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Strategic Choices in Developing a Geospatial Web 2.0 Application for Rural Economic Development

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Abstract

The ways in which we use the Internet have changed in recent years. Compared to consuming online content passively, users are more frequently adding their own content, often with a place-based aspect to it. This volunteered geographic information can represent local perspective in a rich way, and can be quickly shared with others. This case study presents the development of an online mapping application built using newly available web development tools. This application was used as part of a rural economic development initiative in the region of Acton, Quebec. The mapping application, GéoActon, provided a way for local business owners to add information on their business to a map that was embedded in an economic development website. We describe three strategic choices made in the development of GéoActon that reflect the organizational constraints often found within rural areas: minimizing development costs, user verification of contributed information, and strengthening linkages with partners. We anticipate that these choices can provide insights into the future development of Geoweb applications in rural areas.

Keywords: Geoweb, volunteered geographic information, participation, information technology

1.0 Introduction

Online activity has changed dramatically in recent years. Traditionally, online content has been provided in a top-down, read-only manner. More recently, content originating from the user-community, rather than authoritative sources, is becoming a popular source of information for government and the private sector (Dovey &

Eggers, 2008; Ganapati, 2011). This user-contributed information, or in a place-based context, 'volunteered geographic information' (VGI) relies on the efforts and contributions of the general public to create content and share it with others (Goodchild, 2007; Tulloch, 2008). Examples of this online contribution of VGI can be found in a variety of applications, including base mapping (Haklay, 2010), crisis mapping (Goodchild & Glennon, 2010; Liu & Palen, 2010), tourism reviews (Johnson, Sieber, Magnien, & Ariwi, 2011), citizen science activities (Newman, et al., 2010), and public participation (Rinner, Keßler, & Andrulis, 2008). In many ways, the creation of VGI, done largely outside of the formal routines of one's employment, with little expectation for financial remuneration, represents a type of social economy enterprise (Amin, Cameron, & Hudson, 2002; Carpi, 1997), as individuals seek to contribute to a broader communal project or collaborative outcome. This rise in the amount of VGI contributed online, particularly in cases such as crisis mapping and environmental monitoring, can also be seen as a response to the retrenchment of neoliberal governments, with individuals and community organizations bearing increased responsibility for the provision of services once the domain of centralized governments (Johnson & Sieber, 2012a).

Directly supporting the increase in VGI is the uptake and development of online mapping interfaces. This collection of geospatially-referenced data and supporting framework is called the Geospatial Web 2.0, or 'Geoweb' (Haklay, Singleton, & Parker, 2008; Scharl & Tochterman, 2007). The Geoweb is built on the proliferation of volunteered and publicly-available geospatial information that can be displayed and analyzed using freely available Application Programming Interfaces (APIs). These APIs provide programming environments and services to customize and re-configure (or mash-up) existing base maps with various sources of geospatial data, whether VGI or from authoritative sources. APIs such as Google Maps (http://code.google.com/apis/maps/index.html) and the open source OpenLayers (http://openlayers.org/) offer free mapping tools that have become more intuitive and feature-rich, especially compared to traditional methods of web Geographic Information Systems (GIS) that required extensive knowledge of computer programming and at-times expensive mapping-specific software (Goelman, 2005; Kingston, Carver, Evans, & Turton, 2000). Due to the popularity of these APIs, detailed documentation, developer's guides, and a number of user forums are available to aid users. The Geoweb promises to enhance the ability of developers to create mapping applications more easily, with lower resource requirements for development. Considering the reduced cost of entry for the Geoweb, there is potential for its use and application in wide range of settings and organizations.

This paper describes a case study of the development of an online mapping platform for public participation in rural economic development, set in the municipality of Acton, Quebec, which is located approximately one hour east of Montreal. The Municipalité Régionale de Comté (MRC) of Acton has a population of 16,000, and an economy dominated by agriculture and a shrinking light manufacturing industry (LaCERE, 2011). Acton shares several characteristics with many rural areas throughout Canada, including a rapidly aging population, with a population over 45 increased from 39.1% to 43.8% between 2001 and 2006 (Institut de la statistique du Québec, 2012), a net outmigration to larger population centers as well as economic struggles of primary industries, environmental degradation as a result of input-intensive agriculture, and difficulties in diversifying the local economy (LaCERE, 2011; CLD de la région d'Acton, 2006). As a component of a broader economic development program, the Acton Local

Economic Development agency (centre locale de développement, or CLD) built an economic development portal to describe the town and its offerings. More uniquely, CLD Acton also partnered with McGill University to develop a participatory map-based application where citizens can upload information about business opportunities, creating a searchable map of community assets that can reveal both the spatial patterns of the location of economic activity, but also serve as a conduit to gather the most up-to-date data from business owners, automatically making this information available online.

