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Engaging Communities in Adaptation to Climate Change by Understanding the Dimensions of Social Capital in Atlantic Canada

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Abstract: This paper examines the role of social capital and its influence on the capacity of coastal communities in Atlantic Canada to respond and adapt to climate change, especially when dealing with extreme weather events. Three elements of social capital—social trust, institutional trust, and social networks—were considered. They were analyzed based on four questions targeting social capital during semi-structured interviews on climate change adaptation in 10 rural coastal communities located in three Canadian provinces (Quebec, New Brunswick, and Prince Edward Island). Results showed that these communities exhibited strong social capital, mainly because of a high level of social trust. People were ambivalent in the way they connected to institutions, especially with governments. They often felt isolated and left to themselves to deal with climate change adaptation decisions. The research conveys the difficulties and challenges of multilevel governance, where coastal communities generally ensure trust within the community first before trusting higher levels of government. Initiatives to improve public engagement and participation in decision making should be supported for further adaptation, although they would require greater accountability and transparency.

Keywords: social trust; social networks; adaptive capacity; adaptive governance; social learning; institutional trust

Citation: Vasseur, L.; Thornbush, M.J.; Plante, S. Engaging Communities in Adaptation to Climate Change by Understanding the Dimensions of Social Capital in Atlantic Canada. *Sustainability* **2022**, *14*, 5250. https://doi.org/10.3390/su14095250

Academic Editor: Carmen Elrick-Barr

Received: 1 February 2022
Accepted: 22 April 2022
Published: 26 April 2022

1. Introduction

Coastal zones are dynamic systems exposed to many hazards that are increasing due to climate change, such as storm surges and sea-level rise [1]. These ecosystems are rich in natural resources, and people are attracted to them for various reasons, such as tourism, aesthetics, and spirituality. In Canada, similar to many other countries, many coastal communities established in the past centuries benefit from fisheries and the exploitation of other natural resources, such as forestry or land for agriculture. This has been the case in Atlantic Canada, which encompasses New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland and Labrador, as well as the maritime coasts of Quebec along the Estuary and Gulf of St. Lawrence, where most communities are small, rural, and coastal. For example, in New Brunswick, 60% of the population is coastal, with fisheries and tourism significantly contributing to the economy of the province [2].

The reliance of coastal communities on the ocean and its ecosystems is strongly anchored in traditions and lifestyles. Changes have always occurred, but the current pace due to climate change is adding pressure on these communities [3,4]. In many cases, extreme events, such as hurricanes and storm surges that can cause rapid coastal erosion and flooding, can test the social capital of coastal communities and their capacity to deal

with these new conditions or build community resilience (e.g., [4,5]). Social capital, which is the focus of this article, can impact how knowledge transfer is mobilized, and its analysis may help to advance the agenda on climate change adaptation.

The concept of social capital is useful for examining how interactions within a community may influence people's involvement and social acceptability. It helps clarify the filters used by individuals to interpret the realities. Adger [6] (p. 389) defines social capital as the " ... relations of trust, reciprocity, and exchange; the evolution of common rules; and the role of networks" within a group or a community. The concept is also relevant to studying the balance between individual and collective actions and to identify the types of necessary networks to enhance adaptive governance and social cohesion. Inkpen and Tsang [7] argue that the various dimensions of social capital can either limit or influence the type of knowledge being transferred. Contextualizing social capital, and especially community-based social networks, is important to define which type of knowledge transfer is necessary and how it can be mobilized to increase awareness and public engagement. In many adaptation projects, adaptation plans are developed by municipalities with little or no engagement of the community [8]. This limits the level of implementation of these plans and reduces the trust of the community regarding the capacity of the municipality to help adapt to changes [9,10].

