compared to unweighted specifications; however, income coefficients are very similar (even lower for yearly total family income) compared to unweighted specifications.

In the weighted analyses, we found substantially lower standard errors for the income estimates in caliper matching, which result in changes in the significance of income estimates. This variation in standard errors may be due to the substantial differences in the proportion of cooperative members between weighted and unweighted samples. Indeed, we applied "teffects psmatch" Stata tools to calculate treatment effects in the weighted model that claims to calculate approximate standard error taking into account that the propensity score is estimated (Abadie & Imbens 2016). However, we discussed earlier, the error variance that comes from matching techniques would be negligible when we used PS matching techniques without replacement. Due to this, differences in significance level in income estimates between weighted and unweighted specifications are not likely to be meaningful.

The Nepalese government has prioritized cooperative development for poverty reduction of smallholders in Nepal since the 1990s. Many studies outside Nepal have found

that agricultural cooperative membership influenced the income of cooperative members. Given this background, we measured the impact of agricultural cooperatives on total family income and net crop income from cereal and vegetable crops because cereal and vegetable crops were the focus of the agricultural cooperatives in Nepal. We used different regression techniques, including various propensity score matching and 2SLS techniques, to estimate the effect of cooperative membership on yearly farm income and total family income. We also used different specifications within those techniques (PS matching without replacement, PS matching with replacement, OLS with village dummies/without village dummies, etc.) to examine the robustness of the estimates of the effects of cooperative membership on income.

All these estimates imply that cooperative membership may significantly impact family net crop income but not total family income. The magnitude of the estimated effect of cooperative membership is similar in alternative specifications, except for 2SLS estimates. The magnitude of the 2SLS estimates of the effect on total family income was nearly double the other estimates but neither the effects on net crop income or total family income are statistically significant. The magnitude of the 2SLS point estimate of the effect of cooperatives on family income was more than 19% and on net crop income less than 10% of surveyed families' average total income (411,152 Nepalese rupees). We also estimated all the effects of cooperative membership on income with the same specifications

in a weighted sample to be representative of the population in the sample villages and found no meaningful changes in the estimates.

To summarize, we found that agricultural cooperatives in Nepal increase the earnings of the smallholders, but estimates are often not statistically significant. Our KII findings, based on interviews with cooperative management, suggest that it takes time for cooperatives to evolve to reduce smallholders' poverty substantially. Currently, agricultural cooperatives appear to be focused on financial services like saving and credit activities but are less concerned with agricultural production, and undertake almost no marketing activities. Cooperative managers ranked marketing service below financing and related cooperative goals. However, marketing services were the services cooperative members were most likely to indicate they would value, reflecting the fact that cooperatives do not buy the product of the members for resale. Managers argue that members have only recently become aware of the importance of cooperative savings for reducing their dependency on outside lenders. They suggest it will take some years for members to understand the cooperative guidelines and the potential of the cooperative structure/approach, to provide marketing services and achieve the common goal of economic gains. Most chairpersons/mangers argue that they can not compete with the imported agricultural produce from India and China due to the differences in the cost of production of crops and vegetables. They strongly believe that agricultural production is heavily subsidized in neighboring countries and both countries have well-developed

agricultural marketing infrastructures. Indeed, Nepalese farmers face many problems in the agricultural sector, and the government has not focused on developing the agricultural industry; therefore, it takes time for smallholders to be engaged in agricultural cooperatives efficiently and effectively.

There has been rapid growth in agricultural cooperative membership since the 1990s due to changes in political regime and government policies, including cooperative and economic liberalization policies. However, these changes have not materialized into the economic gains for smallholders. It takes time for cooperatives to develop expertise where they can support agricultural production and engage in commericial marketing. Currently, most agricultural cooperatives provide financial services and distribute subsidized seeds and fertilizers in their locality. It appears that many cooperatives were formed just to get the benefits from many small-scale subsidies offered by various organizations, including the government. Many cooperatives received a one-time grant of up to 500,000 NPR from central and local government agencies under institutional development programs.

Many cooperatives reported that they need to make investments in agricultural technology and infrastructure, to allow them to provide improved varieties of cereals and vegetables, collection centers, storage houses, tractors, irrigation canals, market information systems, etc. They strongly advocate the role of government in developing agricultural infrastructure and technology, thereby developing agricultural cooperatives.

Very few members are taking large agricultural loans due to the inadequate development of the agricultural sector. In our study areas, some of the agricultural cooperatives were even considering converting their cooperatives into saving and credit cooperatives if the government would not support and execute the development of agricultural cooperatives. After all, they were primarily engaged in saving and credit services, notwithstanding their main stated objectives of increasing farm income through agricultural production and marketing.

Summary and Conclusion

This study in Nepal addressed the two research questions. First, we estimated three probit regression models to measure the factors affecting cooperative membership. We used eighteen explanatory variables based on the literature and applicability in the Nepalese context and report the average marginal effect on membership. We omitted some variables that were used in the literature due to collinearity and endogeneity problems that may cause coefficients to be biased. Those omitted variables were membership in other organizations, position in other organizations, and non-farm income. We added other variables due to their applicability in the Nepalese context. Those additional variables were the household head's main occupation, household active labor force size, an index of livestock value, availability of an agrovet in the village, distance to a farmers' market, and availability of any industry in the village. In some specifications, we included dummies for the 25 villages.

