Articles

The Geoweb for community-based organizations: Tool development, implementation, and sustainability in an era of Google Maps

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Recent advances in web-based geospatial tools (the Geoweb) show promise as low-cost and easy-to-use methods to support citizen participation. This research presents two case studies of Geoweb implementation set in community-based organizations in rural Quebec, Canada. When comparing the development and sustainability of each Geoweb tool, the implementation time frame plays a key role. Two implementation time frames are defined; a discrete, or 'one-off' time frame associated with lower resource requirements, and a continuous, or ongoing time frame, that has a higher total resource cost, but can fulfill a different set of goals than a discrete implementation.

Introduction

The Geospatial Web 2.0 (Geoweb) is an online framework for collecting, distributing, and using geospatial data in a collaborative manner (Haklay, Singleton, & Parker, 2008). The Geoweb consists of a framework of multiple components, such as geographically referenced data sources and digital earths, that can be interlinked, or

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'mashed up' via application programming interfaces (APIs) to create an online map (Hudson-Smith, Batty, Crooks, & Milton, 2009; Lake & Farley, 2009). Information exchange on the Geoweb is multi-directional, in that it supports use both in a traditional 'read-only', informational manner, and in a Web 2.0 'read-write' fashion that encourages users to contribute and share information (Batty, Hudson-Smith, Milton, & Crooks, 2010; O'Reilly, 2005). The Geoweb is generally built on the development of free or low cost online mapping platforms, such as Google Maps and Open Layers, assisted by the provision of open, shareable data from governments, organizations, and companies, and the acknowledgement that individuals can provide information based on their own experience (volunteered geographic information, or VGI) (Goodchild, 2007).
The Geoweb has been applied within a variety of contexts, such as data gathering and communication in crisis situations (Goodchild & Glennon, 2010; Liu & Palen, 2010; Zook, Graham, Shelton, & Gorman, 2010), the facilitation of citizen science activities such as invasive species identification and environmental change (Connors, Lei, & Kelly, 2012; Ricker, Johnson, & Sieber, 2013; Wiersma, 2010), and to map the location of injuries in urban areas (Cinnamon & Schuurman, 2013). These applications frame the Geoweb as a rapidly deployable, low-resource cost framework that non-experts, or 'neogeographers' can use to gather, visualize, and share geospatial data (Beaudreau, Johnson, & Sieber, 2012; Haklay et al., 2008). The potential of the Geoweb for community development is as a way to engage with citizens and communities of interest (Ganapati & Reddick, 2012; Johnson et al., 2015; Johnson & Sieber, 2012b). This approach can be seen in the use of Geoweb as an enabling technology for citizen science, where organizations provide a Geoweb site as an input portal for data collected by citizens.

Despite the broad enthusiasm for the Geoweb, the process of developing, implementing, and sustaining a Geoweb site can present a barrier to adoption for many organizations (Newman et al., 2010; Sieber, Robinson, Johnson & Corbett, 2016). While at the national, state, and city levels or within private enterprise, there may exist both the resources and expertise to develop, implement, and sustain a variety of technology tools, these resources can be lacking in regional and municipal governments, not-for-profit and volunteer-run organizations, and particularly in rural areas (Beaudreau et al., 2012; Corbett, 2013; Johnson & Sieber, 2012b). If the promise of the Geoweb is to be broadly realized at the community organizational level, there must be greater focus on the implementation and sustainability issues that are created by the context into which the technology is being deployed. The popularity of the Geoweb has been driven by a perception that these tools are simple, easy to use, inexpensive, and thus able to be quickly adopted by any organization (Hall, Chipeniuk, Feick, Leahy, & Deparday, 2010). This perception considers the Geoweb to be fundamentally different than its precursors, desktop GIS and Web GIS, both of which have a significant history of organizational adoption constraints that are well articulated in the literature (Z. D. Budić & Godschalk, 1994; Onsrud & Pinto, 1991). Despite the supposed evolution of the Geoweb as a potentially more democratic and participatory form of GIS (Haklay, 2013; Johnson & Sieber, 2013; Miller, 2006) it remains to be seen if the type and nature of organizational adoption constraints differ accordingly.

