Free and Open Source Software for Geospatial (FOSS4G) Conference Proceedings

Volume 16 *Bonn, Germany* Article 4

2016

Involving communities in environmental protection by Community Information Systems: the case study of "La Cuicadora"

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KEYWORDS: Participatory GIS, Participatory Sensing, Crowdmapping, Sustainable Development, Environmental Protection

ABSTRACT:

The involvement of the communities is a key-strategy to enable fast responses both case of emergency and environmental protection.

On this goal geospatial system could allow to collect information directly from the citizens. More specifically they can act on "feedback-loops" between "communities", "decision-makers" and "environment" catalysing participation and the perception of local knowledge. The work will present the case study of "la Cuicadora" project, a Ushaidi based crowdmapping system provides an information sharing network to assist Peruvian indigenous communities in better protecting themselves from contaminated water sources.

The analysis offers the chance to understand the concept of Community Information Systems (CIS) and its role in the involvement of communities in environmental protection.

1 Introduction

Promoting participation through community development projects and local decentralization has become a central tenet in environmental protection.

Although the participatory approach has certainly not a narrow focus, it surely concerns the involvement of the population in the planning and implementation of community policies.

Such "holistic" form of people's participation are certainly required for area-based operations which affect all inhabitants like environmental protection, soil and water conservation, provision of physical, economic and social infrastructures and irrigation, sanitation and health schemes.

The necessity of public participation for successful environmental policy has been recognized for some years at both the international and the national level.

As implemented in Agenda 21 one of the most important focus for get environmental policies more focused on communities is the participatory approach and public participation, including participation by specific sections of the population, e.g. women, children, indigenous peoples and farmers (Eden, 1996).

Considering the capillarity and the community contribution to environmental problem solving, the diffuse involvement of society within environmental issues could represent a key factor for the success of those actions.

Successful environmental policy has therefore been linked to the notion of 'concerned citizens', coupling individual activism to institutional action (Kingston et al. 2000).

The 'concerned citizen' is strictly related to the way the information about the specific topic comes from the top to the bottom (Macnaghten et al. 1995), and how the mechanism of involvement about the specific problem reaches both policy maker and the stakeholders.

Such mechanism nowadays could be strongly mediated by geographical information system, and in particular the use of Web represent a bidirectional way to realize participation, in the sense that they allow to gain information's, notices, ideas directly from the citizens. By the involvement of communities, Geospatial Information Systems through the Internet, can be widened into Community Information Systems (Fraternali et al. 2000), that can be used by both institutional political actors, by civil societal actors, and even by single individuals enhancing bidirectional mechanisms of information gathering.

This work proposes the case study of "la Cuicadora" project, a crowd mapping system provides an information sharing network to assist Peruvian indigenous communities in better protecting themselves from contaminated water sources. La "Cuicadora" represents an example of Community Information System, that offers a system for fast response to environmental problems.

At first, the basic concept of sustainable development and participation, and their relationship will be introduced. They represent the theoretical basis and the keys of understanding for all following discussion. Subsequently a focus on participatory mapping and sensing will be proposed to finally present the case study of "La Cuicadora". The case study will be the chance to identify the role of CIS in environmental protection.

1.1 Participation and relationship with lands

More than 2000 years ago, the Greek philosopher Aristotle defined citizens as all who share in the civic life of ruling and being ruled in turn, and considered as good citizens who brings the knowledge and the skills both to rule and to be ruled (Gigler & Savita 2014). This definition of citizenship is strongly connected to the concept of participation.

There is a wide range of definitions and interpretations of participation.

In more descriptive terms it stands for; "the involvement of a significant number of persons in the decision-making process which regards their development" (Mansuri & Vijayendra 2013).

Thus participation has a strong relationship with the concept of development and furthermore with the relationship of a community with its inhabited land.

Classical approaches identifies the sustainable development as the intersections among economic, social and environmental dimension (Figure 1.a).

This model implies that some parts of the economics system are independent from the social system. and on the other side that some social structure could exist without a natural system which supplies natural resource.

To have an exhaustive vision for an effective strategy of sustainable development; D'Alisa (2007) propose a concentric framework where a fourth dimension is added, that is participative democracy (Figure 1.b).

