



Carbon-offset Networks in Mexico: The Heterogeneity of Regulation and Its Effects on the National Carbon Market

Redes de captura de carbono en México: la heterogeneidad de la
regulación y sus efectos en el mercado nacional de carbono

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Abstract

This paper aims to provide evidence on how the concurrence of multiple carbon markets in Mexico that differ in regulation —highly regulated, semiregulated, unregulated— can affect the ability of actors to coordinate their actions. It follows the implementation of a carbon-offset project in Mexico called *Scolec Te* over time. Based on the social exchange theory, we show that the concurrence of multiple carbon markets with different degrees of regulation can influence the tactics or competitive strategies of actors in the network. In particular, it encourages changes in actors' strategies (balancing operations) in the network to minimize regulatory costs and to become competitive by attracting financial resources to the project. Another finding is that the emergence of an unregulated local carbon market in Mexico creates unintended incentives for actors to adopt less environmentally responsible strategies and avoid participation in more environmentally responsible markets, such as Clean Development Mechanisms (CDMs).

Keywords: carbon market; coordination; network; regulation; Mexico.

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Resumen

Este documento tiene como objetivo proporcionar evidencia sobre cómo la concurrencia de múltiples mercados de carbono en México que difieren en regulación—altamente regulada, poco regulada, no regulada— puede afectar la capacidad de los actores para coordinar sus acciones. Este trabajo estudia la implementación de un proyecto de secuestro de carbono en México llamado *Scolec Te* a través del tiempo. Con base en la teoría del intercambio social, mostramos que la concurrencia de múltiples mercados de carbono con diferentes grados de regulación tiene la capacidad de influir en las tácticas o estrategias competitivas de los actores de la red. En particular, incentiva cambios en las estrategias de los actores (desbalances de poder) en la red para reducir los costos regulatorios y ser más competitivos atrayendo recursos financieros al proyecto. Otro hallazgo es que la aparición de un mercado de carbono local poco regulado en México promueve incentivos no deseados para que los actores adopten estrategias menos responsables con el medio ambiente y previenen la participación en mercados más responsables con el medio ambiente, como los Mecanismos de Desarrollo Limpio (MDL).

Palabras clave: coordinación; mercado de carbono; red; regulación; México.

Introduction

Carbon sequestration projects for deforestation and reforestation are one of the main mechanisms created by global environmental institutions, such as the Organization for Economic Co-operation and Development (OECD) and the United Nations (UN), to solve the problem of climate change (OECD, 1974; Opschoor and Vos, 1989). The overarching aim is to build a system that supports the “polluter pays principle” (PPP). This economic approach considers that market prices fail to reflect the true social cost of producing a pollutant, because they do not consider the costs its production entails for society. This, in turn, gives private firms an incentive to produce more pollutants than is socially optimum, causing market failure (Richardson, 1998). The PPP is designed to prevent market failure by obliging firms to pay and absorb the full social cost of their actions (Baldwin, 1978; Gouritin, 2016). Internalization of pollution costs has led to the establishment of many international agreements that compel or incentivize governments, industries, and society to comply with the PPP. The principal mechanism has been the creation of an environmental carbon market where polluters are compelled to buy pollution rights if they exceed the given allowance.

In the forest sector, implementation of the PPP has prompted the emergence of an environmental service sector dedicated to the establishment of tree plantation projects that supply carbon sequestration



certificates. However, a major problem in the economic implementation of carbon offset projects is the lack of a single market to standardize the rules around carbon sequestration projects. This is especially important in developing countries, where weak institutions prevent law enforcement and the proper surveillance of the different carbon markets. In this context, there are three types of carbon market operating in Mexico: 1) the compliance market, 2) the voluntary market, and 3) the local market.

The compliance carbon market (highly regulated) was established through the Kyoto Protocol as a legally binding obligation for its member states (Nelson and De Jong, 2003; Skutsch, 2003). Each member country has a pollution quota divided into pollution certificates among all its national industries. A certificate contains a pollution right and represents part of the total emissions targets. In developing countries, one way for industries to reduce their carbon emission obligations is to buy carbon sequestration certificates for tree plantation projects through the Clean Development Mechanisms (CDMs) (Caruso and Reddy, 2005). In turn, carbon projects must ensure that the project achieves a real impact, the impact is measurable, and that it provides long-term emission reductions (Kosoy *et al.*, 2008).

In contrast, the voluntary carbon market is highly flexible and can vary from semi-regulated to unregulated. First, the semi-regulated market is an option for polluters wishing to reduce their carbon footprint voluntarily or needing to fulfill their obligations based on the Kyoto Protocol (Aune, 2003; Brohe *et al.*, 2009), such as Verified or Voluntary Emissions Reductions (VERs). Certified carbon projects must comply with a set of international standards and be certified by international auditors to guarantee that carbon projects are real and that carbon reduction in the atmosphere will occur in the time and amount specified in the certificate. Second, a local carbon market (poorly regulated/unregulated) serves as a voluntary market, with little or no regulation, making it difficult to determine its true environmental impact. This market has emerged to meet local demand for carbon sequestration between firms and/or private organizations wishing to voluntarily reduce their emissions without making a formal commitment. Government carbon reduction initiatives operating through public programs under a minimum monitoring system also belong to this third category.

Our hypothesis is that the concurrence of multiple carbon markets with different degrees of regulation poses a coordination problem for organizations involved in the carbon-offset sector due to the difference in costs between the alternatives. For instance, every carbon market (compliance, voluntary, local) has different benefits and costs for the actors involved in the establishment of tree plantation projects. The implementation cost can vary according to the regulation rules of each market - highly regulated, semi-regulated, unregulated. Market regulation heterogeneity (different rules in each market) provides incentives for actors



to strategically choose which market they participate in, which has implications for environmental outputs.

We attempt to contribute empirical evidence on how the degree of compliance in the concurrency of carbon markets can bring about changes in the configuration of strategies among actors. Each set of rules offers different sets of incentives for actors to participate in a carbon market according to their interests and cost-benefits alternatives. In principle, alternatives are important, but unequal options can lead actors to make decisions in the wrong direction for society. On the other hand, it is important to understand how carbon market concurrency and individual strategies can impact carbon-offset projects' environmental outputs. In other words, how individual strategies adhere to or derail international environmental policy aims due to the network effect.

To address these issues, this paper will use the social exchange theory to analyze the coordination process over time in the context of the first carbon project in Mexico called *Scolec Te*, through a retrospective analysis of the latter. This paper will take into account the concurrency of the various carbon markets operating under different regulatory terms (highly-regulated, semi-regulated, unregulated), and their impact on the individual strategies of participants and the environmental outputs of the carbon offset projects.

Regulation and Carbon Markets

There is a dearth of literature analyzing PPP schemes from the perspective of the problems of regulation and coordination (Wara and David, 2008). In other words, from the point of view of how the heterogeneity of carbon market regulation can create coordination problems between actors. For example, from cost-benefit studies of carbon markets, we have learned that lack of regulation impacts environmental outcomes, a trend most cost-benefit studies reflect.

Bumpus (2008) considers that lack of regulation prevents accountability because it encourages people to work for the benefit of their customers/buyers rather than encouraging environmental protection. Likewise, Healy (2009) and Bakker (2005) show that the lack of minimum standards in the carbon market undermines consumer confidence and discourages investment in the environmental services sector. In this context, Bumpus (2008) notes that carbon markets must comply with minimum standards to provide uniformity, transparency in monitoring and standardization of the process involving forest carbon offset projects. Accordingly, environmental benefits are difficult to protect.

In this context, we attempt to empirically analyze coordination problems in a scenario of multiple actors and regulatory schemes. In other words, we explore how the heterogeneity of carbon markets can lead to



coordination problems among actors in the implementation of PPP initiatives.