This concern for the implementation context surrounding geospatial technology, particularly in community-based organizations, is mirrored in the literature on GIS and PPGIS, and on the implementation of GIS in local government (Budic, 1994; Sieber, 2000). Budic (1994) found that major constraints on the adoption of GIS were a poor fit to the tasks of the organization and an implementation process that was too complicated or required more resources than the organization could provide. Though developing a Geoweb site is arguably much less of a financial burden than the purchase of a commercial desktop GIS of the 1990's (Haklay et al., 2008; Ricker et al., 2013) we will describe how these concerns of resource requirements, particularly human resource requirements for implementation remain valid when considering the development and sustainability of the Geoweb within community-based organizations.

The long-term sustainability of a given technology is a significant concern for many types of community-based organizations. Budgets are both smaller and funding often fluctuates from year-to-year, constraining the ability of community-based organizations to commit to long-term support, both financially and with staff time (Johnson & Sieber, 2012a; Rideout & Reddick, 2005). To date, very few published results have investigated the sustainability of Geoweb technology within community-based organizations. Rather, focus has been on emphasizing the lower cost of entry to the Geoweb, both financially and in required level of expertise (Beaudreau et al., 2012; Hall et al., 2010; Johnson et al., 2015). This ostensibly means that the Geoweb has lower implementation and sustainability concerns compared to traditional desktop GIS or web-based GIS (Haklay, 2013; Turner, 2006), though this remains largely unexamined.

This paper presents research on the implementation and sustainability of the Geoweb in a community-based organization context. We aim to clarify questions concerning the adoption path(s) of the Geoweb, primarily the implementation and sustainability of the technology in community-based organizations. We compare the development path of two Geoweb platforms with community-based environmental management and economic development organizations in rural Quebec, Canada. Both Geoweb platforms were used as VGI portals to gather information from citizens, but over different implementation time frames, one discrete, and one ongoing. We describe the development and application of each platform within its organizational context. We then discuss how differing implementation time frames affect the development, implementation and sustainability of the Geoweb within each organization.

The Geoweb for community-based organizations: Two case studies

This paper compares the implementation of the Geoweb in two community-based organizations. These case studies are set in the rural area of Acton (population ~16,000), located one hour east of the major Canadian city of Montreal (Figure 1). The Acton region is located in the agricultural heartland of the province of Quebec, its economy largely dominated by agriculture and light manufacturing. Like many rural areas in North America, Acton is experiencing a low level of economic growth, coupled with depopulation as young people migrate to nearby city centres. Environmental

degradation is also an issue in Acton, as years of agricultural pollution have resulted in severe impacts on water quality in the area lakes and rivers.

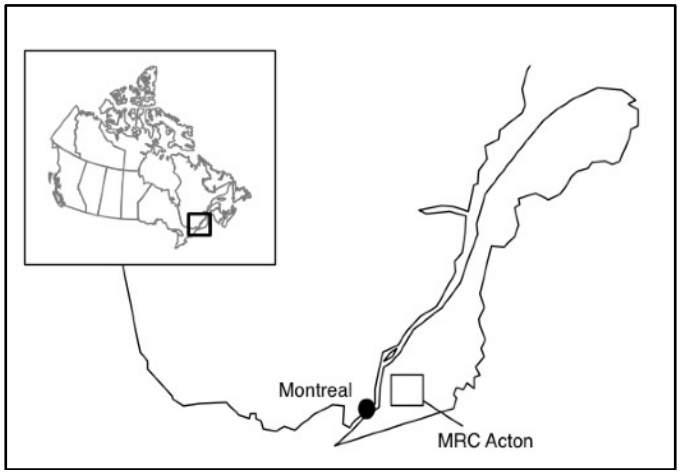

Figure 1: Map of Acton in relation to Montreal, Quebec, Canada

In conducting this research, the authors were involved as part of a multi-year collaborative research partnership between provincial, municipal, and local organizations to investigate the potential for and constraints to the use of the Geoweb in a community context. As part of this research, we worked in partnership with two Acton-area community-based organizations to develop and implement Geoweb tools as a way to increase citizen participation in local development issues. In conjunction with project partners, we developed and implemented two Geoweb tools; one for community-based watershed mapping, and one for community economic asset mapping. These tools were implemented within two different community-based organizations, each with different structures, funding sources, and mandates.

The first organization is the corporation de développement de la rivière noire (CDRN), a community-based watershed management organization with a mandate to mobilize citizen efforts to protect and improve water quality and management practices in the region. This organization is largely volunteer-run, and takes an activist role in directing community effort and working with municipal and provincial partners. For the CDRN case study, we used a Google My Map Geoweb tool, a platform developed and hosted by Google that allows for the rapid creation and sharing of simple maps annotated with user-contributed points, lines, and polygons. This tool is deployed by CDRN to gather citizen reports of erosion, pollution, and other watershed issues.