The aim of this paper is to examine how social capital may influence the capacity of coastal communities in Atlantic Canada to deal with the impacts of climate change, mainly focusing on extreme events, such as storm surges. This analysis is a follow-up reflection extracted from the lessons learned from a large project entitled "Coastal Community Challenges," under the Community University Research Alliance program of the Social Sciences and Humanities Research Council of Canada in 2010–2016. The project aimed to work with 10 coastal communities in Quebec (QC), New Brunswick (NB), and Prince Edward Island (PEI) to coproduce strategies to improve their resilience to climate change [11]. The main project used a participatory action research (PAR) approach to understand the processes by which people could work together to enhance social learning and co-construct the knowledge necessary to define solutions [12]. Participatory action research (PAR) combines "research, education, and action that brings researchers and participants together to identify, examine, and address problems in community settings" [13] (p. 2). The activities used to engage communities, therefore, require understanding the various dimensions of social capital.

Through the assessment of the three dimensions of social capital, which are outlined next, we identified the barriers in each dimension that reduced the ability of the communities to engage in developing adaptation strategies. Differences were observed among communities, with some of them feeling isolated. The complexity of multigovernmental levels for climate change adaptation made decisions, especially at the individual level, more difficult, as resources were not always fairly distributed. In the next section, we develop further the concepts of social capital, adaptation, and resilience, which are key concepts for consideration.

2. Social Capital and Climate Change Adaptation

Social capital in climate change response remains a key component, especially when dealing with extreme weather events and disaster management [14] or disaster resilience [15]. It can be defined as the interactions among individuals (micro), families or groups (meso), or within a community or nation (macro) [16]. Social capital starts at the individual level, where individual trust must be built first [17]. Social capital then relates to what Putman [17] (p. 665) defines as the "features of social life—networks, norms, and trust—that enable participants to act together more effectively to pursue shared objectives". Thus, social capital can be considered as a safety net or glue that allows people to connect, trust each other, and collectively act in the face of an event [18]. The presence of social capital can be key for the capacity of a community to make decisions that can be more socially acceptable and benefit the most people [6].

Social capital has been analyzed in different ways. Woolcock and Narayan [19], in the sphere of international development, have classified it into three spheres: bonding, bridging, and linking social capitals that separate formal and informal actors and their relationships. Rostila [20] argues that social capital relates to individual and collective facets of social relations. In the sphere of climate change adaptation, three elements have been defined as important to analyze social capital: social trust, institutional trust, and social networks [21]. Social trust relates to reliability and can be exhibited in cases of family kinship, community groups, and established networks in a locality. Institutional trust relates to the various governmental institutions or agencies that can be local, provincial, or federal in their roles to support a community. Social networks are either closed within a locality or loose, where people are not connected to the locality per se (e.g., suburban residential division) [6]. Mistrust and conflicts among people or groups may affect social capital and weaken relations and networks. In this study, we chose to analyze social capital by examining these three aspects and how it can influence adaptation to climate change and, ultimately, the resilience of coastal communities.

It is known that social processes among people at the local level can help enhance the capacity of a community to adapt to climate change [22]. Adaptation to climate change, although essential for coastal communities facing sea-level rise and more frequent storm surges, can be limited depending on its social capital. The way communities define adaptive strategies is based on social interactions among people who may have different levels of influence and trust. Adaptation has been defined as any adjustment—social, structural, economic, or policy—that can increase the capacity to respond to an external event [23]. The process of adaptation, which is initiated when a problem or vulnerability is defined, includes decision making and planning, where strategies are examined for their feasibility and social acceptability [24]. It should lead communities to be able to deal with greater uncertainties and unpredictability [5]. As stated by Noser et al. [25] (p.132): "The process that produces adapted outcomes is resilience; the more rapid the return to pre-event functioning, the greater the resilience."

The concept of resilience is not new in many disciplines, such as engineering, ecology, psychology, physics, and the social sciences. In his classic paper, Holling [26] introduces this concept to ecological systems, which has since been appropriated by social researchers and for interdisciplinary applications (e.g., social-ecological resilience [27]. The concept of resilience has also become part of climate change and natural disasters research (e.g., [28]). Various models of resilience with different definitions and understandings of the term exist. Social resilience mainly targets how people in communities or institutions, as a group, can better face change [2,6,29]. Engineering resilience focuses on the physical construct as a way to improve the capacity of communities or systems to face change [30]. On the other hand, psychological resilience can also look at the personal impact of events, and how people directly respond and adjust to them. The paper by [31], for example, acknowledges community resilience from a psychological perspective, and recognizes pre-existing dense social networks based on trust and reciprocity as improving the preparation for, response to, and recovery from disasters. The authors define such an approach as collective psychosocial resilience, based on solidarity and a shared (community) identity, which can overcome any limitations of social capital.

