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Community-Based Water Projects' Sustainability: Lessons and Challenges – A Case study from Sudan

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Abstract: In the current paper, sustainability assessment framework was designed using a set of multidimensional indicators to assess and monitor eight community-based water projects in four different states in Sudan. The assessment framework consisted of site visits, a systematic secondary information collection, and analysis (SSICA) approach and documents reviews. The sustainability scores were calculated based on weighted sub-indicators analysis system. The study revealed that 40% of the implemented water projects were fairly sustainable although they are considered as young projects (1-4 years age projects). This weak sustainability was mostly related to the poor organizational and financial performance due to poor post-implementation governmental and/or external agencies involvement and support in terms of monitoring, capacity building facilities, and financial support. There is a strong need to develop post implementation stratigies and models and mechanisms to backup community-based water projects technically as well as financially to assure the sustainability and verify the project implementation goals.

Keywords: Community participation; Functionality; Sustainability indicators; Water projects.

1. Introduction

Poverty assessment research has consistently showed that improvements in water services are a core element in most strategies designed to alleviate poverty. These water utility projects were considered to be a one-time investment by most of the governments and there was little participation from the community. This has led to a poor maintenance and misuse and threatened the main developmental goals. Although economists have long remained skeptical of the community participatory approach in developmental projects, only recently, the theory of development economics highlighted the role of community in economic development. Since then, the community participation has become one of the focal issues in the developmental plans (Hayami and Godo, 2005).

Community-Based Development (CBD) and its more recent variant, Community-Driven Development (CDD), became among the fastest growing mechanisms for channeling development assistance. To clarify concepts, CBD is an umbrella term that refers to projects which actively include beneficiaries in their design and management. CDD is a term, originally coined by the World Bank, which refers to CBD projects where communities have direct control over key project decisions as well as the management of investment funds (Mansuri and Rao, 2004). Much of this massive expansion and adopting either CBD or CDD was mainly due to the fact that these approaches are regarded as a mechanism which: 1) can enhance sustainability; 2) improves the efficiency and effectiveness; 3) poverty reduction scale; 4) empower poor people and strengthen their governance; 5) complement market and public sector activities.

According to Omer (2010), there are more than 10 million people in Sudan do not have access to safe drinking water. Therefore, considerable government and donor funding was channeled towards implementing integrated community development projects in specific areas of Sudan. However, these were limited in scope and duration, while opportunities for scaling up successful experiences to the national level were difficult due to lack of financing and limited institutional capacity. In the period 2005-2011, many community developmental projects been implemented in Sudan and funded by the national government and multinational partners. Most of these projects aimed to meet the urgent community driven recovery and development needs in the war affected and underdeveloped areas of North Sudan by providing social and economic services and infrastructure.

For the community–based projects, sustainability is a major cause of concern to all the stakeholders (Dube, 2012; Harvey and Reed, 2003; Montgomery *et al.*, 2009). According to (Wouters and Rieu-Clarke, 2001), sustainable water resources can be defined as a resource designed and managed to fully contribute to the objectives of society, now and in the future while maintaining their ecological, environmental and hydrological integrity. From this holistic context; there are different factors influences community-based water project's sustainability which include: policies and legislation, institutional structures, social aspects, technology used, financial issues and capacity building (Mays, 2007). The application of Monitoring and Evaluation systems to assess water facility