Productive Networks: The *Scolet Te* Project

According to the Social Exchange Theory (SET), a productive exchange network is a pattern of interactions and resource interdependencies requiring a high degree of coordination to produce valuable output through the joint coordination of multiple actors (Lawler *et al.*, 2008). For Ekeh (1974), benefits in productive exchange networks are generated by the flow of resources from each actor to group, involving a collective obligation to the individual actor. The productive exchange network has three elements: 1) there is a socially produced output, 2) each actor provides a single element that enables the occurrence of such an output, and 3) outputs generate a single source of obligations and benefits everyone shares (Emerson, 1972). Non-cooperation can prevent the realization of the output (Molm *et al.*, 2000).

This paper focuses on the implementation of a tree plantation project in Mexico called *Scolet Te*. It argues that the *Scolet Te* project is a productive exchange network for several reasons. First, the project involves a collective effort to create a tree plantation project to reduce carbon emissions through reforestation and afforestation activities in local communities in Chiapas and Oaxaca. The project assigns a series of roles to coordinate the contribution each actor must make to the project. The coordination process is embedded in a complex normative framework regulating the exchange process among actors. Secondly, the various stages of the project allow the participation of a wide range of public and private actors—including transnational actors such as environmental NGOs—which allow different resources (human, financial and social capital) to be brought to the project. Thirdly, through a process of resource exchange, actors can achieve a common objective: issuing carbon certificates. As we noticed before, lack of coordination among the various actors can cause the project to fail. Consequently, the *Scolet Te* project can be studied as a network structure in which actors are embedded and which requires a high degree of coordination to achieve its objectives.

This paper will consider the main objective of the *Scolet Te* network as an environmental one. If the set of individual strategies among participants lead to the project participating in the carbon market offering the most benefits to the environment, the project achieves its environmental aims. Conversely, if the set of individual strategies leads to participation in the carbon market that offers the least environmental benefits, the project will fail to achieve its objectives. The SET framework will enhance understanding of the dynamic process of coordination among actors in the *Scolet Te* project through the analysis of power dependency relationships over time in a network approach.



Data Collection

From April to September 2014, 47 organizations involved in the *Scolel Te* carbon sequestration project were approached. A total of 45 of these organizations agreed to be interviewed, with two exceptions. One local community refused because of internal conflict while an environmental NGO was unwilling to participate for unknown reasons. Information was collected from thirty-five local communities in Chiapas and Oaxaca (Annex 1), five environmental NGOs in Mexico, one in the UK, and four government organizations in Chiapas, Oaxaca, and Mexico City.

Survey

This study uses a retrospective analysis to capture the dynamic process of the *Scolel Te* project using two types of data gathering methods. First, the collection of relational data through the administering of semi-structured interviews. Respondents were asked to recall the project implementation process at three points: 1) the formation phase (1998), 2) the expansion phase (2001), and 3) the consolidation phase (2009). The study subsequently collected relational data (Scott 1991; Marsden, 2005), using Social Network Analysis (SNA) and the snowball technique as a data gathering technique.

Next, face-to-face relational surveys were conducted with 45 organizations. Specifically, we asked different types of question about ties and interdependencies among actors in the network at three points in time (as described above): 1) indicate a list of organizations with which your organization had any relationship in the *Scolel Te* project, 2) from the list of organizations you mentioned, which ones did your organization exchange ideas and information on the *Scolel Te* project with? 3) from the list of organizations you mentioned, indicate those which your organization received funds from for the *Scolel Te* project, 4) from the list of organizations you mentioned, indicate those that were most influential in the *Scolel Te* project.

This analysis performs a whole network rather than an egocentric network analysis. The main questions concerned a set of interweaving relationships embedded in a specific space (Koehly and Pattison, 2005). In this context, network boundaries were delimited by strict participation in the *Scolel Te* project at three points in the project: 1998, 2001, and 2009. Finally, this research considers each community as a unique organization / node. Likewise, all the communities were collapsed into a single node to help visualize the local actors in the structure of actors more clearly.



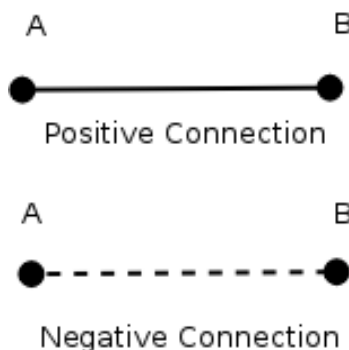
Methodology: Social Exchange Theory

SET is used as the main theoretical approach. SET seeks to analyze the dynamism of power relationships among actors in the network to explain how the network's structure emerges and why it changes. SET is mobilized to examine the relative dependencies among actors, and the way actors' dependency changes. The study focuses on the source and use of power in a network as a mechanism for changing the network structure (Cook *et al.*, 1983; Stevenson and Greenberg, 2000; Blau, 1964).

According to Emerson, "a network exchange is a set of two or more connected exchange relationships to the degree that exchange in one relation is contingent upon exchange or non-exchange in the other relationship" (Emerson, 1972: 50). Consider, for instance, the case of an environmental network exchange where three NGOs –A, B, C–, exchange two different kinds of resources: information and financial capital. In this case, if A-B exchange information and A-C exchange financial capital, we can say that there is no B-A-C relationship. Both relations, A-B and A-C, provide A with a different resource. In other words, A-B and A-C exchange relations are not in the same domain. The relation between B and C does not exist. In contrast, if B and C only exchange information with A, then B and C are connected because they share the same domain with A.

Along these lines, there are two different types of connections according to SET: positive and negative ones. A positive connection occurs if an exchange relationship is contingent upon exchange in other relationship, whereas negative connections occur if exchange in one relationship is contingent on a non-exchange in the other relationship (Emerson, 1962; Yamagishi *et al.*, 1988; Cook and Whitmeyer, 1992). Figure 1 shows positive and negative connections. For the sake of simplicity, we use a continuous line to refer to positive connections and a dashed line to refer to negative connections.

Figure 1. Positive vs. negative links.



Source: compiled by the authors.



For instance, let us assume that, due to a bidding contract, A should obtain information from a single source B. Another actor C begins imitating B and provides information to A. In this case, A can fulfill its information needs through either B or C, but not both. Thus, we can say that C is an alternative exchange actor to A. So, if A obtained information from C, C would obtain a benefit that represented a loss to B. The C-A relation is negative as regards the B-A relation because C introduces a negative or competitive factor into the exchange network. According to SET, the degree of dependency among actors in the network determines the distribution of power and should be measured in three main dimensions (Emerson, 1972):

1. Domain preferences, which is a measure of the local scarcity of a given resource in the network. It implies that the value of a resource depends on its relative scarcity and the actor's needs – the principle of “local satiation/deprivation” or “diminishing marginal utility”.
2. Number of alternatives available in the same domain, which is a measure of the degree of dependency of an actor on their exchange partner. That is, actors with few alternatives of exchange are more dependent on the resources of their exchange partner. In contrast, actors with many exchange alternatives can increase the value of their resources and caused a reduction in the value of the resources of their exchange partner when they share the same domain.
3. Cost of initiating the exchange with alternative partners.

It is against this background that the power relationships in the *Scolec Te* network are studied in this paper. As a first step we determine the relative dependence of actors in the network according to SET in each phase of the project (formation, expansion, and consolidation). We then explore how power relations change and influence participation decisions given the opportunities offered by each of the carbon markets (highly regulated, semi-regulated, unregulated). Two relevant domains are analyzed: 1) actors' coordination in the exchange of carbon certificates (productive network), and 2) actors' coordination in the exchange of financial capital.