The second organization we worked with is the Acton centre local de developpement (CLD), a community economic development organization with a mandate to develop, market, and support economic growth in the area. Acton CLD is funded directly from the provincial government, with multiple full-time staff and a strong presence in the local area. For this case study, a Geoweb tool was custom-created by the research team using the Google Maps API. Called ‘Acton 2.0’ this tool allows business owners in the

Acton community to add a point to a map and fill out a relevant form with information. Both the point and form information are then immediately added to a server-side database and made publicly viewable and searchable. Acton CLD used this tool to create a series of community asset maps, providing the location and description of local businesses.

Despite key differences in terms of organizational structure, funding source, and operational mandate, there are parallels that can be drawn between both organizations. First, they both operate within the same rural milieu, and must negotiate the unique challenges inherent in that context, including low levels of population growth, a transitioning economy, tension between long-time residents and newcomers, and a dispersed population (Markey, Halseth, & Manson, 2010). Most importantly however, each of these organizations has had little exposure to the use of the Geoweb. This makes a comparison between two organizations, operating in the same area, but with different resources and structure, a useful comparison for the tracing of the adoption path of the Geoweb. We frame these case studies in three areas of concern induced by Geoweb technology use: the development, implementation, and sustainability of the Geoweb for each community-based organization (Onsrud & Pinto, 1991; Rogers, 2010). This analysis then is used to frame a discussion of the opportunities and constraints to the use of the Geoweb within a community-based organization context, with a particular focus on developing strategies to improve the sustainability of the Geoweb.

Watershed issue mapping with Google My Map

Development

Google My Map provides individuals and organizations with a free tool that can facilitate the quick and easy creation and sharing of personalized web-based maps. As with most digital earths, it offers ease of use in panning and zooming as well as search functions, shareability of data and mashability with other applications. Users can augment the content of base map and satellite imagery layers by contributing their own points, lines, polygons, and annotations, essentially adding additional layers of geographic information. To access Google My Map, the user must login to maps.google.com with a free Google Account password. Users can then create a map using a palette of tools, drawing attributes and adding descriptions, media, and hyperlinks. Users can then share a given map by making it publicly searchable, sending an email link to others, embedding in a website, or inviting others to collaborate on the map.

The human and technical resources required to set up and use a Google My Map are minimal. To set up a Google My Map, the developer must have a general understanding of the Internet, email, web-based applications, and a general level of spatial literacy. No knowledge of computer code is required. Google hosts Google My Map, so an organization or user need not purchase or invest in servers. The only technical requirements to use the Google My Map implementation are a modern computer and preferably a high-speed Internet connection. From a financial perspective, the Google

My Map tool is provided free of charge, making this implementation extremely cost-efficient, other than the cost of a computer and Internet connection.

Implementation

The Google My Map tool was implemented as part of a mapping workshop conducted by the research team and CDRN with citizens in the region of Acton. In total, five workshops were held, with 18 citizens participating. Each workshop followed a similar pattern. Participants were engaged in a discussion of environmental issues in the region, using post-it notes to tag areas of concern on paper maps. Participants were then introduced the Google My Map interface and given the opportunity to each use the website to contribute their personal opinions of environmental impacts in the region. Users were required to log on to the site, either by using a Google Account set up by the research team, or by creating or using their own Google Account. In this way, the user is logged and their participation - either in adding or modifying a point on the map, is registered. This type of user authentication can possibly reduce vandalism to the map by only allowing it to be accessed by those with some connection to the process, though this may also reduce participation by preventing users from leaving anonymous comments.

Once participants were logged into the account(s) they were asked to add comments about environmental concerns to the map. To do this, users added points and lines to familiar areas in the region, found using the Google Maps satellite imagery. A sample of the Google My Map interface and commentary contributed to the Google My Map is presented in Figure 4. Despite the promised ease of use, some end users in the CDRN workshops demonstrated a low level of both spatial and digital literacy, reporting difficulties situating themselves on the map and navigating using the pan and zoom controls. These difficulties were attributed to a level unfamiliarity with web applications and challenges interacting with a computer. We also could not discount the lack of spatial (map-reading) literacy of some of the users.

