

Datoon, Rodmyr F.; Camacho Junior, Jose V.; Lapitan, Aileen V.; Gapas, Jeanarah M.

## Article

Bridging and bonding social capital for sustainable technology adoption, the Landcare program in the resource poor rural town of Claveria, Philippines

Research in Globalization

## Provided in Cooperation with:

Elsevier

*Suggested Citation:* Datoon, Rodmyr F.; Camacho Junior, Jose V.; Lapitan, Aileen V.; Gapas, Jeanarah M. (2023) : Bridging and bonding social capital for sustainable technology adoption, the Landcare program in the resource poor rural town of Claveria, Philippines, Research in Globalization, ISSN 2590-051X, Elsevier, Amsterdam, Vol. 7, pp. 1-8, <https://doi.org/10.1016/j.resglo.2023.100152>

This Version is available at:

<https://hdl.handle.net/10419/331080>

## Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

## Terms of use:

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*



<https://creativecommons.org/licenses/by-nc-nd/4.0/>



# Bridging and bonding social capital for sustainable technology adoption, the Landcare program in the resource poor rural town of Claveria, Philippines

Rodmyr F. Datoon<sup>\*</sup>, Jose V. Camacho Jr., Aileen V. Lapitan, Jeanarah M. Gapas

University of the Philippines Los Baños, College, Los Baños, Laguna 4030, Philippines

## ARTICLE INFO

### Keywords:

Bridging social capital  
Bonding social capital  
Landcare program  
Soil conservation  
Philippines

## ABSTRACT

The important role of bonding and bridging social capital in technology adoption has been well documented. This holds true in the dissemination of soil conservation technologies in the town of Claveria under the Landcare program. Past studies unanimously attribute high adoption rates to the formation of farmer Landcare groups, which is a form of bonding social capital, and to the provision of human and physical resources through external networks, a form of bridging social capital. After more than 20 years since the project ended in the town, this study unpacks this relationship and illustrates how the two types of social capital are complementary for sustained technology adoption. Data from household surveys, focus group discussions, and key informant interviews illustrate that the training and physical resources provided through external organizations and partnerships greatly contributed to program participation and high adoption rates of technologies. When such external organizations left the town, adoption rates fell and some farmers reverted to their traditional farm practices. These findings contribute to the debate on the complementation of the two types of social capital in sustaining adoption as well as illustrate how the two types relate to each other for sustainable rural development programs.

## Introduction

The rugged terrain and the lack of infrastructure in the town of Claveria, in the province of Misamis Oriental, Philippines not only made farmers in the town prone to soil erosion, but it also posed a huge obstacle in the flow of information, knowledge, innovation, and investment. There were a handful of programs that aimed to disseminate soil conservation technologies in the town in the decades before 1996. The gains of these programs, however, were limited. It was in 1996 that the International Council for Research in Agroforestry (ICRAF, currently known as the World Agroforestry) introduced the practice of natural vegetative strips (NVS) through working with small groups of farmers rather than the old practice of engaging individual farmers. A handful of farmers, ICRAF staff, and one government agriculture technician adopted the name “Landcare” which was, at that time, independent of the Australian Centre for International Agricultural Research’s (ACIAR) project with the same name (Williams et al., 2021). Capitalizing on the early success of the ICRAF’s efforts, ACIAR funded a Landcare program with ICRAF in the town in 1999 which marked the start of their decade-

long engagement. ICRAF activities in the town ended in 2004 but the program was continued by Landcare Foundation of the Philippines, Inc. (LFPI) until 2011. Both ICRAF and LFPI served as technical facilitators of training and capacity development. Both organizations fostered the development of partnerships and networks, including the formation of farmer groups in the promotion of soil conservation technologies.

Past studies that assessed the Landcare program in the town were unanimous to declare that the main catalyst for the successful adoption of soil conservation technologies is the establishment of Landcare groups among farmers in the villages. These groups have been found to play a vital role in facilitating training, dissemination, and adoption of soil conservation technologies. Many studies have also cited that the success of the Landcare program in Claveria highlighted the importance of two types of social capital in disseminating and adopting soil conservation technologies. The positive roles of bonding and bridging social capital are well documented in successful cases of agricultural intervention and adoption of agricultural technologies. On one hand, the Landcare groups capitalized on bonding social capital among the farmers and further built on it to promote and organize the program among villagers. On the

<sup>\*</sup> Corresponding author at: Division of Agricultural Extension and Rural Studies, Agriculture Systems Institute, College of Agriculture and Food Science, University of the Philippines Los Baños, College, Los Baños, Laguna 4030, Philippines.

E-mail address: [rfdatoon@up.edu.ph](mailto:rfdatoon@up.edu.ph) (R.F. Datoon).

<https://doi.org/10.1016/j.resglo.2023.100152>

Received 12 July 2023; Received in revised form 2 September 2023; Accepted 2 September 2023

Available online 3 September 2023

2590-051X/© 2023 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

other hand, partnerships from external organizations like ICRAF and the LFPI provided the bridging capital in the form of funding, technical knowledge, physical resources, and training, among other things. Such resources are not found in the village due to its remoteness. The objective of this paper is to unpack the concept of social capital by analyzing the relationship between bridging social capital and bonding social capital in the adoption of and practice of soil conservation technologies introduced in the Landcare program. It seeks to answer the question “How does bridging social capital and bonding social affect each other in the sustained adoption of technology in a remote rural community?”