In this case study paper, we provide an overview of the Geoweb development process based on our co-development with municipal and community partners in rural Quebec. We briefly describe the application from the developer and end user perspectives. We then discuss three strategic choices made during the development of GéoActon; minimizing development costs, implementing user verification of contributed information, and linking with partners. These three choices can be framed as lessons learned through the development of GéoActon that can be useful to other communities that are contemplating Geoweb application development for rural economic development.

2.0 Developing GéoActon

Recently CLD Acton developed a website to attract outside investment to the area. This website highlights numerous economic development opportunities in the region (www.regionacton.ca). Missing from this site, however, was a component that engaged the actual residents of the area in taking a more active role in presenting Acton's online economic image. To fill this gap, CLD Acton, with support from McGill University, developed 'GéoActon', a participatory mapping portal. CLD Acton saw GéoActon as an opportunity to make their economic development website more participatory, allowing local business owners and the general public to take ownership of this aspect of community economic development. The application is designed to elicit information from individual citizens and business owners and make it publicly available and searchable. As a subsection of the main CLD economic development website, GéoActon allows citizens to add their business to a map, complete with a detailed listing. This tool is built on the assumption that the individual citizen possesses valuable information about their business or property. By contributing this information to a publicly accessible map, all citizens can benefit through a broadened awareness of community assets both within the region, and throughout the province of Quebec. A similar project is the Atlas of Rural and Small Town America, made by the United States Department of Agriculture (http://www.ers.usda.gov/data/ruralatlas/). This atlas offers mapping tools that display various sources of data (census, survey, geographic) to provide information concerning various rural communities in terms of local assets, opportunities and challenges to help decisions concerning allocation of resources and investment. GéoActon differs from this atlas in that it looks to involve citizens in contributing information, compared to viewing only authoritative data.

GéoActon consists of two main components; first, a client (or user)-side map-based graphic user interface, and second, a server-side architecture that manages the information contributed by users. It utilizes what is called a 'WAMP stack', or combination of the Windows operating system, Apache web server, MySQL, which is a web-based data base management system, and PHP and JavaScript, two

programming languages (Figure 1). These components are connected to the Google Maps API, a service that consists of a series of tools and programming scripts for gathering data from the client-side web site, sending this information to the server-side database, and then retrieving and displaying this information onto a dynamic map in a web browser on the user device.

WAMP was chosen because it is a popular web server software stack that works well together, is open source, and is well documented with many user guides. The Google Maps API was chosen for four reasons. First, Google Maps provides a very popular and familiar interface to users, along with high quality aerial imagery, even in many rural areas. Second, Google Maps supports the use of a widely used coding language (JavaScript) that offers custom functionality options to application developers. Third, Google Maps supports the display of additional data layers. These layers allow topics of interest (e.g., municipal infrastructure) to be overlaid on the Google-supplied imagery. Lastly, the Google Maps API is a very well documented technology, with a large repository of examples, functionality breakdowns, help documents, and a very active user community. This has made the technical development of GéoActon significantly easier, allowing our development team to include more advanced features like photo uploads, easy record modification, and quick searching between categories of businesses.

