New tools for public participation in urban planning - a case from Dar es Salaam

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Public Participation GIS har i efterhånden en del år været foreslået som et relevant redskab for bedre byplanlægning også i de hastigt voksende storbyer i udviklingslandene. Der synes dog ikke at være så mange eksempler på, at PPGIS er velintegreret i planprocessen. Denne artikel handler om nye tekniske muligheder for fælles kortlægning, registrering og deling af geografiske informationer gennem web-baserede services som f.eks. ArcGIS-Online. Vil disse kunne tages i anvendelse af berørte borgere og medvirke til en bedre byplanprocess og en forbedret retslig stilling for storbyens marginaliserede grupper, sådan som det har været foreslået?

1. Introduction

In its traditional meaning, Public Participation GIS (PPGIS) seeks to involve and empower segments of society that are traditionally marginalized from the decision making process concerning issues related to place (McCall, 2004). This is done by supporting the creation and analysis of various types of spatial data as well as the shared access to these data. In this context PPGIS is seen as a vehicle for supporting better planning practices aimed at social justice, equal service and, more generally, for improving the quality of life (Yaakup et al., 2004). It is commonly understood that PPGIS requires technical solutions that focus on properties such as broad acquisition and ease of use (Haklay & Tobon, 2003).

The concept of PPGIS which was originally coined in North America changes somewhat according to the spatial context of its application. In Denmark web-based GIS tools are used by municipal planning authorities for facilitating public dissemination and discussion of spatial planning proposals. The idea is that planning implications may be explored by individual citizens who can access a number of relevant data layers and, ultimately, that critical feed-back to the planning authority is provided. In many cases such systems are closed and will only allow access to the data provided by the authority. In order to fully qualify as a PPGIS it could be argued that the possibility of integrating data sets obtained from other sources or collected by a group of citizens is required.

1.1 PPGIS in Tanzania

This paper deals with the situation in Sub-Saharan Africa, more specifically in Dar Es Salaam, Tanzania. We argue that certain aspects of recent advances in software and strategies of companies such as Google and ESRI and new platforms for PPGIS may potentially bring the sometimes 'oversold' concept of developing world applications of PPGIS closer to reality.

Urban development in countries like Tanzania faces a number of challenges: rapid population growth, largely uncontrolled and haphazard spatial development, inadequate housing provision, constant traffic jams, lack of accessibility to many areas, high levels of pollution etc. This especially affects the living conditions of marginalized segments of the population. Vacant urban space in central Dar es Salaam is occupied by settlements of people who have been forced out of other areas within the city or have migrated to the city from outside. In some cases these settlements are informal and strictly speaking illegal and in other cases people have been officially 'moved to' the area in order to make space for land development projects or for other reasons. The conditions of living are insecure since no formal rights of land are obtainable; furthermore there is a lack of public service, often close proximity to different types of waste dumps and frequently on-going land conflicts with other groups or individuals. Also, there is a vulnerability to effects of climate change, without means to mitigate such