In the past decade, resilience of the social-ecological system (SES) has been promoted to better capture the various components of the system and how they respond to change. Both ecological and social systems must deal with change, and social-ecological resilience acknowledges the intricacy and complexity of how one can affect the capacity of the other to remain resilient. Resilience is, therefore, complex to analyze, since it can be assessed at the individual, community, and SES levels [27]. Gunderson [32] emphasizes the relevance of considering ecological and human communities as part of resilience research in the face of natural disasters. Community resilience has also been used to deal with disaster risk reduction and other such unpredictability. Community resilience supports the importance of community engagement and development of the resources needed to ensure continuous

functioning [33]. It emphasizes the social aspect of resilience. However, how individuals define it for themselves versus how they perceive it should be defined at the community level as it may greatly vary and, thus, affect decision making and planning. Analyzing social capital allows one to better understand how the actors interpret or represent themselves and the situation and to influence how communities are able to improve their resilience capacity in the face of climate and environmental change.

3. Research Methods

The methodological approach that was used in the overall project is described in detail in [11]. Briefly, 10 coastal communities were selected between late 2010 and early 2011 as case studies, where half were impacted by the storms of December 2010 and half were not affected. To be included in this study, these coastal communities had to be small with <9999 inhabitants according to the 2011 Statistics Canada [34] census. A profile of each community was initially developed (information can be found at http://aruc.robvq.qc.ca/en/bibliotheque/aruc (accessed on 3 December 2021)). Because differences between communities from the same province were minimal, the analysis was completed per province, except for New Brunswick (NB) where the Acadian Peninsula differed from the Southern Gulf of St Lawrence. The specific communities included in this study were, therefore, categorized into four regions: Prince Edward Island (PEI, with the towns of Stratford and Morell); New Brunswick (NB, Southern Gulf of St. Lawrence, Cocagne); NB (Acadian Peninsula, including Shippagan, Sainte-Marie/Saint Raphael, Cap-Bateau, and Pigeon Hills); and Quebec (QC, Sainte-Flavie, Maria, and Bonaventure).

Interview questions were developed through a PAR approach [35] involving participants of these communities and the researchers. It was decided that one semi-structured interview scheme for the large project would be better and would include 18 questions reflecting community and research needs. The rationale was the small size of the communities, their capacity to interact, and the concern of intervention saturation—as other projects were happening in some of these regions. Four of these questions specifically targeted social capital and were of particular interest in the present paper. Interviews were conducted between December 2011 and January 2012, with participants interviewed either singly or as couples in their primary language (French or English) (ethics approvals: UQAR CER-61-324 and Brock REB 11-210).

The interview questions targeted social capital in terms of the three components—social trust, institutional trust, and social networks—through questions that linked to (1) relationships, (2) volunteering, (3) networking, and (4) assessment of actions. The interviews included the following questions:

- How did the events affect your relationships with others, including your neighborhood and community as well as other interactions? Were there conflicts with other people, or were there any other threats that could have affected your social network?
- Did you volunteer or receive help from others (volunteers or other institutions) after the storms? Do you think that collective action was present and strong during and after the storms?
- Which networks within and outside your community did you rely on? What factors influenced your network?
- How would you assess the actions taken by your neighbors, local authorities, provincial or federal governmental agencies, or other groups (e.g., Red Cross)?

A total of 74 residents in QC (n = 17), NB (n = 47), and PEI (n = 10) participated in the interviews (Table 1). A snowball sampling approach [33] was the basis for reaching as many participants as possible, and interviews stopped when the responses became similar and no additional information was provided. The small size of these communities led us to stop interviewing in each relatively early, as the responses were the same. Interviews were recorded after consent from the participants and lasted between 45 and 60 min. Further details on the descriptions of the communities and the interviews can be found in other articles [11,36,37]. The interviews were transcribed on a computer by an assistant and

rechecked by one of the coauthors. Data were preliminarily analyzed using Nvivo 10 for categorization according to the three themes of social capital and used to extract some of the major quotes. A discursive analysis [38] was used to codify units of meaning emerging from the interviews.

