Chapter 36
Participatory Geographic Information Systems Within a Crowdsourcing Environment, With Special Reference to Volunteered Geographic Information

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ABSTRACT

Geographic Information Systems (GIS) are essentially concerned with fixing locations of features and attaching data to them. This geographic data is subsequently used in spatial analysis as a means to support problem analysis and solution modeling through exploratory data analysis and experimentation with various alternative solutions. Ultimately GIS is used for informed decision making. With the advent of technologies that support participation, digital mapping, Global Positioning System (GPS), the internet, Web Mapping, Web GIS, Web 2.0 and Web 3.0 technologies and smart phones, many people all over the world have become capacitated to collect and communicate geo-tagged multimedia information, a phenomenon that is known as crowdsourcing. One example of crowdsourcing is incorporating geo-tagged information collected by volunteers into a GIS. Consequently, crowdsourcing facilitates PGIS to become a powerful practice that can be leveraged to collect geographic data over extensive landscapes and often in near real time.

INTRODUCTION

Geographic information systems (GIS) have come to support most decision making processes in both central and local government settings (P. Jankowski & Nyerges, 2001; O'Looney, 2000). Their power lies in that they are essentially map based (Fiol & Huff, 1992) information systems, where maps derive their intelligence from attached attributes. Topographic maps show land surface features to aid navigation

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and to serve as basis for the production of various types of thematic maps while the attached attributes facilitate spatial analysis. Participatory GIS (PGIS) defines methodologies that ensure contribution of the local community in all processes that determine the inputs, outputs and ownership of the resultant GIS artefact (Rambaldi, Chambers, McCall, & Fox, 2006). Mapping therefore underlies most decision making on the land surface and ultimately shows access to land and the distribution of economic power. Maps then can imbue one with effective argumentation power, especially within participatory GIS (Piotr Jankowski, 2009; Rinner & Bird, 2009). Nonetheless, GIS and mapping have often been criticised as elitist domains of government, the academic institutions and large private firms.

Although mapping is discussed more often in formal settings, mapping is also natural and all people use cognitive maps (Helen Couclelis, Golledge, Gale, & Tobler, 1987; Thorndyke & Hayes-Roth, 1982) every moment of their lives (Portugali, 1996). GIS is also natural and people inertly associate information with locations (H. Couclelis, 2005). The observation that both mapping and GIS are natural in human beings augers well for the mobilisation of the general public to participate in contributing to the compilation of geographic information. The trend in the mobilisation of the public to contribute to the compilation of geographic information spans several decades. In the 1980s strategies included tools such as Participatory Rural Appraisal (Binns Trevor & Nel, 1997; Chambers, 1994), participatory mapping (Bauer, 2009; Wu & Isaksson, 2008) critical cartography (Billings, Casterton, & Cidell, 2008; Harris & Harrower, 2006), counter mapping (Louis, Johnson, & Pramono, 2012; Peluso, 1995; Taylor, 2013), participatory 3D mapping (Dwamena, Banaynal, & Kemausuor, 2011; Gaillard & Maceda, 2009). Post internet participatory mapping instruments included public participation GIS (PPGIS) (Bugs, 2009) in urban planning environments, participatory or community GIS (Aynekulu & Wubneh, 2006; Rambaldi et al., 2006) in rural development environments, geospatial web in collaborative mapping (Sarah Elwood, 2010; Rouse, Bergeron, & Harris, 2009) and crowdsourcing during web 2.0 (Brabham, 2008; Hetmank, 2013; Oomen & Aroyo, 2011). Yet the debate about the value of the contribution of the public still continues, such as the quality of data (Parent & Eskenazi, 2011) and problems of big data (Xu et al., 2016). Yet, within the formal structures, old failures to adopt GIS still persist, such as internal communication and organisational willingness to adopt (Eria & McMaster, 2016). In many other cases, it is the failure to develop national spatial data infrastructures (Oloo & Van der Krapf, 2015) that has been the challenge for many developing country contexts.

For practitioners in rural and community development, planning, engineering works, policy development, natural resources conservation and management and all other practices that aim at the practical interventions in real life challenges, the issue is not about data quality, questions of lack of or inadequate participation, unfair representation or non-balanced power relations (S. Elwood, 2006). In real life challenges, reality is about acknowledging the limitations of epistemologies and technologies while finding practicable innovations to get the work done and to deliver often critical output. Otherwise, research for development discourse becomes irrelevant (Edwards, 1989) when the issues are embedded in academic rhetoric and financing the international development experts. What is often the challenge is the limitations of conventional expert led data collection practices which result in incomplete data pools as well as limited spatial coverage and currency of the data.

On many occasions, when people need to make decisions, the issue of the practicality and cost of collecting data over large and extensive areas then arises; this has been the case particularly in the past. Nonetheless technologies that relate to data extensive and timely data collection have continued to evolve. Since the advent of digital mapping in the 1960s, GPS in 1985 (El-Rabbany, 2002), the internet in 1994 (Hafner & Lyon, 1998) Web 2.0 technologies in 2004 (Alexander, 2006), introductions of

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