This paper will use only use SNA as visual support to understand the power structure of the *Scolec Te* network. SNA assumes that power relationships depend on the type of network structure in which actors are embedded (Granovetter, 1985). An actor's position not only defines the set of available opportunities (e.g. access to information, flow of resources, and influence) but also, their power (Bala and Goyal, 2000). According to SNA, an actor's position can affect the access and distribution of resources among other actors. From this perspective, a centrally located actor is more successful than peripheral actors since they have access to more contacts and



resources. Conversely, peripheral actors can be powerless due to the independent position and the difficulty in accessing the network resources (Granovetter, 1992, 1973). Accordingly, the structural distribution of power will be determined in this paper according to the centrality analysis and should be measured in three main dimensions (Scott, 1991; Everett and Borgatti, 2006):

1. Degree: measure of how well connected an actor is in the network. Degree score determines the amount of variation in the number of connections between actors. This measure ranges from 0 to 1, where 0 means that an actor is a singleton (no connection at all) and 1 that an actor is connected to everyone in the network.
2. Closeness: measure of distance among actors. In other words, it measures how many steps an actor is from others in the network. Again, the closeness score goes from 0 to 1 with a high score representing a short distance to others.
3. Betweenness: measure of how important an actor is in the transmission of resources in the network, i.e. how often an actor is in the middle of a path between two others. The betweenness score goes from 0 to 1 with a high score showing that the individual plays an important role in the transmission of information or other resources.

The result of this analysis will only be used to help with the visualization of the structural properties of power relationships in the *Scolet Te* network.

Analysis of Power Relationships in the *Scolet Te* project

The formation phase

The pilot project of the *Scolet Te* project began in 1998 with the association of four main relationships: 1) PAJAL, a coffee producers' organization in Chiapas, 2) ECOSUR, a local think tank in San Cristobal de las Casas, Chiapas, 3) the *Scolet Te* fund managed by PAJAL, 3) The Edinburgh Centre for Carbon Management (ECCM) in the UK, and 4) Government organizations³, which, although they do not participate directly in the project, collaborate informally since their activities overlap with the activities of the *Scolet Te* project. For example, they tend to promote the project among farmers, help to generate information related to tree plantations, and provide training on nurseries and seed collection, among other activities. In this context, they are peripheral actors with a limited role

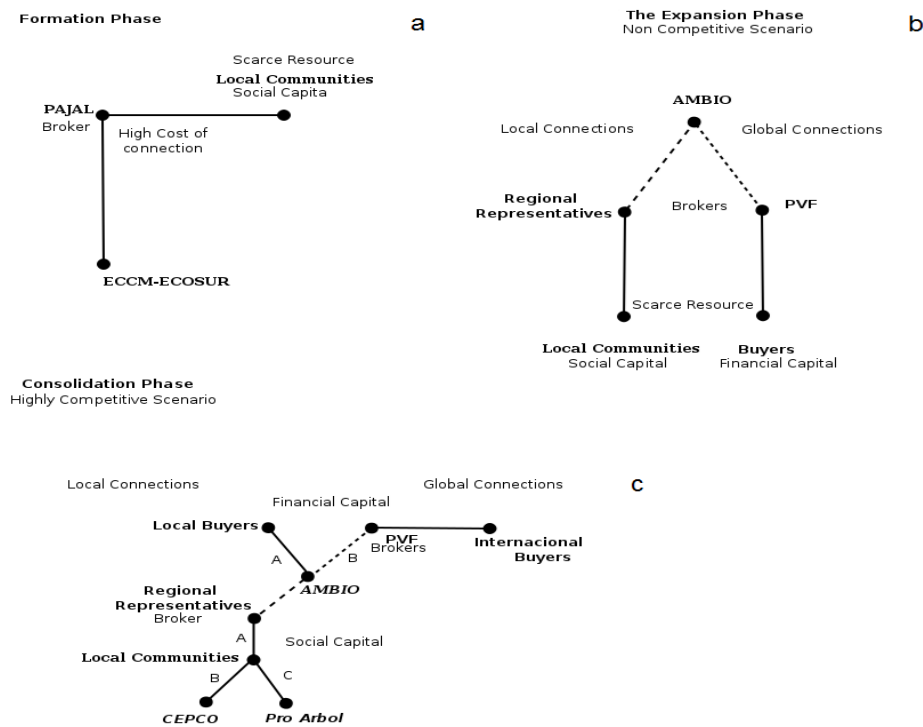
³ National Institute of Ecology and Climate Change (INE), National Commission, National Commission of Protected Areas (CONANP), National Forest Commission (CONAFOR), National Institute of History (INH), Mexican Oil Company (PEMEX).



in the network dynamics (Tipper and De Jong, 1998; Tipper *et al.*, 1998). Each actor in this case is a set of individuals since they are all organizations.

The initial alliance between ECOSUR and PAJAL allowed the integration of the organizational capital of *Scolet Te*. Indeed, PAJAL provided the labor force, the land, and its organizational capacity as a coffee producer to set up the *Scolet Te* project. Moreover, ECOSUR and ECCM provided human capital (knowledge) and financial capital for the *Scolet Te* project. Here, the local knowledge of ECOSUR and its connection with ECCM enabled the project to make contact with the international carbon market. This partnership was able to attract economic resources by allowing the sale of carbon certificates on the international market (Figure 2).

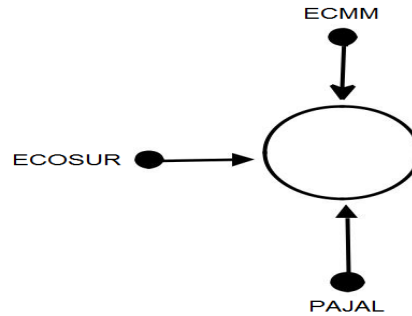
Figure 2. Social capital International buyers



The *Scolet Te* project was the first carbon project in the region and in Mexico, there were no alternatives available for the participant. Consequently, resources in the network were relatively scarce and the distance of each actor from the resource source determined the distribution of power. The initial configuration of the network was a decentralized power-dependency structure (Figure 3).



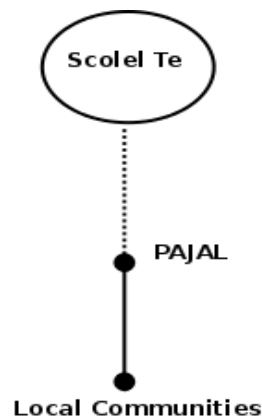
**Figure 3. *Scolet Te*'s productive network:
all actors were positive connected**



Source: compiled by the authors

The initial success of the project also led to an initiative to extend the *Scolet Te* project to other parts of Chiapas. The idea was to consolidate the project with a view to participating in the compliance market as part of the international environmental agenda of the Kyoto Protocol (De Jong *et al.*, 2005; Castillo *et al.*, 2006). PAJAL was responsible for the entry process of new participants. PAJAL had a strong position in relation to other members of the network because it occupied a central position. It represents differences in terms of influence and power respect other members who are on the periphery (Diani, 2015). For instance, actors more centrally located in the network can engage in a better exchange of resources and/or information than peripheral ones. This began producing negative connections (broker position) in the network between local communities and the remaining actors (Figure 4).

Figure 4. PAJAL's brokerage position



Source: compiled by the authors.



Indeed, PAJAL began as a local initiative designed to eliminate the abusive intermediation between coffee producers and wholesale buyers through the establishment of a bartering system in the region among local farmers. PAJAL provided coffee to other communities in exchange for other products from the region such as maize, squash and beans. The main role of PAJAL was to act as a broker between local producers and external broker coyotes to protect the price of local production by paying a higher price for products if the offer from external brokers was too low or unfair. Local communities felt obliged to collaborate with PAJAL in return for its role in the bartering system. This loyalty to PAJAL led local communities to engage in a series of projects suggested by the coffee organization, such as the *Scolet Te* project. Otherwise they would have not engaged in the project. In other words, PAJAL had enough power to influence local farmers (AMBIO representatives).