Table 1. Description of the interviewees in the 10 Atlantic Canada communities.

Region	No. of Interviews	No. of Affected Interviewees	No. of Nonaffected Interviewees	Unknown *	No. of Men	No. of Women	No. of Couples
PEI	10	2	8		5	5	
NB	47	21	19	7	29	13	5
QC	17	11	6		11	5	1
Total	*74*	*34*	*33*	*7*	*45*	*23*	*6*

* Where it was unclear if they had been affected.

4. Results

The following subsections describe the results from the analysis of the interviews based on the three themes that are central for social capital (social trust, institutional trust, and social networks). It was not possible to find differences in perceptions between people coming from the communities that had been affected by the 2010 storms and those who were not. This may be because other storms occurred in recent years (at least four since 2000), and their perceptions were most likely linked to those.

4.1. Social Trust

Across all regions, the interviewees stressed the importance of family relations. Sixty-two participants (84% of the participants) responded that family members lived nearby, kept contact during the storm, and came to help after the event. As the interviewees were from small communities and close neighborhoods, they stated that everyone knew each other, and people were always willing to help a neighbor in need. The analysis suggested that there was a high trust level among people. Sixty-five (88%) participants stated that a strong spirit of volunteerism in Canadian Atlantic communities existed, especially among Acadian communities. As one interviewee stated, "people have (a) tendency to get involved when there's a storm or just after the storm . . . they're going to help their neighbors . . . (as there is) good community involvement" (woman from NB Acadian Peninsula, translation LV).

After a storm event, residents would help or volunteer because they were already accustomed to helping those in need, and the feeling of support and volunteerism in these small and tightly linked communities were often mentioned (stated by 85% of participants). One respondent from the Acadian community of NB noted that when someone had an issue or was affected, others would come out and help. However, if there was a need to meet to make a decision, they preferred kitchen-table type of meetings over Town Hall meetings. Interviewees explained that they felt more comfortable in their own environment, where they were able to better express their ideas without judgement. A 54-year-old interviewee stated, "I think people cannot talk in public. Thus, they don't. They say: even if I go (to the Town Hall meeting), I would not be able to speak. It's frustrating." (man from NB Acadian Peninsula, translation LV).

It was also observed that storm events actually served to strengthen social relations due to a shared experience, such that storms brought people in these already close-knit communities even closer (mentioned by 65% of the residents). During storms, people helped each other and discussed the storm before the event and its impacts afterwards. People looked out for each other during storms, as for instance in Shippagan and Le Goulet (Acadian peninsula, NB), where interviewees mentioned that due to their small population size, people became even closer after the 2010 storms. In PEI, a 65-year-old woman interviewee explained that, while previously they were not close to the neighbors, "neighbors became closer or turned to each other more for help after (the storm)."

Social mistrust and tension were frequently detected during the interviews (67% of participants), however, pertaining to two major contentious points: (1) the building of protection walls, as neighbors disputed the building of rock/retaining walls to protect the coast and (2) disagreements about coastal management and development between residents living on shorelines versus those living more inland. For example, one interviewee explained that conflicts arose when a local landowner decided to build a protection wall that triggered more coastal erosion in a neighboring property, stating that "conflicts also exist with neighbors. For example, with enrockment, the one who has no rocks complains that its land is being eroded because water gets there, not to the neighbor. Conflicts between landowners and the Ministry of Transportation happen because the Ministry only fix for public safety, so houses and roads on the sea don't see theirs fixed as it's considered private safety" (man from NB Southern Gulf of St Lawrence, translation LV). In another example, some residents of Maria (QC) refused to pay to install protection walls, instead preferring to avoid living on the shoreline. Tensions were identified between those residents and others who decided to remain onshore and installed walls.