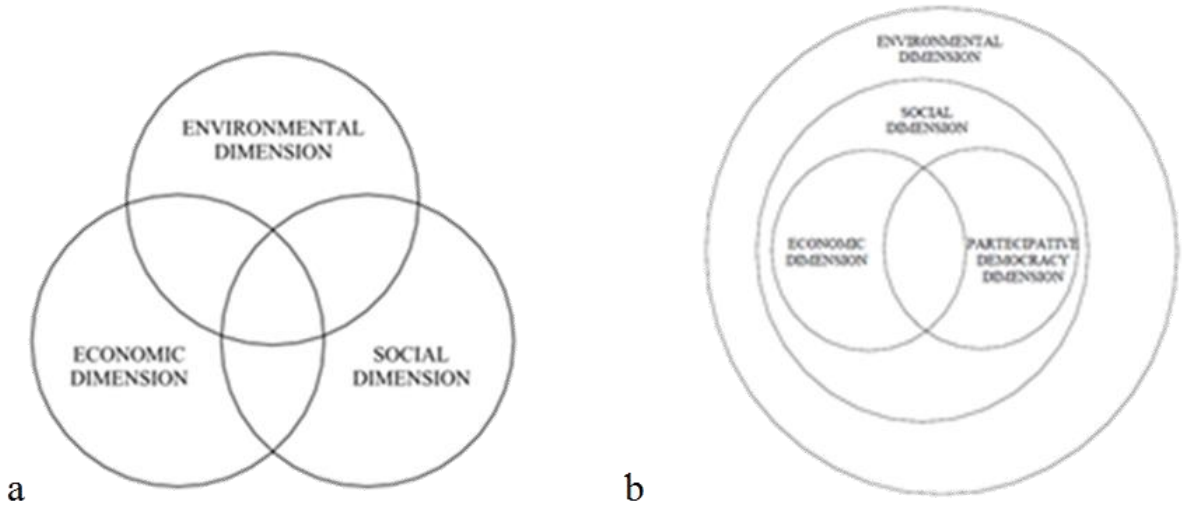

Figure1: a) classical approach b) concentric dimensions of sustainable development

As can be deduced from the graphical representation, participation and sustainability have a strict relationship of inter-dependency. This relationship has not linear fashion of cause-effect, but stands in a circular shape that traduce the complex link between a inhabitant community and its territory.

1.2 The role of local knowledge

Local knowledge is a key element for sustainable development and environmental management.

Standing to Minang and McCall (2006), it has also the characteristics of an informative system, in fact:

- it is a system of spatial information that is developed by the close relationship between the local population, its land and its natural resources
- Members of the community have a pool of experiential data of different categories according to their age, and social status
- it is an original knowledge of the local community.
- the system is a "pseudo" in the sense that consists in the classification of facilities and employs certain methodologies (e.g. Oral transmission)
- it is a holistic system in that it uses for decision different areas of knowledge

For this reasons is important to include local knowledge, as significant source of information when a specific action is done within a territory.

However as informative system, local knowledge has obviously some drawbacks as it has no facilities prediction, it has some gaps in transmission and finally it has little quantization.

1.3 Spatial Data Infrastructure to improve local knowledge involvement

Spatial Data Infrastructures (SDIs) are usually intended as the framework of technologies, policies, and institutional arrangements that together facilitate the creation, exchange, and use of geospatial data and related information resources across an information-sharing community .

Such a framework includes all the technologies like Geographical Information Systems (GIS), geoportals and diffuse georeferenced infrastructures that enable the sharing of geospatial information within an organization or more broadly for use a national, regional or global level.

In particular, if we consider a delimited area framed in a specific space and time, SDI can catalyze “feedback-loops” between the main actors involved in the processes related to that area (Figure 2).

This actor can be defined as communities, decision-makers and environment. Participation, empowerment and sustainability lies within the feedback loops as driving forces of circular relationships as explained above.