However, PAJAL began to exploit its strategic position when the bartering system failed. When coffee prices dropped, PAJAL began to experience economic problems and used resources from the *Scolet Te* fund to support the organization. At that point it was clear to PAJAL and its constituency that their main objective was the coffee organization's security rather than the success of the carbon sequestration initiative. Eventually, local actors' pressure for the control of the carbon fund economic resources was so high that ECOSUR and ECCM decided to break off their relationship with PAJAL.

The decision to end the relationship with PAJAL entailed a high cost as *Scolet Te* lost most of its participants at the local level (social capital). This is explained by the fact that the relationship between PAJAL and the communities was based on reciprocal exchange (positive links). Local communities were voluntarily engaging in the project because trust had been built over a long period of constant, continuous interaction in the bartering system. Such trust relationships belong to PAJAL but not to the project. Consequently, and to show their support and commitment, most of the communities that form PAJAL withdrew from *Scolet Te* at the same time (Lawler Thye and Yoon, 2008; Jackson *et al.*, 2016).

In contrast, breaking off relations with PAJAL made it possible for ECOSUR/ECCM to not only take control of the financial resources but also the project. The break-up was a strategic decision that not only guaranteed the viability of the *Scolet Te* project but also prevented the derailing of its environmental aims.

According to SET, there was a power imbalance in the relationship between PAJAL and ECOSUR/ECCM. ECOSUR/ECCM were more dependent in their relationship with PAJAL. The source of this dependency was PAJAL's control of a strategic resource for the carbon project: access to local communities - social capital. This scarce resource was so valuable to ECOSUR/ECCM that PAJAL began increasing the cost of connection to the *Scolet Te* project at the local level (For more information on connection costs



see Emerson, 1962; Emerson, 1972; Emerson, 1972a). However, the cost of connection was so expensive for the *Scolet Te* project that ECOSUR/ECCM made the decision to withdraw from the exchange relationships with PAJAL. Social withdrawal emerged as a relational mechanism (balancing operations) to reduce the power imbalance in the relationship (Emerson, 1962; Blau, 1964; for power imbalance).

The Expansion Phase

In 2001, the *Scolet Te* project was restructured to fulfill the requirements established for the CDM as part of the climate change policy of the Kyoto Protocol. Three recommendations from the CDM panel were addressed: 1) ensuring the long-term participation of local communities, 2) guaranteeing the long-term permanence of the tree plantations and the availability of land, and 3) increasing the number of participants at the local level with a view to reducing the project's transaction costs (Schwarze *et al.*, 2002; Tipper *et al.*, 1998).

The changes involved an internal re-organization of *Scolet Te*. First, the scientific committee from ECOSUR in partnership with former PAJAL members set up AMBIO, an NGO responsible for managing the project at the local level. Second, the tree plantation system called Plan Vivo's intellectual property was transferred from the Edinburgh Centre for Carbon Management (ECCM) to a non-profit organization called Plan Vivo Foundation (PVF). PVF became an international organization dedicated to providing carbon sequestration services to local projects on a global scale. Core activities of PVF include managing the intellectual property rights of the Plan Vivo system and issuing carbon sequestration certificates. In addition, PVF kept the commercial platform for the *Scolet Te* project. In this new configuration, AMBIO became a client of PVF and had to pay for the services provided. Third, the PAJAL local trust was dissolved and replaced by the Bio-Cambio Climate Fund (FBCC), a fiduciary managed by a private bank (BANKSEFIN).

Moreover, AMBIO initiated a strategic alliance with a local organization called The Coordinating Office of Coffee Producers of Oaxaca (Spanish acronym CEPCO). This alliance was formed to expand the carbon project in the Oaxaca region. AMBIO would help CEPCO and the new communities by providing human capital and transferring the technical and operational rules of the Plan Vivo system.

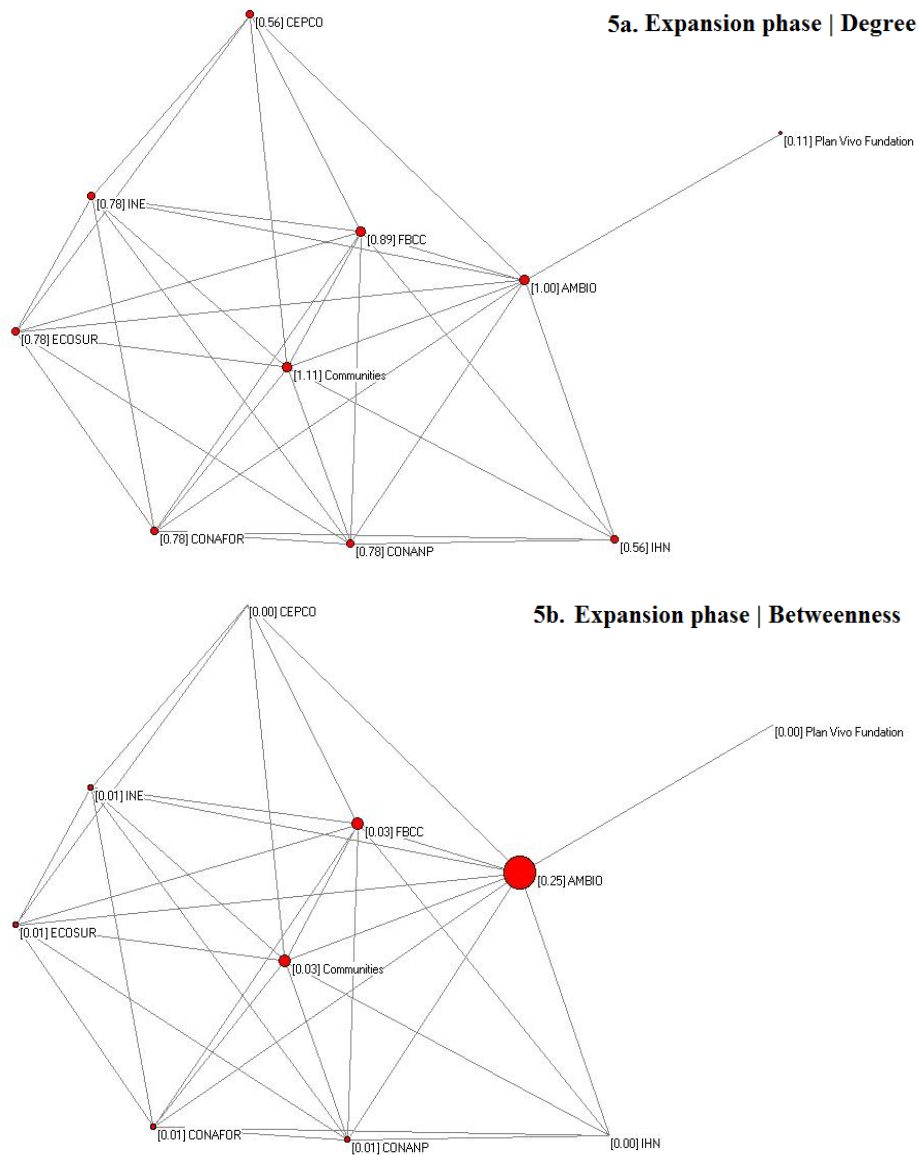
THE SNA FINDINGS

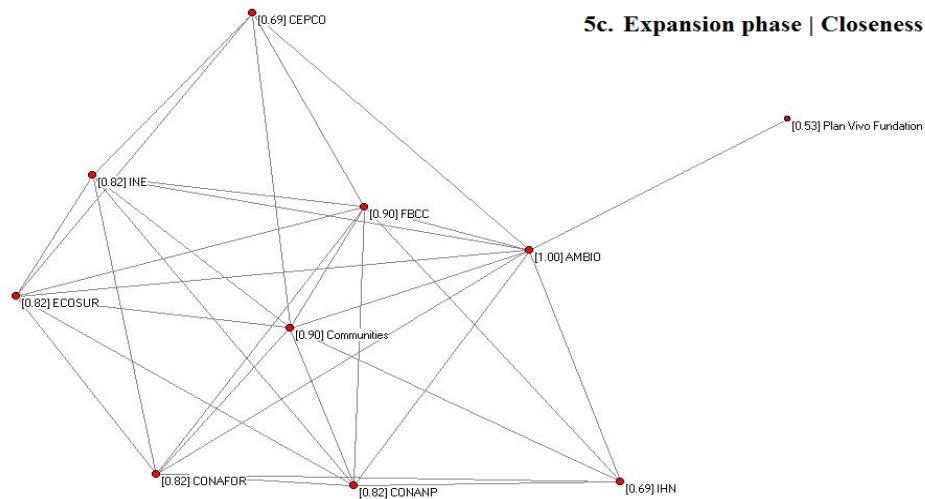
According to SNA, the new structure of the *Scolet Te* project shows that AMBIO is the most connected actor in the network - it has the maximum



degree score in network 1. AMBIO is also the most important actor in the transmission of resources in the network - it has the highest betweenness score in the network 0.25. Finally, AMBIO is the actor that can most easily reach resources from the network at local and international levels; its closeness score is the highest possible 1 (Figures 5a, 5b, 5c).