4.2. Institutional Trust

Institutional trust was mostly emplaced with the local government. For example, 20% of the participants specifically mentioned that they relied on the municipality, and sometimes more precisely public works, after a storm to have trees removed. In other cases, they first identified the police (12% of the participants). Because of the tight-knit social structures operating within these communities, in general, few other institutions were mentioned. One respondent also pointed out that the reason for the lack of people showing up to emergency refuge centers during storms in one province was mainly due to social trust and the close-knit nature of the community. One person from the Acadian community (NB) said, "I can give you an example; if we have an emergency, they open the center but the percentage of people going is zero. Ridiculous? They open it because they have to offer the option, but people will go to their families or friends. When they opened a few years ago, people went to the center to get a coffee and left" (translation LV). He explained that help from provincial governmental agencies or other organizations, such as the Red Cross, was unnecessary.

It was reiterated that the local government had its heart in the right place, and wanted to do what was best, but resources were often limited. This was mentioned in most communities (eight of the ten communities). In some cases, people believed that the current local government was keen to inform the public, elicit public opinion, and rapidly repair roads. Some people in QC (six participants) felt that the local government was looking after their safety. Finally, there was no apparent difference in perspectives on local government decision making between those who were and were not affected by the 2010 storms.

During the study and the interviews, participants took opportunities to voice their opinions and expressed dis/approval concerning provincial government decisions in the past and present. Indeed, 46 of the 64 participants who mentioned the provincial government stated their disapproval or a lack of trust in higher-tiered (e.g., provincial or federal) governmental decision making. Common themes that emerged from this feedback included the reactive and short-term scope of government decision making. For example, one interviewee stated that a temporary measure was used to move a road affected by flooding such that tourists could better access a local fair. In this case, the government was accused of making decisions primarily based on profits (for the government from tourism) instead of the convenience and acceptance of local residents. Another person from Baie des Chaleurs (QC) was not as negative and argued, "They fixed the infrastructure. We had major cleaning work to do. People were happy to have access to the park. It's a community park, it's owned by everyone" (translation LV). One interviewee in the Acadian Peninsula (NB) stated that the province was delegating everything to the municipality, leaving everyone having issues to call the municipality.

The analysis showed that tension was evident between residents and the provincial government concerning two main issues: building permits and emergency measures. In Cocagne (NB), an interviewee mentioned that there was tension around a slow emergency response as well as allowing permits for building rock walls. Other permit-related issues included approving permits and funding for repairing public roads, but not private roads. In Baie des Chaleurs (QC), a public servant from the local authorities expressed mistrust against the provincial government when permits in coastal areas were denied despite the need to address the impacts of storms and flooding.

A few residents of QC (five participants) explained that despite having built their homes before the 1980s, at a time when permits were not required, permits to fix or modify their home were still denied by the regional government ("Municipalité Régionale de Comté"/regional county municipality or MRC). This was the case for participants that had their houses condemned, as more than 50% of their land was threatened by erosion. These interviewees expressed frustration towards the government because permits for infrastructure that could benefit tourism were being approved rapidly; meanwhile, local private infrastructure was slower to approve and was often rejected. A question of being isolated and far from the provincial decision-making power was commonly cited as a reason for feeling that their voice was not heard and for mistrusting the provincial government.

Other criticisms included a lack of enforcement; slow reaction by the provincial government; uninformed citizens; political decisions; and uncoordinated decision making. In the case of Cocagne (NB), which was a Local Service District (LSD—an unincorporated municipality), mistrust originated from the fact that the decision makers of the LSD were appointed by the province and not elected by the community. Thus, even locally, there was evidence of provincial (higher-tier government) mistrust and criticism.

4.3. Social Networks

A summary of the available social networks in the study area appears in Table 2. Overall, participants located in QC and NB (85%) relied more on the various levels of government for help with the impacts of storms and climate change adaptation actions than respondents in PEI (50%). Although PEI had several community/watershed groups, emergency services, and research organizations in addition to government for support, the general community (including friends, neighbors, etc.) was not mentioned. However, it is possible that it was assumed and, therefore, not expressed. In NB, participants referred to support from emergency services, government agencies, and various community groups. The Sustainable Development Group of Cocagne (NB) was often cited as a central group to receive information and knowledgeable of issues regarding climate change and sustainable development. Only two participants in this area complained about not having a central group or call center and no official support network within the community for storms and climate change adaptation. This was most likely related to the challenge of being an LSD and, therefore, not having a municipal entity. While participants of a region mentioned the importance of community members (including family, friends, and neighbors) as important in their networks, emergency services, and governmental agencies or representatives were certainly more cited than any other communities examined in this study. In one case, the provincial government was preferred over the municipality because of the municipality's small size and limited capacity to deal with issues (due to its limited budget). In one province, the networks were situated mainly around friends, neighbors, municipal, and MRC employees. Provincial agencies were also mentioned but appeared to be in a more external circle than the region.

