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Implementing Community Sustainability Plans through Partnership: Examining the Relationship between Partnership Structural Features and Climate Change Mitigation Outcomes

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Abstract: Addressing society's most complex challenges, such as climate change, requires bringing together stakeholders from the business, government, and nonprofit sectors. At the municipal level, multi-stakeholder partnerships are often formed to implement community sustainability plans. However, these partnerships can create new challenges, as it is cumbersome to coordinate action among a group that is made up of such diverse stakeholders. Past research suggests that it is important for these partnerships to have the appropriate structures in place to mitigate some of the coordination challenges to which they are prone. Yet, very few studies have examined the influence that different structural features have on plan outcomes. This article seeks to address this important research gap by using quantitative methods to examine five different features that can compose partnership structures—oversight, monitoring and evaluation, partner engagement, communication, and community wide-actions and their impact on climate change mitigation outcomes. Based on data collected through a global survey and publicly available greenhouse gases emission data from 72 different partnerships that implement community sustainability plans (CSPs), this study finds that structural features related to oversight and community-wide actions are positively associated with climate change mitigation outcomes. These results indicate that certain features of partnership structures may be more important for achieving desirable climate change mitigation outcomes, and thus contribute to research on collaborative governance structures and climate action.

Keywords: cross-sector partnership; climate change; climate action; climate mitigation; urban sustainability; sustainable communities; Local Agenda 21; collective action; collaboration; SDG 17

1. Introduction

Sustainable development has attracted significant attention from scholars, policymakers, and industry since 1987, when it was first proposed in the Brundtland report [1,2]. While it is a global issue, achieving sustainable development also requires local community-level efforts [1,3]. In 1992, Agenda 21, which is an action plan for pursuing sustainable development, was adopted at the United Nations Conference on Environment and Development [4]. Within Agenda 21, a local approach called Local Agenda 21 (LA21), which addresses community-level sustainable development planning and implementation, was introduced [4]. Worldwide, the LA21 process has been adopted by communities to form and implement community sustainability plans (CSPs). A CSP, created through

the LA21 process, embodies a holistic perspective of sustainability, integrating social, environmental, and economic aspects into a community's sustainability visions, goals, and targets [5,6]. Due to their holistic and integrated approach, CSPs tend to cover a broad range of topics, including energy, land use, transportation, water, waste, air, housing, civic engagement, social infrastructure, safety, financial security, employment, local economy, food security, ecological diversity, and climate change [7]. In essence, CSPs are a localized version of the United Nations Sustainable Development Goals [7]. Among these topics, climate change, as a serious global issue, has been included in most plans [7].

Due to the massive anthropogenic emissions of greenhouse gases (GHGs), mainly carbon dioxide (CO_2), the global temperature is rising, and climate change is happening [8,9]. Human economic activities, such as burning fossil fuels, destroying forests, and practicing modern agriculture, are the main contributors to the emissions [10]. The adverse effects caused by climate change, such as a higher frequency and greater intensity of extreme weather, the destruction of animals' and plants' habitats, and the increased severity of water shortage, are threatening ecological integrity, economic development, and social stability [10]. While numerous policies and initiatives have been introduced at international and national levels to address the issue, action plans at the local level are also necessary, since local communities have direct control over many emission sources, such as public transportation, heating/cooling municipal buildings, waste management, and land usage, and indirect control over other emissions [11–13]. Therefore, implementing CSPs that cover climate change topics offers an important avenue toward reducing emissions.

Integral to local sustainability planning that is informed by the LA21 process is the principle that CSP goals must be developed and achieved through "democratic dialogue and decision-making" [14] (p. 148). Thus, implementing CSPs often involves stakeholder collaboration, which can take the form of a cross-sector social partnership. Cross-sector social partnerships are voluntary collaborations among organizations from two or more sectors (i.e., private, public, and/or nonprofit) that have agreed to collectively address a mutually prioritized social problem [15–17].

When a partnership forms to address local sustainability issues, it is also common for a new governance arrangement to be created in order to help coordinate partner action for implementing agreed upon sustainability initiatives [18,19]. Such arrangements—referred to in this article as partnership structures—are made up of organizational features that are designed to improve partner coordination and goal attainment [20]. Examples of such features include processes that facilitate ongoing partner communications and engagement, an entity, such as a secretariat that oversees partnership activities, as well as monitoring and evaluation systems that assess partnership progress on its sustainability goals [20–22]. Past research indicates that the structural features of a partnership can influence outcomes [23]. For example, processes that facilitate collaborative decision-making have been linked to higher levels of social capital in partnerships [24]. Thus, to create effective partnerships and make better use of the collaborative approach to addressing local sustainability issues, it is vital to study whether and how different partnership structural features can influence climate outcomes.

Despite the pressing issue of climate change, little is known about the effectiveness of local partnerships and plans that tackle the issue [25]. Past research on collaborative approaches to address sustainability issues have primarily focused on understanding the new governance structures that form to coordinate partner action [26]. Few studies have examined how different features of collaborative governance structures influence outcomes [23,27], and the studies that have tended to focus on partner outcomes, such as human or social capital accrued by partner organizations as a result of partnering for sustainability [28–30]. Very little, if any, research has been done to understand how structure affects plan outcomes, such as reductions in GHG emissions [20,21]. Conducting such studies is challenging due to the limited availability of partnership structure and plan outcome data. In addition to a lack of data availability, it is difficult to obtain objective data on plan outcomes that can be compared across communities. This is because there are no standard metrics or targets that have been universally adopted by communities with CSPs. One objective metric that can be compared across communities is GHG emissions; still, the communities that track and report on their GHG emissions reductions are in

the minority. Of the 106 communities that participated in our survey, only 24 had publicly available GHG emissions reduction data. This paucity of data limits the number of communities that we can include in our study for that specific analysis. While some of our results are based on a small sample, our data are adequate to highlight initial insights about the key structural features, as well as provide exploratory points that can guide future research on this critical topic.

The present study examines the relationship between the partnership structural features and CSP climate change mitigation outcomes. Specifically, this study explores how the abovementioned structural features might influence three climate change outcomes: (1) proactivity of the plan's community-wide climate change actions, (2) progress made on climate goals stated in the CSP, and (3) reduction in community-wide greenhouse gas emissions.