Recent data suggests that there are decreasing numbers of farmers who are practicing soil conservation technologies in the town. The data also suggests that there are lower rates of membership and participation in the Landcare groups compared to the past. The data from the household survey, key informant interviews, and focus group discussions performed in the study support the finding that the decrease in adoption and Landcare group membership was affected by the discontinued support of external organizations, ICRAF and LFPI, to the Landcare program. Such findings suggest that disruptions in the partnership or the discontinuance of support from external actors, which provides the bridging social capital among the Landcare groups in the village, was a crucial factor in sustaining the membership and participation among the groups. This, in turn, facilitates the sustained adoption of soil conservation technologies among farmer members. These further suggest that the two types of social capital play a complementary role in disseminating technology and sustaining the adoption of soil conservation technologies in the remote rural town of Claveria. Data from this study suggest that the resources facilitated by the bridging social capital were an important factor in facilitating and enhancing bonding social capital which has been proven as a catalyst for technology adoption. This complements past studies on Landcare especially studies done in the Philippines as it provides insights into what happened to the project 20 years after its implementation and after external funding for the project ceased. These findings also provide insights for development agencies and projects that aim for sustainable impacts of interventions among rural communities.

## Theoretical framework

### *Types of social capital*

Social capital has been cited by many as one of the influential drivers for many aspects of community development which includes sustainable technology adoption. Social capital is defined by Putnam (2000) as stocks of social trust, networks, and values that people can utilize to improve their livelihoods and pursue objectives shared with others. This is very close to the definition of Woolcock (1998) as ‘the information, trust, and norms of reciprocity inhering in one’s social networks’ or ‘the norms and networks that enable people to act collectively. There have been many studies on the impacts of social capital since the concept was popularized but Patulny (2007) observed that many researchers tend to agglomerate social capital into one catch-all concept. In contrast, social capital is far from being monolithic and can be differentiated into types. Without focusing on the types of social capital, Woolcock (1998) warns that researchers can be misled into assuming that the “accumulation of more social capital is always better.” Instead, he suggests that researchers analyze different types of social capital that work in concert with each other.

Woolcock (1998) identified three types of social capital that play an important role in communities in their pursuit of development. The first is identified as “bonding social capital” which refers to the intra-community ties that enable poor people in a village setting. Examples of this are monitoring of property rights, labor exchange, reciprocal subsistence assistance, and provision of communal facilities. The second is ‘Linkage’ or ‘bridging social capital’ which refers to the extra-community networks that enable individuals and groups to tap outside

sources of information, support, and resources. Examples of this include links to market players, traders, financial institutions, extension agents, and non-government organizations (NGOs). Coleman (1988) distinguished the two types from each other. He referred to bonding social capital as the strong ties between homogenous and intra-community networks (e.g. family, peers, community ties) while bridging social capital is referred to as the ties between extra-community networks and heterogenous groups. Woolcock (1998) developed a third type, which he coined “linking social capital”, which connects the community with more formal economic, political, and social institutions. Granovetter (1985) described linking social capital as the weak ties that allow the use of resources, ideas, and information from formal institutions beyond the community such as government agencies, research, centers, and banks. Patulny (2007), however, argues that when placing such type of social capital on par with bonding and bridging social concepts, it would seem contentious. He argues that “linking” is not part of everyday social interaction in a local setting. The author also argues that the “linking social capital” concept can overlap with other concepts such as confidence in government and democratic governance. The linking concept is also not clearly defined as it overlaps with the bridging concept and thus would be better to be left out for the objectives of this study.

The general view from past studies is that both ‘bonding and bridging social capital have a complementary role in community development. Poor rural communities have always been characterized as having close relationships that enable them to survive and stay resilient. This pertains to bonding social capital. However, Woolcock and Narayan (2000) argue that this is not enough as for development to proceed, there should be new linkages for communities to open up new opportunities for individuals. This is especially true for rural communities that lack investment and are far away from growth areas. Poor communities would need bridging social capital to gain access to resources otherwise not found in their communities (Barr, 1998; Narayan, 1999). Depending on the conditions in the environment and the endowments of social capital in the community, different optimal combinations of the two types of social capital, which could change over time, are needed to arrive at certain development outcomes (Woolcock and Narayan, 2000).

In the case of the Landcare program in Claveria, there is consensus that both types of social capital were necessary for adoption to happen and for the Landcare program to succeed. Cramb and Culasero (2003) cited that there is existing strong social capital in the villages under the Landcare programs in Southern Philippines as illustrated by the presence of labor exchange institutions and other resource-sharing institutions. This bonding social capital was further enhanced with the organization of Landcare groups and the provision of training to capacitate and develop these grassroots organizations. Bridging capital, on the other hand, was enhanced through outside linkages with scientists, researchers, extension agents, and agribusiness facilitated by ICRAF and the LFPI. These external actors, agencies, and organizations were the most important sources of technical knowledge on soil conservation and agroforestry practices (Cramb 2007).

### *Social capital as an investment*

Lin (2001) described social capital as an investment in social relations with expected economic returns. Glaeser et al. (2002) further explained that it is true that individuals invest in social capital by being members of a group but their main incentive for joining is still individual returns. Both authors saw the accumulation of social capital as an investment decision driven by a combination of factors that includes an individual’s characteristics and the social and economic environment. Such investment is made through subscription to the norms and conventions of the group or the community (Woolcock, 1998; Coleman, 1988). This can be manifested in memberships to a particular organization or active participation in the organization’s activities, practices, and functions. Coleman (1988) further explains that because social capital is a product of the collective investments of individuals, it can

then be affected by the behavior of other individuals in the group. As a result, social capital can be destroyed, or diminished by others who undermine the trust and cooperation among the members. At the same time, it can be increased by others who promote group trust and cooperation (Woolcock, 1998).