Figure 5. Expansion phase: whole structure of the *Scolet Te* network

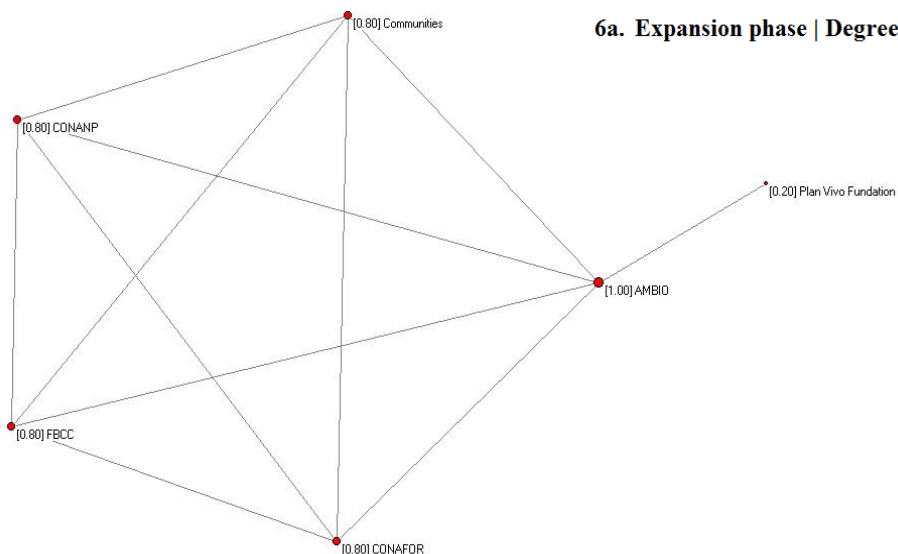


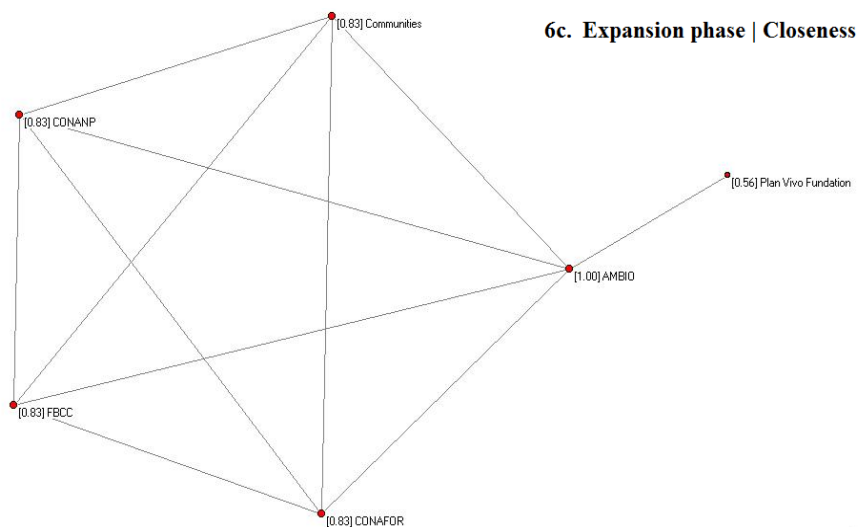
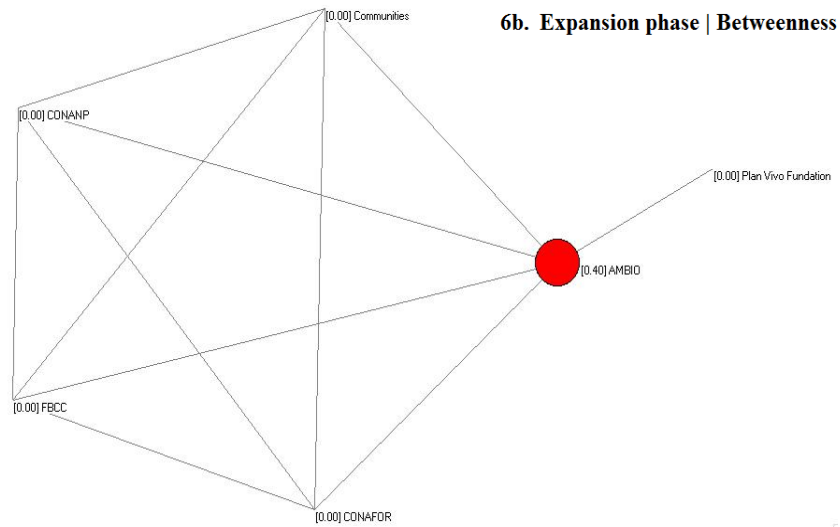


Source: compiled by the authors.

In terms of financial resource exchange, the distribution of power in the network changed slightly in the expansion phase. AMBIO is the most connected actor in the network with a degree score of 1. Similarly, local communities are well connected at the local level, as their own degree score is 0.80. However, the communities have no connection to PVF. Local communities have no connections at the international level (Figures 6a, 6b, 6c).

Figure 6. Expansion phase: financial structure of *Scolet Te* network





Source: own elaboration.

PVF is the actor with the least connections in the network - its degree score is 0.20. However, although PVF is the actor with least connections in the network, it is the only one that brings economic resources to the project. One should recall that CONAFOR, CONANP and other organizations that participate in the finance network do not provide financial resources to support the project. AMBIO is the only actor allowing the flow of economic resources between local communities and PVF. It is a broker between the local and international levels of the project. Conversely, local communities do not play a significant role in the distribution of financial resources - their betweenness score is 0. This does not imply that the communities have difficulties accessing the economic resources in the network. Their distance from AMBIO is small. Their closeness score is high 0.78 with respect to other actors.



In short, according to SNA, the network structure shows a highly centralized network (i.e. a star), where AMBIO seems to be the most important actor in the financial capital distribution in the network, while at the same time PVF is the only actor providing financial capital to the network.

THE SET FINDINGS

According to SET, AMBIO is not the most powerful actor even though it is the most centrally located node in the network. According to the degree of dependency, AMBIO has two negative connections at local level (CEPCO and the communities' representatives). Similarly, at an international level, AMBIO has one negative connection with PVF. Consequently, even though AMBIO is the most centrally located node, it is also less powerful since it depends on the intermediation of other actors to access local communities and buyers' resources (Figure 2b).

From that point onwards, AMBIO paid a fee to PVF for issuing internationally accepted documents, which certified the existence of truly captured carbon in the plantations managed by AMBIO. Furthermore, AMBIO had to pay for a license to use the Plan Vivo system, which became a patent, in the plantations under its supervision. In terms of social exchange, the intermediation of FPV between carbon buyers and AMBIO made AMBIO more dependent on FPV's services. Indeed, the lack of an alternative exchange partner at the international level increased AMBIO's dependency in the network. In this context, changes in actors' mutual interdependencies during the expansion phase led to significant rearrangements in the network's power distribution. The new role of PVF increased its power advantage with respect to AMBIO.