The first probit model includes all the 18 explanatory variables. We include all available explanatory variables to predict cooperative membership to minimize biases due to unobservable factors that may affect membership. Then, we estimated the second model with a limited set of independent variables – assuming they are exogenous. In the third model, we dropped four independent variables used in the second model due to collinearity concerns. We estimated the model with dummies to control for 25 villages of the Chitwan district. We found no changes in the direction and significance of the variables included in all three models, but there were some minor changes in the effect estimates and standard error. We again estimated these three probit models with the same specifications in a weighted sample to adjust our survey to reflect population estimates. There were no changes in the direction and significance of the variables in the weighted specifications compared to unweighted sample specifications.

In our analysis, we have identified some key determinants that increase the likelihood of joining cooperatives such as the ethnicity of a family, the ethnicity of the neighborhood, land size, availability of a collection center in the village, and farming as the main occupation. In contrast, variables like distance to an agricultural cooperative, distance to the nearest local market, and distance to a motorable road have negative effects on cooperative membership. The prior literature has mixed findings on land size, education, market access, and non-farm employment. We found education did not have any effect on cooperative membership. In our study, most families were literate, and about half of the

family heads had attended middle school. Due to the level of literacy in Nepal, families may have a good understanding of the shortcomings of agricultural cooperatives, in particular their failure to offer marketing services to their members. Cooperative managers reported that cooperatives could not compete with imported produce, particularly from India and China. This widespread knowledge among families about the shortcomings of cooperatives in marketing services may result in insignificant effects for education in our study in Nepal.

The previous literature has found inconclusive and inconsistent results on credit access in explaining cooperative membership, although none of the studies have discussed details regarding interest rate, loan size, and available alternative credit institutions. In our study in Nepal, the use of an agricultural development bank (ADB) loan as a proxy for alternative credit access did not significantly affect cooperative membership. This insignificant effect may be due to the low number of surveyed people using ADB loans. Furthermore, in our study area, the ability to obtain credit from a cooperative is the most common reason for joining cooperatives, though the amount of credit provided varies from cooperative to cooperative. That our results are different from those in the literature may be due to the important role of credit services offered by an agricultural cooperative in Nepal.

We included three measures of market access, distance to a farmers' market, distance to a local market, and distance to the main market in our analysis, whereas prior

studies only identified distance to the main market. In our study, the distance to the nearest local market has a negative and significant effect on cooperative membership. The two other measures of market access, distance to a farmers' market and a main market, did not have significant effects on cooperative membership. In our study area, the main market (district capital) does not directly influence cereal crop marketing. Farmers usually sell cereal crops and vegetables to the nearest local market; then, the local trader may sell those products to district traders at the main market. Therefore, access to the nearest local market may influence cooperative membership. Determinants such as gender of the family head, total livestock units (TLU) owned by the household, household family size, and the number of household members active in the labor force did not affect cooperative membership. These findings of no effects are consistent with the literature.

The second research question focused on the effects of cooperative membership on farm income. The literature does not use a common measure for the income gain for cooperative membership. Many authors directly measure the income gain from cooperative membership and relate the income gain data to poverty reduction or improvement in the lifestyles of the household. Some authors measure both income and poverty reduction measures on an index or poverty reduction percentage. Our analysis measured net crop income gain from crops and vegetables and total family income from cooperative membership to identify the effects of cooperative membership. The estimates on net crop income are more meaningful in our study because cereal and vegetable crops were the

focus of Nepal's agricultural cooperatives. We estimated agricultural cooperatives' effects on income using different regression techniques, including various propensity score matching and 2SLS approaches. We also used different specifications within those techniques (PS matching without replacement, PS matching with replacement, OLS with village dummies/without village dummies, etc.) to examine the robustness of the estimates of cooperative membership effects on income.

All these estimates imply that cooperative membership does not significantly impact family net crop income or total family income. The magnitude of the estimated effect of cooperative membership is similar in alternative specifications, except for 2SLS estimates for total family income, which is nearly double the other estimates, but, like the other estimates, is not statistically significant. The magnitude of the point estimate of the effect of cooperative membership on family income was less than 20% of surveyed families' average total income (411,152 Nepalese rupees). If we calculate total family income using gross crop income rather than net crop income, the magnitude of the effect is much lower than 20%. We also estimated all the effects of cooperative membership on income with the same specifications in a weighted sample to be representative of the population in the sample villages and found no meaningful changes in the estimates.

The literature found that being a member of an agricultural cooperative has a significant and positive impact on farm income and poverty reduction, particularly in rural Ethiopia, Kenya, Uganda, Southern Rwanda, and China. These studies reported that

cooperatives offer a higher price to their members due to their access to specific market information, and collective bargaining power. In some cases, cooperative operate at multiple levels of the food value chain, including production, processing, marketing and distribution. Further, cooperatives provide various regular services to their members, such as technical training, input procurement, information sharing, linkages to extension services, and financial institutions for production. Therefore, cooperatives in these earlier studies earned income through achieving economies of scale in production and marketing. As in Nepal, agricultural cooperatives in African countries, such as Ghana, Kenya, Nigeria, Senegal, Uganda, Rwanda, etc., were quasi-cooperatives controlled by the governments up to 1990; during this period cooperatives there did not perform well in reducing the poverty of smallholders.

Like ours, the number of cooperatives grew quickly in these African countries after the 1990s. This growth was due to changes in cooperative structure, as these were initially government-owned and became member-owned as the countries adopted economic liberalization policies. These cooperatives gradually derived financial resources through membership shares, loans, and savings of the members. They work to provide products demanded by their members, with a business-oriented approach while following the cooperative principles and values. Cooperatives that are successful in these African countries provide significant financial and economic benefits to the members.