Cramb's (2006) study cited that farmers not only capitalized on the existing stocks of bonding social capital within their communities to form Landcare groups but, in doing so, also capitalized on the bridging social capital from the external organizations. Based on the finding of Cramb (2007), membership in community Landcare groups in the Philippines can be seen as a mechanism to accumulate social capital by farmers who want to improve their access to farm inputs, soil conservation technologies, and other agroforestry technologies. The author cited that one of the main goals in forming these groups was to take advantage of the farm materials, training, and capacity-building programs being provided by ICRAF at that time. Cramb's (2006) findings point to the presence of an external organization that trains and facilitates linkages outside the village as the main impetus for farmers actively joining and participating in village-level land care groups. Although the author recognized that stocks of existing bonding social capital existed in the villages before the Landcare program, the entry of the external organization rapidly mobilized them to form groups and often in their own initiatives. These findings agree with the study of Micheels and Nolan (2016) on farmers with greater bridging social capital having greater capacity to acquire new technologies and innovations from sources external to the traditional intra-community networks. The authors also found that, on the contrary, networks that are isolated from external actors, more specifically knowledge brokers (e.g. extension agents, NGOs, private organizations) lag in terms of innovation.

The Landcare program in Claveria and other Landcare sites in the southern Philippines shows that although both types of social capital are important, bridging social capital seemed to be the key to mobilizing the available bonding social capital in these remote and poor communities. Nonetheless, past studies on the Landcare experiences in the town of Claveria put equal importance on both bonding and bridging social capital in the early success of the soil conservation technologies in the town. These studies, however, were not able to conclude which type of social capital played a greater role in the adoption of soil conservation technologies. This is mostly due to difficulties in attributing adoption in such a complex environment with different variables. This study, however, may be able to provide answers on which type is more important in sustaining the adoption of soil conservation technologies in the town of Claveria.

## Materials and Methods

### Research design and data collection methods

The lack of baseline data from project documents and ICRAF and LFPI, especially the absence of an official list of Landcare beneficiaries did not permit the study to do a "before and after" approach. Thus, the study implemented a "with and without" approach which involved establishing a credible counterfactual estimation, utilizing a control group. Subsequently, these counterfactual estimates were compared to the outcomes from treatment groups to derive a comprehensive assessment of the program's net effect. The determination of how to establish these control and treatment groups hinged on insights garnered from interviews with local program implementers and stakeholders. These interviews uncovered distinct strategies employed by ICRAF and LFPI in providing assistance to beneficiaries, and the extent of their coverage across different areas (villages) within the town.

The ICRAF project was relatively small with fewer villages compared to the LFPI project which was better funded and was implemented in many villages in the town. According to the interviews with Landcare group leaders who experienced both project implementers, ICRAF

focused more on providing direct material aid in the form of farm inputs, livestock, etc., to complement their training programs while encouraging the formation of Landcare groups. LFPI focused on providing capacity-building with an emphasis on formal technical training in community organizing. This approach was an effort to capitalize on the Landcare groups' positive impact on technology adoption. This, however, did not mean that the LFPI did not provide material incentives for participation as well.

This information then influenced the sampling design, which involved categorizing the population into four distinct groups. The control group included villages where neither ICRAF nor Landcare interventions were present. These areas primarily focused on timber or fruit tree cultivation, rendering Landcare technologies appear inapplicable due to the perceived inherent protection from erosion provided by trees. Treatment 1 comprised of villages where only ICRAF interventions were carried out. Treatment 2 included villages exclusively targeted by Landcare initiatives, without ICRAF involvement. Treatment 3 included villages where both ICRAF and Landcare interventions were extended. The selection of specific villages that were grouped into these categories was contingent on a triangulation of outcomes, drawing insights from various sources: KIIs, FGDs, and review of past reports or documents.

Survey participants were household members who were knowledgeable of farm operations. KIIs were conducted among former Landcare group officials and farmer leaders centering on a similar question asked in the FGDs. Former project managers and project staff of ICRAF and LFPI were also interviewed regarding the implementation of the Landcare program and were asked for project reports and secondary data. The responses from the interviews and focus groups were analyzed through thematic analysis. FGDs were conducted in seven villages in the town that are prone to soil erosion. The discussion centered mostly on the impacts of soil conservation technologies on the livelihoods and community, the reasons for the adoption of soil conservation technologies, and the dynamics within Landcare groups and external organizations. FGD participants ranged from eight to fifteen participants with a mix of males and females. The responses from the interviews and focus groups were analyzed through thematic analysis. Data gathering was performed from June 2018 to April 2019. The research team explained the purpose of the research to all the participants of the data collection activities and all participants have given their consent to use their information and be part of the study.

### Sampling procedure for the survey

A total of 411 farmers in sloping areas served as the eligible population (N) and a proportional allocation scheme with groups as stratification variables was employed. The study used a 95 percent confidence interval, a 0.6 expected true proportion (p), and a two (2) percent margin of error (e2). The formula used is as follows:

$$n_o = \frac{Z_{\alpha/2}^2(p) * (1 - p)}{e^2} \quad (1)$$

Eq. (1). The sample size for large populations.

Ingesting these parameters into the formula yielded an initial sample size of 2,305 farmers. However, it was deemed necessary to adjust this sample size given that the population of the study was finite. Further computations were applied using this formula:

$$\left( n = \frac{n_o}{1 + \frac{n_o}{N}} \right) * n_{deff} \quad (2)$$

Eq. (2). Adjusting for a small, finite population, and accounting for the design effect.

In this equation,  $n$  represents the adjusted sample size,  $n_o$  is the initial sample size, and  $N$  is the eligible population. Finally, a multiplier of 0.5 was applied to account for the sampling design effect ( $n_{deff}$ ). Based on

these computations, the survey covered a total of 176 samples, allocated proportionately across the groups. Farmer respondents were then drawn through a random sampling procedure.