Table 2. Social networks in the study area.

Region	Emergency Services	Community Groups	Government	Community	Other
PEI	•Red Cross •Hospitals •Salvation Army •Fire services •Emergency Services	•Env. Man. Assoc. •Watershed groups •Women's group •Church	•Province •Federal •Municipality		•An Institute •Professional networks •A consultant
NB, Southern Gulf of St. Lawrence	•Red Cross •Fire stations •St. John's Ambulance •Chevaliers de Colomb •Municipal emergency services	•Golden Age Club •Lion's Club •Chamber of Commerce •Committee for rural community	•LSD committee •Province	•Neighbors	•Fishermen Union •Marina
NB, Acadian Peninsula	•Firefighters •Emergency services •Red Cross	•Social clubs •Food banks, clothing banks	•Mayor or LSD •Province •Municipal Council •Federal elected and government	•Friends and family •People with heavy equipment •School board for buses •Community/neighbors	•University •Ecotechnology firm
QC	•Red Cross •Firefighters •Police	•Committee of the Priority Intervention Zone (ZIP)	•MRC •Ministry of Transport •Municipality •Government •Ministry of Environment •Neighboring municipalities	•Family and friends •Neighbors	•Employees/colleagues •Professional network

Twenty participants mentioned that they observed no change in social relations in their community over time and, despite storms, conveyed an already robust social network. Two people from Sainte-Flavie (QC) cited that they turned inwards (towards their own affairs) and did not become more publicly engaged following storms, including the 2010 winter storms. Many others, however, stated that social networks appeared to be strengthened after extreme events. The Nature Trust of PEI stated that, after every event, it wanted to become more involved with the community. Watershed management groups formed (in part) because of increased erosion. More people attended community meetings in Broken River, PEI after a storm. After flooding in 2005, a resident formed an environmental committee with neighbors on the street, taking photographs and signing petitions to ensure that their local municipality in Baie des Chaleurs (QC) would develop adaptation measures. In Sainte-Flavie (QC), another participant started a committee 10 years ago to work towards bank protection, and since, several community members have joined his effort. Similarly, in the Acadian Peninsula (NB), a committee was formed 15 years ago to lobby the federal government for funding to repair the municipal breakwater.

5. Discussion

Most coastal communities in Canada have aging populations, where education level and income would be expected to be limiting factors of adaptive capacity to climate change [11,39]. Knowledge transfer is, therefore, important, but there is a need to understand the social structure of the communities before starting any initiative to know how and what type of knowledge mobilization vehicle, process, and content can be developed to ensure effective social learning and climate adaptation actions. Our research demonstrates that the studied communities have a high level of cohesion, especially at the family or local level, that may allow them to respond and gradually adapt to climate change. The lack of trust and loose interactions with all levels of government also convey the close-knit (local) fabric that has traditionally been present in these communities. This type of social capital constitutes the basis by which people can navigate change and find ways to adjust.

These coastal communities are continuously exposed to harsh conditions and have responded to changes over centuries. As Adger [6] (p. 391) comments, " . . . the collective traditional management of fisheries, forests, and rangelands under informal institutions provide rules, knowledge, and obligations that are mediated through social capital." Van Putten et al. [40] also mention that small rural coastal communities may be more vulnerable in terms of natural and physical components, but have better social capital indicators regarding vulnerability and, therefore, may still be able to cope with change.

