Assessing water service coverage by placeholders: a social media simulation

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Abstract

This paper presents the simulation of a social media approach to assess village domestic water services coverage by using a combination of known methods to capture placeholders. Placeholder is location based information given by local people who are familiar with a specific area due to a longer period of living in, using and managing that area. Placeholders as such represent experiences and perceptions of local people. This simulation has been realized during 2011-2012 in the Kondoa district of Dodoma region Tanzania to find out in what way local communities may support water services given the options of upcoming mobile technologies. Simulation has been done by collecting data through sketch mapping, geocoded transect walk, focus group discussion and cross-checked by interviews. Results of the simulation show that this type of community water service mapping supports collection and validation of relevant, accurate and representative information on water service coverage at village level. It depicts the intersections between seasonality and accessibility to water services, revealed yet unreported intra-village variation and has added value for updating the status of water services and assessing their adequacy at the village level, in the light of population change and development of new settlements. Regarding social media the acquisition and control of point based waterservice facilities may be an easy first step to set. However the link to a wider community accepted spatial context and options to update village demographics and settlements demand for baseline data and inclusion of social infastructures.

Introduction

Domestic water is a crucial input and resource for a household's livelihood activities, health and sanitation needs. In Tanzania the proportion of the rural population with access to potable water services has been gradually increasing from about 46% to 57% during the 1990s to 2010 (URT[1], 2002, 2009a, 2010a, 2011a; MoWLD et al., 2002). However, about 40% of the rural water schemes are not functioning properly due to hardware problems, sources being dry and poor management (Giné and Pérez-Foguet, 2008; Taylor, 2009a, 2009b). Non-functional water schemes disrupt water access indicators guided by the 2002 national water policy. That policy defines water as accessible when one water point serves 250 persons within a distance of 400 meters and users spend no more than 30 minutes for a round trip (URT, 2002, 2008a, 2010c, 2012). A water collection round trip is defined as going to the source, waiting in line to collect water and coming back to the house. Moreover, studies indicate under-reporting of the non-functionality and over-reporting of service coverage in terms of accessibility (URT, 2010b; Welle, 2010). This leads into inaccurate information which interferes the sector's management for many years (MoWLD et al., 2002; URT, 2010b; Jiménez and Pérez-Foguet, 2010a, 2010b, 2011b).

To address the problems on information anomalies in the water sector, water point mapping (henceforth WPM) was introduced (URT, 2010b, 2011b; Jiménez and Pérez-Foguet, 2011b). The WPM approach was designed by WaterAid to measure access indicators for improved water points in a specific area (Stoupy and Sudgen, 2003). WPM supports visualisation of the relationship between physical and socio-economic factors related to access to water and reveals patterns that would otherwise be difficult to see (MacDonald et al., 2009). In Tanzania since 2000s, WPM has been used by international and local organisations working with water and development sectors such as WaterAid, Stichting Nederlandse Vrijwilligers

[1] URT stands for United Republic of Tanzania

(SNV) and the resident Ministry of Water (Welle, 2005, 2010; SNV-Dar Es Salaam-TZ, 2010; URT, 2010a). WPM has been applied in other African countries including Ethiopia, Ghana, Nigeria, Malawi, Uganda and Kenya (cf. MacDonald et al., 2009; Welle, 2005, 2010). Most of the WPM applications in Tanzania have been done beyond village level, on an ad hoc basis, and is neither well consolidated at the national level nor regularly updated (Jiménez and Pérez-Foguet, 2010a, 2010b; URT, 2010a). Previous studies on WPM (Jiménez and Pérez-Foguet, 2008, 2010a, 2011a, 2011b) do not explicitly show how villages and households participate. Therefore, the outputs from WPM is likely to miss processes at the micro level i.e. villages and households; because its applications lack inputs from the actors who are local service managers and users. These inputs we call placeholders; actual location based information given by local people who are familiar with a specific area due to a longer period of living in, using and managing that area. Placeholders as such represent knowledge given experiences and perceptions of local people (Vervoort et al., 2013). Placeholders may overcome mismatches regarding local in time needs due to questionable validity of the information in terms of relevance, correctness and representativeness.

Additionally, villages depend on the District Water Department (henceforth DWD) for technical expertise when their water infrastructures break down. To get the required assistance members of the VWC inform the Village Executive Officer who then notifies the District Water Engineer (URT, 2010a). In these procedures location based information is rarely used because it's hardly available at the district and village levels. If it is; it is fragmented, outdated, poorly accessible, or not in standardized formats, which hinders timely and appropriate interventions.
Besides, the DWD uses population size from census and national surveys such as the Household Budget Surveys and the Health and Demographic Survey to plan for village water projects. These figures tend to be outdated because Tanzania conducts a census once every ten years and the surveys are scheduled in different periods. To actualize population's information, the DWD makes projections. Such projections estimate population size rather than its composition and spatial distribution, which are much affected by internal migration. This information's weakness, compromises achieving the national standards which depend on population size and distribution to determine accessibility to water service.