### Analysis of determinants of adoption

A binary logistic regression was implemented to estimate the probability of adoption of Landcare technologies based on a combination of factors. The choice of the explanatory variables included in the model was based on 1) the list of impact indicators identified through iterative context mapping and impact scoping and 2) previous literature that proved the relationship of the variables to the outcome variable. The adoption equation includes the following factors:

$$\text{Adoption}_i = \ln\left(\frac{P_i}{1 - P_i}\right) = \beta_0 + \beta_1 \text{HHSIZE} + \beta_2 \text{FSIZE} + \beta_3 \text{Org} + \beta_4 \text{Aware} + \beta_5 \text{Trust} + \beta_6 \text{CropA} + \beta_7 \text{CropB} + \beta_8 \text{DivInc} + \beta_9 \text{LandO} \quad (3)$$

Eq. (3). Binary Logistic Regression for Landcare Technology Adoption.

The variables in the model are defined as follows. *HHSIZE*: Number of heads in a household (continuous). Household size can influence the division of labor, resource allocation, and decision-making dynamics within a family. In the context of Claveria, where the average household size is 4, larger households might have varying resource capacities that can affect their readiness and ability to adopt Landcare technologies. *FSIZE*: Lot/farm size in hectare (continuous). Given that the typical farm size within the municipality of Claveria is less than 2.0 ha, and implementing Landcare technologies would necessitate allocating a portion of their land away from current crop use, farm size was deemed influential to adoption. *Org*: Participation in farmer organizations, whether participated in any community organizations or otherwise (binary). Participation in farmer organizations can catalyze the diffusion of information, knowledge sharing, and peer influence. *Aware*: Awareness of Landcare, whether aware or unaware (binary). The degree of awareness about the Landcare Program directly affects a farmer's likelihood of adopting its technologies. Including this variable acknowledges the foundational role of awareness in influencing adoption decisions. *Trust*: Trust in Landcare groups (ordinal). Trust is a linchpin in the adoption process. The inclusion of trust as an ordinal variable recognizes its multifaceted nature and its potential impact on technology adoption. Trust, in the context of this study, serves as an intermediary variable that bridges awareness of and membership in Landcare, and adoption of technologies, making its inclusion essential. *CropA*: Type of crop planted, whether high value or otherwise (binary). The selection of whether high-value crops or not reflects a farmer's risk appetite, market orientation, and willingness to embrace new practices. High-value crops might correlate with a higher motivation to adopt technologies that optimize returns. *CropB*: Practice of agroforestry, whether planted fruit/timber trees or not (binary). It was found in the FGDs that farmers in sloping areas who planted timber and/or fruit trees were less inclined to adopt Landcare. This disinclination stemmed from a perception of the planted trees providing inherent safeguarding against erosion, rendering the introduced technologies seemingly inapplicable. However, there were farmers who embraced adoption along with the practice of agroforestry. This finding underscores that the presence of trees within their cultivated lands might necessitate different approaches, making the inclusion of this variable relevant for understanding Landcare adoption. *DivInc*: Diversity of income, whether has other non-farm and off-farm income sources or otherwise (binary). The inclusion of this variable can provide insights into whether diversified livelihoods empower farmers with greater risk tolerance to adopt new technologies, or lead to a sense of contentment among farmers with the ability to financially compensate to any losses due to erosion, potentially diminishing the likelihood of adopting technologies. *Land*: Land Ownership, whether

owned or otherwise (binary). The inclusion of this variable could shed light on the motivational factors of land ownership related to a farmer's capacity to mitigate losses resulting from land erosion.

Furthermore, this study defines adopters as farmers adopting at least one of the four soil conservation technologies espoused in the Landcare program. Although NVS was an innovative technology that made Landcare popular among the farmers, the adoption of the four soil conservation technologies highly depends on the needs of the farmers. Thus farmers may opt to adopt one technology or a combination according to their needs.

## Results and discussion

### The early success of the Landcare program in Claveria

Soil conservation technologies were not new to the farmers of Claveria as many efforts had been made to disseminate the technologies to them before the establishment of the Landcare program in 1996. Many groups like the International Rice Research Institute (IRRI), Southeast Asian Research Council for Agriculture (SEARCA), and others have all implemented dissemination programs in the town and other nearby areas in the past. However, according to [Cramb and Culasero \(2003\)](#), there was an observed low adoption of soil conservation technologies in the Claveria and other Landcare sites in nearby provinces before the organization of farmers into Landcare groups. This led [Cramb \(2005\)](#) to conclude that programs implemented in similar sites in the region that lack the elements of the Landcare approach have resulted in less adoption of soil conservation technologies. The organization of farmers into Landcare groups was cited by various authors as a crucial factor in accelerating the adoption of Landcare technologies ([Arcenas, 2002](#); [Cramb and Culasero, 2003](#); [Catacutan and Cramb, 2004](#); [Vock and Aspera, 2013](#)). These authors even go on to attribute rapid technology adoption to the partnership among the Landcare groups and the external organizations. The key element in this partnership proves to be the farmer-to-farmer approach. It is also characterized as non-hierarchical and decentralized which has proven effective in knowledge management and technology dissemination. This approach provided a less formal atmosphere and provided practical and hands-on exercises which the farmers appreciated better. Furthermore, training sessions also fostered social bonding among farmers and networking among farmers and farmers from other villages, trainers from different research organizations, and project staff members of project implementers. ([Catacutan and Cramb \(2004\)](#)). This partnership facilitated the development of human capital in the villages through the training provided by external organizations. These, in turn, enabled farmers to understand better the soil conservation technologies and incorporate them into their farming systems, which yielded environmental and economic benefits. These attracted other farmers to join the program through the Landcare groups and a rapid increase in the formation of Landcare groups among communities was observed. In some cases, according to the study of [Cramb and Culasero \(2003\)](#), farmers themselves help neighboring villages and hamlets form their local groups.