2. The Role of Cross-Sector Social Partnerships in CSP Implementation

As mentioned, cross-sector social partnerships are often part of how CSPs are formulated and implemented [19]. Four different types of partnerships have been identified in the research on cross-sector social partnerships: (1) private-public partnerships, (2) nonprofit-public partnerships, (3) nonprofit-private partnerships, and (4) multi-stakeholder partnerships [16,31]. While all four partnership types have been associated with implementing projects or initiatives that are linked to sustainability goals in CSPs [16], the focus of this article is on multi-stakeholder partnerships. Multi-stakeholder partnerships have one or more partners from each of the public, private, and nonprofit sectors [31]. Multi-stakeholder partnerships typically involve a wide array of stakeholders, a strategy which is generally accepted as best practice for addressing problems that are beyond the capacity and jurisdiction that any single organization could address alone [16,32]. For example, typical partners in CSP multi-stakeholder partnerships include the local government, universities, environmental non-governmental organizations (NGOs), community associations, local businesses, industry associations, etc. [3].

Implementing CSPs through multi-stakeholder partnerships means that diverse partners are engaged, which is thought to bring together diverse knowledge, experience, resources, and perspectives needed to address complex challenges [33–35]. Indeed, recent studies provide empirical evidence that more comprehensive forms of collaboration are linked to desirable outcomes for climate change [36] and support community-wide plan implementation and goal realization [37]. However, in practice, these large partnerships are highly complex and demand significant investment to create, develop, and sustain [38,39].

The challenges and limitations associated with multi-stakeholder partnerships are attributable to factors such as the diversity of partner goals and priorities, conflicting aims and views on the precedence of different sustainability goals, and obstacles in developing collaborative modes of operating [40]. Implementation performance of partnerships often relies on the stability of the situation, the status of the consensus among partners, and the capability of partners to accomplish tasks and take actions [39]. The challenges can result in costly, time-consuming, and ineffective partnerships [38,39]. Therefore, care is required while designing and implementing partnerships so that they are applied only where appropriate and have realistic expectations about their potential [41].

Past research suggests that certain governance arrangements or structures can help to lessen the impact of the above-mentioned challenges of multi-stakeholder partnerships [32,42]. For example, the design of decision-making processes has been found to influence the capacity of a partnership to achieve its sustainability goals [24]. Likewise, formalized systems for monitoring and reporting on partnership progress and impact have been shown to have a positive impact on ongoing partner engagement [38,43]. Clarke [20] proposes that there are five key features of a partnership's implementation structure that will determine its effectiveness when implementing a CSP, they are: (1) oversight, (2) monitoring and evaluation, (3) partner engagement, (4) communications, and (5) community-wide actions.

2.1. Oversight

Research on CSP partnership suggests that oversight responsibilities can be assumed by an arm's length organization, the local government, or a multi-organizational body, such as a committee or secretariat made up of different partners [20,44,45]. The oversight structure oversees and monitors plan implementation and identifies—or helps the partners to identify—issue-based short-term actions [20,44,45]. Having an oversight body that allows partners from different municipal departments and sectors to get involved in decision-making, monitoring, evaluation, and collaborative activities could improve the availability of data and resources and help with generating responsive and innovative solutions [44,45]. A participatory oversight structure that allows for collaborative decision-making has been shown to be important for improving partnership performance regarding setting periodical targets, making high-quality decisions, information sharing, and enhanced partner motivation and commitment [46–48]. For example, Barcelona (Spain) has a multi-stakeholder council, which oversees the partnership's sustainability activities, deals with communication, monitors progress towards partnership goals, and engages partners from various sectors [35]. Barcelona's oversight council helped to coordinate the climate actions taken by the partners and the community, and these efforts resulted in a decrease of CO_2e emissions by 29% per capita within 14 years (from 1999 to 2012) [35]. In this study, we examine two dimensions of oversight, (1) the oversight structure, and (2) decision-making processes.

Hypothesis 1 (H1). *There is a positive correlation between partnership structures that have collaborative oversight entities (composed of partner organizations) and CSP climate change mitigation outcomes.*

Hypothesis 2 (H2). *There is a positive correlation between partnership structures that facilitate collaborative decision-making and CSP climate change mitigation outcomes.*

2.2. Monitoring and Evaluation

Monitoring and evaluation involve mechanisms for developing status and action indicators, collecting and interpreting data on an ongoing basis, and evaluating progress based on the collected data [20,49,50]. Such mechanisms facilitate consistent and regular adjustments to be made to the implementation actions and initiate plan renewal as needed. The essential functions of monitoring and evaluation processes is that they facilitate the articulation of plan outcomes and impacts and help to identify areas in which improvements are required [50]. In other words, monitoring and evaluation ensure the continuous improvement of the plan and its implementation [20,49,50]. Past research suggests that having a clear sense of plan outcomes and impacts helps to orient the direction of actions and motivates partners to fulfil their commitment to the plan's implementation [50]. However, research has found that this is often a forgotten stage, because of time constraints, expertise, and financial resources [50,51]. To this end, we hypothesize:

Hypothesis 3 (H3). *There is a positive correlation between partnership structures with mechanisms for monitoring and evaluation and CSP climate change mitigation outcomes.*

2.3. Partner Engagement

Partner engagement mechanisms help partnerships to identify key stakeholders, engage stakeholder organizations from different sectors in the implementation of the CSP, and expand the number of partners involved on an ongoing basis [52]. Research has shown that it is not only essential to involve key organizations in partnership activities, but also to reach a critical number and high diversity of partners for taking actions related to community-wide topics [53,54]. This feature is considered important, as it is thought to contribute to the diverse expertise and knowledge within the partnership, which is considered an asset to innovative problem-solving [37,41]. This leads to the following hypothesis:

Hypothesis 4a (H4a). *There is a positive correlation between partnership structures that have mechanisms for partner engagement and CSP climate change mitigation outcomes.*

Conversely, it is also possible that this structural feature could create new challenges, as collaborator diversity is also known to contribute to communication and coordination problems [55]. Such negative impacts are equally as likely to result in disengagement of some partners from the partnership, which could have a negative impact on goal achievement [40,56]. Thus, we also hypothesize:

Hypothesis 4b (H4b). *There is a negative correlation between partnership structures that have mechanisms for partner engagement and CSP climate change mitigation outcomes.*

2.4. Communications

Communication systems are composed of processes that ensure information exchange and sharing within the partnership and with the public [20]. This structural feature helps to facilitate partner networking and keeps citizens updated and informed about CSP activities and progress. Examples of partner networking events include annual task force meetings, monthly networking breakfasts, or awards nights [20]. Such events are designed to let partners learn from each other's success stories, provide opportunities for new collaborations to form, and help with building new and stronger relationships among partners [57]. Moreover, reporting to the public and disseminating findings that show the plan's progress towards achieving local sustainability is crucial for building trust between the public and decision-makers [57]. Besides this, the quality and quantity of the information provided by communication systems and having diverse communication approaches are both vital for organizations, in terms of understanding sustainability and planning goals, as well as knowing how to get involved [58,59]. Previous research shows that communication systems help to build mutual respect and understanding between partners, which improves the implementation of climate actions [43].

Hypothesis 5 (H5). *There is a positive correlation between partnership structures with communication systems and CSP climate change mitigation outcomes.*

2.5. Community-Wide Actions

Community-wide actions are a structural feature of partnerships that helps to enable individual partner organizations to integrate sustainability into their own organization's actions. This might involve partners integrating sustainability into their core values, strategic plan, and operations [60–62]. Incentive programs, such as awards nights that provide recognition for high performing partners or free training workshops that help partners to identify areas in their organization where they can reduce waste or energy use, help promote community-wide actions [27,33,38]. In partnerships with this structural feature it is not sufficient for partners to support the plan in principle and provide advice to the local government on how to implement, as the partners themselves are also expected to implement the CSP through their organizational effort [20,63]. Partner organizations that implemented the Montreal Community Sustainable Development Plan 2010–2015 were asked to commit to taking a certain number of sustainability actions each year and to report back to the local government on their progress [27]. Actions taken at the individual partner level are essential constituents of a collaborative strategy, including CSP implementation, since more can be achieved when as many local organizations as possible take actions to reduce their GHG emissions [19,64].

Hypothesis 6a (H6a). *There is a positive correlation between partnership structures with community-wide climate action and progress made towards climate change mitigation goals.*

Hypothesis 6b (H6b). *There is a positive correlation between partnership structures with community-wide climate action and community-wide GHG emission reductions.*

3. Materials and Methods

To achieve the research objective, this study followed a quantitative method research paradigm. R (Version 3.2.2) was used to analyze the data. The process was granted ethics approval from the researchers' academic institution. Data were collected through an online survey conducted in collaboration with ICLEI—Local Governments for Sustainability (ICLEI). The survey was designed to collect information about the implementation structures of different partnerships and outcomes resulting from the implementation of CSPs [7,34]. The total population examined in this research included 984 communities from around the world that are members of ICLEI. We chose this population of communities because they implement their CSPs through the LA21 recommended approach and are committed to achieving local sustainability, as evidenced by their membership with ICLEI. Of ICLEI's 984 members, 787 speak one of the four languages that the survey was offered in (English, French, Spanish, and Korean), and so these were the communities contacted to complete the survey. Of the 787 communities contacted, 106 completed and submitted the survey, resulting in a response rate of 13.5% of our sample and 10.77% of the total population (i.e., ICLEI member communities). The responses to survey questions pertaining to partnership structural features, proactivity of climate change actions, plan progress on climate change goals, and GHG emission reduction were statistically analyzed and interpreted. The proactivity of community-wide climate actions variable was treated as the independent variable in Hypothesis 6 and as a dependent variable in all other hypotheses.

3.1. Partnership Structural Features

The survey questions developed to assess partnership structural features were based on Clarke's [20] five key features framework. Discussed in this section are the variables: oversight, monitoring and evaluation, partner engagement, and communication. The community-wide actions feature is described in the next section, which describes the climate change outcome variables.

Oversight was divided into two groups of survey questions: oversight structure and decision-making. Oversight structure was measured with a three-item scale, each item was assessed on a five-point Likert scale ('never' = 1 to 'very frequently' = 5). Decision-making was evaluated with a two-item scale, each item was assessed with a five-point Likert scale ('disagree' = 1 to 'agree' = 5). Monitoring and evaluation was assessed with a four-item scale, each item was evaluated with a five-point Likert scale ('disagree' = 1 to 'agree' = 5). Partner engagement was measured with a two-item scale, each item was on a five-point Likert scale ('disagree' = 1 to 'agree' = 5). Communication was measured with a two-item scale, each item was assessed with a five-point Likert scale ('never' = 1 to 'very frequently' = 5). Table 1 provides a summary of each variable and its associated survey questions.

Table 1. Summary of variables and survey questions.

Structural Feature	Variables	Description
Oversight structure	Arm's length organization	CSP implementation activities are organized through an arm's length organization
	Collaborative entity	CSP implementation activities are organized through a committee or task-force composed of partner organizations
	Local government	CSP implementation activities are organized through the local government
Decision-making	Local government decision-making	Strategic and implementation decisions are made by the local government partner
	Collaborative decision-making	Strategic and implementation decisions are made collaboratively by partners

Table 1. *Cont.*

Structural Feature	Variables	Description
Monitoring and evaluation	Report on community-wide progress	Monitor and report on progress made on community-wide sustainability goals
	Report on local government progress	Monitor and report on progress made on local government's sustainability goals
	Report on sustainability actions	Report on local government and partner sustainability actions
	CSP renewal	Renewal of the CSP
Partner engagement	Partner involvement in partnership	The CSP includes mechanisms that ensure partners' involvement in the partnership
	Partner engagement in CSP implementation	The CSP includes mechanisms that encourage partners' engagement in the implementation of the CSP
Communication	Information-sharing	Amount of communication done through one-way information sharing (i.e., website, newsletters, email updates)
	Social events	Amount of communication done through social events or partner meetings (i.e., partner networking and recognition events, in-person meetings among partners, sustainability focused educational seminars and workshops)