Thanks to the development of information and communication technology the setting of information exchange is changing dramatically. In Tanzania the 12 network operators did expect that by 2015 40% of the area and 80% of the population may be covered (http://www.africamobilenetworks.com/our-coverage/tanzania). Such mobile network coverage gives way to liberating GIS technology (Sui, 2015) in which social media (Waal et al., 2013) may support actual information on local water services by tackling the previously mentioned issues. Placeholders may help to rectify information irregularities in the rural water sector. This calls for an approach which we call Community Water Service Mapping (CWSM). CWSM simulates social media needs to find out if placeholders can be created. CWSM addresses the following questions: (1) what is the added value of the CWSM approach to assess water services coverage at village level? and (2) how do methods and processes involved in the CWSM enhance the relevance, accuracy and representativeness of micro-level information?.

Community water service mapping: a theoretical framework

The base of the intended social media should be grounded in community mapping (Amsden and VanWynsberghe, 2005). Community mapping produces maps which communicate information that is shared, relevant and important to the community needs based on open, interactive, transparent and inclusive processes (Parker, 2006; Corbett and Rambaldi, 2009). Community maps are made through the participation of community members who live in and do know the area. In this way they may co-create and locate, by visualising as map, micro-level, up-to-date information (Glockner *et al.*, 2004; Corbett and Rambaldi, 2009). As such this placeholders represent micro-level understanding on their locality that enhances the power and capacity of the local community (Amsden and VanWynsberghe, 2005). This approach has been advancing parallel to critical cartography and participatory Geographical Information Systems, and, recently, qualitative GIS (Elwood, 2006; Parker, 2006; Corbett and Rambaldi, 2009; Elwood and Cope, 2009; Wilson, 2009, Sui, 2015). Besidesthere is scant academic literature showing the application of community mapping in rural-public domestic water services.

CWSM in this study views villages as heterogeneous and dynamic entities in terms of population composition, size and spatial distribution. Besides, the methodology is attributed by its capacity to elicit users' perspectives on the spatial aspect, which are not easily captured through other methods of data collection such as a household survey (Cleaver and Elson, 1995; Glockner *et al.*, 2004; Amsden and VanWynsberghe, 2005). In our study, CWSM merges and integrates three methods: Focus Group Discussion, participatory sketch mapping, and geo-coded transect walk. The triangulation by combining these methods enhances information validity in terms of relevance, accuracy and representativeness (Figure 1). In line with the concepts of geo-information placeholder relevance refers to actuality of the information, since CWSM connects the source of information with the current state of micro-level features and phenomena. Accuracy of the gathered information refers to the quality of the described states, events and locations. Representativeness of the information refers to the daily lives importance and link to (concerted).

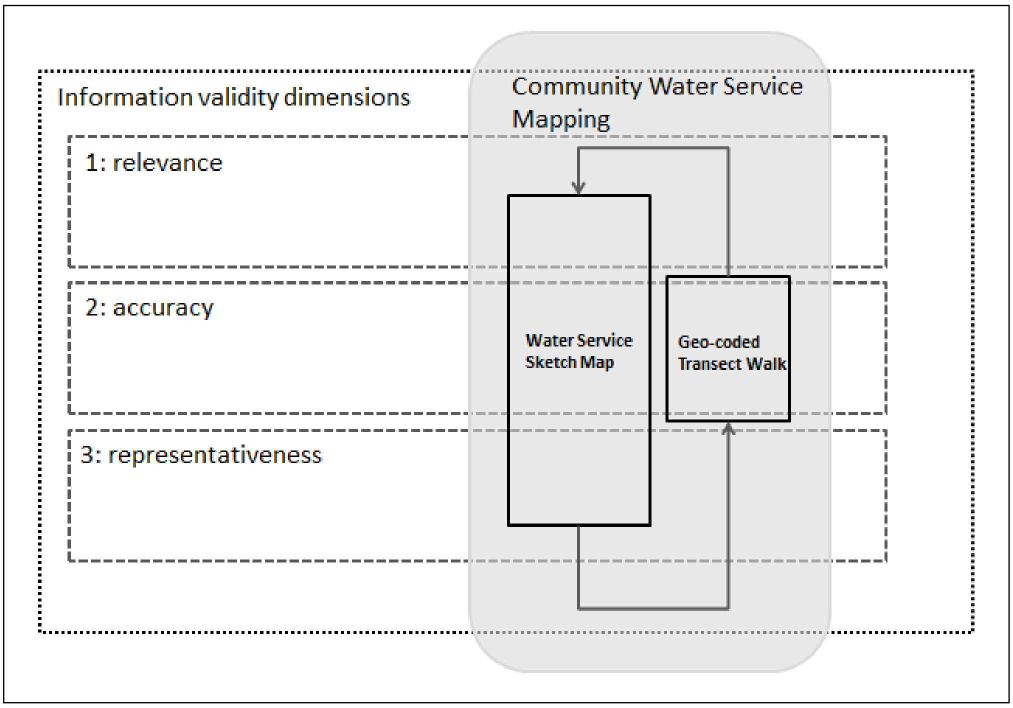

Figure 1: Community Water Service Mapping related to information validity dimensions (Inspired by Vajjhala, 2005).

Regarding the validity dimensions, the added value of CWSM realized placeholders by:

i. Investigating the appropriateness of water service delivery and existing infrastructures *from the perspective of the users;*
ii. *Documenting the actual functioning of the services and infrastructures and their shortcomings* as experienced by the users while taking into account seasonal variation;
iii. *Eliciting demographic trends* that according to the users have consequences for services delivery in terms of adequacy of the infrastructures; and
iv. As much as possible *involving representatives of different groups of users* and varied experience of users in the process.