The findings of [Cramb and Culasero \(2003\)](#) point to the program facilitating the building of "bridging social capital" as it enabled the building of vertical linkages between the farmers' groups and external organizations. These vertical linkages are what fueled the provision of technical training on contour farming, vegetable production, propagation and establishment of perennials and other technical farming techniques, and group organizing and facilitation ([Catacutan and Cramb, 2004](#); [Cramb, 2005](#)). These external linkages also facilitated access to material inputs such as seeds, other types of planting materials, livestock, and some farm equipment by members of the groups. Aside from the training, these provided added incentives for farmers to join Landcare groups. The same findings are observed in other land care sites where a similar approach was implemented. In the nearby town of Lantapan, the main reason for joining Landcare groups was mainly to



take advantage of the training on new technologies, tapping into the wider network of information and technical support, and access the wider Landcare network which is facilitated by external organizations (Cramb 2005). Such external partnerships and linkages are rare for underdeveloped and isolated rural communities in the Philippines. This is the main reason why farmers take advantage of such opportunities whenever they are available in their community.

It was hard to pinpoint from past studies which type of social capital played a greater role in the increased adoption of Landcare technologies in Claveria. Although the authors have noted that there ample amount of bonding social capital among the villagers, it was when the external organization brought in resources and when the rapid formation of Landcare groups happened adoption rates took off. This argument highlights the importance of bridging social capital. But at the same time, there is a counterargument that can be made that without the bonding social capital within land care groups, the program will not find success.

### Decreasing adoption of soil conservation technologies

Past studies have documented high rates of adoption among Landcare group members in the town and other Landcare sites. One study by Cramb et al. (2006) found that the adoption of NVS in Claveria grew significantly from 1996 to 1999, where a growth of 300 percent in total land area with the said technology installed was observed. The study also noted that about 90 percent of farmers that were practicing agroforestry and NVS by the middle of 2003 had adopted the practices during the period of the Landcare program. A more recent study by Vock and Aspera (2013) reported that during the early onset of the project (1999 to 2004), 65 percent of the farmers in Claveria were adopting Landcare conservation measures. These findings were supported by data from the key informant and FGDs in this study as farmers revealed that indeed most of the farmers in Claveria during that time were still adopting Landcare technologies.

The average years in farming among the survey participants were 18 years. It is possible that farmers' needs pertaining to soil conservation might have changed over the course of 20 years but numerous field visits in the town suggest that many farmers in sloping areas have not yet adopted contour farming and NVS which are fundamental in mitigating soil erosion. It was clear in the FGDs and interviews that controlling soil erosion remains a significant and ongoing concern among the farmers. Roads linking villages together and roads linking farms to markets are still not well developed adding to the isolation and remoteness of villages from each other and the government in the center of town. Outside interventions like training on a wide scale are still quite rare.

Data from the survey of this study revealed that the adoption rate of Landcare technologies went down. Data from the survey and the focus groups also revealed that there were farmers who reverted to their previous production practices. As seen in Table 1, less than half of the sampled farmers in the study reported continued use of soil conservation technologies. Hedgerows were the least utilized among the technologies while contour farming was the most utilized. Contour farming is the most fundamental technology prescribed by the Landcare program. It can be seen from the survey that even the most basic of technologies from the program have not been used by the farmers in Claveria recently. This trend can also be seen across villages that received the

program, whether from ICRAF or LFPI.

Except for contour farming, all other technologies were not utilized by almost more than half of the farmers. Using contour farming as the benchmark for assessing the adoption of Landcare in the town as it is the most fundamental and the other technologies require it, we could see that adoption was at 47 percent. Some studies would argue that a good indicator of the adoption of soil conservation technologies would be the adoption rates of NVS. During the study, the percentage of farmers adopting NVS was 38 percent. These adoption rates are relatively still high as this translates to many farmers still using the soil conservation technologies in the town. However, this is far from the findings of Vock and Aspera (2013) of a 65 percent adoption rate.

The data from the survey indicates that ICRAF-only villages had lower adoption rates of soil conservation technologies. This can be attributed to the lack of awareness of the programs among current farmers and the shorter activity of Landcare groups compared to villages with both ICRAF and LFPI projects. ICRAF left the villages earlier and farmers experienced shorter periods of Landcare project. This may have resulted in limited awareness of the project among farmers and limited time to build strong trust in Landcare groups. The LFPI's focus on formal technical training in community organizing may have also resulted in better adoption rates in their village sites.

### Factors affecting adoption

As shown in Table 2, awareness of the Landcare program, trust in Landcare groups, and land ownership were significant at a one percent level of probability. Other factors in the model such as farm size, diversity of income, type of crops planted, and practice of agroforestry were found to be statistically significant at 5 and 10 percent levels of probability. A p-value significant at the one percent level represents the strongest evidence, indicating a very low probability of obtaining the observed results by chance alone. Conversely, a p-value significant at the 10 percent level suggests weaker evidence, with a higher probability of chance being a factor in the observed results. In essence, regression results firmly establish that awareness of Landcare and trust in Landcare groups have a strong influence on the adoption of Landcare technologies in Claveria.

The strong and significant effect of a high level of trust on adoption is consistent with earlier studies that found the positive impact of membership in Landcare groups as it enhances the learning experience of members and serves as a reinforcement mechanism in practicing soil conservation technologies. Farmers who were not aware of past Landcare programs tend to not adopt soil conservation technologies. This stresses that current adopters of soil conservation technologies are past members of the Landcare groups or those who have known the program before. This points to the lack of dissemination of the technologies outside the Landcare groups or spillover to farmers who are not part of the past programs. About 60 percent of the surveyed farmers expressed awareness of the Landcare program while 40 percent reported that they were not aware of the program.

The adoption of soil conservation technologies requires farmers to leave a considerable part of their land untilled to establish hedgerows and NVS to control erosion. Because of this, farmers with smaller farm sizes tend to be discouraged from adopting these technologies because of the potential reduction in production and income. Approximately 53

**Table 1**  
Relative distribution (%) of farmer-respondents according to the type of Landcare technology adopted, by the group.