3.2. Climate Change Outcomes

Three survey questions were used to assess climate change outcome. The first question was developed to measure the proactivity of community-wide climate actions. This question assessed proactivity with a four-point proactivity continuum (i.e., 1 = compliance, 2 = beyond compliance, 3 = proactive and 4 = leading edge), which was developed based on the business environmental strategic options model developed by Roome [61,62]. The second question was developed to assess the progress made on the CSP's climate change goals. This question used a five–point Likert scale (1 = Did not meet goals at all to 5 = Greatly exceeded goals). Seventy-two responses were available for both questions. The last set of questions contained five open-ended questions regarding the community-wide GHG inventories. These questions asked survey respondents to report their community-wide GHG targets, the baseline year for the community-wide GHG inventory, the total CO_2e emissions in the community-wide GHG inventories in the baseline year, the year of the latest community-wide GHG inventory, and the total CO_2e emissions in the latest community-wide GHG inventory.

Only 12 of the 106 survey respondents completed the GHG inventory survey questions, and so we needed to collect additional data from other sources to ensure a valid sample size for analysis. Survey respondents identified their municipality in the section of the survey that collected demographic information, so we were able to search for publicly available data on the GHG inventories for the communities that responded to our survey.

Two sources of supplementary data were used to complete our GHG inventories data set: (1) the carbonn® Climate Registry, and (2) publicly available sustainability reports and information posted to municipal websites. First we searched the carbonn® Climate Registry (cCR), which is a public platform for local as well as sub-national governments to report, evaluate, and improve their climate and energy goals, GHG emissions performance, climate plans, and mitigation and adaptation actions [65]. Information, such as baseline year and the latest year community-wide GHG inventories until the survey were distributed, as well as total carbon dioxide equivalent (CO_2e) emissions in community-wide GHG inventories in the baseline year and the latest year, was recorded. We searched for the names of the 106 municipalities in cCR and downloaded all available data from the municipalities represented in our survey. For the municipalities that did not post their data to the cCR, we searched through their community plans and public sustainability reports, in order to extract the relevant data. In total, we were able to collect GHG emission data for 24 communities.

The GHG emission data from all the three sources of data were converted to CO_2e. To make the emission data comparable across the communities, the percentage of CO_2e emission reduction

of baseline emission per year was calculated using the equation below to create a measure of standardization. The results calculated from all three sources were put together and used as one of the dependent variables, community-wide GHG emission reduction. Community-wide GHG emission reduction is made up of the following items: community-wide total CO_2e emission in the baseline year (GB); community-wide total CO_2e emission in the latest year (GL); the baseline year of community-wide GHG inventory (BY); and the latest year of community-wide GHG inventory when the survey was distributed (LY).

$$\text{Percentage of } CO_2e \text{ emission reduction of baseline emission per year} = \frac{\frac{GL-GB}{GB}}{LY-BY} \times 100, \quad (1)$$

Publically available data about CO_2e emissions are supplied in Appendix A.

3.3. Survey Reliability and Validity

To address issues of content validity, the survey was reviewed by local sustainability and social partnership experts [34]. Collaborators, including the director, acting director, and municipal sustainable development coordinator from ICLEI Canada, reviewed and provided feedback on the survey questions, which was valuable because they work directly with the target survey participants [34]. Moreover, the validity of survey variables was assessed in an exploratory factor analysis (EFA) [24]. In addition, the survey was anonymous, which contributes to reliability of the results. Research has shown that, compared with in-person interviews or questionnaires, anonymous survey methodologies show higher levels of self-disclosure as well as more honest, candid responses [66]. The degree of homogeneity of the variables was also checked using Bartlett's test and Levene's test, which ensures the internal consistency reliability of the results [67].

3.4. Data Analysis

In this study, R (Version 3.2.2) was used to analyze the collected data to examine how different structural variables affect plan outcomes in the topic area of climate change. The mean and mode values and standard deviations of the dependent variables were calculated. The results of the descriptive analysis displayed fundamental features and particular patterns of the data, including central tendencies and data dispersion [68]. The descriptive analysis results were used to provide a profile of the climate change plan outcomes. Moreover, simple linear regression (SLR) was adopted to test hypotheses 1 to 6. The coefficient of the SLR model shows the strengthening of the correlation, and p-values less than 0.05 (with a 95% confidence interval) indicate that there is a significant relationship between the two variables [69].

4. Results

4.1. Partnership Structural Features

Table 2 summarizes the descriptive statistics for the partnership structure variables. As shown in Table 2, it is common for the CSP's implementation activities to be organized through the local government, while more collaborative forms of organizing implementation happen occasionally. Moreover, most study participants agreed that the strategic and implementation decisions are made by the local government partner, but also indicated that some decisions are made collaboratively by partners. As well, most communities include mechanisms that monitor progress made on local government's sustainability goals in their CSPs, whereas fewer have mechanisms for monitoring and reporting on community-wide goals. Table 2 also reveals that the CSP very often embraces mechanisms for engaging partners in the implementation of the plan's sustainability initiatives; however, communities also report that CSP-related communication activities are only occasionally organized.

Table 2. Summary of descriptive statistics for the partnership structure variables.

Structural Features	Variables	*n*	Mean	SD	Mode
Oversight structure	Arm's length organization	95	2.979	1.158	3 (Occasionally)
	Collaborative entity	87	3.061	0.800	3 (Occasionally)
	Local government	100	4.130	0.971	5 (Very frequently)
Decision-making	Local government decision-making	95	3.721	1.137	5 (Agree)
	Collaborative decision-making	99	3.707	0.983	4 (Somewhat agree)
Monitoring and evaluation	Report on community-wide progress	95	3.576	0.909	4 (Somewhat agree)
	Report on local government progress	101	4.203	0.928	5 (Agree)
	Report on sustainability actions	103	3.961	1.047	5 (Agree)
	CSP renewal	102	3.868	1.128	5 (Agree)
Partner engagement	Partner involvement in partnership	101	3.698	1.005	4 (Somewhat agree)
	Partner engagement in CSP implementation	101	4.079	0.940	5 (Agree)
Communication	Information-sharing	103	3.201	0.838	3 (Occasionally)
	Social events	98	2.867	0.738	3 (Occasionally)

4.2. Climate Change Outcomes and Greenhouse Gas Inventories

Table 3 reports the descriptive statistics for the climate change outcome variables collected in the survey. Of the 106 communities surveyed, only 72 included the topic area of climate change in their CSP. Of the communities with climate change in their CSP, most took proactive community-wide climate actions and met some of their climate goals.