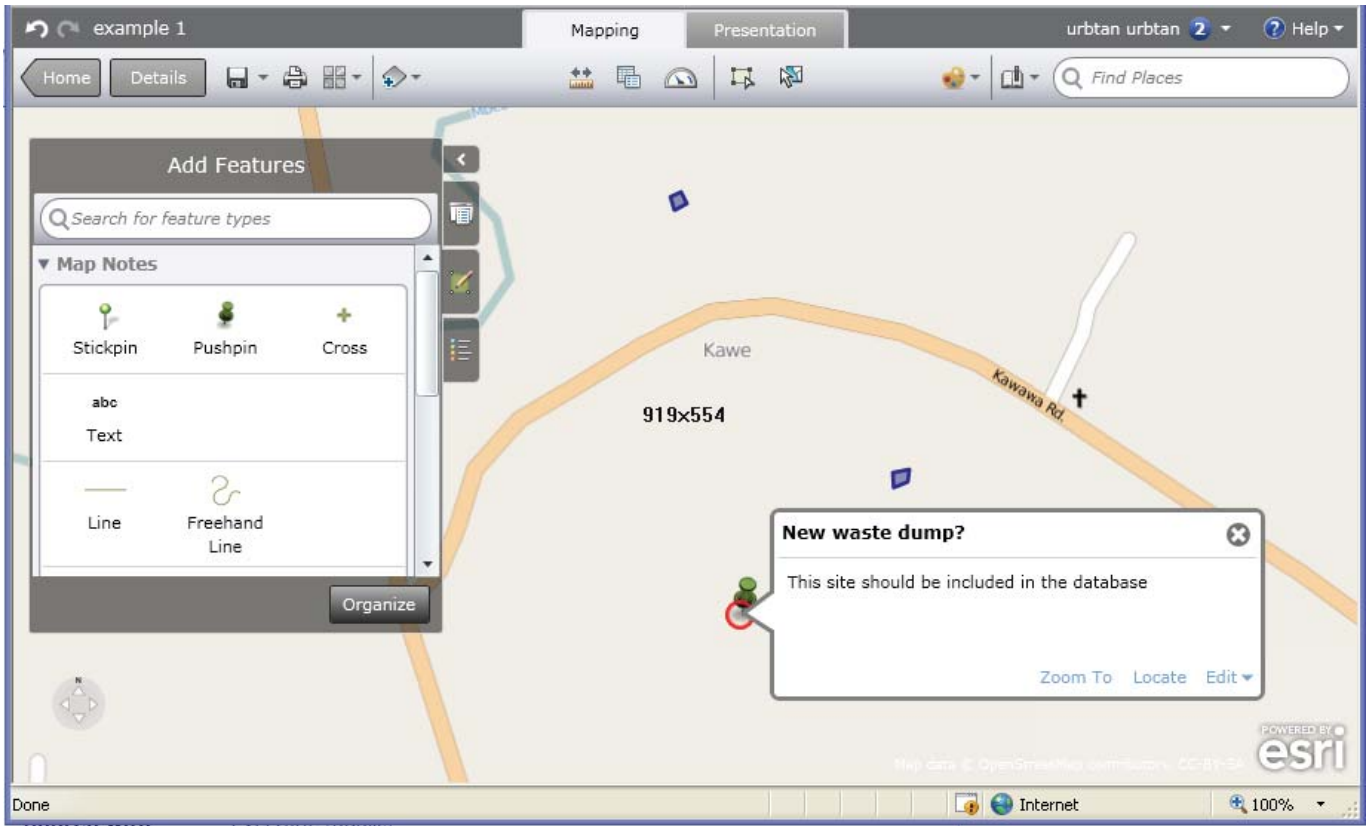

Figure 1. Community-based mapping using ArcGIS-online. Tools exist for establishing the local map content by attaching push pins, attribute data and annotation directly to the map while online.

effects. PPGIS can be seen as a vehicle for both documenting the actual conditions in local neighbourhoods and, moreover, for helping to document and secure spatial property rights. It has been argued that the inability of marginalized groups to gain formal recognition of their property rights is a major stumbling block to alleviating poverty (de Soto, 2000).

1.2 Collaborative urban planning

Urban planning authorities in Dar es Salaam are mainly hampered by lack of enforcement power, lack of funding and the issue of corruption. Nevertheless, a functioning urban planning system is necessary to reach the goal of more sustainable development of the large urban areas in the future. Public participation in decision making can be viewed as a corner stone within a collaborative planning framework aiming at better governance. Planning is seen as ”reasoning together”: According to Rambaldi et al. (2006) PPGIS provides an information infrastructure that facilitates interpersonal communication and debates towards achieving collective goals. It enables urban land administration at the grass root level. Moreover, it potentially mobilizes opportunities at the grass root level to enable a more effective bottom-up land use planning and administration effort. Keywords are *scenario planning, dispute resolution, public facility siting, access to service provision, and environmental issues.* This requires a general sharing of spatial knowledge within a user community.

Whether these ‘golden’ predictions related to public involvement facilitated by PPGIS have any merits to them depends to some degree on the types of software and hardware platforms available and their cost and level of penetration.

2. New platforms for PPGIS

2.1 Community-based mapping

One example of an activity related to PPGIS is the concept of community-based mapping. It involves registration of objects in the local neighbourhood or community and mapping of the relationship between this neighbourhood and the surrounding urban areas. Potential challenges for this activity have traditionally been:

- Low data availability at the local level.
- Low availability of general base maps for African countries.
- Problems with collection and upload (file formats) of GPS data collected by the community.
- Problems with data conversion and compatibility between maps. What type of software should be used for conversion if necessary?
- Advanced GIS tools (desk-top GIS) may be needed to complete the process.
- Issues of data currency and quality checks as well as maintenance (updating) of data and map product.
- Problems concerning map sharing and multi-user contributions to maps.
- Pricing of data.
- Copyright issues may hamper dissemination.Several different technical strategies have recently evolved that potentially reduced the negative effects of these challenges and support the creation, use and sharing of spatial data within the context of PPGIS.