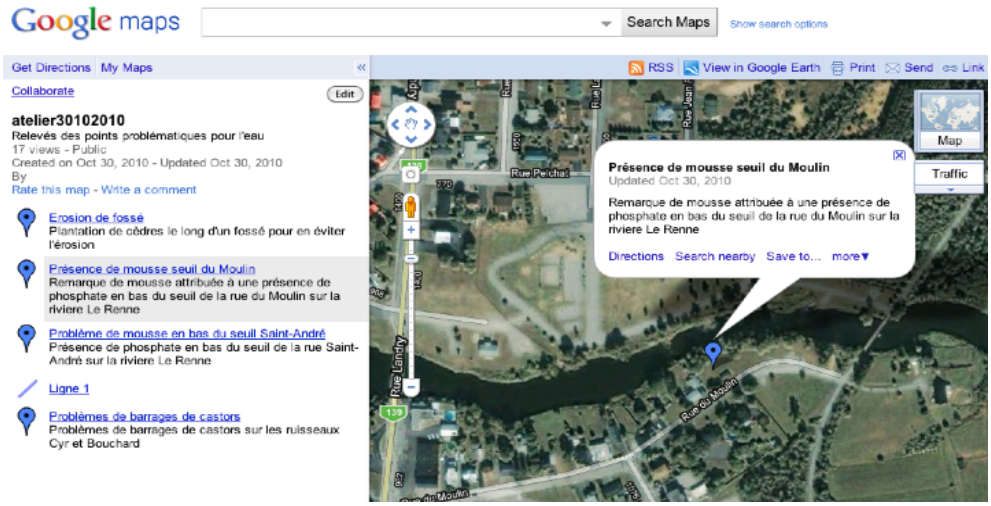

Figure 2: Google My Map interface and workshop map

During the five workshops a variety of comments on environmental and erosion management issues were added to the Google My Map. Participants used the conventional base map, satellite imagery, and Google Street View to locate specific areas of concern. Data collected in this manner was seen as valuable for CDRN, as it describes issues that are of importance to local stakeholders and gives those issues an explicit geographic context. The further use of the Geoweb in this manner was seen by CDRN to have potential as a way to both generate community-level interest in watershed management and as a way to rapidly gather information in a low-cost manner.

Sustainability

When considering the long-term sustainability of the Google My Map tool within an organization such as CDRN, the low level of resources required to implement the Google My Map should be seen as a positive factor. With a staff comprised largely of volunteers, and a project-to-project budget, for CDRN, Google My Map is a free tool and one that can be set up and delivered with only a general level of understanding of the Internet. Despite this low level of financial and human resource requirements to maintain the tool, the way in which Google My Map was used by CDRN was on an ad-hoc basis. CDRN has no immediate need for the Google My Map and workshop protocol to be used continuously. For this organization, the Geoweb was a tool that can be used in a discrete, project-based, manner. When required, it can be used, paused, and then used again in the future without requiring ongoing organizational resources to sustain it. This makes Google My Map a relatively sustainable tool for community-based organizations, as there is little commitment required by CDRN to continuously invest in the tool, but rather it remains a tool in their tool box, ready to be applied to a specific problem if deemed appropriate.

Acton 2.0: A Google Maps API Geoweb tool

Development

Acton 2.0 is a Geoweb tool built using the Google Maps API. This approach allows for significant customization of the Geoweb tool, in both appearance and functionality. Compared to the Google My Map implementation, which is supported by Google through hosting, Acton 2.0 requires a web server on which to store and serve the backend database where user-contributed information and other code that displays the various webpages are hosted. Though it is increasingly easy to purchase server space (e.g., for the web, application, database, and file servers) and support, this makes the financial requirements of the Acton 2.0 tool higher than the free Google My Map. A typical cost for web hosting with required level of server capabilities at the time of writing could cost $100 (CDN) per year, though this cost is minimal compared to the expertise required to develop and maintain a Geoweb site.

Embedded as a participatory component within a pre-existing economic development site, Acton 2.0 is built around a standard Google Map interface; the user double clicks on a location on the map to add a point. Data that is entered into this form is stored in the hosted database where it can be retrieved in a number of ways. The simplest form of retrieval is for the user to click on an existing point (Figure 3) This produces the pop-up balloon of a single point. Multiple points can be queried according to set categories. Visitors can use the associated search box and category selection box to filter results for different categories, including commercial sector, products available, and municipality. For example, visitors could use this interface to search for all restaurants in the region, or all manufacturing enterprises with a certain focus. From a skills perspective, developers must have familiarity with common web programming languages, such as HTML, Javascript, and PHP. To make any customizations, developers must still be comfortable working within a programming language and web server environment.