Table 3. Descriptive statistics for the survey climate change outcome variables.

Variable	*n*	Mean	SD	Mode
Proactivity of community-wide climate change actions	72	2.514	0.979	3 (proactive)
Plan progress on climate goals	72	2.556	0.948	2 (met some goals)

Only 24 of the communities that participated in the survey reported their GHG inventory data. The baseline year of community-wide GHG inventories ranged from 1990 to 2010, while the most commonly reported baseline year was 2007 ($n = 7$). The latest GHG emission data that communities reported ranged from 2006 to 2013 (up to the time of distributing the survey). Most communities reported their data in 2012 ($n = 8$). Shown in Table 4 are descriptive statistics for the per year percentage reduction of CO_2e emissions. On average, communities reported approximately 4.5% in CO_2e emission reduction per year; however, the standard deviation is relatively high, which means the GHG emission reduction values are widely spread. See Appendix A for the community-wide CO_2e emissions data by community.

Table 4. Descriptive statistics for community greenhouse gas (GHG) inventories.

Variables	*n*	Mean	SD	Minimum Value	Maximum Value
The percentage of CO_2e emission reductions per year (%)	24	4.534	10.419	−3.010	34.490

4.3. Results of Hypotheses

SLR was conducted to explore the relationship between five structural features and three climate outcome variables.

For hypothesis 1, three different oversight structures for plan implementation were assessed, (1) implementation activities organized by an arm's length organization, (2) implementation activities organized by a committee composed of partner organizations, and (3) implementation activities organized by the local government. The results show partial support for hypothesis 1, as a significant positive relationship was found between implementation activities organized collaboratively by partner organizations and community-wide GHG emission reductions (p = 0.0182, β = 9.554). However, no correlation was found between collaborative implementation and other climate outcome variables. We did not find evidence that either of the other two oversight structures (arm's length organization or local government) influences the assessed climate outcomes. These findings, summarized in Table 5, provide indirect support for hypothesis 1, which predicted a positive correlation between partnership structures that have collaborative oversight entities (composed of partner organizations) and climate change outcomes.

Six regression tests were conducted to test hypothesis 2. As shown in Table 5, we found only one positive and significant relationship. We did not find any statistical correlation between collaborative decision-making and the climate outcome variables; thus, we did not find support for hypothesis 2 in this study. Instead, our results indicate that decision-making by the local government partner has a positive and significant correlation to planning progress on climate goals (p = 0.049, β = 0.183). This finding contradicts hypothesis 2, as it suggests that decisions made by a single partner (i.e., the local government partner) rather than decisions made collaboratively by partners (as predicted) result in a positive climate outcome.

We did not find any relationship between the structural variables and climate outcomes predicted in hypotheses 3–5. These results indicate that the monitoring and evaluation, partner engagement, and communications structural features may not have a direct impact on the outcomes assessed in this study. See Table 5 for a summary of these results.

As for hypothesis 6, we found significant positive relationships between the proactivity of community-wide climate actions and two outcome variables, (1) plan progress towards climate goals ($p < 0.001$, β = 0.389), and (2) GHG emission reductions (p = 0.003, β = 11.446). These results indicate that the proactivity of climate actions is important to both perceived progress on climate goals and actual CO_2e emission reductions.

Table 5. Simple linear regression results for hypotheses 1–6.

Hypotheses	Variables	Proactivity of Community-Wide Climate Actions (n = 72)		Plan Progress on Climate Goals (n = 72)		The Percentage of CO_2e Emission Reduction Per Year (n = 24)	
		p-Value	Slope(β)	p-Value	Slope(β)	p-Value	Slope(β)
H1	Arm's length organization	0.189	0.144	0.128	0.156	0.659	1.603
	Collaborative entity	0.489	0.118	0.951	0.01	**0.018**	**9.554**
	Local government	0.319	−0.121	0.436	0.095	0.073	5.68
H2	Local government decision-making	0.929	−0.008	**0.049**	**0.183**	0.059	4.313
	Collaborative decision-making	0.885	0.016	0.732	0.036	0.747	−0.875
H3	Report on community-wide progress	0.359	0.12	0.266	−0.155	0.652	−1.201
	Report on local government progress	0.148	0.2	0.941	−0.01	0.088	5.763
	Report on sustainability actions	0.299	0.126	0.254	0.131	0.378	2.724
	CSP renewal	0.119	0.169	0.712	0.042	0.804	0.72
H4	Partner involvement in partnership	0.463	−0.094	0.221	−0.156	0.423	0.24
	Partner engagement in CSP implementation	0.952	−0.008	0.368	−0.117	0.813	0.89
H5	Information-sharing	0.992	0.001	0.488	0.098	0.628	1.703
	Social events	0.358	0.152	0.46	0.115	0.191	5.015
H6	Proactivity of community-wide climate action	-	-	**<0.001**	**0.389**	**0.003**	**11.446**

5. Discussion

This study assessed the relationship between partnership structural features and climate change mitigation outcomes based on the responses of an online survey and publicly available GHG emissions data. While the paucity of data on local climate change outcomes limited our sample size and thus the generalizability of some of our results, our study presents two key findings that provide direction for future research. Specifically, our results indicate that the oversight structure of the partnership, as well as the proactivity of community-wide climate actions, may have a positive impact on realized CO_2e emission reductions. Also, since the survey was sent to communities worldwide, our data demonstrate a global pattern that eliminates regional bias, which has rarely been done in this field. In fact, even having a sample of 106 partnerships is a novel contribution to the cross-sector partnerships literature that is mostly based on case studies. That said, had a larger sample size been possible, some additional relationships might have been significant. In the sections that follow, we discuss our results in light of past research on partnership structure.