These include:

- More easy and low-cost ways of setting up adhoc web-based solutions that handle spatial data through service providers without the requirements for managing server solutions. Free services support the creation of community maps as a collaborative effort.
- Good quality base maps, specialized maps, satellite images, templates etc. increasingly available online.
- More advanced GIS server solutions for professional environments that support various platforms.
- More easy collection of spatial data, upload and field validation through mobile devices (GPS-enabled mobile phones) or handheld GPS.
- Widespread access to mobile internet in many African cities.

It can be concluded that the task of creating community-based maps as an aspect of public participation efforts is potentially supported by the higher availability of GPS devices and smartphones with GPS, the possibility of using online map resources (such as Google Map and ArcGIS-online) and the online availability of air photos and high-resolution satellite images. The next section provides an example of its application.

2.2 ArcGIS-online

An example of a commercial product that is targeted towards the above described application is ArcGIS-online (ESRI, 2012b) that has recently been launched. While potentially supporting a number of activities related to PPGIS it also still presents some problems when exposed to the reality of Sub-Saharan Africa. This is elaborated below.

ArcGIS-online can be seen as a free ESRI provided cloud repository for digital maps, GIS-data and functions. It facilitates creation of online maps by users or user groups (ESRI,2012a). Base maps, aerial photos and satellite images are available for the whole globe although in varying scale and quality. It supports easy sharing of maps and geodata between members of a group over the internet. It is basically free. Users can access data and some GIS functionality using only a web browser. It has a flat learning curve concerning setting up web pages with GIS content.

The first step is to establish a basic map that includes a relevant base map background extracted from the common library