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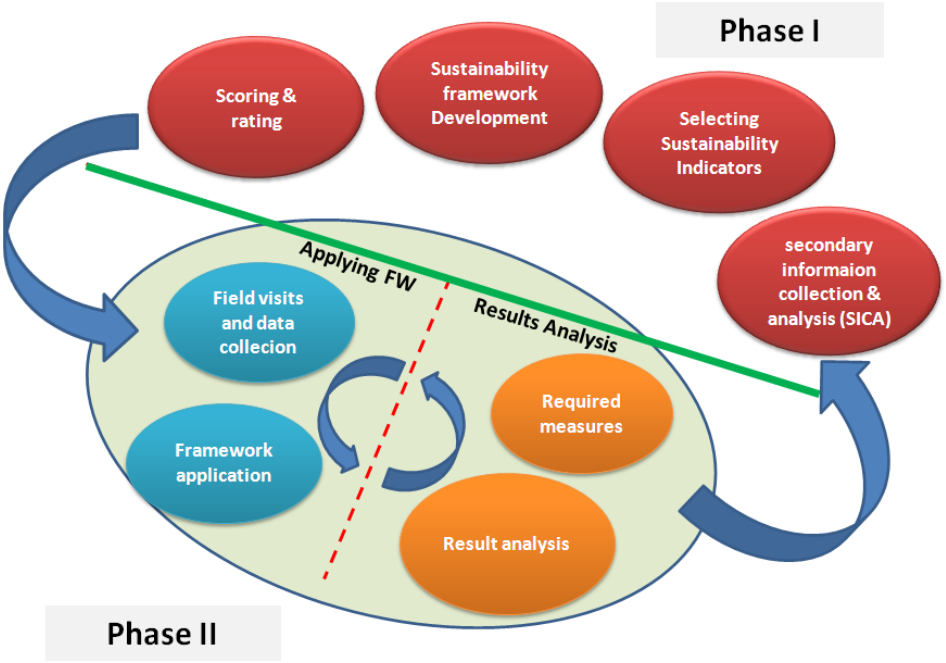
projects helps decision makers to plan for the sustainability of the future projects based on the performance of the existing projects. Projects' sustainability can be measured and/or assessed using different Sustainability indicators, which are either qualitative and/or quantitative. Indicators currently used to measure aspects of sustainability are not mandatory, leading to subjective monitoring (Lim *et al.*, 2004). Therefore, it is essential that a modest number of key sustainability indicators be incorporated into projects' monitoring systems.

In the present study, sustainability assessment and monitoring framework was designed using a set of multidimensional sustainability indicators (Technical, social/environmental, financial and organizational) for assessing and monitoring community-driven water projects. This sustainability assessment and monitoring framework was applied to already implemented water project as a case study to evaluate the community participatory approach experience and its application in Sudan, lessons learned and limitations.

2. Methodology

The current sustainability assessment study process was conducted to evaluate and assess sustainability of community-driven developmental projects as a case study. The study was carried out in two phases (Figure 1). In phase 1, the sustainability assessment framework was designed. In phase 2, the designed framework was utilized to assess and monitor the sustainability of the selected community-based water projects. Only projects with age more than 1 year have been chosen.

Figure-1. Sustainability assessment and monitoring framework design process.