Notwithstanding, in Nepal, we found that agricultural cooperatives influence smallholders' earnings but not as much as suggested in other countries in the literature.

Agricultural cooperatives are currently focused on financial services like saving and credit activities instead of agricultural production and marketing in Nepal. However, marketing services were the services cooperative members were most likely to indicate they would value. Cooperative managers reported that cooperatives could not compete with the products coming from India and China. Further, they observed that there were many problems in the agricultural sector in Nepal. Managers suggest that the government should prioritize the agricultural sector to develop agricultural cooperatives. At the same time, cooperatives should play effective policy advocacy roles through cooperative federation, union and other possible networking to address cooperative development. Cooperatives could build strong partnerships by networking with business for policy advocacy and resource collaboration for agricultural growth. A serious effort from cooperatives is equally important to develop their own capabilities. Only with time will smallholders learn to engaged in agricultural cooperatives efficiently and effectively.

CHAPTER 8

CONCLUSION AND IMPLICATIONS

Nepal is a small land-locked low-income South Asian country with 29 million people situated between China and India. More than half of the country's population is engaged in the agricultural sector as the main occupation, but its contribution to the national Gross Domestic Product (GDP) is only 27percent, which indicates the agriculture sector is not yet commercialized. One-fourth of the Nepalese people still live below the international poverty line, with an average annual GDP per capita less than $1050. There are a total of 3.7 million agricultural holdings across the nation, and half of the farmers own only 15 percent of total arable land with less than 0.5-hectare land holdings on average[17]

Given this background, Nepal's policies have emphasized the poverty reduction of smallholders through cooperative development, which would transform subsistence-oriented agriculture to commercialization. In essence, an agricultural cooperative is a form of a formal institution in which a group of farmers work together to improve their socio-economic condition utilizing their own resource endowments such as land, labor, savings, traditional skills, information sharing, collective bargaining, etc. Farmers can reduce transactions cost in agricultural production and marketing practices through cooperatives that result in better market access and break up private market monopolies. Nepal recently

[17] Sources are cited in Table 1 above.

passed the new federal republic constitution in 2015 that mentioned the importance of cooperatives as a key player for the nation's economic prosperity. Cooperative development for economic prosperity is a proven approach in many parts of the world, especially in developing countries.

Cooperative development begins in Nepal in 1960 when the government passed the cooperative societies act and regulations. However, those acts and regulations are very basic in terms of cooperative structure and governance. Until 1990, cooperatives were not true cooperatives owned by the members and responsive to their needs but were controlled by the government as per the provision of cooperative rules and regulations, which did not conform to cooperative principles and gave government employees authority to control cooperatives. This may have be due to ignorance or lack of understanding among policymakers about cooperative development and its effective execution at the community level. When the government revised cooperative policies in compliance with recognized cooperative principles in 1992, cooperative numbers increased significantly and began to function in a broader array of activities, including savings/credit mobilization, supplying agricultural inputs, and marketing of products.

The number of cooperatives increased from 883 in 1992 to 34,512 in 2017. This cooperative growth was dramatic from 2007 due to changes in political regime after the Comprehensive Peace Agreement (CPA) signed between the government of Nepal and a Maoist group in 2006, which was associated with a spike in non-profit organizations at the

community level with the restoration of peace ending 10 years of armed conflict. Approximately 35 percent of the cooperatives across the nation were registered as agricultural cooperatives, although it appears a smaller proportion of agricultural cooperatives were functional. Indeed, acts prior to the latest act of 2017 did not clearly recognize the differences in the objectives of the cooperatives in the formation and registration process. Cooperatives registered as "multipurpose cooperatives" could be involved in agricultural activities. Farmers could register a single crop-based cooperative or vegetable and fruit production cooperative with similar objectives as agricultural cooperatives. This previous ambiguous legal provision may have caused the establishment of many cooperatives in different names with the same objectives in the same community, which eventually led to the nonfunctional and closure of some cooperatives. In our study area, there are cases where individuals joined more than one agricultural-related cooperatives. This form of membership is against the cooperative principle of ownership. There are only 74 functional agricultural cooperatives in our study area, while 128 agricultural cooperatives were registered between 1992 to 2014. Our Key Interview Informants reported that, after the enactment of the latest cooperative act, many agriculture-related cooperatives are in the process of merging with other cooperatives, which fall under the same objectives and area coverage.

There were a series of supportive policy and institutional changes from 1990 to 2017 to encourage cooperative growth and development with the goal of improving the

livelihood of smallholders in Nepal, though it would obviously take some years for members to understand the role of cooperatives and to adjust their own activities to fit with cooperative goals. Most importantly, poverty in Nepal was reduced by approximately 60 percent during the same time period (WB, 2019). However, no empirical studies are available in Nepal that answer whether this poverty reduction was due to cooperative development or something else. In its essence, this empirical research study estimates the factors affecting smallholders' decisions to join agricultural cooperatives and the resulting impact of agricultural cooperative membership on income level in terms of net crop income and total household income. This study is conducted in Chitwan District, out of 77 districts of Nepal, as its plain topography represents the plain region in terms of agricultural practices, the number of functional agricultural practices, easy road access, time constraints, and diverse ethnicity that is representative of the whole nation. We have a sample size of 573 families, including 200 cooperative members and 372 others identified through simple random sampling covering 27 villages of the Chitwan District. Apart from the household survey, this study conducted a Key Informants Interview (KII) with either the Chairperson or the Manager of 37 agricultural cooperatives, choosing these cooperatives to include at least one cooperative from each village and have many as of our sampled members in those 37 agricultural cooperatives. In this way, this study can explore the structure of services provided by the cooperatives and the role cooperatives serve as viewed by their chairpersons/managers.