Figure 3: Viewing user-contributed information on Acton 2.0

When considering the implementation of Acton 2.0, the base functionality for these maps was designed by the research team, in collaboration with a professional web developer contracted by the Acton CLD to create and support their economic development website. This meant that the technical details concerning the development and implementation of the site were handled by trained individuals, either the research team (Geoweb development) or the web developer (integration with the existing website, server-side deployment, ongoing maintenance). Though CLD staff were involved with design and overall concept of the site, the technical aspects of implementation were handled outside the Acton CLD organization.

Implementation

Acton 2.0 was used by Acton CLD to gather information on specific community assets from citizens and business owners in the Acton region. The goals of this Geoweb implementation were to expand and enrich a recently re-designed regional economic development website with community-sourced information. Acton 2.0 was implemented to engage citizens and business owners to gather information on the location and select information for businesses and services in the Acton region, and to display this information on a publicly viewable map. Upon visiting the Acton 2.0 site, users click to add their business, and fill out a relevant form with key information or the addition of a photograph. This information is then stored in a database and users could return to edit or modify the information for that feature. The Acton 2.0 tool has no process of

authenticating users, an intentional choice designed to encourage participation by making the contribution of an entry as quick and easy as possible. Any visitor to the site can add a point or edit an entry. Once an entry is edited, however, a notice is sent to any email address that had been previously present in the entry, as a way to alert a business that their entry had been altered. This site was seen as both a way to engage the community in regional-level marketing of their businesses on-line, as a form of economic development, and also to provide a sense of pride in the range of businesses and services offered within the community.

Sustainability

The nature of the technology introduced to Acton CLD requires a greater organizational commitment in development, implementation, and maintenance, compared to the Google My Map tool. Acton 2.0 was embedded within an existing, recently re-designed website, which necessitated the hiring of a professional web developer so that Acton 2.0 matched the look and feel of the existing site. This integration of Acton 2.0 into an existing site suggested that the organization was committed to its development. Because organizational resources, both financial and time, had already been committed, the organization was much more invested in the development, implementation, and sustainability of the site. We argue that the greater technical complexity and implementation resource requirements of the Acton 2.0 site led to greater support by the organization. Long-term sustainability is still unknown; in the short term, Acton 2.0 is maintained as a component of the outreach and advertising strategy of the CLD. In this way, Acton 2.0 is a type of Geoweb implementation that was designed to be continuous - both in its availability online and in the interaction of users to add or modify points. This ongoing nature (as opposed to the discrete CDRN Google My Map) requires a higher level of financial and human resources investment to ensure that Acton 2.0 is available, maintained, and active for business users and any visiting community user.

The adoption of Geoweb technology by community-based organizations

We compared two Geoweb tools for their suitability in community-based organizations through three phases of the adoption process: tool development, implementation, and sustainability. From this analysis, we look to develop a better understanding of the adoption path of Geoweb technology in community-based organizations. Our results indicate that the potential for sustainability of the Geoweb within a community-based organization is mediated by two connected factors; first, the implementation time frame of the Geoweb tool, and second, by the resources available within the organization. We classify the use of the Geoweb by implementation time frame - a discrete, or ‘one-off’ time frame compared to an ongoing, or ‘continuous’ time frame. Both Geoweb tools presented here can be implemented within either time frame, depending on the organizational goals. Within these case studies, the sustainability of the Geoweb tool is connected to the chosen implementation time frame, and the resulting implications this has for resource requirements.