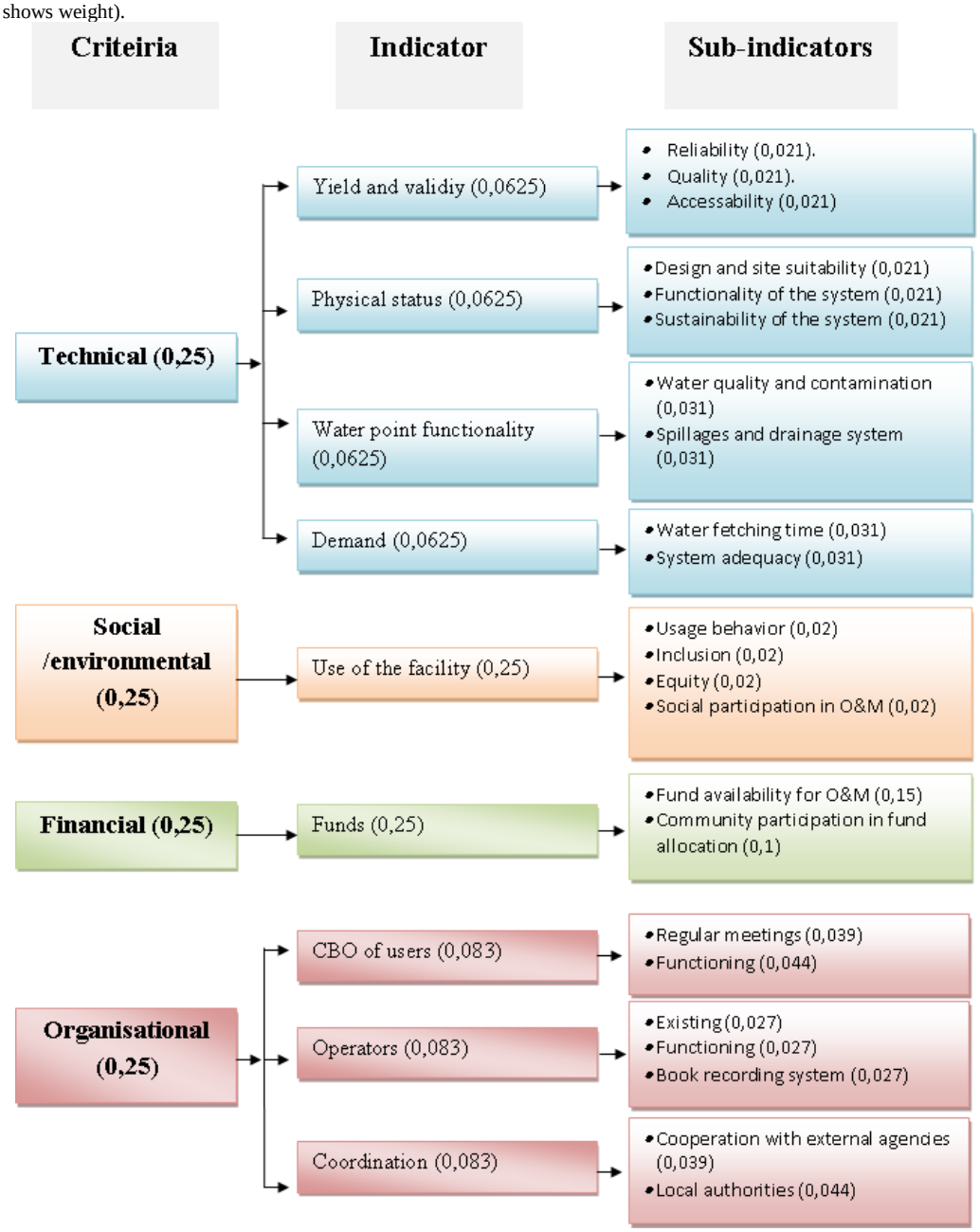


2.1. Phase One- Sustainability Assessment and Monitoring Framework

During this phase, the sustainability assessment and monitoring framework was designed. For this purpose, a workshop was conducted with the participation of representatives from the NGOs, The Ministry of Fiance and National Economy, Ministry of Water Resources and Electricity, projects' engineers and social mobilisers. Based on the group discussions and the cases raised, sustainability indicators were studied and selected. The variations in the chosen water projects in terms of technology used, community structure and inclusion, and other variables, were considered to balance the sustainability measure, and also to record as many variables as possible to ensure the applicability of the framework. This step helped in identifying and integrating the different aspects related to sustainability into the sustainability framework.

The framework consists of four major criteria, nine indicators and 23 sub-indicators (Figure 2). The criteria used in the current study – which is located on the upper level of the hierarchy- are technical, social/environmental, financial and organizational. Each of these criteria was divided into a number of indicators at the lower level, which in turn consists of a number of sub-criteria in the bottom level of the hierarchy. The sub-criteria are the indicators used for the assessment and monitoring water projects in the field. The sub-criteria were then weighted according to its relevance and importance to the sustainability of the project. The calculation of the project sustainability score was made by giving each sub-criterion in the specific project a score based on a five points scale – 5 for excellent performing projects and 1 for poor performing water projects, and this score was then multiplied by the weight of the sub-criterion. The scores recorded for all sub-indicators were then summed up for each water project to result in a single final score representing the final sustainability score of the specified project. The projects were then ranked and classified according to their sustainability scores into unsustainable; fairly sustainable and sustainable. The scores for each criterion (technical, social / environmental, financial and organizational) were plotted visually to identify the criteria status for each water project.

Figure-2. Hierarchal structure of the indicators used for the design of sustainability assessment and monitoring framework (numbers between parentheses shows weight).