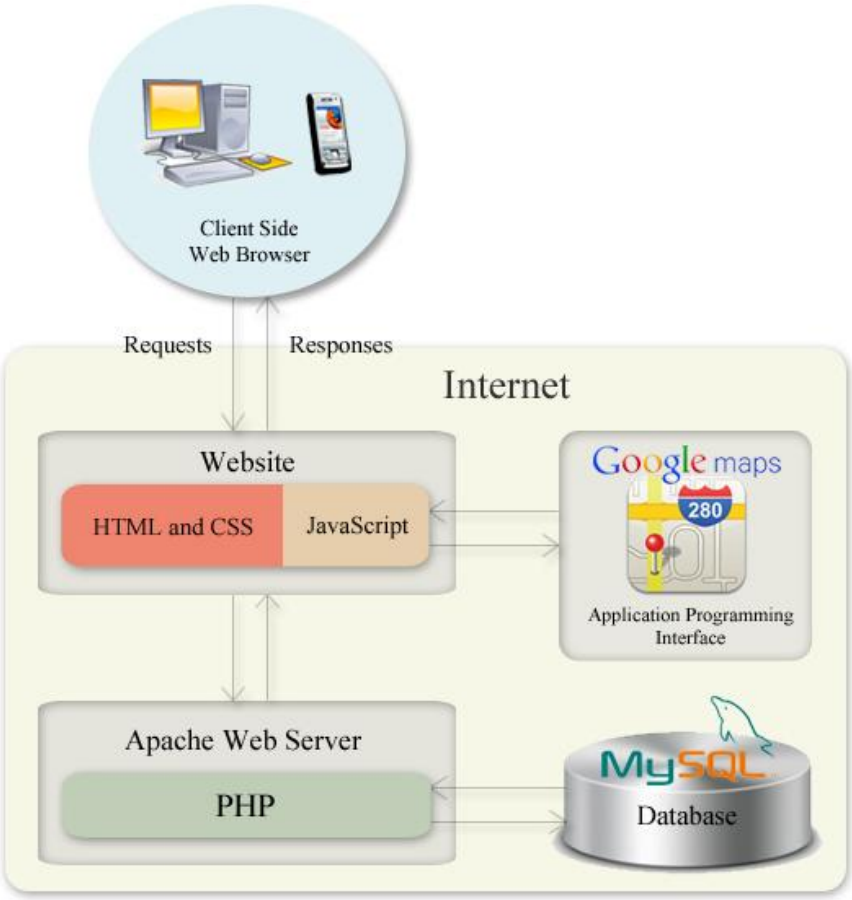

Figure 1. The WAMP stack and Google Maps API

Users contribute information to GéoActon by clicking on the map interface to add a point and complete a form that describes their businesses (including contact information, photograph, business website, and other descriptive content). This information is then saved to the server database and instantly added to the map where it is publicly displayed and searchable (Figure 3). Users can edit their listing, including moving to a new geographic location. An advanced search function allows users to search through the businesses according to pre-defined categories and key words. For example, users can find all contributed points for manufacturing enterprises in a specific town, or all tourism businesses. Users can also display authoritative information in GéoActon, including municipal boundaries, land use zoning, and property parcels. These sources of data are provided by the municipal government as a way to share information with the general public. Property parcel information in particular was considered by CLD Acton as a valuable addition to advertising economic development potential. Lastly, parallel components of the site help to orient the user, including frequently asked question section and instructions for contributing information to GéoActon. This data is stored and controlled by Acton, and provides a more accurate listing of businesses than what is offered by Google itself. It is a customizable application that serves the purpose of connecting local businesses with each other, and the province more broadly.