The bad news for AMBIO did not end there. AMBIO learned soon enough that the only way of contacting local actors (communities and individual farmers) was through community representatives. Local representatives became brokers between AMBIO and the peripheral actors in the exchange network. Most local communities do not allow visits from strangers in their lands and villages. They have well-enforced entry rules and the general attitude is not to trust strangers, which leads to the creation of a negative link between AMBIO and the communities. From the communities' perspective, AMBIO was a stranger, barely known in the region since they did not trust its intentions. AMBIO quickly found it could not access local communities' resources on its own and had to pay a brokerage fee to the communities' representatives, especially those who were successful in bringing new participants to the *Scolet Te* project. (Regional representative of Naha, Río Palenque, and AMBIO representative).

Even though the *Scolet Te* project remained the only carbon sequestration project in the region with a great potential to expand the project, AMBIO had been unable to initiate many new relationships at the



local level. AMBIO's monopolistic advantage did not guarantee a large base of secure "participants".

Indeed, historically, local communities have worked with governmental projects at the local, regional, and national level. This kind of social programs have usually been used as a political tool (a kind of bribery) to buy votes or support in the Mexican political context. There are very few institutional programs truly committed to local capacity building (Corbera and Brown, 2008). Consequently, local actors tend to participate in this kind of social programs because they know they can access economic resources without any commitment or effort. This perverse system of exchange is difficult to modify. Against this background, most local actors tend to participate in the *Scolet Te* project believing that they will not have to comply with any obligations. Once they realize that economic resources do depend on their efforts, local actors tend to desist (Corbera and Brown, 2010).

For AMBIO, responsible for the project at the local level, ensuring adherence to the disciplinary rules among local actors is a constant battle because local groups usually generate a great deal of pressure to modify the rules of the game of the project in order to make it more flexible. For Burns (1977) this "subversive behavior" among actors is part of the normal process of exchange. Given that the exchange is a dynamic process, actors are constantly manipulating the conditions of exchange to modify resource distribution and other actors' action. Accordingly, actors who can control the exchange process can shape the exchange condition and therefore increase their payoffs. Actors can exert power over other actors to increase their gains. When local actors refuse to participate in the project or threaten to withdraw from it, they attempt to exert their power. This behavior among local actors has been the principal way of modifying -or attempting to modify- the exchange conditions and influence AMBIO's behavior.

However, one of the principal advantages of the central position of PVF is that the power of PVF over AMBIO and the rest of participants helps ensure discipline in the network and maintain the environmental aims of the project. Indeed, PVF will only issue carbon certificates if AMBIO succeeds in making local communities comply with the rules and conditions of the Plan Vivo system. For that reason, PVF considers the fulfillment of the Plan Vivo rules as a precondition of promoting the *Scolet Te* project at international level, and the main way to allow the flow of economic resources at local level.

Misbehavior in the network can have a high cost: PVF can sanction indiscipline by refusing to issue carbon sequestration certificates. One of the key mechanisms to enforce obligations is by monitoring tree plantations (Corbera and Brown, 2010). This verification ensures that farmers plant trees according to the technical rules stipulated by the Plan Vivo system and that trees are yielding the environmental benefits they are meant to produce. In turn, the inflexibility towards modifying the Plan Vivo system standards



has been the main reason for withdrawals among local actors and the principal cost to AMBIO (representative of PVF, AMBIO, and Arroyo Palenque).

The Consolidation Phase

Two main reasons explain the major change that occurred in 2007 regarding the distribution of power in the *Scolet Te* carbon network. First, the *Scolet Te* project failed to expand in the region at the expected rate. As a result, the *Scolet Te* project was unable to participate in the Kyoto Protocol since the project did not fulfill the recommendations of the CDM's panel (Costedoat *et al.*, 2015). Although AMBIO consolidated the carbon project in many communities in Chiapas and Oaxaca, efforts by AMBIO to bring in new participants failed to guarantee the project's expansion. It reduced the possibilities of the project to participate in the compliance market. The project kept working in the voluntary market, which affected the economic viability of the project for one reason: certificates from the voluntary market (semi-regulated) are not fully recognized in the compliance market. Potential buyers tend to offer lower prices for the voluntary certificates given the few possibilities of re-selling them on the secondary market (Brohe *et al.*, 2009). This situation reduced the possibility of allocating *Scolet Te* certificates on the international carbon market in favorable conditions.

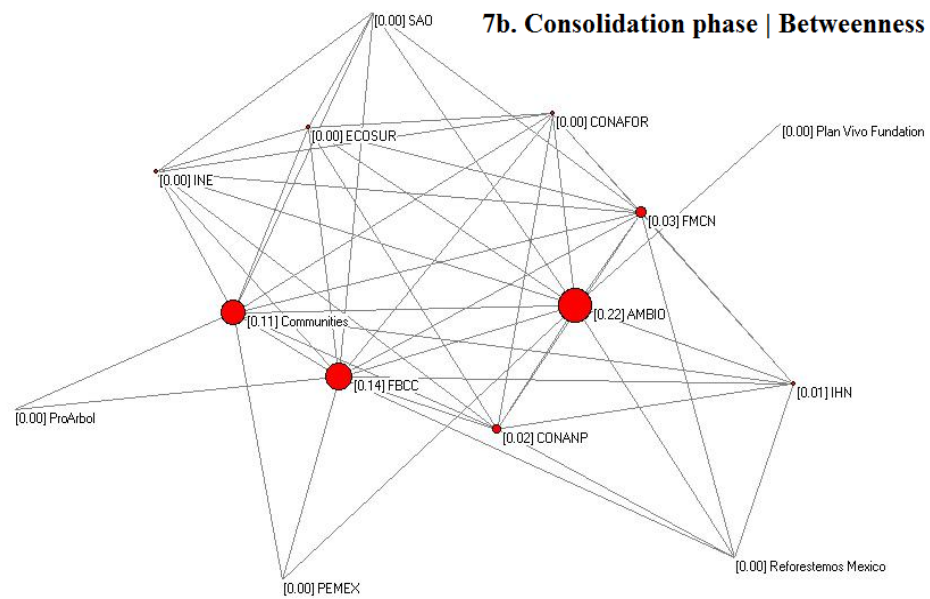
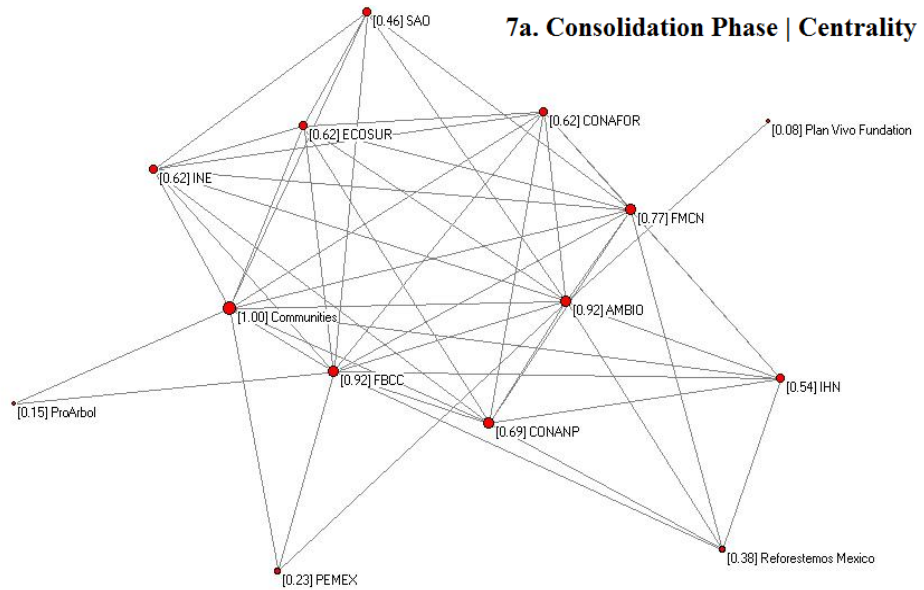
Second, the monopolistic position of the *Scolet Te* project as the sole carbon sequestration project in Mexico ended when local competitors emerged: 1) ProArbol, a national carbon program launched by the federal government, and 2) Environmental Services of Oaxaca (Spanish acronym SAO) -an environmental NGO- began running carbon projects in Oaxaca.