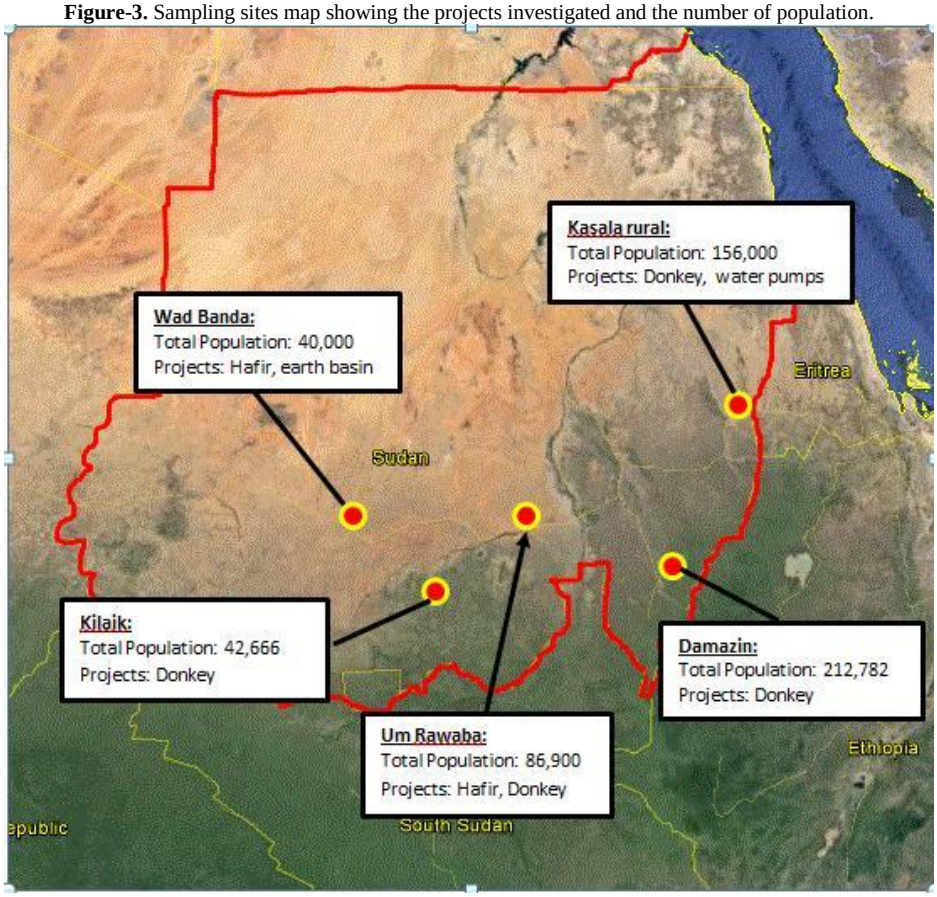
2.2. Phase Two – Applying the Framework

The sustainability assessment and monitoring framework was utilized to assess the current status of eight different water projects in operation in five localities (Fig 3). A Systematic secondary Information Collection and Analysis (SSICA) approach was used to collect and analyze all the documents (e.g. engineering designs, social documentation reflecting the community participation and driven approach) related to the projects under study.

This desk review work was followed by site visits to the selected projects. In these site visits, different tools were used for data collection including reviewing documents, interviews, and group discussions, observations and photographing. Based on the data collected, the pre-designed framework was used to evaluate and gave a rate for each sub-indicator for the specific project.

The scores of the sub-indicators were summed up to calculate the score for the indicator in the upper level of the hierarchy, and subsequently, the summed scores of the indicators resulted in the final score for the each of the criteria used in the framework and plotted on the sustainability chart. For calculating the final sustainability score for a single project, the sum of all the criteria were taken and the sustainability status of the projects was evaluated. The sustainability status was rated on a pre-defined scale according to the calculated sustainability score (< 2 unsustainable projects; between 2-3 fairly sustainable projects; and > 3 sustainable projects).

Figure-3. Sampling sites map showing the projects investigated and the number of population.



3. Results and Discussion

The data collected from the sustainability assessment and monitoring framework were analyzed to assess the sustainability performance of the selected projects. As mentioned, the water projects subjected to the assessment and monitoring framework are those projects, which were implemented and entered operation phase. In total eight different water projects were assessed.

3.1. Sustainability Analysis

According to the sustainability assessment and monitoring framework results, five water projects were accounted as sustainable projects; the remaining three projects were fairly sustainable condition (Table 1). That means 40% of the studied projects are already running with a low sustainability performance although these projects are considered as young projects (age range between 2 and 4 years).