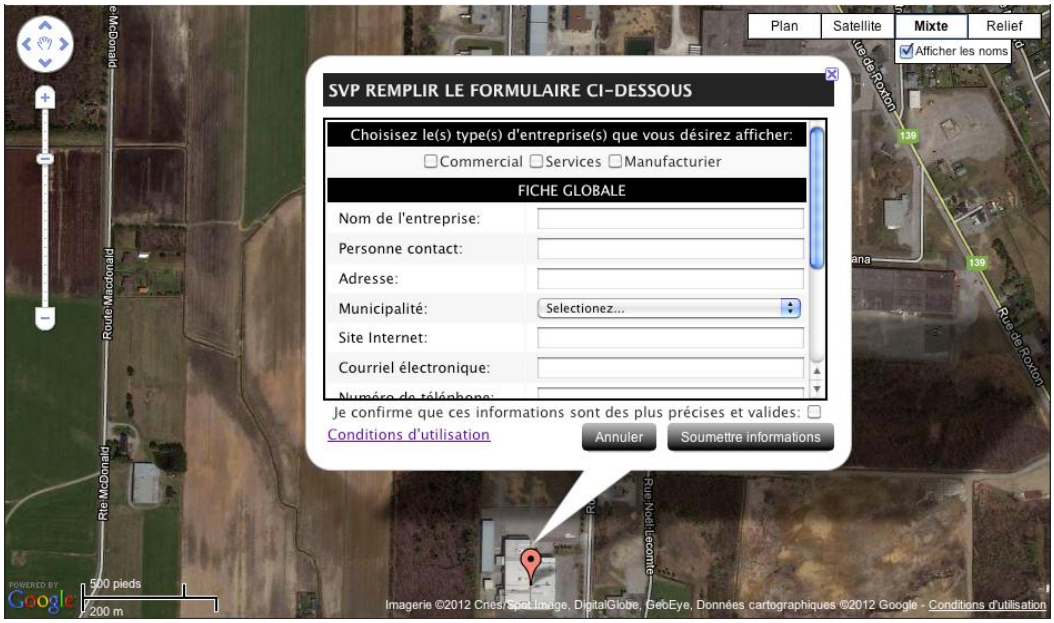

Figure 2. GéoActon Interface

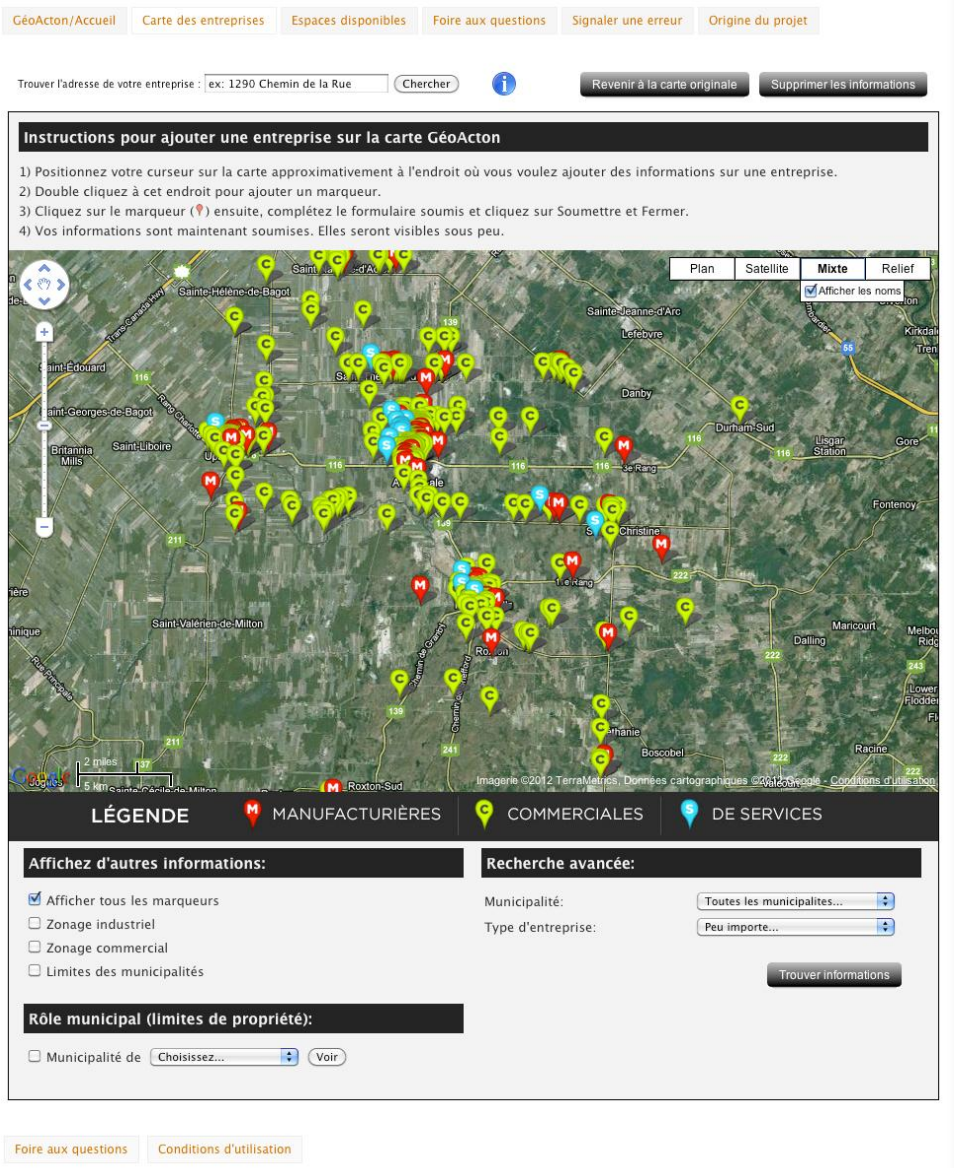

Figure 3. Business listings on GéoActon

3.0 Making Strategic Choices in the Development of GéoActon

The development of GéoActon required a balance among the technical constraints of Geoweb technology, the need to create a tool that is easy for the end user to interact with, and specific feature requirements and resource limitations as identified by the CLD Acton. We identify three major strategic choices made in the development of GéoActon that can guide other organizations developing Geoweb tools: minimizing development costs, user verification of contributed information, and strengthening linkages with partners.