Despite its practicality and potential, CWSM, as other participatory approaches, faces challenges related to the participation of actors and its implications for the inputs and outputs (McCall, 2004; Amsden and VanWynsberghe, 2005; Chambers, 2006; McCall and Dunn, 2012). More specifically, these challenges deal with information ownership and uses, legitimacy of the empowerment, power relations, and trust between the mapping participants. The latter refers to local participants and facilitators (most of the times these are outsiders), which raises issues of institutional and interpersonal trust (Abbot *et al.*, 1998; Rambaldi, 2004; Chambers, 2006; Corbett and Rambaldi, 2009; McCall and Dunn, 2012). Other challenges include unintended and unanticipated consequences, such as heightening tensions and uncertainty in the community (Corbett and Rambaldi, 2009; McCall and Dunn, 2012), which could become a source of conflict between and within communities (Abbot *et al.*, 1998). Besides, this simulation is time consuming, but the output is worth the time invested in it (Amsden and VanWynsberghe, 2005; Chambers, 2006; Corbett and Rambaldi, 2009).

To mitigate the challenges pertaining to the methodology, we paid repeated visits to the village to do the following: familiarisation, collecting demographic data through household survey, building trust and networking with villagers and leaders. Note the survey data are not used in this paper. These visits enabled us to clarify the intention of our research to the community and leaders and inform them on the uses of the results, for them to make informed decision to participate or not.

Context, aims and activities undertaken

The simulation was conducted by field research in Kidoka village, in Dodoma region in November 2011 through September 2012. The village is located on the Kondoa-Dodoma main road, 65 kilometres from the Kondoa District Council headquarters. Kidoka was selected because it is a good representative of the villages' water service development and of the management shift from the VWC per se to VWC in collaboration with a private operator. Data collection was done by combining Focal Group Discussion (FGD), participatory sketch mapping, and geocoded transect walk. Through the FGD, mapping participants produced a sketch map with village resources and water services on two joined flip charts. According to Mohamed and Ventura (2000), the geocoded transect walk entails a walk with a hand-held GPS receiver (Garmin 12) to collect positional data (UTM) and write all observations related to mapped items in a field notebook. During the transect walk a digital camera was used to capture location based photographs of the physical condition of the water points and other water infrastructures which is rather common in social media. To double-check our findings and to get leaders' insights on our study we interviewed the following village leaders: village's chairperson, council members and executive officer. Nine villagers, six men and three women, participated in the mapping exercises.

The mapping participants were selected based on the following criteria: availability and willingness to participate, involvement in village leadership and experience in local politics, duration of living in the village, gender, age and involvement in water services management. By using the earlier mentioned criteria, a tendency of "community homogenisation" was avoided Craig et al., (2002), the essential parameters of participation of types of participants and their roles in the mapping exercise were included (cf. McCall, 2004; McCall and Dunn, 2012). The composition of the focus group was not meant to represent the village as a whole, the criteria applied to compose it aimed at benefiting from participants' knowledge and perspectives diversity. Its size had to be kept to the limits amenable for the focus group discussion (cf. Morgan, 1996). Regarding duration of living in the village, six participants were natives and three had migrated to the village at the end of 1990s. The participants had different ages, ranging from 39 to 67. In terms of education, six participants had primary education, two had secondary educations and one had post-secondary education. All nine participants were farmers and were engaged in small-scale business. One of the three women had been a leader in the women's wing of the current ruling party. The other two women were not involved in any political activity. Three of the six men had been involved in village leadership at different capacities during the 1980s and 1990s.

The mapping exercise was carried out in a classroom at Kidoka primary school. That setting supported discussions among participants and between them and a researcher. The size of the flip charts was sufficiently large to allow interactive mapping. After having completed the sketch map, three mapping participants accompanied the researcher for the transect walk, to record the location of the water distribution points and other on-site attribute data through observation. These participants clarified users-waterpoint interaction to the researchers to avoid misinterpreted observations. During the mapping process, a checklist was used to understand the appropriateness, accessibility and functionality of domestic water service from the users' perspective.

Main results and lessons learnt

Kidoka village and context of domestic water service

In September 2011, the village had 784 households and a population of about 3274 in its four subvillages Mkalama (910 persons), Mkombozi (911), Shule (684) and Kimambo (769). Kidoka has mixture of tribes, mainly the Rangi and Gogo others are Maasai, Sukuma, Barbaig and Bulunge. During the fieldwork, the village leaders reported on the migration of Sukuma and Barbaig pastoralists to the village. The main sources of income are farming and animal husbandry. The current water project was established in 2007, through the Water Sector Development Programme that supports the implementation of the Rural Water Supply and Sanitation Programmes. To establish the project, villagers contributed money and physical labour to meet the criterion of a 5% village's initial contribution to the capital investment (Giné and Pérez-Foguet, 2008). To plan for this water project, the DWD used the population from the 2002 Census.

Water infrastructures in Kidoka comprise one diesel-pump borehole, seven domestic distribution points, one cattle trough, eight water meters and one pump house. The number of domestic distribution points varies per subvillage; there are two in Mkalama, two in Mkombozi, three in Shule and one in Kimambo. In Shule subvillage, the waterpoint at the village dispensary is not functioning. With regards to functional water points, the average number of users per waterpoint is 467. This implies a shortage of water points because the existing ratio exceeds the national standard (one water point per 250 people) by 217 people.