We use a probit model to analyze the probability of being a member of an agricultural cooperative and estimate the effects of agricultural cooperative membership on net crop income and total family income using different techniques, including propensity score matching (PSM), ordinary least squares (OLS), and two-stage least squares (2SLS). We know that OLS and PSM estimates may suffer from bias due to unmeasured or unobserved variables, so we employ a two-stage least squares method to avoid the biases embedded in OLS and PSM estimates. Our PSM, OLS and 2SLS estimates suggest that these estimates do not suffer from misspecification or biases due to failure of overlap between cooperative members and non-members observations. In addition to estimates using our unweighted sample, we also estimated factors affecting cooperative membership and membership effects using all our specifications/techniques for the survey sample as weighted to reflect the populations in the sample villages. We observed no meaningful changes in the direction and significance of the variables in the weighted specifications compared to unweighted specifications.

The literature identifies some key factors, such as land size, market access, education, gender, non-farm income, access to credit, ethnicity/race of the community, and membership in other groups/organizations, which influence cooperative membership. There are mixed findings on some of those factors: land size, education, gender, market access, non-farm income, and membership in other groups/associations. Some studies find these factors increased the likelihood of being members of cooperatives, while others

identified the opposite. These mixed findings may be due to the crop type, local context, types of cooperatives, and research design differences. This study presents results predicting cooperative membership with all the variables noted above except membership in other organizations, position in other organizations, and non-farm income. We omitted these measures because we were concerned that the measures could be influenced by cooperative membership, causing coefficients to be biased. We added other variables due to their applicability in the Nepalese context, and those variables are the main occupation of the household head, active labor force size, an index of livestock value, availability of an agrovet in the village, distance to a farmers' market, availability of any industry in the village, and 24 village dummies. Prior literature is not consistent in defining and measuring market access, so we included several alternative proxies that could capture market access, such as distance to the nearest local market, distance to a farmers' market, distance to the district capital, distance to a motorable road, availability of any factory/industry in the village and availability of a collection center in the village. In this way, we use eighteen variables based on the literature and applicability in the Nepalese context and report the marginal effect on membership.

In our analysis, we have identified some key determinants that increase the likelihood of joining cooperatives, such as the ethnicity of a family, the ethnicity of the neighborhood, land size, availability of a collection center in the village, and farming as the main occupation. In contrast, variables like distance to an agricultural cooperative,

distance to the nearest local market, and distance to a motorable road have negative effects on cooperative membership. The prior literature has mixed findings on land size, education, market access, and non-farm employment. Indeed, our results differ from those in the literature in our findings on land size, education, and credit access. We find no effects on membership for gender of the family head, total livestock units (TLU) owned by the household, household family size, and the number of household members active in labor. These findings of no effects are consistent with the literature.

Like the results as of Kenya and Ethiopia, we found that smallholders are less likely to join agricultural cooperatives than middle-size farmers, but, in contrast to their results, we found large landholders are more likely to join cooperatives. In the literature, the exception is that larger farmers are likely to join cooperatives if they are involved in cash crops like watermelon, sugarcane, cotton, etc. because these cash crop cooperatives are not suited to smallholders since these cash crops require large land size to get economies of scale in production. Studies in Kenya and Ethiopia consider smallholders to have land around 1.5 hectares, but, in our study, surveyed families, on average, own only 0.4 hectares. The surveyed families in our study area did not grow cash crops due to small land size and relatively low prevailing prices for these crops. In Nepal, the volume produced and marketed may not be sufficient to pay the membership fee or to buy the cooperative shares, or additional earnings through their involvement in agricultural cooperatives may not be

sufficient to justify membership costs. Hence, smallholders are less likely to join agricultural cooperatives.

We found Hill Brahmin and Chhetri castes, the socially dominant castes in Nepal, are more likely to become cooperative members. Indigenous\Ethnic and Dalit caste were previously excluded from mainstream politics in Nepal so that they may have limited access to agricultural cooperatives. Even if they have formal access to cooperative membership, they may not be able to influence the decision-making process either due to the status associated with their caste or inadequate wealth. Income inequality and social status are associated with the caste system in Nepal, so that we may be observing the effect of economic inequality. Consistent with our findings, prior literature based on data from India, rural Tanzania, and Bangladesh suggested that people are more likely to join a group/cooperative that is homogenous because they may have greater trust in members of their peer group or caste. It is possible that ethnic homogeneity increases the ability to resolve conflict due to common culture and tradition.

Distance to the nearest local market, agricultural cooperatives, and a motorable road are key factors influencing Nepal's cooperative membership. We tried to include as many proxy variables as possible to capture market access; in contrast, the prior literature neither included multiple proxy variables nor defined the market type. In our study, we specifically included the three of measures market distance, distance to a farmers' market, distance to a local market, and distance to the main district market, whereas other studies

only identified distance to a single market. In contrast to the study in Ethiopia, we found distance to the nearest local market has a negative and significant effect on cooperative membership, although, in their studies, families were larger landholders than ours. Indeed, land size may be associated with household income, so this may cause differences in findings. In our study, distance to the main market, which is a district headquarters, does not directly influence the marketing of major crops produced by Nepalese farmers. Farmers, for the most part, sell major crops to local traders residing in the nearest local market. Then, the local trader sells those products to traders who reside at the main district market. We, therefore, may have found no significant effect of distance to district market in predicting cooperative membership.