3.1 Minimizing Development Costs

Compared to the development or deployment of many types of information technology, particularly GIS, the development of a Geoweb application is

traditionally seen as low cost (Cinnamon & Schuurman, 2010; Haklay et al., 2008; Johnson & Sieber, 2012b). This makes the Geoweb a particularly attractive technology for implementation in rural or otherwise resource-constrained environments (Pigg & Crank, 2005; Sudharsan & Adinarayana, 2009). This is largely due to the lack of software site licenses and the low cost of Geoweb software. These low or no-cost options often come at the cost of substantial human resources required in the development of Geoweb applications. Resources are largely in the form of web development skills, including some knowledge of web server computer programming. The level of skills required in the development of GéoActon was mediated through our selection of the Google Maps API as a base for development. Google Maps, like many digital earths, is not open source, but offers an extensible API. The Google Maps API proved a more mature development environment than Open Layers, with sufficient documentation for newcomers to computing and numerous samples that could be extended or modified instead of coded "from scratch". Such is a selling feature of the Geoweb: its repurposing and mashability of one application with another (Haklay, et al., 2008; Turner, 2006). Considering that time was a key factor in the development cost of GéoActon, any opportunity to minimize the amount of time spent on development was beneficial to the entire project.

Despite the many benefits of using the Google service, there are also notable constraints. Because Google Maps is not an open source product but rather is owned by Google, the terms of service governing the use of the API can change in accordance to the wishes of Google. Considering that advertising and product placement form a significant part of the Google business model, this may create a situation at odds with the needs of users. For example, Google may gather data contributed on GéoActon and use this to display related advertising for competing areas, effectively undermining some of the economic development and marketing goals of CLD Acton. By contrast, the open-source Open Layers platform is controlled by a community of developers and users, so there is little concern of an intervening corporate agenda restricting or altering the terms of service. In the choice of the Google Maps API, the project team acknowledged a trade-off between the control and the development costs and user experience. Reduced development costs afforded by the Google Maps API was worth the potential impacts of relinquishing full control over the toolset.

3.2 User Verification of Contributed Information

The development of GéoActon evoked concern over how users would contribute information and how that information would be verified. With the project relying on the public to contribute information, which ultimately would be viewable by anyone, there were concerns over data accuracy and the motivations to participate. CLD Acton was concerned about the possible addition of malicious content or sabotage of business locations. The question was asked: how could we ensure that the information being contributed to the site was valid and appropriate to the economic development goals of GéoActon? This is a commonly voiced concern in the literature on VGI, with data quality representing a major area of study (Goodchild, 2007, Haklay, 2010). Initially it was proposed that an employee of CLD Acton would moderate information contributed prior to its publication, reading each post to ensure the information was valid, accurate and respecting terms of use. This method was ultimately deemed too time consuming and would diminish the user experience because posts would not appear immediately on the

application. Instead the project team decided to emulate the successful Web 2.0 site Wikipedia, where users ensure information quality through successive refinements and anyone can modify information. The Wiki model is particularly successful in that it allows for user correction/modifications to be individually tracked and revisited in the event that a contribution is erroneous. While the opportunity for people to provide incorrect information is present, a combination of dedicated "Good Samaritan" users and more advanced automated corrections allow for the system to be advantageous for all parties involved in information production (Oh & Walsh, 2010). Through a similar yet less sophisticated 'modify' section of every contributed point in GéoActon, any user could correct flawed information immediately. Every modification automatically generates a quality control email, which is sent to the original author of the contributed point to notify them of the change. This approach offered three benefits: first, it removed a barrier to participation by giving users the immediate feedback of seeing their contribution appear on the map in real-time; second, it removed a time consuming task on the part of the CLD Acton staff to do any editing; and third, it gave users a reason to re-visit the site, by giving them the ability to modify and update their own entries. This feature ultimately makes GéoActon more community oriented and reduced the need for a CLD Acton employee to continuously monitor the application.