The water project is managed by the eight members (four men and four women) of the VWC and operated by a private operator. The equal number of men and women in the VWC conforms to the requirement of the 2002 water policy. The VWC members are elected through the village assembly. Each sub-village has two representatives in the VWC, a man and a woman. From the FGDs and interviews with the leaders, the following qualification criteria to become a member of the VWC transpired: being an adult (aged 18 and above), able to read and write, trustworthy, and willing to volunteer. The last two criteria are essential because VWC's members handle money and are not compensated for their time. The VWC meets once a month and it convenes an extra meeting when there is an emergency such as a breakdown. The current members of the VWC were elected in April 2011 and had not been provided with any training. They manage water services through sharing their experience with the village leaders and other villagers who are willing to contribute their knowledge upon request.

According to the village secondary data on water management and the FGDs, the private operator is contracted for one year through a tender conducted in the village. The village receives technical support on contracting the private operator from the district council mainly the DWD and the District Legal Officer. The private operator is responsible for the 'minor' operation costs (minor repairs), paying monthly allowances to the pump attendant and the security guard, and daily allowances to water sellers. Repairs are considered minor when the costs do not exceed TSH 100,000/= (about US$ 63.98)[2]. The daily allowance is for seven water sellers, six for the domestic distribution points and one at the cattle trough. Each water seller is paid TSH 2,000/= (about US$ 1.28) per day.

The users' fee is paid per bucket of 20 litres, at TSH 20/= (US $ 0.013) and TSH 30/= (about US$ 0.019) per head of cattle and TSH 10/= (about US$ 0.006) per head of goat and sheep. As reported by the Village Executive Officer and the VWC treasurer, the private operator is required to pay the village every month with specifications based on seasonality. During the dry season, mainly from July to November, the operator pays the village TSH 800,000/= (about US$ 511.84) and during the rainy season, from December to June, the operator pays TSH 100,000/= (about US$ 63.98). The amount of water revenues the operator pays to the village during the dry season exceeds that of the rainy season by TSH 700,000/= (about US$ 447.86). This is because during the dry season the villagers use more water and people from neighbouring villages with unreliable sources come to Kidoka to get water for domestic uses and livestock. Seasonal fluctuations in the availability of water in rural water schemes are known in other

[2] Based on exchange rate of 1 US Dollar equal to 1,563/= Tanzania Shillings on August 2012. The exchange rate was taken from Indicative Foreign Exchange Market Rates in the Central Bank of Tanzania in http://www.bot-tz.org/Default.asp.

African countries as well, as documented in various studies (Katsi *et al.,* 2007; Arouna and Dabbert, 2010; Aper and Agbehi, 2011). Looking at the terms of payment of the water service provider's contract, we see intersections between the water service, seasonality and the legal context. However, the legal context is not the focus of our research.

Community mapping process and participants' roles

The CWSM participants provided inputs in the mapping activity on village boundaries, land uses and land cover, public social services, and the location and condition of water distribution points. Before drawing the sketch map, the participants discussed the location of the village in relation to the main road and the compass direction. During that discussion, the participants requested two old village maps to use as references. At first, they requested for the oldest map available in the village which was used when Kidoka was an Ujamaa[3] village in 1970s. It shows the layout of different land parcels and their uses during the Ujamaa era. The second map was made during the village registration exercise in the 1980s by the Ministry of Land, Housing and Settlement Development. This map mainly shows boundaries that demarcate Kidoka and neighbouring villages. The maps referred to are shown in Figure 2 (although not very visible). While referring to the old maps, discussions on historical issues continued among the participants and they affirmed that the old maps helped to place their village in the right location and identify its boundaries with the neighbouring villages. The following fragment of the discussions during and after mapping exercise illustrates this:

> *"These two old maps have helped us to find a starting point to draw the sketch map and to place our village in the right location. In fact, the old maps have enabled us to use relatively less time for the mapping exercise because we did not have to figure out so much about the site and boundaries of our village by ourselves."* (Mapping participants in Kidoka village, 8 August 2012)

The previous quotation affirms Corbett and Rambaldi (2009), findings on ability of community mapping processes to illustrate close relationships between local people and their area, which Parker (2006) refers to as inclusion which supports partly the idea of placeholders.