Landcare technology	Villages with no Intervention	ICRAF Villages	LFPI Villages	Both ICRAF & LFPI Villages	Overall
Base	37	12	15	112	176
Contour	8	25	67	60	47
Natural vegetative strips (NVS)	5	17	47	49	38
Hedgerows	8	–	40	44	33
Ridge tillage	27	–	40	50	40

**Table 2**

Summary Results of the binary logistic regression results, with the adoption of Landcare technologies as the dependent variable.

Independent Variable	Odds Ratio	Standard Error	z	P > [z]
Household Size	1.0645	0.1480	0.45	0.653
Farm Size	0.8599*	0.0697	-1.86	0.063
Participation in Farmer Organizations	1.4632	0.6071	0.92	0.359
Awareness of Landcare	6.3197***	3.2736	3.56	<0.001
Trust in Landcare Groups				
Very little	0.6768	0.4772	-0.55	0.580
Somewhat little	1.2355	1.3086	0.20	0.842
Undecided if much or little	0.8251	0.5741	-0.28	0.782
Somewhat much	3.7970*	2.7110	1.87	0.062
Very much	5.6976***	3.2777	3.02	0.002
Type of crop: Planted High Value Crops or Otherwise	2.4576**	1.0511	2.10	0.036
Agroforestry: Planted Fruit/Timber Trees or not	0.4508*	0.1984	-1.81	0.070
Diversity of Income	0.4525*	0.2151	-1.67	0.095
Land Ownership	0.1785***	0.1011	-3.04	0.002
Constant	0.7763	0.6554	-0.30	0.764

\*, \*\*, \*\*\* Significant at 10, 5, and 1 percent levels of probability, respectively.

percent of the farmers surveyed manage lands ranging from one to two hectares, while 20 percent indicated that they cultivate less than one hectare. The remaining farmers reported managing more than two hectares of land. About 80 percent reported ownership of their land compared to 20 percent not owning their farms. During the past projects managed by ICRAF and LFPI, membership in Landcare groups can facilitate access to material inputs such as seeds, other planting materials, livestock, and other potential supplementary livelihoods (Cramb and Culaseo 2003). These can offset the potential loss of income from the reduction in the size of the tilled area. One can argue that access to these materials and training can more than makeup for a reduction of tillage area as such resources are not found in their respective communities if not for the program. Without these materials and technical support from external organizations, farmers in Claveria became very prone to reverting to their traditional farming practices.

Farmers with diversified sources of income have fewer incentives to adopt soil conservation technologies as they can financially compensate for the effects of soil erosion and loss of fertilizers. Performing contour farming and maintaining hedgerows and NVS would only require additional labor and time on the part of these farmers. Survey data showed that 71 percent of the surveyed farmers had other sources of income and 29 percent relied solely on farming for their livelihood. Data validation through focus groups on the other hand revealed that farmers have few non-farm income sources. These two findings further support the result of the logistic regression that there is a weak relationship between diversified income streams and the adoption of soil conservation technologies.

Farmers planting fruit trees and other perennials with extensive root systems tend to not adopt the technologies since they are less prone to soil erosion than farmers planting maize and vegetables. According to the survey, 45 percent of farmers planted some fruit trees while 55 percent reported they did not plant. However, farmers that exclusively plant fruit trees for livelihood are also few and represent only a minority of farmers in the sloping lands in the town. This was confirmed in the interviews and FGDs. Farmers who planted high-value crops were at 49 percent compared to those who did not plant high-value crops at 51 percent.

#### *Types of social capital, membership, and sustainability of adoption*

It may be difficult to pinpoint which type of social capital played a greater role in accelerating the adoption of Landcare technologies in its early implementation. However, data from this study illustrates that support from an external organization, which is a form of bridging social capital, is crucial in enhancing the existing bonding social capital in the community, which in turn, is vital in sustaining the operation of Landcare groups, which, in turn, contributed to the sustained adoption of the technologies in the past.

Past studies have also reported a decline in the activity of Landcare groups in Claveria. A previous study by Vock (2015) attributes this to activities of other farmers' organizations such as cooperatives, Landcare associations, and informal farmers collaborations as these new organizations have taken some of the functions of Landcare groups (Vock 2015). It could be argued that the capacity building and human capital development training in the Landcare programs have also contributed to the rise of other types of farmers' organizations in the villages. Farmer leaders, from the interviews, have traced their improved human capital from the training they received from the program. Even with decreased activity, Vock (2015) reported that farmers still identify with their Landcare groups. This is related to Cramb's analysis that bonding social capital among the members remains strong despite the inactivity of the land care groups for some time. Despite the reduction in the overall number of these groups, Cramb (2006) reported an increase in membership of existing groups in Landcare sites in Southern Philippines. This increased membership among Landcare groups and increased activities of other local groups in the town is a good indicator of the stock of bonding social capital in Claveria villages. They also cited that even defunct Landcare groups can be easily restarted as social ties between farmer-to-farmer and neighbors-to-neighbors remain (Cramb and Culaseo, 2003).

The data in this study suggest that the recent decrease in membership and activity of Landcare groups can be attributed to the cessation of activities of external organizations ICRAF and LFPI, which facilitated the overall program. Farmers who became members of Landcare groups were asked in the household survey about the problems they encountered during their membership in Landcare groups. More than half of them reported that the Landcare Program in Claveria just suddenly "stopped" and had no idea when, how, and most importantly, why the program ceased to operate while 33 percent reported some "irregularities concerning resources of budget in the implementation of the projects" and six percent reported "not enough funding" for groups as the main reason. This is seen in Table 3. These same reasons were raised by the farmers in the FGDs. Some of the farmers mentioned that the program became less effective due to some concerns about budget and resource utilization. Although the LFPI project ended in 2011 and the

**Table 3**

Relative distribution (%) of farmer-respondents according to problems encountered during Landcare membership.