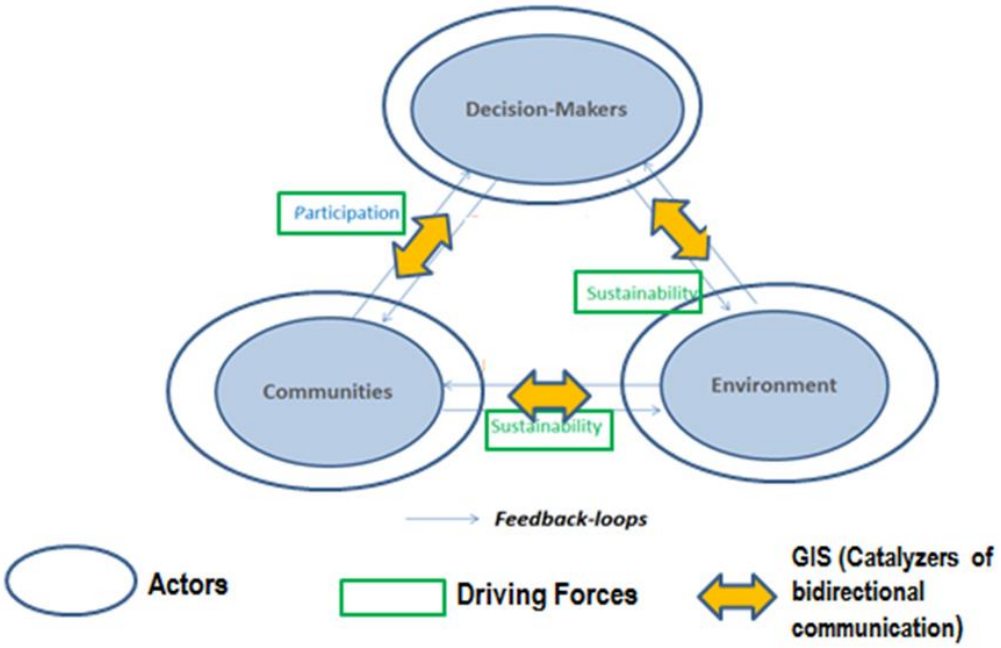

Figure 2: Informational Flux between institution, citizens, providers “feedback-loops” between “communities”, “decision-makers” and “environment” catalyzing participation (Gigler & Savita 2014).

Central to the information flows catalysis, is the question of how to close the "feedback loop" between the involved actors. One approach is to "put citizens in the circuit"(Fraternali et al. 2000).

As citizens will be considered inside the loop, local knowledge could be part of process, and thus thanks to GIS, it comes to be organized in a spatial and a temporal scale. Public Participatory GIS (PPGIS), human computation and participatory sensing are some approaches that realize the involvement of citizens in the loop.

2 Participatory Mapping

In its broadest sense, participatory mapping means the creation of maps by local communities – often with the involvement of supporting organizations including governments, NGOs or other actors engaged in development or land-related planning (Lienert 2009).

Participatory Mapping is a well-known practice that can contribute to building community cohesion, help to engage participants to be involved in resource and land-related decision-making, raising awareness about pressing land-related issues. Participatory approaches in spatial analysis are rooted in the implementation of Participatory Rural Appraisal (PRA) methods during the 198Os. Their success shows the fast growth of people's participation (Oakley 1991). During the 1990s, Participatory Rural Appraisal (PRA) and Geographical Information Systems (GIS) came together for delivering Public Participatory Geographical Information Systems (PGIS).

The term public participatory GIS (PPGIS), originated during two meetings of the National Center for Geographic Information and Analysis (NCGIA) (NCGIA 1996a, 1996b) is aimed at defining the use of GIS technologies to expand public involvement in the policy to promote the objectives of local communities and grassroots organizations (Sieber 2006).

Geographical data and community maps may support the participatory approach during the data integration process by the ability to translate the gathered data into an explicit map location, as geospatial and time-series. However the participatory approach become effective only on certain conditions

Basically, maps represent an intermediary output of the long-term process and need to be integrated into the networking and communication initiatives.

The maps produced and the spatial analyses represent important steps in the process.

2.1 Human Computation and Participatory sensing

Participatory sensing can be defined as the use of mobile devices to form sensor networks that enable interactive and participatory to public and private users to collect, analyze and share local knowledge.

The participatory sensing implies the exchange of data through the collaboration of the users of mobile devices, thus obtaining a direct "feedback mechanism" with individuals.

Mobile devices in facts are increasingly capable of capturing, classifying and transmitting image, acoustic, location and other data, interactively or autonomously. Given the right architecture, they could act as sensor nodes and location-aware data collection instruments.

Including consumer devices as a fundamental building block of the sensing system implies that the human owners of these devices play an important role in the resulting system architecture.

The application of participatory sensing realizes the implementation of the paradigm of "human computation" (Quinn & Bederson 2012).