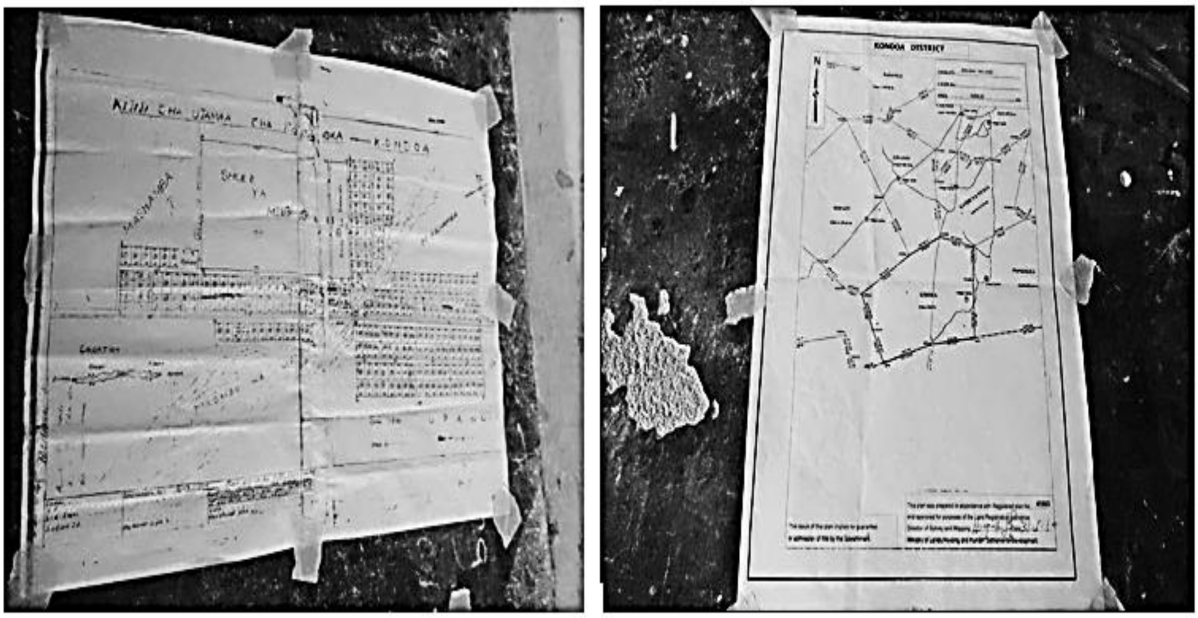

Figure 2: Old maps of Kidoka village used as point of reference during the mapping exercise
The map on the left-hand side was used in Ujamaa village management and that on the right-hand side was used during the village and land registration exercises

[3] The Ujamaa concept was introduced in 1960s in Tanzania by its first president the late Julius Nyerere as the core focus of social and economic policies for rural development based on collective agriculture and the villagization approach

In a study carried out in Canada by Johnson (1992) as cited in Corbett and Rambaldi (2009), it is pointed out that local knowledge about the land in participatory mapping is communicated in form of stories. Using the two old maps, the participants started to draw sketch map by beginning with the main road, public institutions at the village centre, and the boundaries between the study area and other villages. When asked why they started with those areas, the participants explained that they always use the main road to travel and to go to the public institutions, such as the village office, primary school, and dispensary. This demonstrates the connection between the mapping participants and important public spaces in their environment. Our findings concur with a study on community mapping in Canada that discovered that "maps are able to capture emotional and other abstract connections experienced by the mapmaker" (Amsden and VanWynsberghe, 2005: 361).

During the mapping exercise, the following patterns were observed: division of roles related to map drawing based on age and sex, interactions among men and women, age variation among group members and turns in speaking per subject matter under discussion. Older men and women from 55 to 67 years dominated the discussion on village boundaries, changing land uses and linking it to the history of the village since its establishment in the 1960s. Two relatively younger men (39 and 45 years) had been chosen by their fellow participants to lead the drawing exercise because they could draw faster than the others. One of the two men had participated in the mapping exercise during the preparation of the 2009 village development plan. There were no major differences between men and women participants in terms of their contribution; though an age pattern could be observed in the discussions on the settlement and its expansion when labelling residential areas. Participants in their early 50s and older who are natives of Kidoka village could say more on the expansion of settlements in Majengo, Songambele, Mbagostaa and Ndachi neighbourhoods that were previously farmlands. The use of the old maps in our study has enthused retrospective dialogues and enhanced the correctness of the sketch map as shown in Figure 3. This corroborates the findings of Corbett and Rambaldi (2009) that show that local and supplementary sources of spatial and non-spatial information have the potential to improve the accuracy of the final map output.