5.1. Oversight (Hypotheses 1 and 2)

In the survey, this feature was divided into two questions: oversight structure and decision-making approach. Our results indicate that collaborative oversight structures where partners are responsible for organizing the implementation activities of their CSP enable the achievement of climate change relevant plan outcomes. This finding is consistent with statements from the literature that collective oversight groups can directly or indirectly promote progress towards the success of the partnership and reaching, or even exceeding, climate goals [20,24,25,44,45].

Our findings also indicate that when decision-making was led by the local government partner, there was better performance in plan progress towards climate goals. This finding contradicts our prediction in hypothesis 2. In the literature on environmental governance, collaborative decision-making has been shown to improve transparency, promote knowledge generation and dissemination, and facilitate problem-solving [19]. However, research has also found that when compared to private and nonprofit partners, government partners provide a distinct advantage in terms of the administrative support and expertise in management that they can offer the partnership [37]. In comparison with other sustainability topics, local climate action is a relatively new but urgent issue, and so experience with tackling this issue is still developing. Under such conditions, decision-making activities, which determine the direction of CSP implementation, are vital and require considerable knowledge about climate change [23]. Local government partners have administrative and coordination capacity; such capacity enables this partner to aggregate community knowledge and information, collect local climate change data, develop expertise about the current situation, and make projections about plausible future directions [37]. Combined, these two factors (i.e., the early stage of local climate action and the capacity of local governments to guide activity in this topic area) provide one possible explanation for this unexpected finding.

Another possible explanation is that this study was done with data ending in 2013, and at that time, leadership dominated by the local government was adequate. That is, before the 2015 Paris Accord and the 2018 IPCC 1.5 °C report, which raised the level of climate ambition considerably. In the early days, communities were aiming for targets of 5% reduction by 2012 compared to 1990 levels, and then 15–20% reductions by 2020. To achieve that level of ambition, small partnerships between the local government, local utilities, and perhaps a few other vital stakeholders were enough [70]. A focus on the local government's corporate emission reductions was enough to reduce community-wide emissions by 5%. Today, communities are committing to carbon neutrality by 2050; this calls for significant partner engagement, as a broader spectrum of organizations is required to achieve these more ambitious targets.

5.2. Monitoring and Evaluation (Hypothesis 3)

This study did not find any statistically significant relationship between the existence of monitoring and evaluation mechanisms and climate change relevant plan outcomes. However, theoretically, monitoring is expected to facilitate the implementation of the plan [27]. Indeed, Delponte, Pittaluga, and Schenone [71] recognized monitoring as one of the three critical phases (the other two phases are planning and implementation) for achieving the Sustainable Energy Action Plan goals through partnership. The result fails to provide practical support for theory.

A potential reason for this contradiction is that the mechanism may not be well-designed. For instance, the mechanism should include measurable indicators for the assessment of progress made towards the goals, and according to a study, there is a gap "between the wealth of knowledge about indicators" and their utilization in many community plans [50] (p. 435). Another potential reason is that monitoring and evaluation may not be conducted regularly and consistently. Seasons [50] stated that monitoring and evaluation are very often the forgotten steps in plan implementation. Many planners do not or are not able to conduct monitoring and evaluation consistently or formally, and this is usually due to the lack of resources (e.g., time, money, and expertise) [50]. The design and implementation of the mechanisms for monitoring and evaluation are both critical for their effectiveness. Failing to include monitoring and evaluation mechanisms in the implementation of a CSP could reduce the efficacy of the plan and partnership, and may lead to redundant implementation activities or incomplete plan goals.

5.3. Partner Engagement (Hypotheses 4a and 4b)

This study did not find a statistically significant relationship (positive or negative) between mechanisms for partner engagement and climate change plan outcomes. Theoretically, mechanisms that encourage partner engagement help to identify and involve key organizations (e.g., major GHG emitters in the community) in the partnership, which is expected to promote public participation and cooperation [23,27,41,72]. Hypothesis 4a was based on past research that suggests that establishing cross-sector partnerships helps to achieve mass action in various areas (e.g., energy, transportation, and waste areas) that impact climate outcomes, and that such partnerships are required to achieve transformational change in this area [73–75], whereas hypothesis 4b predicted the opposite of 4a, as there is also past research to suggest that collaboration among many diverse partners could have a negative impact on plan outcomes. This research presents the argument that bringing together collaborators with diverse backgrounds also means bringing together organizations that may have competing or conflicting interests, and that such arrangements stand to create new challenges in coordination, which decrease the effectiveness of the partnership, and eventually have a negative impact on the completion of the plan [40,56].

Our study findings fail to support either hypothesis for the partner engagement structural feature. These results indicate that in addition to partner engagement, there are likely other factors that need to be considered to achieve plan outcomes. For example, Frisby et al. [72] identified several partnership managerial issues that impact outcomes, such as a lack of communication, training, and evaluation. The descriptive statistics of the structural features revealed that for most of the communities surveyed, communication to partners about CSP activities happens occasionally. It is possible that both structural features (i.e., partner engagement and communication) are needed to achieve climate change mitigation outcomes. For example, limited communication makes it harder for junior partners to get involved in the partnership, which may weaken their enthusiasm and commitment [40]. Thus, while a partnership may have mechanisms to find new partners, if the communication mechanism is weak, then new partners may disengage from the plan's implementation before their involvement can have an impact on climate or other plan outcomes. An exciting possibility for future research is to build on this study by investigating how different structural features interact and the resulting impacts on plan outcomes.

5.4. Communication (Hypothesis 5)

We did not find a statistically significant relationship between the amount or type of communication to partners on activities related to the CSP and climate change plan outcomes. Thus, we did not find support for hypothesis 5. However, past studies show that open and frequent communication is the key to partnership success, while having diverse communication activities and developing two-way communication channels are also crucial for addressing climate change issues [58,59,76]. Communication is needed not only for delivering information to partners, but also for providing opportunities for building mutual understanding among partners, as well as between partners and the community [43]. The deviation between past research and our findings could be driven by the low frequency of communication reported by our study participants. The descriptive statistics for the communication variables reveal that communication activities are carried out occasionally for most of the communities surveyed. It is possible that the low frequency of communication limits the impact on information flow and networking among partners, and thus the effect of this feature on climate outcomes [77].