There is no significant effect of distance to a farmers' market in predicting cooperative membership. That there is no effect of distance to a farmers' market may be due to the operation of farmers' markets close to the district capital. In fact, the farmers' markets are temporary markets managed and operated by farmers themselves to sell their fresh products under a temporary shelter. In Chitwan, most farmers' markets operate twice a week for limited hours targeting nearby customers. Mostly, poor and very small landholders are involved in these practices, and they sell vegetables, milk, ghee, eggs, and locally made handicrafts in the market in order to obtain needed income in the short run. In our study, access to a motorable way is available in every village and almost all neighborhoods. The distance to the motorable road has a negative and significant effect on

cooperative membership, possibly due to its importance in accessing the market and the office of the agricultural cooperatives.

In the literature, collection centers work as a substitute for agricultural cooperatives, and even proxy for market access, but our case is different. In our study, collection centers were not established and operated as in the literature because cooperatives could not provide marketing services to their members, and cooperative members reported credit services are the most common reason to join cooperatives. Given this context, the distance to agricultural cooperatives matters for members and influences cooperative membership due to the other services such as credit services, savings, seed distribution, etc., that are provided from the office of an agricultural cooperative. We also included the availability agrovets in the village as a proxy to capture market access, and of any industry/factory to capture labor market opportunities; none of these variables have been discussed in the literature. These variables did not significantly influence cooperative membership, although we dropped these variables in our final specification with village dummies since they are collinear with village fixed effects.

As we expected, farming as the main occupation has a positive and significant effect in predicting cooperative membership, although it appears in the literature that most of the surveyed farmers had agriculture as their main occupation and were more likely to be tied to commercial agriculture than our farmers. There are very limited opportunities outside agriculture in Nepal, so even large landholders who are engaged in agriculture as

their main occupation are more likely to become cooperative members, while prior literature has just the opposite finding. We found education did not significantly affect cooperative membership, although results in the literature are inconclusive. None of the studies measured education as a continuous variable, as we did in our study in Nepal. Furthermore, there are differences in the educational level of families studied in the prior literature and in Nepal. In our study, nearly half of the family heads attended middle school, and only 11 percent of family heads were illiterate. Families may have a good understanding of the cooperatives' services due to the level of literacy in Nepal. Agricultural cooperatives in Nepal did not provide marketing services to the families, though marketing services appear to be valued by households. The widespread knowledge about the shortcomings of cooperatives in providing marketing services to families may result in an insignificant effect of education in our study in Nepal.

Loan availability is the most common reason for members to join cooperatives. Members' access to credit from a cooperative depends on their own regular monthly savings, although the amount of credit provided varies from cooperative to cooperative. In particular, cooperative members develop the habit of savings, and it reduces their dependency on outside lenders. Most agricultural cooperatives provide credit up to 100,000 Nepalese rupees without individual collateral, keeping a farmer group at a neighborhood level, consisting of 5 – 10 members, as collateral. The literature found inconclusive and inconsistent results on credit access, although none of the studies discussed details

regarding interest rate, loan size, and available alternative credit institutions. Our results are different from theirs because credit services are offered by agricultural cooperatives and the Agricultural Development Bank (ADB) in Nepal. A variable identifying the use of agricultural development bank loans as a proxy for alternative credit access did not have a significant effect on cooperative membership. This insignificant effect may be due to the low number of surveyed households using ADB loans, reflecting the fact that farmers could obtain credit from cooperatives at an interest rate lower than ADB and other formal financial institutions. Some farmers obtain ADB loans because they need higher loan amounts than they could have borrowed from their cooperatives.

For the second research question, our analysis estimated the effects of cooperative membership on net crop income and total family income. The estimates of effects on net crop income are more meaningful in our study because cereal and vegetable crops were the focus of Nepal's agricultural cooperatives. We estimated agricultural cooperatives' effects on income using different techniques. All these estimates imply that cooperative membership may significantly impact family net crop income or but not total family income. The magnitude of the point estimates of the effect of cooperative membership on family income were less than 20% of surveyed families' average total income (411,152 Nepalese rupees). If we calculate total family income using gross crop income rather than net crop income, the magnitude of the effect is much lower than 20%. This level of income difference between members and non-members may be due to the differences in crop

production scale. The income difference may reflect production activities, which are the focus of the agricultural cooperatives, and differences in some unobservable factors that we could not measure, such as risk aversion, entrepreneurship, the motivation level of the farmers, etc.

The literature found that being a member of an agricultural cooperative has a significant and positive impact on farm income and poverty reduction, particularly in rural Ethiopia, Kenya, Uganda, Southern Rwanda, and China. These studies reported that cooperatives offer a higher price to their members due to their access to specific market information and collective bargaining power. In some cases, cooperatives operate at multiple levels of the food value chain, including production, processing, marketing, and distribution. Further, cooperatives provide various regular services to their members, such as technical training, input procurement, information sharing, linkages to extension services, and financial institutions for production. Therefore, cooperatives in these earlier studies earned income through achieving economies of scale in production and marketing. As in Nepal, agricultural cooperatives in African countries, such as Ghana, Kenya, Nigeria, Senegal, Uganda, Rwanda, etc., were quasi-cooperatives controlled by the governments up to 1990; during this period, cooperatives there did not perform well in reducing the poverty of smallholders.