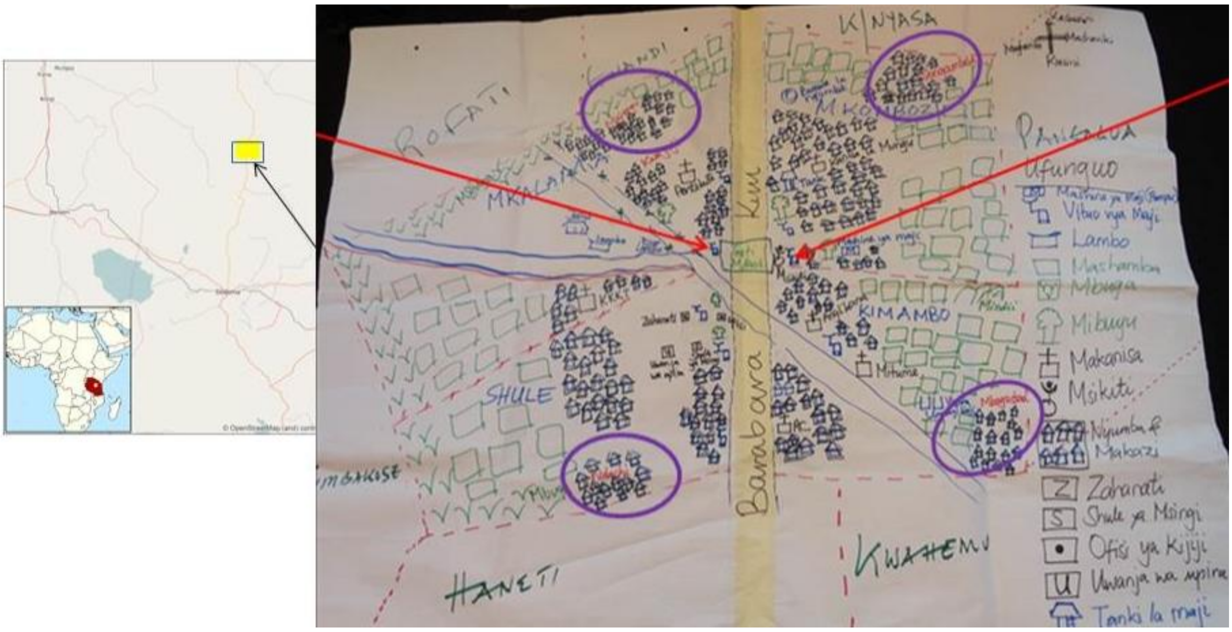

Figure 3: Kidoka village skecth map showing village resources and dynamics in accessibility to domestic water service (arrows point at water points during the rainy season; circles show recent residential areas)

Geocoded transect walk and inspection of water infrastructures' condition

Throughout the geocoded transect walk most water infrastructures observed had some defects, such as leakage in a water tank, broken water meters (all 9), cracked and missing water meters' tops (6 out of 9), broken taps (2 out of 8), and an incomplete pump house. Figure 4 shows a set of photographs displaying water infrastructures with defects. The sustainability of the water service in the study area is at jeopardy if immediate and essential measures to repair the infrastructures are not taken.

From the FGD and the interviews with the village's leaders, we discovered that leakage of the water tank and non-functionality of water meters occurred since 2007, just a few months after project inception. Nevertheless, since then the tank and meters have not been repaired. The situation has not been given due attention, because the breakdowns have not (yet) caused acute unavailability of water services in the village. In the discussions while mapping, it transpired that type and prominence of broken-down water infrastructures influence promptness to repair it. The village's chairperson commented: *"The water pump is a very important machine for water availability in the village. Its importance to the availability of water service in this village is almost like that of the heart to human life"* (Village's chairperson, 7 August, 2012). We confirmed from the mapping participants that women play instrumental role in the VWC and 'push' timely repairing of the water pump whenever it collapses. One participant clarified:

> "*Truly the women in the water committee are a very big 'push', because when the water pump is broken women members insist that it should be fixed on the same day or very quickly because the broken pump implies no water in the village. Absence of water affects women more because a woman always 'plays with water'. Women will be required to walk longer distances to fetch water from our neighbouring village called Haneti, which is very far by foot"* (Chairperson of the VWC, 8 August 2012).

The above quotation reaffirms that women's roles in provision and collection of domestic water subject them to more difficult experience than men whenever water pump cease to function (Mandara *et al.,* 2013). The leakage of the water tank inhibits its use to its full capacity, which compels the pump attendant to pump water twice or thrice a day. This is inconvenient to the attendant, especially during the farming season. The broken water meters in all eight distribution points pose a challenge to the monitoring of water funds, because neither the VWC nor the operator can keep track of the exactly amount of water pumped and the revenue from selling water. Other studies have found that unmetered water supplies lead to heavy losses of revenues to water utilities (Mashauri and Katko, 1993; Chitonge, 2010). Likewise, presence and use of working meters support the estimation of the daily amount of water and generated revenue in the village. When broken-down parts of water taps are unattended for a long time, it may lead to major failure of the water point and ultimately interfere with the sustainability of the whole project. The loose window in the pump house (see picture in Figure 4) jeopardises security of the pump and its frames. From a technical and managerial perspective, neglected, broken and loose infrastructures may deteriorate and become costly to replace.

2) Water tank leakage can be seen in the darker part, halfway the tank

1) Broken water meter

3) Broken part of the water tap

4) Pump house with loose window

Figure 4 Photographs showing water infrastructures with defects in Kidoka village (photos by C. Mandara during the fieldwork 2011/2012).

The GPS captured locations of water service facilities, like in WPM, gave geometrical correct locations which have been compared with the water services locations in the sketch map. The spatial relations between the water service facilities is in both data sets comparable but the geometrical precision shows doem distortion as indicated in Figure 5.

Seasonal water services accessibility

A wide range of literature has reported on the relationship between seasonality and the availability of domestic water in the rural areas of developing countries (Rached and Rathgeber, 1996; Thomas, 1998). It is habitually assumed that during rainy seasons the distance to water points in rural areas decreases because rainwater can be harvested by those with iron sheets roofing, gutters and other appropriate gears. Moreover, temporary sources such as seasonal rivers develop and ponds are sometimes formed (Katsi *et al.*, 2007; Arouna and Dabbert, 2010; Aper and Agbehi, 2011). In our study we observed that rain water, especially from ponds, was not used for all types of domestic water uses. For details on the latter, (cf. Mandara *et al.*, 2013). Most households continue to collect drinking and cooking water from the public water points. In fact, during the rainy season to some villagers time and distance to the nearest water point increased from 1.5 to 6.4 kilometres because the private operator closes five out of the seven functional distribution points for domestic water. The operator closes the identified water points to reduce administration costs under assumption that rainwater becomes an alternative source of water. When five water points are closed, water users in different subvillages are affected in different ways depending on the number of water points and the location of the ones that continue to be operational. For example, in the subvillages of Mkalama and Mkombozi, one distribution point is closed and one continues to provide services. Shule and Kimambo remain without water services in their subvillages because all water points at Shule are closed down and the only water point in Kimambo is closed as well. This implies that during rainy season the whole village depends on only two distribution points for drinking and cooking water uses: 'Stendi' or 'Kwa Mama Ndee' in Mkalama sub-village and 'Msikitini' at Mkombozi sub-village (indicated by arrows in the sketch map in Figure 3). Referring to Section 5.1 the whole village population of about 3274, depend on two water points (ratio of 1 : 1637) during the rainy season, which by far exceeds the water policy standard. The mapping participants reported that villagers from Mkombozi subvillage, especially those living at Songambele neighbourhood, have to walk up to about 6.4 kilometres to fetch drinking and cooking water at the 'Msikitini' distribution point. In Kimambo subvillage, villagers from Mbagostaa neighbourhood have to go to Mkombozi subvillage, which is about 4.8 kilometres away. These distances substantially exceed the 400 metres that is the national water policy. Moreover, closing the two functional distribution points during rainy season at Shule subvillage where there is village dispensary, causes unnecessary inconveniences to dispensary workers and patients, particularly to women for whom the dispensary also functions as a place to give birth.