Issues/problems	Relative distribution of farmer-respondents (n = 176)
The Landcare Program suddenly stopped	61
There were irregularities in the implementation concerning resources and budget	33
Not enough group fund	6

ICRAF project ended in 2004, Landcare groups did not officially dissolve or were defunct. This is consistent with the findings of Cramb and Culasero (2003) in Landcare project sites in other towns. He cited that these groups can be restarted as members can come together when the need arises. These Landcare groups are technically present in the villages but data from this study suggest that they have become less and less active in years after the external organization exited the town. This has contributed to the diminished trust of the farmers in the Landcare groups.

Participants in the survey who were members of Landcare groups were also asked to rate their level of trust in said groups, with five (5) being very much, four (4) being somewhat much, three (3) being neutral, with two (2) being somewhat little and with zero (1) being none at all. About 32 percent of the respondents answered not having trust at all, 14 percent had somewhat little trust, 10 percent were neutral, 13 percent had somewhat much trust, and 30 percent had very much trust. Data from the survey suggests that half of the farmers still have trust in the Landcare groups while the others expressed little trust. This coincides with the adoption rates yielded from the survey. Furthermore, according to the regression results, trust, specifically strong trust, has a positive relationship with adoption. The importance of trust in the Landcare groups, which, in turn, facilitates adoption, is further highlighted in the interviews among farmers. According to the FGDs and KIIs, trust may have been negatively affected by what the farmers describe as the sudden exit of the project from their town.

According to the focus groups and interviews, the abrupt cessation of ICRAF and LFPI activities affected the activities of the Landcare groups in the villages and, in turn, the participation of its members. When asked why the participation and active involvement in Landcare groups greatly decreased in recent years, one farmer explained that:

*The reason why no one became active in the Landcare in the village is because no one facilitate the activities from ICRAF. When the organization from the above disappeared, the organizations below also disappeared because the organization from the above provides the financial resources. For example, food and other expenses for seminars and meetings of Landcare groups (A Male farmer FGD participant from the village of Madaguig. Translated from Visaya Language).*

Participants of focus groups and key informants also cited the importance of the resources being provided by the external organization in adopting soil conservation technologies. This relationship between incentives from external organizations, active participation in Landcare groups, and technology adoption is further explained by a farmer in one of the village FGDs. The farmer explains that:

*In our village, the animals we received greatly help our livelihoods. It also incentivized us to adopt contour plowing and to become a Landcare group member. We had to be a member immediately because we might not receive the animals that they are giving out. When there was a project, the Landcare groups in the villages were alive. When the project ceased, the Landcare groups also disappeared (A male farmer FGD participant from Brgy. Panampawan).*

The strategy of providing material incentives combined with enhancing the human capital of farmers proved to be an effective mechanism to increase Landcare group membership. It is possible that other farmers became active in the groups because the program also enhanced their knowledge and human capital. However, when ask why the Landcare program was effective in soliciting active participation among Landcare groups. Two farmers expressed in the FGDs that:

*Before, the Landcare project had good management and strategies. They just don't give training and seminar, they also give out other benefits like livelihood inputs and allowances among members and officials. This was*

**Table 4**

Relative participation (%) of farmers in community organizations in the past years.

Year	More	Same	Fewer
Compared to the past five (5) years (2013)	14	15	71
Compared to the past 10 years (2008)	7	16	77
Compared to the past 25 years (1993)	4	9	87

*not sustained which is why participation became less (A male farmer FGD participant from Brgy Mat-i. Translated from Visaya Language).*

*Usually in every barangay, if there is a project, that is the core that holds the people to participate. If there is no project, there are no incentives for people to participate (A male farmer FGD participant from Brgy. Panampawan, Translated from Visaya Language).*

The results of the FGDs and interviews were consistent with the survey data. When asked about their participation in community organizations in the past years, the majority of survey participants expressed less participation from community organizations, including Landcare groups from previous years as illustrated in Table 4.

Interviews and FGDs among farmers support the findings that the partnership with ICRAF and the LFPI provided bridging social capital among farmers in the villages in the form of access to experts for training and seminars and farm production inputs such as animals for raising, seeds, and other farm inputs. These proved to be a crucial factor in sustaining the operation of the Landcare groups in the villages. This, in turn, was a major factor in sustaining the adoption of Landcare technologies among its members. Cramb (2007) has cited that membership in Landcare groups can be seen as strategies or investments among farmers to expand their stock of social capital to gain access to soil conservation technologies and agroforestry technologies which would be impossible to obtain outside the Landcare program. In the resource-poor and erosion-prone slopes of Claveria, membership in Landcare groups proved to be a key investment to access technical knowledge and material inputs to improve their production and income, resources which were otherwise difficult to find within the villages if not for the Landcare program. Through the program, bridging social capital is transformed into human capital and physical capital. Since membership in the Landcare groups was an investment for the farmers, it required a certain degree of time and trust on the part of farmers. Once the expected benefits from the group members were not received as the project funding for ICRAF and LFPI projects run out, investing in the form of participation and membership in the Landcare groups became less appealing for farmers.

## Conclusion

Many studies have documented the importance of both bonding and bridging types of social capital in the adoption of soil conservation technologies in Claveria and other Landcare sites. This study aims to unpack the role of both types of social capital in the sustained adoption of soil conservation technologies. The data from this study supports the findings that bridging and bonding social capital were complementary in facilitating adoption as well as in maintaining the adoption of soil conservation technologies in the rural town of Claveria. Data from this study supports that bridging social capital highly complements the existing bonding social capital in the communities and even stimulates or creates incentives for bonding social capital such as membership to Landcare groups and other offshoot organizations to develop. It does this as external agencies facilitate the entry of material inputs and expertise to develop human capital in the rural communities which is impossible otherwise given the remoteness and lack of resources and linkages of the town.