Another possibility is that the communication feature may work in combination with other structural features to impact climate change mitigation outcomes. As mentioned, in our discussion of partner engagement, it could be that both these structural features are needed to influence plan outcomes. Likewise, the influence of the communication feature is also likely to rely on the quality of the monitoring and reporting mechanisms. This is because an important aspect of maintaining partner enthusiasm and engagement is to communicate progress on plan goals and thus the overall success of the partnership's activities [24]. Thus, it is also possible that the communication, monitoring and evaluation, and partner engagement features work together.

5.5. Community-Wide Actions (Hypotheses 6a and 6b)

The proactivity of the community-wide climate actions was found to have a significant and positive relationship with the climate change mitigation outcomes assessed in this study. Communities tending to be more proactive with their climate actions also managed to make more progress on their climate goals and reduce more GHG emissions. This finding supports past research from Clarke [20] that taking actions at both partnership/project level and within individual organizations are of importance to CSP implementation and goal accomplishment. Similarly, at the organization level, past research has shown that organizations that adopt proactive environmental practices also tend to develop policies that acknowledge their "responsibility and action beyond the existing current legal requirement and social expectations" [60] (p. 16).

In the context of climate action at the individual organization or partner level, partners can incorporate climate change mitigation and adaptation consideration into their strategic priorities, prompting the organization to commit to taking proactive climate actions [61,78]. Examples of proactive mitigation actions include using high energy efficiency appliances and adopting or improving green technologies [79–81]. However, the literature shows that actual effects of adopting proactive climate actions on the individual organization can be both positive and negative. Research on sustainability in organizations shows that, on the one hand, the proactivity of sustainability actions can bring long-term benefits, such as eco-efficiency, reduction of GHG emissions, and improvement of impact and reputation [28,30,79,82], whereas that research also indicates that, on the other hand, proactive climate actions can increase operation costs, decrease competitive advantage, and negatively affect capital market returns [76,83]. Such a contradiction is a challenge to the adoption of proactive community-wide climate actions because not all partners will be willing or capable of adopting such proactive measures. Still, this study shows, when community-wide action is taken, there is more climate mitigation progress.

There is, however, the possibility that the abovementioned challenges preventing partners from adopting proactive actions can be addressed through partnership-level efforts. At the partnership level, partners have the opportunity to share knowledge and experience, which reduces human capital barriers to adopting proactive climate actions [30]. Moreover, partnership communication mechanisms,

such as awards nights or positive public recognition for sustainability achievement, offer the possibility of reputational benefits to partners, which has been shown to attract funding, as well as talented employees [30,70]. Through well-structured partnerships, organizations can more readily realize the social and economic advantages to their organization of adopting proactive climate actions, as well as gain awareness of and confidence in pursuing such actions [27,30]. Thus, partnerships can be structured to lower barriers to taking positive climate action and support partners in reaching their organizational goals, and in doing so are likely to incentivize partners to take proactive actions that result in better climate outcomes.

6. Conclusions

The interest in community-level sustainable development has greatly increased over the last few decades, due to the realization of its importance [84]. Since the introduction of LA21 in 1992, over 10,000 communities have adopted this approach to achieve local sustainability goals [6,85]. One strategy that responds to the complexity that LA21 sustainability issues present is to form cross-sector social partnerships to help with the implementation of community sustainability plans [27]. However, a gap still exists in understanding the degree to which these partnerships address the climate issues that they are formed to resolve, and if successful, how they achieve results [86]. The present study sought to address this gap in understanding by examining the structural features of CSP partnerships and their impact on climate outcomes. Table 6 provides an overview of our main research findings, where 'No' indicates that there is no statistically significant relationship, and 'Yes' means that there is a positive relationship between variables. In sum, our findings suggest that three key structural features have a direct impact on climate outcomes, (1) an oversight structure that facilitates collaborative implementation, (2) decision-making by the local government partner, and (2) the proactivity of climate actions.

Table 6. Summary of the relationships.

Independent Variables \ Dependent Variables		Proactivity of Community-Wide Climate Actions	Plan Progress on Climate Goals	Community-Wide CO_2e Emission Reduction
Oversight	Oversight structure	No	No	Yes
	Decision-making	No	Yes	No
Monitoring and evaluation		No	No	No
Partner engagement		No	No	No
Communication		No	No	No
Community-wide climate actions		-	Yes	Yes

This study contributes to research on cross-sector social partnerships by validating past findings that overseeing the implementation of the CSP through a collaborative process tends to have direct or indirect positive effects on climate change outcomes. Moreover, since research about achieving climate goals through CSP partnerships is at an early stage, this research makes a theoretical contribution by identifying two structural features that may contribute to the achievement of better climate outcomes.

The findings from this study also have practical implications for local governments and other partners implementing local sustainability initiatives. For example, improvements can be made to oversight structures. The results of this research indicate that the communities that choose to organize implementation activities through partner collaboration have better climate outcomes. However, these results come with the caveat that due to the complexity of the issue itself and the inherent conflict among some sustainability goals, climate change policies can be challenging to plan and implement. Therefore, when addressing climate change issues, it is likely that the design of the CSP, among other situational factors, is also essential. Thus, while collaboration and partnership may contribute to achieving sustainable development, it is necessary to recognize the potential limitations of the partnership approach [41], as well as the influence of other success factors.

This study also has some limitations. First, when answering the research question, we considered the five partnership structural features separately; however, these features could be interrelated [20]. According to Clarke [20], without an oversight entity, it becomes difficult to renew the plan systematically, just like without the engagement of organizations from multiple sectors, it is impossible to get them to implement the sustainability initiatives that contribute to the CSP's goals. Also, the monitoring, evaluation, and communication systems are fundamental for complementing the initiative and maintaining the partnerships [20]. Moreover, we only investigated the relationship between the structural features and climate change outcomes, and so it is possible that for different sustainability topics, the relationships could be different. Thus, a future study is needed to examine and compare these differences.