A discrete Geoweb implementation time frame

Many of the most well-known examples of the Geoweb are implemented in a discrete timeframe. This is often seen in crisis mapping applications (Goodchild & Glennon, 2010; Zook et al., 2010). These applications are often developed in an ad-hoc, decentralized manner by volunteers, and with a minimal budget using free and open source software components (Roche, Propeck-Zimmermann, & Mericskay, 2013). These tools are used for a specific purpose - the sharing of information in the context of a crisis, and for the hopefully limited duration. The Google My Map tool developed for CDRN is a discrete implementation of the Geoweb. As a discrete implementation, the Google My Map is developed to serve a specific, time-limited purpose, in this case, the gathering of watershed information during a series of workshops. As an example of this specificity, the pool of participants is limited to those who attended the workshops or were invited by project participants. Once this task or series of tasks is finished, the Google My Map no longer needs to be used or maintained. All sustainability requirements on the part of CDRN can be put on hold until a time when the organization chooses to use the Google My Map again. In this situation, CDRN would revisit the development stage in the context of a new or modified application area. The way that the Google My Map is implemented by CDRN supports use in a discrete manner. The tool is not available to the public, as a login control restricts use to those attending workshops, and a final series of maps that are not publicly distributed, but rather kept for the use of CDRN. This lack of public distribution or requirement for the tool to be open to ongoing commentary and participation means that there is no need for CDRN to make a long-term investment in the tool.

This discrete nature of the Google My Map has implications for the resources needed to develop, implement, and sustain the tool. We propose that in the context of the discrete CDRN implementation, the Google My Map tool has a high level of sustainability. This high level of sustainability is based on the short required time frame for the technology to be active, its low cost of entry in terms of resources, and the lack of ongoing maintenance costs. Contrast this to desktop GIS, where even if an organization is not actively using it, they still must pay for a license to have it available and a trained staff member to use it. Similarly, the cost of simply having access to geospatial data, such as satellite imagery to use for citizen participation workshops is prohibitive. For an organization with low resource capacity (both financial and human resources) the ability to access, essentially on demand, a basic participatory mapping platform complete with satellite imagery data is a substantial asset. This discrete use of the Geoweb, and in particular the low resource Google My Map, is a technology that has great promise for sustainability within the context of a community-based organization.

An ongoing, or continuous Geoweb time frame

Geoweb tools and technology can also be used within an ongoing, or continuous time frame. By ongoing, we mean that it is an implementation intended to be continuously available for user input and public viewing over an undefined time period. Prominent examples of this type of Geoweb site include e-democracy style sites, such as Fix My Street, where citizens post complaints to municipal government. This type of site is

operated as a service, often as a response to a government or organizational failing or gap. Other continuous time frame Geoweb sites include citizen science projects, (Connors et al., 2012; Wiersma, 2010) and Open Street Map, the crowdsourced global base map (Haklay & Weber, 2008). These types of sites are intended to form a social network around the geolocation and identification of animal and plant species and topographic features respectively.

The Acton 2.0 tool developed for Acton CLD can be considered as an ongoing implementation of the Geoweb, as users must be able to revisit the site, to revise or update listings. Acton 2.0 is intended to grow and change over a longer time frame, compared to discrete Geoweb implementation used by CDRN. This ongoing time frame of Acton 2.0 is a product of the tasks that the tool was designed to accomplish. Due to its use as a type of marketing tool, Acton 2.0 needs to be accessible and continually updated, maintained, and even given a refreshed look to remain current. This means that both financial and human resources are needed to ensure the longer term sustainability of Acton 2.0. For example, business listings contributed by users may become outdated. Though the intention is that business owners themselves will return to the site to update their listings, the responsibility for contacting these business owners may fall to the Acton CLD staff. Other maintenance tasks such as removing vandalism, obsolete, and erroneous listings are other tasks that must be performed by Acton CLD staff over time. These types of resource requirements are symptomatic of an ongoing Geoweb implementation. This contrasts significantly with the intermittent allocation of resources required to support a discrete implementation of the Geoweb. This higher level of required resources gives an ongoing Geoweb implementation a similarity to conventional desktop GIS, where regular maintenance, updating, staff training, and associated costs are major considerations. The sustainability of such an implementation within a resource-constrained community-based organization is questionable, as resource availability in such organizations tends to fluctuate (Johnson & Sieber, 2012a; Sieber, Robinson, Johnson & Corbett, 2016).

Classifying the Geoweb by resource requirements and implementation time frame

This research suggests that Geoweb tools can be classified on the basis of implementation time frame, itself a factor of the application purpose (Figure 4). Figure 4 compares the two Geoweb tools described in this research, providing an example of the impact that differing implementation time frame has on resource requirements. The Google My Map used by CDRN has a low initial cost that persists for the discrete duration of the project. Should the tool be used again, a similar resource cost should be expected. Comparably, the Google Maps API tool used to create Acton 2.0 for Acton CLD agency has a much higher initial resource cost. These costs then gradually decrease, yet are ongoing, due to the implementation time frame. This leads to a higher overall lifetime resource cost to support a Geoweb tool. Additionally, organizations using an ongoing Geoweb implementation should expect periodic spikes in additional resource cost to update, refresh, or otherwise maintain the Geoweb tool. For community-based organizations with limited and fluctuating budgets, this presents a distinct choice for Geoweb adoption path, based on resource availability both in the short term, and for long-term sustainability.