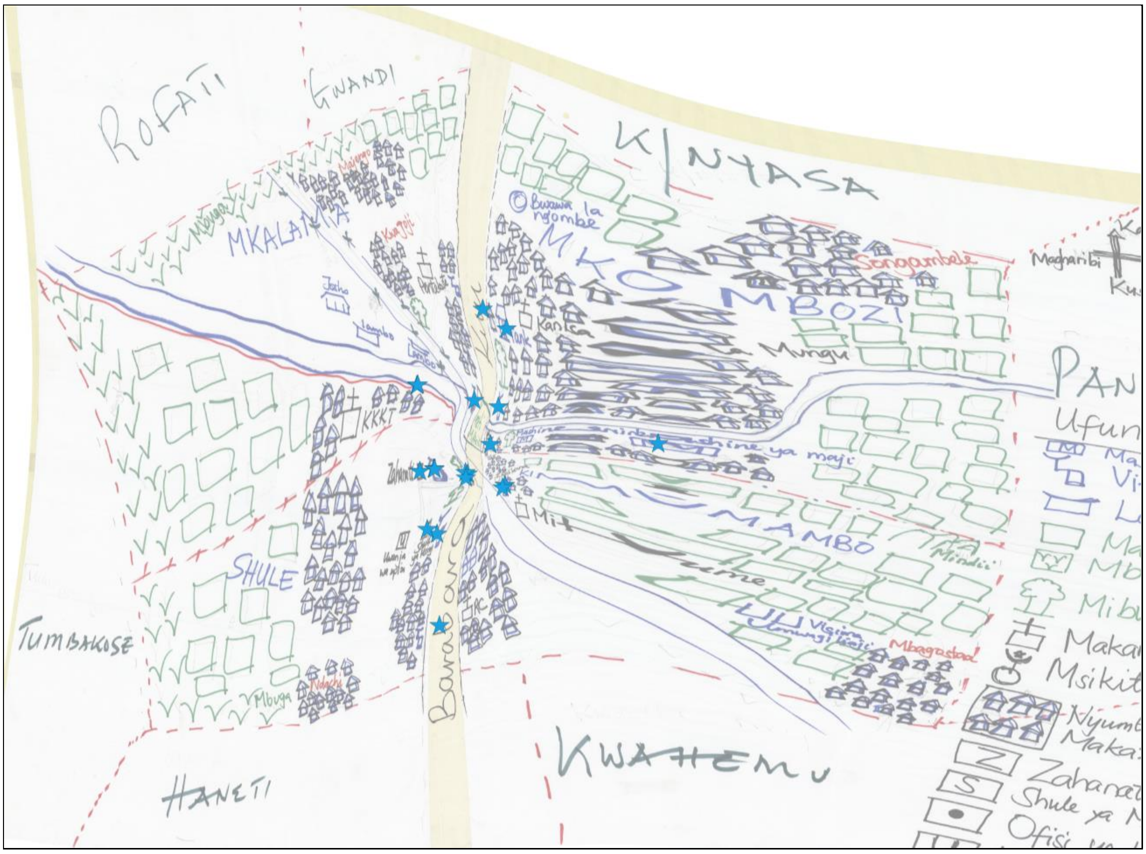

Figure 5 Distortion of Sketch map by using GPS measured locations (blue stars) as geometrical correct reference points

In Figure 3, the four encircled areas are relatively new settlements: Majengo in the northwest, Songambele the northeast, Mbagostaa in the southeast and Ndachi in the southern part of the village. The land on which these settlements are built was farms in 2007 when the water project was implemented. The village leaders disclosed that the settlements are increasingly expanding towards earlier mentioned neighbourhoods; and households in those areas experience water shortages since there are no domestic water points. Furthermore, the villagers residing in the newly developing settlements have to walk from 45 to 90 minutes to get water services from the nearest distribution points, while the national standard for a round trip is 30 minutes (MoWLD *et al.*, 2002; URT, 2010c; 2012). This implies that after implementing village water projects it needs to consider population changes in monitoring and evaluation because population variables change over time. To achieve basic service level in rural areas, the water policy requires year-round supply of 25 litres of potable water per capita per day from a protected water point serving 250 people within 400 meters and spending 30 minutes for a round trip (URT, 2002; 2010c; 2012). Evaluating extent to which these criteria are achieved or not requires timely, valid and up-to-date information on the village's population size and its spatial distribution. Village Executive Officer confirmed that the trend of settlements development continues due to migration of pastoralists from other areas.