In the Human Computation Paradigm (Law & Von Ahn 2011) the interaction among users is harnessed to help in the cooperative solution of tasks.

Human Computation (HC) is usually applied in business, entertainment and science, but can also useful in the management of environmental resources, which are by definition shared and distributed and demand new approaches to their management, based on an increased consciousness of mankind's collective responsibilitie.

This approach connects with the concept of "concerned citizen", representing a way to open the informative stream between institutions and civic engagement.

Crowdsourcing and crowdmapping can be considered cases of HC.

Human computation opens the way to a more open and collaborative governance and environmental management..

2.2 Crowdmapping technologies: Ushaidi

Ushahidi Inc. is a non-profit software company that develops free and open-source software (LGPL) for information collection, visualization, and interactive mapping. Ushahidi created a well-known web-platform in the aftermath of Kenya's disputed 2007 presidential election (see 2007–2008 Kenyan crisis) that collected eyewitness reports of violence reported by email and text message and placed them on a Google Maps map (Okollo 2009).

The Ushahidi platform includes crowdmapping tools, which allows location data points sent by SMS message to be mapped, and Swiftriver, a data filtering system to control information flow in crisis situations so it can be effectively and rapidly employed. Ushahidi's website includes instruction videos, a wikispace, datasets, other literature and a blog. Ushaidi technologies constitute a diffuse crowdbased SDI: in a broader sense the constitute a of Community Information Systems (CIS).

2.3 Community Information System

A Community Information System (CIS) is normally an spatial information aggregator that's able to interact with user-citizens by means that are familiar to them and that are available and used in their everyday life (Fraternali et al. 2000),

It generally aims at organizing the citizen participation activities in the areas of risk and resource management as the case of "La Cuicadora"

3 Case Study: La Cuicadora

The project, called The Cuidadora, "the guardian" was born on initiative of Jonathan Rupire (Rupire 2015). It provides network shared information to help indigenous communities to better protect themselves from the dangers of contaminated water. It also report social-environmental conflicts and corruption.

The "Cuicadora" is an interactive crowdmapping platform for the collaborative georeferencing and dissemination of real-time alerts. The "Cuicadora" stems from the problem of contamination of water sources water due to the strong presence of sites for the extraction of oil. Using a distribution Ushahidi (translated into indigenous Shipibo), the information provided by affected communities are reported, mapped and then distributed to national organizations and media, as well as the communities themselves. The website is hosted on a server collective Ourproject.org.

It consists of a main page that displays a georeferenced map in the foreground.

Figure 3: Home page of "La Cuicadora" (Source: http://cuidadora.ourproject.org/)

The main menu is put over the map and allows to access to the various sections. The alert can be sent by registered user that can also receive alerts via email and SMS when the access to internet is unavailable. The reported events are geo-referenced and marked on the map. They are also grouped according to specific categories that can be expanded by users' suggestion. Section "recibe alertas" will also organize a period digest of all the repot displayed through the title, the description, time and photo within the specific category. The "Cuicadora" system is also provided by a Twitter account where the alert "tweets" is reported by specific signaling hashtags.

4 Conclusions

The case study of "la Cuicadora"; represents an example of "community information system" based alert system. The CIS infrastructure is able to spread fast response and equally fast propagations over all the places where it insists.

These two features are essential for an alert system, and became more effective as the number of user increases. As discussed in this work, "feedback-loops" could be strongly mediated by spatial information systems and thus CIS.

The way by which it is realized is related to the capability of information systems to catalyze bidirectional communications.

Bidirectional communication contributes to strength two mechanisms related to a community within its environment that are:

- the information-decision mechanism
- the action-reaction mechanism.

If we consider the first mechanism, it's possible to argue that the use of diffuse spatial information technologies enhances sustainability because they help to find the best fitted solution to a specific problem considering the boundary conditions related to environment and community needs. By diffuse spatial information the 'boundary conditions' of territorial problems are better known, due to the strengthening of the information-decision mechanism. This is more true if communities are involved furnishing the local knowledge of the a specific environment. The reinforcement of the action-reaction mechanism indeed and the catalysis of the feedback-loops between environment-communities and decision makers, could reflect on faster and better responses to environmental hazards.

In other words this means an improvement in resilience. So, it should be said that the use of a CIS help to foster the sustainable development and the resilience of the involved community, increasing furthermore the awareness of the population on environmental problems as result of citizen involvement in the process of territorial information gathering.

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