3.3 Strengthening Linkages With Partners

A major strength in the development of GéoActon is the relationship among all project partners, including McGill University, CLD Acton, and staff from the municipal government of MRC Acton. GéoActon was built in large part because of the recent development of the CLD Acton economic development website. To develop this site, the CLD Acton hired a local web developer. This co-development process led to a significant transfer of expertise between the McGill project development team and the local web developer, who held responsibility for integrating the GéoActon site within the existing economic development website. In this way, CLD Acton provided indirect funds and support for GéoActon, both in the development stages, and by assuming long-term maintenance tasks of GéoActon within those of the larger economic development site.

A second important partnership link in the development of GéoActon was the involvement of staff from the municipal government of Acton. MRC Acton collects, maintains, and distributes data on the land use zoning and property parcels in Acton. To support CLD Acton's goal of encouraging outside investment in the Acton region, MRC Acton decided to, for the first time, allow key geospatial datasets to be viewed online by the general public. These datasets included land use zoning and property parcels, data that within a Canadian context, is rarely made publicly available online. Users can now check the specific zoning within an area of the MRC, and also look up property ownership and pricing information without needing to visit the municipal offices to view a hard copy. This creates a potential valuable tool for citizens of the MRC Acton, enabling the sharing of municipal government data online through a simple web GIS.

4.0 Conclusion

The development of GéoActon was a strategic choice on the part of CLD Acton to create a conduit for the contribution of local information, allowing residents to participate in the promotion of their own businesses and region. The process of

developing GéoActon demonstrates how information technology such as the Geoweb is not an a-contextual artifact to be uniformly implemented in any area. Rather, what the Geoweb offers is a customizable set of tools that can be applied in many ways, as dictated by the problem at hand, the resources available, the implementing organization(s), and the local user context. Unlike traditional Web GIS, the Geoweb, and in the case of GéoActon, the Google Maps API, gives developers a set of more accessible tools to quickly create participatory online maps. These tools do come at a cost, as many of the tools of the Geoweb, while supporting the democratization of information and enabling participation in the contribution of VGI, also have the potential to support corporate interests. As discussed, open source alternatives do avoid much of this concern, yet come with an accordingly higher level of resource requirement. This decision between corporate and open source API is one that rests with each individual Geoweb project, and is largely dependent on developer preferences, level of knowledge, and resources.

There were many challenges encountered in the development of GéoActon. While the mapping APIs used can provide a more accessible programming environment, the technical development of a Geoweb site is only one aspect of the larger development process. For example, many of the challenges of the GéoActon development project were not technical, but rather focused on goal setting and 'soft' tasks, such as writing supporting text and determining classification schemes for regional business types. This broader development process took a considerable amount of time. From the initial drawing board to the project launching was nearly 2 years, including several rounds of testing and revision. To help overcome these proceedural challenges, one strength was that Acton's CLD team proved to be a partner capable of providing local expertise and resources as well as hosting and maintaining GéoActon for the forseeable future. The development and deployment of GéoActon benefitted from CLD Acton's previous experience with web development, and their retention of a web development specialist. Other communities looking to develop a Geoweb site may not have a similar level of resources to host such an application, let alone maintain it over time. This issue of sustainability is a major critique of the Geoweb as a technology when applied in a community development context. What happens once the initial development is complete and the product launched? Without in-house or contracted expertise to maintain and refresh a Geoweb site, a host organization runs the risk of the site becoming outdate, inoperable, or largely forgotten. It is possible that with increased ease of development, the Geoweb represents a more 'disposabe' technology; one created for a specific, time-limited purpose, to be replaced as technology and trends continue to evolve, rather than to be maintained for long-term usage. As with many types of technology, this question of sustainability, particularly in a rural context, remains a relevant concern.

As rural communities gradually become more familiar with emerging tools and technologies, one could expect an increased uptake of Geoweb tools more broadly. Likewise, as municipalities seek to increase their online presence and acquire the resources to do so, the expertise to coordinate, maintain, and possibly develop such tools should also increase, offering more opportunities for partnerships similar to those of this project. Through the process of developing GéoActon, we uncovered three strategies that, within the context of the CLD organization and in the rural location of Acton, were important in the success of this project. These choices included minimizing development costs, through the use of the more mature and fully-featured Google Maps API development framework, user verification of

contributed information by opening editing of content, and by linking with partners, in this case a university, local web development company and municipal government, to provide ongoing support and important data for the application. We anticipate that these strategies will make an informative contribution to the Geoweb development process in other rural areas.

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