> *"There is an increase of migrants in our village especially from pastoralist societies like Sukuma, Barbaig and Maasai. This happens to the extent that the village population records of February this year are expected not to be correct anymore because some of the migrants do not report to the village office upon their arrival. Most of them are settled far away from the village centre, especially in the neighbourhoods of Mbagostaa and Songambele*" (Village Executive Officer, 8 August 2011).

During the feedback session after the mapping exercise, the participants and village leaders expressed that from their experience as villagers they knew about a need for additional water points in the emerging settlements. Then the mapping participants said that after producing the sketch map it became clearer on the exact neighbourhoods which need additional water points. They further mentioned that, their experience from sketch mapping could become a starting point for the discussion on additional water points with the District Council. The participants' views are expressed as follows:

> *"Our participation in the mapping exercise and the map we have produced has enabled us to know the exact areas that need immediate attention, especially Mbagostaa and Songambele, as there is no any water point in their neighbourhood. The experience can also contribute to the discussion on the expansion of water services in the village"* (Mapping participants, 8 August 2012).

Conclusions and Recommendations

Simulating social media by a community water service mapping approach to create placeholder information which is of relevance, accurate and is representative offers the following conclusions and recommendations. It has shown an added value in assessing village domestic water coverage. Placeholder is considering actual demographics, location based information and most recent state of domestic water service features. This makes it valuable methodological tool to enhance relevance of information. The interactive setting with the participants from local households, elicits users' knowledge and perspectives on spatial and non-spatial aspects of domestic water services in their locality. In social media this interaction must be secured.

The simulation has shown the intersections between seasonality and the dynamics of the accessibility of water services, as well as intra-village variation among the subvillages in Kidoka village. The mapping exercise in our study was done once; insights on seasonal variability were obtained by additional questioning. Yet, the application of the CWSM approach enabled to reveal changes on the population's spatial distribution from the pattern that existed when the water project started. The situation depicted in the sketch map links spatial and demographic features at village level. This information could allow the relevant higher administrative levels from the district council onwards to prearrange possibilities for expanding installed water service to reflect changes in the population size and distribution. Afterwards, to strategize and prioritise interventions to the neighbourhoods with limited water access.

Accuracy of information shows that numbers, features and locations are far more accurate than any other source may offer. We checked for example Open street Map (OSM, 2016). The topology seems correct but geometrical the placeholder information shows many errors (see Figure 5). Regarding a social media application basemaps must be offered which functions as well as baseline information considering administrative boundaries, land use and cover, stream and road patterns, public services (schools, churches, community houses) and water services. Demographics and water use numbers must be given as well.

Such basemaps represent the main information need to maintain community water services.

Combining by social media application (participatory) sketch mapping with the geocoded transect walk has the potential to better observe, understand and document the actual situation of the village's water infrastructures. Finally issues considering the amount of obervations and who did observe will be critical to derive reliable information. Community processes revolving around these techniques and their triangulation play an important role in validating the information on actual village's water services coverage and the status of the infrastructures. Social media as such will not address this. There should be a need to organise this within the communities themselves to avoid a Wikipedia – effect .

Our results imply that application of the CWSM methodology yields relevant, accurate and representative information that is important for monitoring and evaluation components of the rural water sector. Therefore, we suggest starting with CWSM in villages with domestic water project knowing that within villages with improved water services there are differences in patterns and dynamics of the accessibility among sub-villages and neighbourhoods. We propose to do this annually. The appropriate time could be at the end of the dry season. During that time water use and breakdowns increase and the villagers will have time to participate because it is not a peak time for farming activities. Such social media approach can be integrated in the preparation of the annual village development plan and be incorporated in the annually scheduled district development plans exercise at the district level. In this study we didn't look for the most convenient interface because we relied upon traditional techniques like sketching, focus group discussion and some simple technologies like location based mapping inspired by water point mapping. We expect that especially sketch mapping may be a difficult item to offer a usable interface (Jiménez and Pérez-Foguet, 2008; 2010a, 2010b, Welle, 2010; URT, 2011b).

The social media simulation by CWSM as applied in our study can be placed in the category of ethno (carto)graphic methodologies (Wilson, 2009), sharing the theoretical and operational underpinnings of the ethnographic and cartographic research strategies. We add to these the ideas of emerging GIS (Sui, 2015) because we strongly believe in empowering factor of emerging GIS technology that is already available by nowadays social media. Such application of social media will derive placeholders which positively support the community water service coverage.

There is a need to be alert to the risks of up-scaling caused by the multiplicity of local context features, limitations from its interactive nature, and its chances to become politicised. Therefore, when CWSM is introduced as a social media, the facilitators need to adhere to good practices and ethics pertaining to mapping and participatory processes (cf. McCall, 2004; Chambers, 2006; Corbett and Rambaldi, 2009). Application and up-scaling of CWSM requires an answer to the question of the harmonisation of CWSM with monitoring and data collection tools of the officially authorized organisations. An equally relevant issue is that of the relationship between the facilitator of the social media and the local participants in safeguarding the shared placeholders. Local power relations and the dynamics of different positions of the community members involved in such social media-based CWSM processes can cause the results to be contested. These challenges require a thorough and transparent preparation of CWSM that is sensitive to socio-cultural differentiation among the users and can avert it from being politicised.

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