Social capital as a cultural component of modern societies is inherited by local communities through successive generations [41]. Through this, social networks are built that help maintain the capacity of communities to deal with extreme events and represent an important aspect of resilience (capacity to cope with uncertainties, integrating new knowledge and acceptance of new actors in the local governance process). Building social trust, therefore, appears to be essential for actions and responses to disasters developed in such a way that it enhances community resilience.

Community resilience is regarded as a process through which solutions and strategies can be effectively implemented and adjusted as needed, but for which community engagement is necessary. To succeed, this governance process must involve "participation and empowerment through working with social relationships, strengthening institutions and working with human desires and capacities in a context where politics and power matter" [42] (p. 35). This can only happen when we consider how crucial the aspect of building social trust and knowledge-sharing is in such a way that individuals see their role in the system and accept their responsibility to act [43]. It happens that citizens want to be involved, although they may not know the amount of work that is involved.

Social capital, as seen in this research, also represents an important component of community resilience. Aldrich [44] (p. 363) argues that " . . . disaster managers, town planners, decision makers, and local residents alike should think about mitigation and recovery strategies involving social infrastructure." A sense of social connection among neighbors or family members should continue to be encouraged to develop a governance around shared capacities or values. In Sudbury (Ontario), for example, the 2012 Greater Sudbury Climate Change Consortium [45] has developed a Friends and Neighbors Sudbury pilot project that aims to help the community continue to build its resilience (at the community level). This neighborhood system supports the connection between a volunteer and a person who may be more at risk or vulnerable (e.g., elderly, disabled people, or single parent) in emergency or extreme events, such as a flood, snowstorm, freezing rain, and heatwave, to ensure that no-one is left behind. Similar systems are implemented in other places such as in the Mississippi region after Hurricane Katrina [44].

Institutional trust can also greatly affect the capacity of a community to respond to any change. "Institutional trust has been linked to the level of community engagement in climate change adaptation, and to the belief that competent organizations will effectively discharge their responsibilities to mitigate climate change impacts" [22] (p. 135). In the current study, some residents felt excluded from the governmental decision-making process. The use of funds and permits to support coastal infrastructure to accommodate tourists instead of supporting needs at the community level led to mistrust of the provincial government by local residents. This suggests that even in these socially cohesive communities, tensions can arise around climate change impacts and adaptation targeting the provincial and federal governments. Such tensions could reduce the resilience of coastal communities, as they could weaken community social networks and action and, thereby, hamper local governance. This could have implications for bottom-up processes in coastal management decision making.

A participatory approach works best with a combination of top-down and bottom-up (multilevel) governance. To do so, there is a need for greater openness, transparency, and accountability at all levels. Education, communication, and social learning are essential elements to enhance any processes that promote ecosystem-based adaptation to climate change, as was the case in this project [46,47]. Knowledge transfer may need, on

some occasions, to be two-way, where both governments and communities need to be informed, but about different components. Kulin and Sevä [10] report the importance of trust towards government institutions to ensure positive public attitudes to act on climate change adaptation.

To improve collective and adaptive governance, public engagement, and governmental accountability and transparency may be crucial to ensure institutional trust and the capacity of communities to maintain some social cohesion. Participatory governance and community-based management are both integrated in Canada's Oceans Act, an act that is intimately linked to most of the people in the study communities (and coastal environments at large) due to their fishing livelihoods [48]. Community participation is needed for building trust with all institutions that may be involved in the various aspects of their lives, and not only when extreme events happen. Adaptive governance is one of the main characteristics of social adaptive capacity, but it also needs to include other aspects, such as the capacity to learn, flexibility and an open mind as well as access to financial and human capital [8,47,49].

Study Limitations and Recommendations

Communities are usually composed of several types of social networks, with some most likely having different or even conflicting perceptions on issues [21]. While in this study a complete social network analysis was not performed, the interviews suggested that communities rely on various connections for help and services, demonstrating the complexity that social networks can represent. This omission at the beginning of the project was resolved later with the development of a module on how to complete a social network analysis with communities [50].