Another limitation of this study is that we did not examine power dynamics and other limitations of partnerships, such as the challenges of coordinating action among many and diverse partners. Future research is needed to understand better how such aspects impact CSP climate outcomes. As well as this, we cannot make claims about causality between the variables examined in the present study. Our data do not eliminate all other variables that could impact our results, and so it is possible that our findings are attributable to factors other than the partnership's structural features. For example, the number of partners in the partnership [54], demographic characteristics of the community, and time horizon of the plan [87] are additional factors that have been shown to influence plan outcomes. Furthermore, our study does not escape the limitations of self-reporting that exist for most studies that use a survey design. However, the GHG data that were collected from the cCR and official local government reports should be sufficiently reliable, and self-reported survey data on GHG emissions were triangulated with these public sources. We also standardized the data before conducting statistical analysis to ensure its comparability.

For future research, case studies and surveys could be conducted to obtain information, particularly for a single topic, such as climate-specific partnerships tied to climate action plans. It would be interesting to see if climate targets embedded in local sustainability strategies and sustainability partnerships are more holistic in addressing vulnerable citizens and climate justice than those that are pursued as separate climate action strategies and partnerships. There might be other advantages and disadvantages of the two approaches that have yet to be explored and understood.

Moreover, the actual effect of proactively taking climate actions inside organizations could also be an interesting future research topic and deserves more attention. Although it has become obvious that taking actions to mitigate and adapt to climate change will be a future policy tendency, some firms continue to resist making these changes because of the relatively high costs of the actions [75]. Taking a comprehensive view that realizes the actual short-term, long-term, ecological, social, and economic effects of climate change on firm performance can help them to make the right decision from both a social and economic view.

Finally, our study draws attention to the urgent need for publicly available climate change data at the local level, for instance, standardized community-wide GHG inventory data. Regular, ideally annual, recording of the local emissions data is required, as such data are needed to provide robust evidence of the effectiveness of climate change initiatives and plan implementation. In the absence of such data, it is difficult to differentiate between efforts that are wasting valuable resources and actions that are having real and positive climate change mitigation impacts.

In conclusion, this study highlights the potential importance of partnership structure to enabling achievement of climate mitigation. There is still an incredible amount of research and effort needed to help local communities achieve significant (80–100%) reductions in GHG emissions by 2050.

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Appendix A

Table A1. Community-Wide CO_2e Emission Data.

Country	Community	Baseline Year for Community-Wide Greenhouse Gas (GHG) Inventory	Total CO_2e Emissions in Community-Wide GHG Inventory in the Baseline Year (tonnes)	Year of Latest Community-Wide GHG Inventory (Until the Online Survey was Conducted)	Total CO_2e Emissions in Latest Year Community-Wide GHG Inventory (tonnes)
Brazil	Belo Horizonte [1]	2007	3,176,966	2013	8,793,150
Brazil	Rio de Janeiro [2]	2005	116,000	2012	226,000
Canada	Gatineau [2]	2009	879,900	2012	927,757
Canada	Montreal [2]	1990	15,013	2009	14,090
Canada	Peel [2&3]	1990	11,047,000	2006	14,547,280
Canada	Surrey [2]	2007	2,200,000	2010	2,100,000
Iceland	Reykjavik [2]	2007	339.99	2011	336.80
India	Rajkot [1]	2007	882,103	2012	1,704,380
Norway	Arendal [1&2]	2009	150,800	2013	229,656
Spain	Barcelona [1&4]	2008	4,053,765.50	2012	3,595,726
Sweden	Laholm [2]	1990	135,200	2011	104,100
United Kingdom	Woking [2]	2005	601,800	2013	575,952
United States	Arlington [2]	2007	2,572,871	2012	2,312,028
United States	Duluth [1&5]	1999	2,322,834	2008	2,702,137
United States	Flagstaff [1]	2009	1,268,261	2012	1,190,809
United States	Fremont [2]	2005	1,698,000	2010	1,516,500
United States	Las Vegas [2]	2005	28,039,538	2012	30,089,102
United States	Lexington [2]	2007	6,773,029	2011	6,574,968
United States	Louisville [2]	1990	18,208,833	2006	19,249,306
United States	Oakland [1]	2005	1,235,265	2013	2,545,920
United States	Portland [1]	1990	8,549,827	2013	76,363,875
United States	San Francisco [1&6]	2010	5,123,547	2012	4,884,340
United States	Santa Cruz [2&7]	1996	447,831	2008	285,950
United States	Urbana [2&8]	2007	548,700	2013	487,200

[1] Gathered from the carbonn® Climate Registry. Available online: https://carbonn.org/ (accessed on 3rd October 2018). [2] Gathered through an online survey conducted in collaboration with ICLEI—Local Governments for Sustainability. [3] SENES Consultants Limited. Peel climate change strategy: 2006 community greenhouse gas and criteria air containment inventory for the geographic region of Peel. Peel, Canada: 2014. Available online: https://www.peelregion.ca/planning/climatechange/reports/pdf/Region-of-Peel-GhG-and-CAC-Community-Reort.pdf (accessed on 13th October 2018). [4] Barcelona. The energy, climate change and air quality plan of Barcelona (PECQ 2011–2020). Barcelona, Spain: 2011. Available online: http://w110.bcn.cat/MediAmbient/Continguts/Vectors_Ambientals/Energia_i_qualitat_ambiental/Documents/Traduccions/PECQ_english_def01.pdf (accessed on 15th October 2018). [5] City of Duluth. Greenhouse gas emissions inventory and forecast 2008. Duluth, USA: 2008. Available online: http://www.imagineduluth.com/media/542498/2008-duluth-ghg-inventory-3-29-11.pdf (accessed on 12th October 2018). [6] Carbon Disclosure Project (CDP). Available online: https://data.cdp.net/Cities/2014-Citywide-GHG-Emissions/imj3-eat7 (accessed on 14th October 2018). [7] City of Santa Cruz. Greenhouse gas emissions inventory: 2005 municipal and community emissions. Santa Cruz, USA: 2008. Available online: http://www.cityofsantacruz.com/home/showdocument?id=8646 (accessed on 12th October 2018). [8] City of Urbana. Climate action plan—Phase 2: 2015-2020. Urbana, USA: 2015. Available online: http://www.urbanaillinois.us/sites/default/files/attachments/ucap-p2.pdf (accessed on 12th October 2018).

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