The complementary role of the two types of social capital comes, however, with some risks. Disruptions in networks and partnerships with external organizations, problems with funding, and even the end of the project cycle, can also diminish bonding social capital if resources that are used to maintain the operation of such local groups that serve as incentives for memberships no longer flow into the community. Because social capital is an investment on the part of farmers, returns from these investments are an important pre-requisite for sustained membership, which in turn, greatly influence the sustained adoption of soil conservation technologies that membership in the Landcare group espouses.

The implication of this study is twofold. First, it contributes to the literature about the importance of two types of social capital further supporting the complementarity of bonding and bridging social capital. Furthermore, this study provides nuances and unpacks this relationship as the context, the environment, and the characteristics of the people in which the social capital operates were found to drive the nature of the relationship between the two types of social capital. Second, the findings of this study provide insights for project implementers, foreign funders, and development practitioners on how to develop, utilize, and capitalize on bridging social capital and how to enhance and sustain existing bonding social capital in community beneficiaries. This insight allows for more appropriate interventions, project management, and exit strategies for more sustainable impacts of development programs.

#### CRedit authorship contribution statement

**Rodmyr F. Datoon:** Conceptualization, Data curation, Formal analysis, Supervision, Writing – original draft, Writing – review & editing. **Jose V. Camacho, Jr.:** Writing – review and editing, Data Curation. **Aileen V. Lapitan:** Formal analysis and Data curation. **Jeanarah M. Gapas:** Formal Analysis and Data curation.

#### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

#### Funding

This study is funded by the Australian Centre for International Agricultural Research (ACIAR) under project number IAP-2017-101.

#### References

- Arcenas, A. (2002). *Farmer-led soil conservation initiative in a developing country setting: The case of the Claveria Land Case Association in Claveria, Misamis Oriental, Philippines*. Michigan State University, Ph.D. Dissertation.
- Barr, A. 1998. "Enterprise Performance and Functional Diversity of Social Capital." Working Paper Series 98-1. University of Oxford, Institute of Economics and Statistics, Oxford, U.K. Processed.
- Catacutan D.C., Cramb R.A. 2004. Scaling-up Soil Conservation Programs: The Case of Landcare in the Philippines. Paper presented in the 13th International Soil Conservation Organization Conference, Brisbane. July. 2004.
- Coleman, J. S. (1988). Social capital in the creation of human capital. *James S. Am. J. Sociol.*, 94, 95–120.
- Cramb, R. A. (2005). Social capital and soil conservation: Evidence from the Philippines. *The Australian Journal of Agricultural and Resource Economics*, 49, 211–226.
- Cramb, R. A. (2006). The Role of Social Capital in the Promotion of Conservation Farming: The Case of Landcare in the Southern Philippines. *Land Degradation and the Environment*, 17, 23–30.
- Cramb, R. A. (2007). Participation in community Landcare groups in the Philippines: A social capital perspective. *Australasian Journal of Environmental Management*, 14(2), 93–102.
- Cramb R., Catacutan D., Dano N. and Vock N. 2006. Landcare program in the Southern Philippines: past, present, and future. Working Paper No. 8. ACIAR: Canberra.
- Cramb, R. A., & Culasero, Z. (2003). Landcare and Livelihoods: The Promotion and Adoption of Conservation Farming Systems in the Philippine Uplands. *International Journal of Agricultural Sustainability*, 1(2), 141–154. <https://doi.org/10.3763/ijas.2003.0113>
- Glaeser, E. L., Laibson, D., & Sacerdote, B. (2002). An economic approach to social capital. *Economic Journal*, 112, F437. F458.
- Granovetter, M. (1985). Economic action and social structure: The problem of embeddedness. *Am. J. Sociol.*, 91.
- Lin, N. (2001). *Social Capital: A Theory of Social Structure and Action*. Cambridge, UK: Cambridge University Press.
- Micheels, E. T., & Nolan, J. F. (2016). Examining the Effects of Absorptive Capacity and social capital on the Adoption of agricultural innovations: A Canadian Prairie Case Study. *Agricultural Systems*, 145, 127–138.
- Narayan, D. 1999. "Bonds and Bridges: Social Capital and Poverty." Policy Research Working Paper 2167. World Bank, Poverty Reduction and Economic Management Network, Washington, D.C. Processed.
- Patulny, R. (2007). Exploring the social capital grid: Bonding, bridging, qualitative, quantitative. *International Journal of Sociology and Policy*, 27: 1(2), 32–51.
- Putnam, R. D. (2000). *Bowling alone: Collapse and Revival of American community*. New York: Simon and Schuster.
- Vock, N. (2015). Project ASEM/2002/051 *Sustaining and growing Landcare systems in the Philippines and Australia*. In D. Pearce, & A. Alford (Eds.), *Adoption of ACIAR Project Outputs 2015*. ACIAR: Canberra.
- Vock N. and Aspera B. 2013. Final report: project ASEM/2002/051 *Sustaining Landcare systems in the Philippines and Australia*. ACIAR: Canberra.
- Williams L.J., McMillan L., Van Wensveen M., Butler J.R.A., Camacho Jr J.D.V., Lapitan A., Datoon R., Gapas J., Pinca E., Macavinta-Gabunada F., Serino M.N.V., Nunez. L., Recto A.L., Ruales J.H., Enerlan W.C., Cagasan E.G., Ani P.A.B and Aranas M.B. 2021. An integrated approach to ex-post impact assessment. ACIAR Impact Assessment Series Report No. 102. Canberra: Australian Centre for International Agricultural Research.
- Woolcock, M. (1998). Social capital and economic development" toward a theoretical synthesis and policy framework. *Theory and Society*, 27, 151–208.
- Woolcock, M., & Narayan, D. (2000). Social capital: Implications for development theory, research, and policy. *World Bank Research Observer*, 15, 225–249.