Social and institutional trusts suggest that, despite potential tensions and limited trust in some agencies, communities may rely on social networks for help. Therefore, we recommend that at the beginning of a project knowing how this network is established can help strengthen community engagement. When examining social networks, " ... understanding the factors that underpin human, social, natural, physical, and financial capital will help develop pathways by which the sustained and enhanced prosperity of a community can be ensured" [40] (p. 123). With climate change, and especially extreme weather events, communities most likely realized that, while social capital may be first based on social trust, ultimately, social networks and the capacity to trust institutions are needed to improve their resilience [51].

Established multilevel governance involving local communities should be encouraged to enhance a sense of social responsibility and stewardship towards coastal development and management as well as stimulate adaptive capacity through sustainable management and protection of coastlines. Nevertheless, involving communities in local governance and engaging them can be a challenging task that requires negotiation and open communication among various stakeholders. Indeed, " ... building social adaptive capacity through positive proactive action" [49] (p. 22) can help strengthen adaptive governance. Schmidt et al. [52], for instance, report that trust building is necessary for progressive adaptation and participation based on meaningful dialogue and cooperation. Dialogue can lead to action and transformation for these communities to respond to climate change through the social capital processes of social learning and communication. However, to be effective, knowledge transfer to all stakeholders must be similar and transparent to ensure that no misperception remains. Such a process of dynamic ongoing learning can empower community members, while building upon community knowledge, innovation, and resilience [53]. It also means that knowledge may be shared and comes from not only experts (scientists), but others who may have additional or complementary knowledge, such as risk managers, professionals, or nongovernmental agencies [43].

Finally, this research was conducted prior to the global pandemic of COVID-19. We could conceive that this kind of situation could have affected the response of the community, whereby there has been reduced social contact (communication) and more isolation. In

such a situation, social capital may become depleted as some linkages may be broken. Future research is needed to explore these effects on the SES and the consequences on social networks, trust, and quality of relations of the actors in hazard response.

6. Conclusions

In conclusion, these communities demonstrate the importance of understanding the various dimensions of social capital and how it may affect the way that knowledge transfer and community engagement can be planned to enhance resilience to climate change. While social trust can be strong, as evidenced in these communities, without a certain level of institutional trust and social networks that can support them, social capital may actually become a limiting factor. To enhance the capacity of a community to deal with climate change, adapt, and improve resilience, while participatory actions are needed, community involvement and engagement require a strong social capital from the onset. Social capital can be supported by a governance system that allows for dialogue between the various institutions and governments.

Knowledge transfer is critical and should aim to remove misperceptions and improve the cohesiveness among groups or networks within a community, especially if social trust is built. Recommendations for decision makers at all levels of government can be extracted from this study. For example, activities at the community level should enhance social cohesion and capital and build additional trust in communities, especially in situations of emergency. This can also help ensure that social learning and cohesion are sustained through actions that encourage people to work together and increase meaningful public engagement. Institutional trust can be maintained through transparency in decision making. Community engagement may be easier to sustain when social capital is strong and when people are trusting of the various organizations. We suggest that a combination of social capital and community profile can be a solid basis for developing an effective strategy for knowledge mobilization where levels of education and environmental awareness are considered. We believe that understanding social capital dimensions from the start of a PAR project significantly enhances the possibility for greater community engagement and increased success in the implementation of adaptation strategies.

Author Contributions: Conceptualization, L.V. and S.P.; methodology, S.P. and L.V.; analysis, S.P., L.V., and M.J.T.; writing—original draft preparation, L.V. and M.J.T.; writing—review and editing, S.P., L.V., and M.J.T.; supervision, L.V.; project administration, S.P.; funding acquisition, S.P., L.V., and co-applicant. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the Social Sciences and Humanities Research Council (SSHRC) of Canada for funding this research through the Coastal Community Challenges–Community–University Research Alliance (CCC-CURA) project under grant no. 833-2009-4010.

Institutional Review Board Statement: The study was conducted in accordance with the Tri-Council Policy Statement of Canada and approved by the UQAR (#CER-61-324) and Brock University (# REB 11-210).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Data are under ethics approval and need to be requested from the authors with permission from the research ethics committees.

Acknowledgments: The authors would like to thank S.K. Znajda, C. Da Cunha, and H. VanVolkenburg for their help with interviews, analysis, and technical assistance.

Conflicts of Interest: The authors declare no conflict of interest.

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