As in Nepal, the number of cooperatives grew quickly in these African countries after the 1990s. This growth was due to changes in the legal structure governing

cooperatives, as cooperatives were initially government-owned and became member-owned as the countries adopted economic liberalization policies. These cooperatives gradually derived financial resources through membership shares, loans, and savings of the members. They work to provide products demanded by their members with a business-oriented approach while following cooperative principles and values. Cooperatives that are successful in these African countries provide significant financial and economic benefits to their members. But in Nepal we found that agricultural cooperatives increase the earnings of the smallholders, but not as much as suggested by studies in other countries in the literature. Indeed, currently, agricultural cooperatives appear to be focused on financial services like savings and credit activities but are less concerned with agricultural production, and engage in almost no marketing activities. These deficiencies in cooperative services may reduce the effects of cooperatives, reflecting in estimated effects on income that are often not statistically significant.

We can say that it may take time for agricultural cooperatives in Nepal to evolve in such a way so they may offer marketing services. Currently, it appears most of the members joined the cooperatives to receive subsidies and government grants without understanding the broader scope of the cooperative approach to improving their livelihoods. More than half of the agricultural cooperatives in our study area retail subsidized fertilizers to farmers in accord with the provision of Government fertilizer subsidy policy. Cooperatives can receive a one-time grant of up to 500,000 NPR from central and local government agencies

under institutional development headings. Cooperatives could receive free seed and various small-scale subsidies from Government and Non-Government Organization(GOs/N). Most cooperatives utilize this cost subsidy scheme, although these small-scale schemes do not matter as much compared to the agricultural infrastructure needed at farmers and cooperative level.

The government should support the development of cooperatives in the agricultural sector. Many cooperatives reported that they needed to make investments in agricultural technology and infrastructure, such as improved variety of cereals and vegetables, collection centers, storage houses, tractors, irrigation canals, market information systems, etc. They argued strongly in favor of the government's role in developing agricultural infrastructure and technology, thereby developing agricultural cooperatives; otherwise, cooperatives could not compete with the products coming from India and China. We believe there should be coordinated and combined effort from government, cooperatives, and business to promote cooperatives. Cooperatives know better than others the problems they face due to the lack of well-developed marketing infrastructure and agriculture technology. Cooperatives should pressure the government to respond to these issues. In this advocacy effort, cooperatives could build strong partnerships with business through their national, regional, and district networking for policy advocacy. Cooperatives also should join hands with business in resource collaboration and policy advocacy from which both parties would get the benefits of agricultural growth. We found differences in opinion

between cooperative managers, and also between managers and their members regarding the potential scope of agricultural cooperatives in offering marketing and related services. Cooperatives need training and educational campaigns to support cooperative management and entrepreneurship focusing on crops and vegetables. In addition, it would be fruitful if cooperative chairpersons/managers visited successful marketing cooperatives in other countries to get insights into the business-oriented approach that allows many cooperatives to operated at multiple points in the food value chain.

We found that very few members are taking agricultural loans due to the inadequate development of the agricultural sector and marketing infrastructure. In our study areas, some of the agricultural cooperatives were even considering converting their cooperatives into saving and credit cooperatives if the government would not support and execute the development of agricultural cooperatives. After all, they were primarily engaged in saving and credit services, notwithstanding their main stated objectives of increasing farm income through agricultural production and marketing.

Finally, we conclude it will take some years for members to understand the cooperative guidelines and the potential of the cooperative structure/approach to achieve the common goal of economic gains and to reduce smallholders' poverty substantially. Also, there should be a serious attempt from the Government to assist agricultural development. If the government made serious efforts to develop the agricultural

infrastructure and industry and executed cooperative policy concurrently, agricultural cooperatives would evolve to reduce smallholders' poverty.

APPENDIX

Appendix 1. Interview questionnaire for farm families

Interview number: _____ Date: _____

Socio-Demographic Attributes:

1. Does the family farm cereal or grain crops or legumes? Circle one

0) No *(If the family does not farm, thank him/her and leave)*

1) Yes

2. Are you the person who makes the major decision of the farm? Circle one:

0) No *(Go to question 2.1)* 1) Yes *(Go to question 3)*

2.1 If no, would you be able to answer most questions about the farm? Circle one:

0) No *(If he/she is not involved/does not participate in major decision about the farm and does not have ability to respond to most questions about the farm thank him/her and leave)*

1) Yes *(Ask who they are, question 2.2)*

2.2 What is your relationship to the person who makes the major farm decisions?

_____

3. What occupation brings in the most income for the family? Circle one

1) Farming

2) Livestock raising

3) Poultry

4) Own a business

5) Wage or salary employed

6) Other (specify)_____

4. What occupation brings in the second most income for the family?

1) Farming

2) Livestock raising

3) Poultry

4) Own a business

5) Wage or salary employed

6) Other (specify) _____

5. How many years has your family been in farming as one of its important incomes for the family?

_____ years

6. Would you please tell the details about the land owned and rented in/out by the family?

Land Type		Land ownership		Leased in	Total
		Used by family	Rented out		
Khet	Area				
	Measurement				
Bari	Area				
	Measurement				

Pakho	Area				
	Measurement				
Other	Area				
	Measurement				

Note: Bigha; kattha; dhur; ropani; ana; paisa (land measurements in local units)