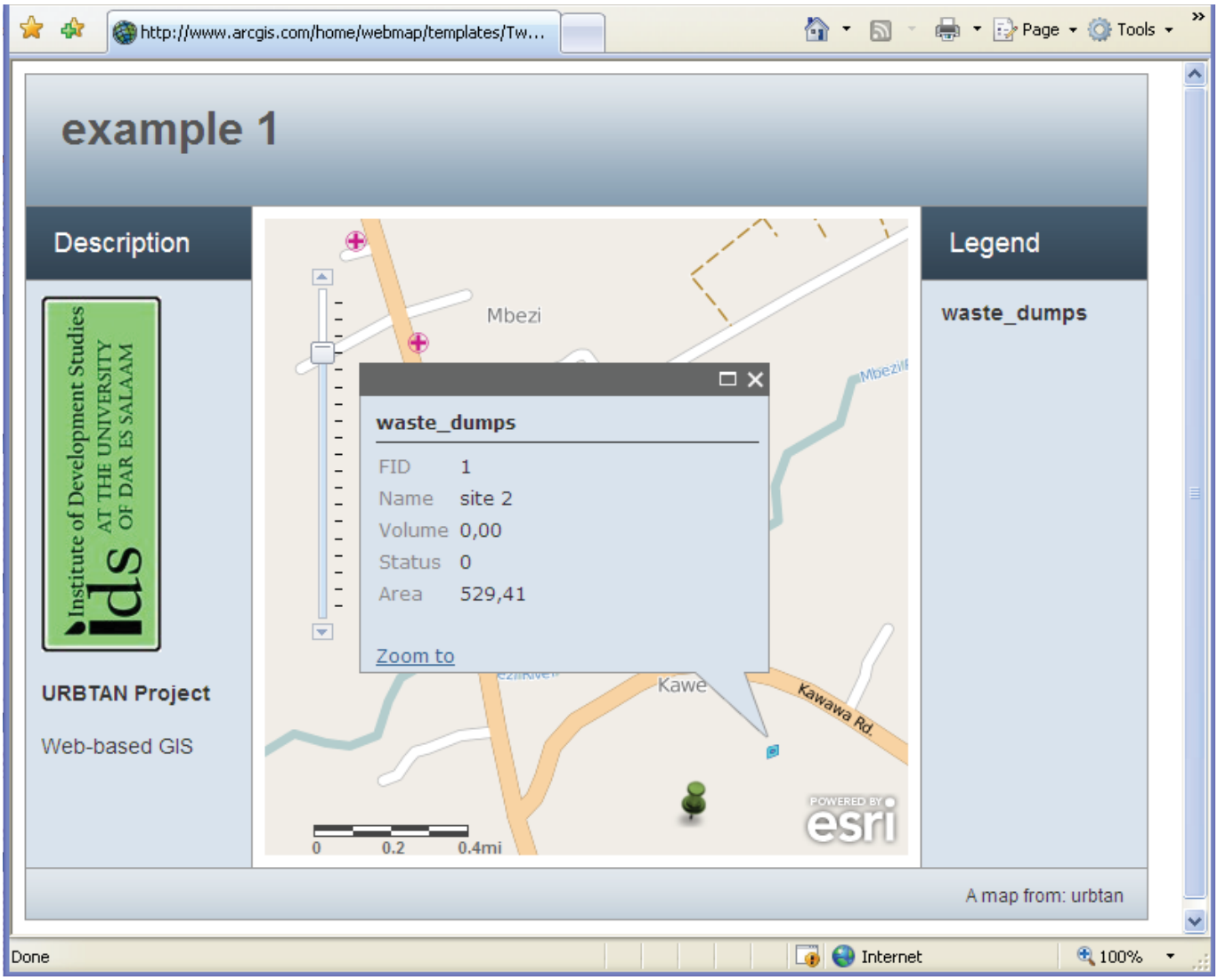

Figure 2. Easy access to web-based sharing of spatial information within community groups. Demo example of a system set up for mapping the location of waste dump sites in a residential neighbourhood in Dar es Salaam.

of maps but without any community specific data. Establishing the initial map requires a free log-in ID that is also used to control the sharing of the map. The new map is saved on ArcGIS-online with a name and tags to facilitate search, and sharing parameters are set. It is straight forward to include data layers, satellite images etc. residing on other map servers than the one hosted by ESRI.

As a tool for PPGIS, ArcGIS-online is primarily designed with direct on-screen interaction with the map in mind. Tools exist for establishing the local map content by attaching push pins, attribute data and annotation directly to the map while online, see figure 1. A number of graphic symbols are available for mapping different types of objects in the neighbourhood. This can be done as a collaborative effort by different users that are granted access to the map.

In many real-life cases it is, however, not feasible to add local data by applying push pins directly to the online map because the base maps are not detailed enough or do not include the content to enable a precise demarcation of the local object to be mapped. It is more relevant in these cases to obtain GPS-coordinates of objects using hand-held GPS devices possibly in combina-

tion with on-screen interpretation and digitizing of high-resolution imagery, f.ex. from Google Earth. Currently it appears to be a bit of a challenge to transfer the collected data to the ArcGIS-online service, especially if a desk-top GIS is not available. If location data are collected by GPS devices these data will need to be converted into the shape file format and subsequently zip'ed. If data are digitized on-screen using a Google map services data would have to be converted from KML vector format to shape file format. In both cases, this requires access to either a desk-top GIS or to other conversion software. Any existing data sources in shape file format may be directly uploaded and added to the map although they need to be zip'ed before upload.

3. Suitability for Public Participation GIS

Once established on ArcGIS-online the map is searchable and visible within the ArcGIS-online environment. The map can be viewed, expanded and edited using either the build-in map viewer or the online ArcGIS explorer (see figure 1). Community users who are granted access may draw objects on the map and provide additional text. It can also be imbedded in standard web-pages and viewed through an internet browser. Figure 2 shows a demo example of a system under development for mapping (and sharing) the location of urban waste dump sites in a residential neighbourhood in Dar es Salaam. The intention is to expand this into a test bench for public participation activities. Under specific consideration is the challenge of setting up a balanced partnership between local representatives and supporting institutions with funding and technical expertise. The overall aim is local empowerment and participation towards better planning and it is important that interest for - and understanding of - the technology and its potentials are created within the local community. Use of computer applications - net access etc. - within the local environment is, however, still a challenge. While local data collection using hand held GPS devices, cameras and survey techniques is expected to be feasible, it is still to be determined to what extend further processing and sharing of the data can be done within the neighbourhood.

As an example of a service provider for individual and community-based mapping the ArcGIS-online environment presents a free and relatively simple solution that does not require high levels of GIS skills. Navigation within the systems is, however, not fully logical partly as a result of the different and partly overlapping ways of using and editing the map. The system is clearly focused on the on-screen mapping task and the idea of collaborative and shared mapping. Focus is on graphic map symbols and simple queries rather than data analysis functionality, export of raw data etc.

For comparison, let us briefly look at an alternative: the GIS Server solution, f.ex. the ArcGIS-server also provided by ESRI. ArcGIS-server is a software solution for managing your own GIS web server with full control over accessibility, functionality, upload etc. It is capable of providing extended GIS functionality through the internet, e.g. buffer zoning, network analysis etc. It can provide good support to mobile devices for data collection, map updating etc. The drawback is of course that it is a very expensive solution and more complicated to run and therefore out of reach of urban neighbourhood communities without extensive financial and technical management support. The 'cloud' solution provided by ArcGIS-online is easy to gain access to if a standard PC and internet is available and in this respect the strategy seems affordable and suitable in the African context. It is, however, questionable whether the service is sufficient for supporting all aspects of community-based mapping for public participation. Additional software and hardware for conversion and data collection will most likely still be required.

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