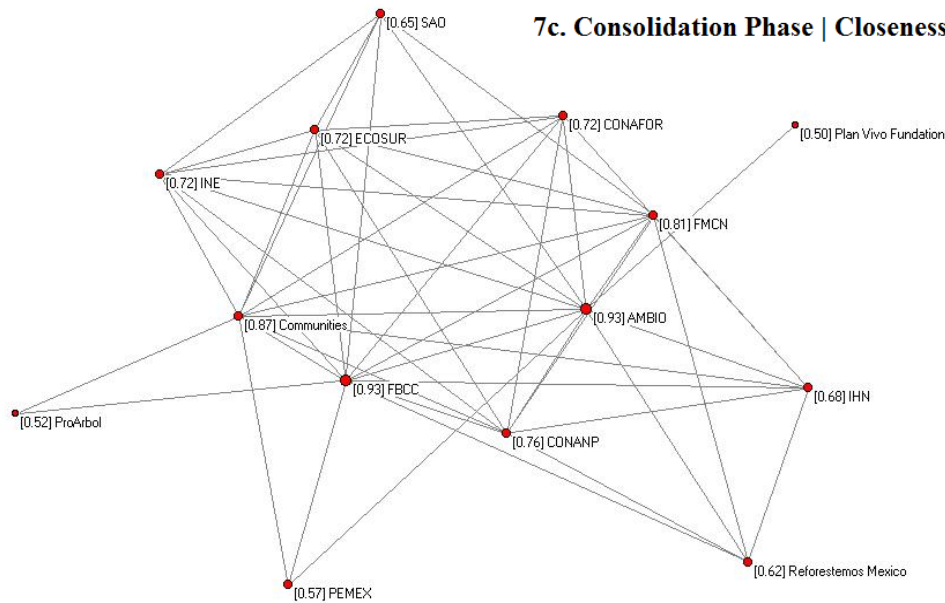
SNA FINDINGS

In terms of SNA, despite competition, the whole structure of the *Scolet Te*'s network did not substantially change as regards the power distribution among the actors. This trend can also be seen in the financial network (Figures 7a, 7b, 7c). This can be explained by the fact that competitors are not part of the *Scolet Te* relationships. For instance, local communities were the most connected actors in the network. They have the highest score degree of 1. AMBIO was the second-best connected actor in the network (degree 0.92). However, although some actors had improved their position in the network, AMBIO's betweenness and closeness score were still the highest in the network (0.22 and 0.93, respectively).



Figure 7. Consolidation phase: whole structure of the *Scolet Te* network





Source: compiled by the authors.

SET FINDINGS

Following the SET analysis, competition in the network had generated a substantial change in power distribution between AMBIO and the local communities. The possibilities for local communities/farmers to establish new partnerships with ProArbol and SAO reduced the power advantage of AMBIO in the carbon market. The emergence of competition in the local carbon market modified the exchange conditions (Figure 2c). AMBIO had to be more competitive if it wished to attract participants (social capital). It had an enormous competitive disadvantage with respect to the newcomers that all worked in the local market because of the regulation's low cost. ProArbol and SAO were in position to offer a higher pay-off to local communities than AMBIO.

Indeed, ProArbol was not under the same pressures as AMBIO to obtain financial resources from carbon sequestration since it had direct access to public funds to run projects in local communities in exchange for a promise to do the work. Conversely, AMBIO had to invest part of its resources to bring carbon buyers to the *Scolet Te* project and to ensure the carbon outcomes through an expensive monitoring system. Moreover, AMBIO had to pay a fee to PVF to maintain an international commercial platform intended to sell carbon certificates. Such fixed costs imply fewer profits for all the actors in the *Scolet Te* project, including local communities.

It is well known among governmental technicians that the monitoring process in ProArbol is not as strict as the one in the *Scolet Te* project. Many communities/farmers prefer participating in ProArbol than *Scolet Te*



because they are more interested in the financial resources than in the environmental benefits provided by reforestation activities.

“...Not all farmers work at the beginning of the project, many people think that AMBIO is not going to do the monitoring, that AMBIO is going to pay them even if they don't work. Farmers think that *Scolet Te* is like ProArbol. For instance, in the government program the technician only checks one parcel and the rest of the parcels are not monitored, but the people don't care because payment does not depend on the work. Farmers receive payment regardless of whether they work. Then farmers realize that AMBIO is different, that they need to work if they want to receive payment...” (CONANP representative).

Similarly, SAO is a new environmental organization created when CEPCO decided to offer environmental services in the Oaxaca region. As noted, CEPCO was the principal partner of AMBIO in the establishment of the tree plantation in Oaxaca. However, after working many years as a broker for AMBIO, CEPCO acquired the necessary knowledge and expertise to run the sequestration projects in Oaxaca on its own. CEPCO decided to perform a balancing operation through a new strategy in the carbon market and create a new environmental organization called SAO to take over the carbon sequestration business in the region.

In terms of social exchange, SAO managed to change the dependence degree with respect to AMBIO as a result of two main factors: 1) SAO had control of the local communities, and 2) SAO had accumulated the human capital for a carbon sequestration project. This decreased value of AMBIO with respect to CEPCO, changing the mutual dependency degree between them. Furthermore, given the difficulties for SAO of establishing a carbon sequestration project with the characteristics of the *Scolet Te* project, the SAO strategy has been to launch a footprint carbon project. It took advantage of the environmental services boom fostered by the Mexican government. SAO was working in the local market (unregulated) with the advantage of not having to fulfill requirements to compete in the international market as AMBIO did. The establishment of a carbon project for SAO was less costly than participating in the international carbon market.

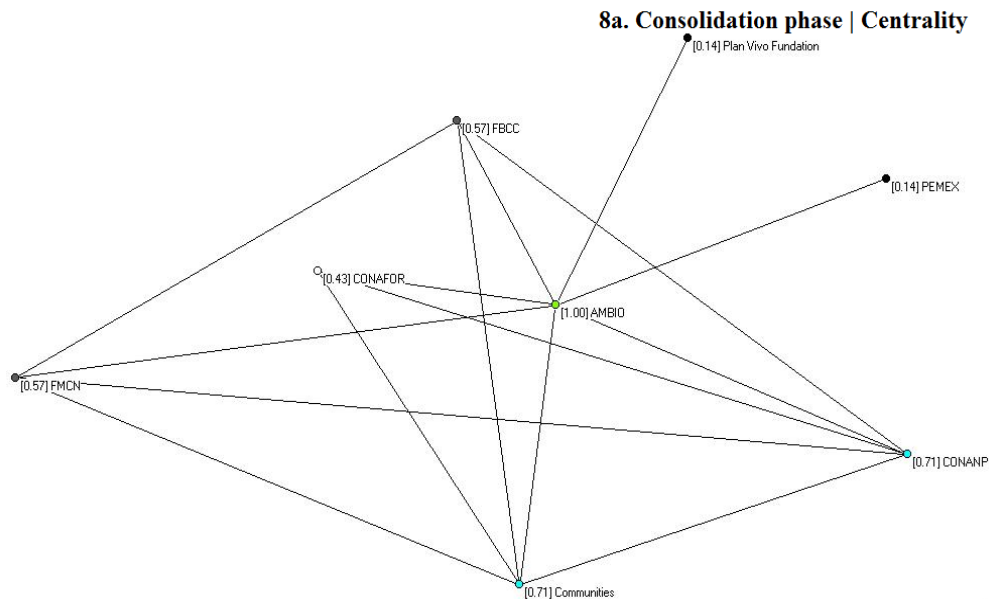
Consequently, the unequal market conditions in terms of regulation in the local and international carbon markets created perverse incentives among local communities that jeopardize environmental protection in the region. The emergence of an expanding, profitable and unregulated carbon market at local level not only offers advantages for local organizations to benefit from the environment, but also offers local communities “better deal”.