Community Organizations & Coop membership

7. Are you or any family member of your family a member of a community organization?

Organization	Who is a member?(Code below)	Year became a member	Board member (only tick those that apply)
Agriculture cooperative			
Saving & credit cooperative			
Multi-purpose cooperative			
Dairy cooperative			
Vegetable &fruits cooperative			
Producer group			
Irrigation users' group			
Community forest users' group			
Women's club			
Other			

Other			

Code:

1- Husband

2- Wife

3- Child

4- Grandfather

5- Grandmother

6- Other (specify)

(If not an agriculture cooperative member, go to Questions 10 to 17)

8. How much did the membership or a share of the agriculture cooperative cost?

_____

9. What are your most important reasons for being a member of an agriculture cooperative?

SN	Services	Do not ask each one. Let the respondent answer and number the services in the order the respondent says them)
1	Marketing services (collection, price, etc.)	
2	Services and input (seed, pesticide, etc.)	
3	Technical training	
4	Group bonding & knowledge sharing	

5	Credit provision	
6	Linkage & extension services	
7	Other (specify)	
8	Other (specify)	
9	Other (specify)	

(Go to Question 18)

10. Do you want to join an agricultural cooperative? Circle one

0) No *(If no go to Question 12)*

1) Yes

11 Why did not you join an agricultural cooperative? Please provide the reasons.

_____

_____

_____

(Go to Question 13)

12. Why do you not want to join an agriculture cooperative? Please provide the reasons.

_____

_____

13. Are you buying any inputs or getting any services from an agricultural cooperative without being a member? Circle one

    0) No *(If No go to Q16)*

    1) Yes

14. What kind of services/inputs you are getting without being a member?

    _____

    _____

    _____

15. How do you get production and marketing services for your farm? Please tell in brief.

    _____

    _____

    _____

16. Have you been a member in an agriculture cooperative in the past? Circle one

    0) No *(If no go to Q18)*

    1) Yes If yes, for how many years? _____

17. Why did you leave the agriculture cooperative at that particular time? Would you please tell the specific reason?

    _____

    _____

    _____

(Continue on to Q18)

Farm and Income generation

18. Please provide information about crops you grow and sell.

Crops	Record of last year (May 2018 to May 2019)						
	Area and measure	Quantity produced (ql/kg)	Quantity sold(ql/kg)	Sell value (NRs)	Where do you sell? (code below)	How far away is it?	How do you get there?
Cereal crops							
1.							
2.							
3.							
4.							
5.							
Legumes/Veg.							
1.							
2.							
3.							
4.							
5.							
Annual fruits							
1.							

2.							
Others							
1.							
2.							

Code: (1) Cooperatives

(2) Government owned collection centre

(3) Hat bazaar

(4) Wholesaler

(5) Middleman

(6) Retailer at local market

(7) Other (specify in the box above)

Note: 1 ql. = 100kg

19. Why did you sell your crops/legumes/vegetables to that particular buyer or more than one buyer? Please provide reasons.

20. Please provide information about livestock during the last year (May 2018-May 2019)

Particulars	Record of last one year				
	Quantity/Number	No./litre/kg (measurement)	Quantity sold	Sales price of animals and product (NRs)	Where did you sell (see code below)
Milk cows					
Male calf/calves					
Female calf/calves					
Milk					
Milk buffalo					
Buffalo Male calf					
Buffalo Female calf					
Buffalo milk					
Ghee					
Chickens					
Goats					
Pigs					
Eggs					

Manure					
Others					
1.					
2.					
3.					
4.					

Code: (1) Cooperatives

(2) Government owned collection centre

(3) Hat bazaar

(4). Wholesaler

(5) Middleman

(6) Retailer at local market

(7) Other (specify in the box above)

21. Would you please provide your best estimate of the cost for farming (crops & vegetables) during last year?

Costs	Quantity/number and unit	Annual cost (NRs)
Farming (cereals & vegetables)		
Land leasing		
Ploughing & manure		
Total seeds & Pesticide		
Household labour		
Hired labour		
Marketing cost		
Transportation cost		
Others		
Total		

22. During the last three years(May 2016 to May 2019), have you made any additions or replacements to your physical assets because of income from the farm and livestock? (Circle below)

0) No *(go to Q24)*

1) Yes

23. Which assets have you added or replaced using farm income within past 3 years?

Property	Quantity	Addition or replacement (1=addition 2=replacement)	Value at the addition/replacement (NRs)	Ownership (1= Household own 2= jointly owned)
House				
Exterior/interior of the house				
Any savings				
Land				
Cattle adults				
Cattle Male calf				
Cattle Female calf				
Buffalo adults				
Buffalo Male calf				
Buffalo Female calf				
Pig				
Ox				
Television				
Radio				
Mobile				
Bicycle				
Sprayer				

Iron Plough				
Shovel				
Deep tube well				
Rower pump/Dhiki				
Power tillers				
Tractor				
Thresher				
Animal drawn cart				
Pumping set/motor				
Others				

24. Please tell me all income from all sources for all members of the family.

Income source	Record of last year (May 2018-May 2019)
	Annual Income (NRs)
Farm & Livestock income	
Trader/business	

Wage or salary job	
Trainer as Local Resource Person (LRP)	
Dividend from cooperatives	
Other income received from cooperatives	
Remittance money	
Others (specify)	
Total income	

25. Did you take out a loan last year from may 2018 to may 2019? Circle below

    0) No *(go to Question 27)*

    1) Yes

26. Please, provide the initial loan amount you have received from each organization and amount of loan you currently owe on each loan.