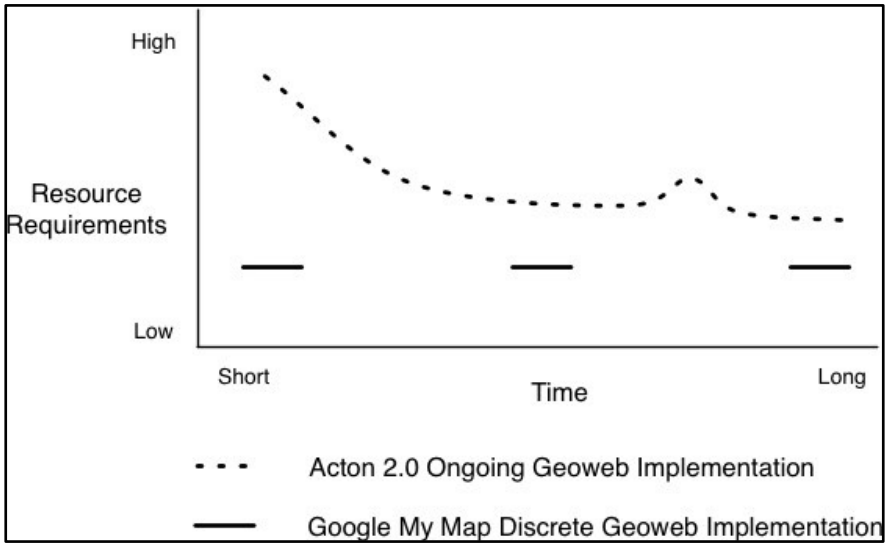

Figure 4: Geoweb Typology of resources and implementation time frame

Conclusions

When considering the long term sustainability of both Geoweb tools described in this research, the issue of tool ownership must be acknowledged. Both the Google My Map and Acton 2.0 tools use services provided for free by Google. Compared to the traditional software ownership model, where a user purchases a hard copy of software for their use, both Geoweb tools use what is termed a Software as Service (SaaS) model. SaaS is an approach to distributing software whereby users do not actually own or retain a copy of the software locally on their computer, but rather access software hosted remotely ('in the cloud') on a company server. Many popular web email clients follow the SaaS model, as does Geoweb software such as Google Maps and ArcGIS.com. The Google My Map tool used by CDRN and the Google Maps API used in building Acton 2.0 are both examples of SaaS. By using this SaaS, both organizations are essentially borrowing a service and set of software components provided by Google. Accessing this service provided by Google implies no long term commitment to supporting or using the service on either part of the transaction. Google can end the service or change the terms of the loan at any time. In exchange, the organization receives access to a useful service, provided for no cost, as-is with no guarantees of fit to organizational task, but also with no requirement for continued use. There is an assumption that some form of Google My Map and Google Maps API will always be available in the future should an organization desire to use it again, though this cannot be predicted, as companies change product direction and feature set regularly (Dalton, 2013, 2015).

There is a significant disconnect between the promise of the Geoweb and the on-the-ground reality for community-based organizations. Many citizen science and online community participation activities are led by community-based organizations that may lack the resources to invest in tool and technology development. A better understanding

of the constraints to the use of the Geoweb at the community-based organization level is required. This research presents two case studies of the use of the Geoweb by community-based organizations, outlining the development, implementation, and sustainability challenges for each organization and tool. A classification according to implementation time frame emerged - the Google My Map tool was implemented on a discrete time frame and the Acton 2.0 tool was intended to be ongoing. We found that the implementation time frame for each tool was a significant factor in determining the resources required for development. We suggest that future studies into the use of the Geoweb at the community-based organization level consider that sustainability of the technology not as a sole function of resource availability, but as a linked property of the implementation time frame and organizational resources. Despite current emphasis on the potential of the Geoweb as a rapidly deployed, and lightweight tool, the reality is that for community-based organizations, the adoption path must still overcome resource limitations.

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