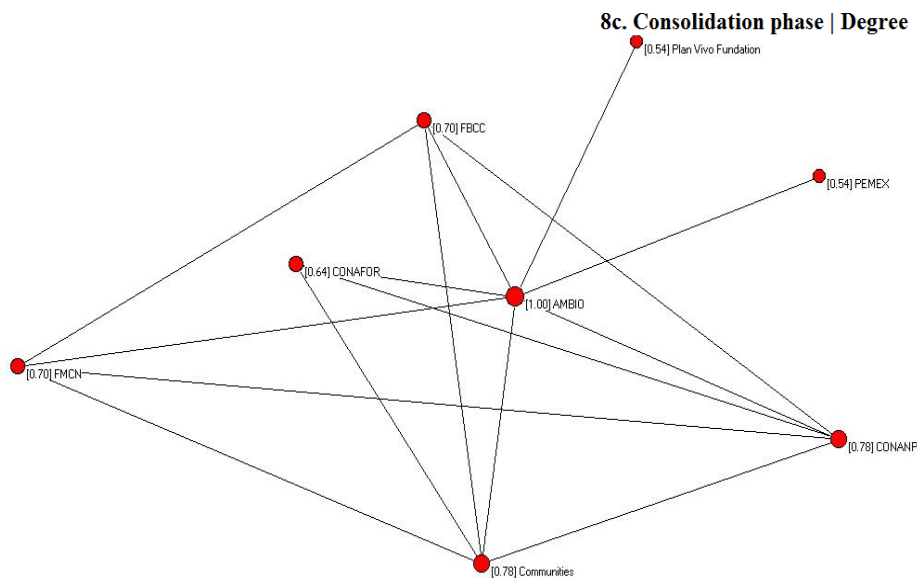
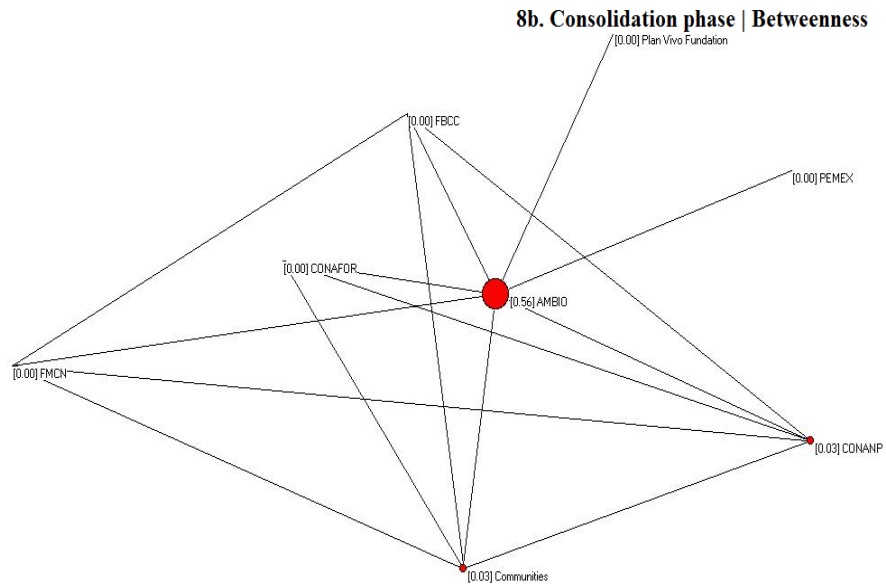


For instance, when local communities obtained access to financial resources from three sources –ProArbol, SAO, and AMBIO– the carbon project which offers better rewards and less costs for the same activities (planting trees) was obviously the one that would attract most participants. And carbon projects with low levels of accountability are clearly more attractive for local communities. In this context, although AMBIO is the most disciplined actor in the carbon market in Mexico, it is also the least competitive one.

On the one hand, competition in the carbon market at the local level also drove a change in power distribution regarding the flow of financial capital (Figures 8a, 8b, 8c). Indeed, the emergence of competitors in the carbon market at the local level and the high connection costs at the international level provided incentives for AMBIO to begin looking for new alliances and reducing its fixed costs. Unfortunately, the upshot was that AMBIO decided to enter the unregulated local market.

**Figure 8. Consolidation phase: financial structure
of the *Scolel Te* network**





Source: compiled by the authors.

AMBIO went a step further and decided to establish a strategic alliance with a local NGO (RM). RM is a fundraising organization, which seeks to promote environmental activities among Mexican firms. This strategic alliance between AMBIO and RM was designed to introduce the *Scolet Te* project into the carbon market at the local level with the aim of increasing economic rewards for local communities and being more competitive in the carbon project. In terms of social exchange, this new position of AMBIO led to a reduction in the power advantage of PVF in the distribution of economic



resource. In other words, AMBIO was no longer dependent on the resources of PVF as RM provided an alternative means of bringing economic resources to the project (Figure 2c). According to AMBIO's representative "the *Scolet Te* project had more opportunities to boost the project in the local market where they can be more competitive".

Despite AMBIO's aim of using the new commercial platform to improve the competitive edge of the *Scolet Te* project and the Plan Vivo system, the real risk is that AMBIO could suffer from the unregulated market's inertia. Maintaining discipline among local communities and services quality runs against the ever more pressing need to reduce certification costs. This is likely to occur if local interests are considered. They are constantly pressing to make the Plan Vivo system rules as flexible as possible. In this context, local carbon market flexibility together with the lack of a local regulation body able to oversee the degree of accountability in the carbon sector in Mexico can create incentives to reduce the quality of the *Scolet Te* project services.

Conclusions

This article shows that the lack of a single market governing carbon sequestration projects under PPP initiatives has created serious difficulties in the implementation of the PPP international environmental policy. For the case of Mexico, we show evidence of how the concurrence of multiple carbon markets with different degrees of regulation (highly regulated, semi-regulated, unregulated) affects the ability of actors in *Scolet Te* to coordinate their actions at the local level. It was found that regulatory heterogeneity encourages actors to adopt strategies (balancing operations) that minimize regulatory costs, reduce transparency, and produce lower ecological benefit. These decisions may jeopardize the environmental aims of carbon sequestration projects when actors face unequal competition. Moreover, our analysis of the *Scolet Te* network suggests that:

1. Actors are more disciplined and keep their environmental aims in the network within a scenario of strictly regulated market conditions (highly regulated), even if the cost of regulation is high or if actors struggle to comply with all regulations. However, high regulation costs prevent the expansion of the project.
2. Actors tend to derail their actions from the environmental aims of the project in scenarios when options with different degrees of regulation concur (highly regulated, semi-regulated, unregulated). The existence of an unregulated local carbon market encourages the adoption of the cheapest, least accountable project alternatives. This, in turn, creates unintended incentives for actors to adopt less



environmentally responsible strategies in the carbon sequestration sector.

3. Finally, this article shows that local, national and international regulation in the carbon sequestration market interact, in an unforeseen and not always positive way, at the grassroots level. A standardized regulatory system that works effectively at different levels of authority is therefore required. The establishment of minimum regulatory criteria at all levels of authority could encourage local actors to respond better to achieve lower levels of carbon emissions. Hence the need to adopt a multilevel perspective when designing a regulatory system.

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