Organization	Initital loan amount (NRs)	Amount owed now (NRs)

Total amount		

27. Could you please provide information about the educational background of all the members, including children who are not yet school age?

Number of HH members	Sex (M or F)	Age	Education (Code below)
1. Farmer (farm decision maker)			
2			
3			
4			
5			
6			
7			
8			

Code: 0) Illiterate

1) Literate only [basic reading and writing without formal education]

Write exact grade they finished or are currently attending

1), 2), 3), 4), 5), 6), 7), 8) [year in primary school or finished primary as highest degree (8)]

9), 10), 11), 12) [year in secondary or finished high school as highest degree (12)]

13), 14), 15), 16) [post-secondary education ior ears in college or has college degree (16)]

17, 18 [studying for masters degree or has masters degree (18)]

C) –Not school age but will go to school when old enough

28. Social background of the family (circle one).

1) Brahmin

2) Chhetri

3) Indigenous/ethnic (Gurung, Rai, Tamang, Magar, Tharu, Newar)

4) Dalit (Kami, Damai, Sarki, Paswan, Chyame, Pode, Mussahar)

5) Madhesi

6) Mixed (more than one ethnicity in a family)

7) Other (specify_____)

29. Please indicate the major ethnicity of your neighbourhood? (Circle one)

1. Majority are general ethnic group (Brahmin, Chhetri)

2. Majority are Indigenous/ethnic (Gurung, Rai, Tamang, Magar, Tharu, Newar)

3. Majority are Dalit (Kami, Damai, Sarki, Paswan, Chyame, Pode, Mussahar)

4. Majority are Madhesi

5. Mixed

6. Others (Specify)

Checklist for your locality:

30. Now I would like to ask questions about whether organization and services exist in your village, if you use them and ones you use even if they are not in your village.

Organizations and services	Do they exist in your village? 0 (No) 1 (Yes)	Are you using their services? 0 (No) 1 (Yes)	Is the service available to everyone? 0 (No) 1(Yes)	Distance from your residence even if they do not exist in your village (Km)
Agriculture cooperatives				
Saving & credit Cooperatives				
Dairy Cooperative				
Producer organization				
Agricultural development bank				
Cooperative association				
Cooperative division office				
Cooperative bank limited				
Grameen Bank				
Credit group				
Private money lenders (merchants)				
Haat bazar				
Nearest market				
District headquarter				

Government agricultural collection centre				
Agricultural Cooperative collection centre				
Agro-vets				
Motorable road				
Any factory/industry				
Others …….				
……..				
……..				

Thank you for your kind cooperation

Appendix 2. Interview questionnaire for designated person of the cooperative (Chirperson/Manager)

Interview number: _____ **Date:** _____

1. What do you see as the primary goals of the cooperative?

   _____

   _____

   _____

2. How many families/households are there in the cooperative? How old is this cooperative? How many families/households were in the cooperative during the first year of operation?

   _____

   _____

3. Are there any requirements to join or to remain a member? If so, please describe the requirements briefly.

   _____

   _____

   _____

   _____

4. Is it common for a person to leave and then after rejoin the cooperative? If so, please tell the reasons?

5. How does the cooperative transfer the ownership (shares, dividends, etc.,) of a leaving member in the cooperative?

6. What services does the cooperative provide? Can you describe each of the services such as input supply to members, pooling produce to direct market, etc. of the cooperative?

7. Are there any services (indicate these above) that the cooperative offers because of requirements or incentives of external agencies such as governments or NGOs/I?

8. How many members actively participate in the meetings, and in the decision making process? If attendance differs by type of meeting, explain. Explain participation in terms of the decision-making process.

9. How are members informed of the rules and regulations of the cooperative? Would you please explain the mechanism briefly?

10. How frequently does the cooperative communicate with members? In what forms does communication take? Please provide the description.

11. Is it members or executive members who take new initiatives or is it cooperative staff? What leads to such new initiatives?

12. Are there any members who sell their produce to multiple channels (to both cooperatives and traders)? If so, why do they are sell to multiple channels? Please provide the reasons.

13. Are there any non-members doing business or engaging in transactions with the cooperative? If so, how many non-members are involved in such practice?

14. How do benefits differ for members and non-member? Why does the cooperative serve non-members? Please describe briefly.

15. Is this cooperative involved in a district union or national federation? If so, what are the advantages of the union or federation for this cooperative?

16. How do you rate the economic performance of this cooperative in terms of raising farm income of the members?

17. If you have worked in other cooperatives, what differences do you see between cooperatives? Please provide the differences you have seen.

18. Are there any ways you see that the cooperative may be able to improve the services it provides to members? If yes, please provide a brief explanation.

19. Is the cooperative active in advocating policy changes to the union at the district level, to the national federation, or to the national government? Explain

20. What would the typical households in terms of land holdings and income in the cooperative? Please tell the tentative figures.

21. Do you have any prior managerial experience before joining this cooperative? If yes, Please provide your previous involvement in each organization starting with most recent previous job?

Name of the organization	Job title	Duration

22. Identification particulars

i) Name of the cooperative: _____

ii) Crop of the cooperative (if more than one crop, then crops and relative importance): _____

iii) Respondent position in the cooperative: _____

iv) Duration of the job title: _____

v) Duration serve by the respondent: _____

vi) Age of the respondent: _____

vii) Gender of the respondent: _____

Thank you for your kind cooperation

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VITA

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