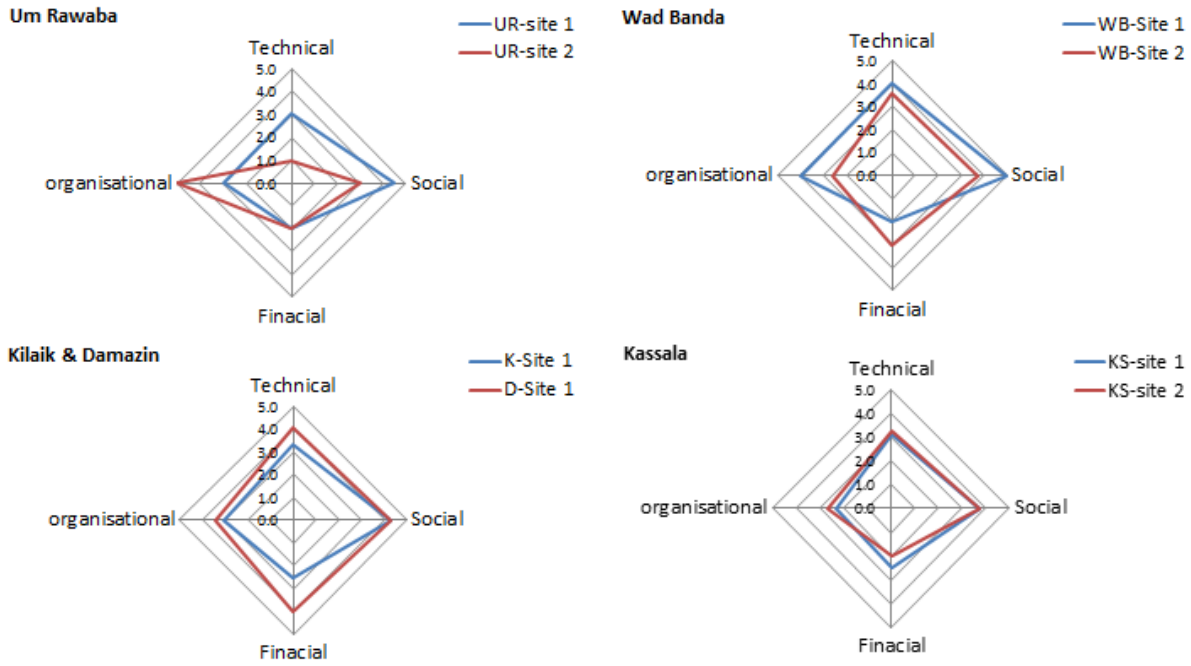
Figure 4 shows the sustainability performance for the different projects. For the technical and the social issues, which are related to the design, technical performance and the social willingness to participate, most projects showed high sustainability scores (80% and 90% of the projects respectively). According to the framework analysis, poor sustainability performance was mainly related to financial and organizational issues of the projects. 90% of the assessed projects showed a low sustainability score for financial related issues, and 50% of these projects showed low organizational sustainability scores.

A correlation analysis was conducted to assess the relationship between the major criteria and how they interact with each other (Table. 2). The results showed a good correlation between the social and the technical criteria. This is mainly due to the communities' active participation in the projects planning and selecting the technologies suitable for their needs, which is one of the main concepts of the community developmental schemes in Sudan right now. This willingness to participate issue from the communities' side was the major driving force in raising the overall sustainability score of the projects.

Table-1. Projects sustainability performance.

Site	N. Kordofan				S. Kordofan	Blue Nile	Kassala	
Locality	Um Rawaba		Wad Banda		Kilak	Damazin	Kassala rural	
No. of People Served	86.900		40.000		42.666	212.782	156.000	
Project code	UR-site 1	UR-site 2	WB-site 1	WB-site 2	K-site 1	D-site 1	KR-site 1	KR-site 2
Age (Years)	1.9	2.8	1.4	2.2	3.6	4.1	1.8	3.3
Score	3.1	2.8	3.8	3.2	3.3	3.9	2.9	2.9
Sustainability status	Sustainable	Fairly sustainable	Sustainable	Sustainable	Sustainable	Sustainable	Fairly sustainable	Fairly sustainable

Figure-4. Sustainability Criteria scores for the different water projects.



No correlation between the age of the project and major criteria was observed. From the above, it is clear that the willingness of communities to accomplish their roles and responsibilities is one of the major pre-requisites for successful community-based development projects. However, communities' willingness is not enough for assuring the sustainability of these projects. The correlation analysis for the sub-indicators revealed that most of the sustainability directly related issues (e.g. reliability, quality, available of funds for O&M, external cooperation etc) which are mainly organizational issues in the first place, were correlated with each other and the absence of one of these factors will lead to poor project performance and low sustainability. Accordingly, good intentions of the communities for active participation and to carry on responsibilities should not be regarded as an assurance for water projects sustainability.

3.2. Lessons Learned From The Community-Based Water Projects In Sudan:

According to the advocates of rural development, the community-based projects aims at accomplishing certain specific functions including: (1) Identifying and eliciting development priorities by the target community itself (2) Strengthening the civic skills of the poor by nurturing community organizations and (3) Enabling communities to work together for the common goods (Mansuri and Rao, 2004). However, the rural water supply sustainability remains low and limited throughout Sub-Saharan Africa - including Sudan - due to limitations associated with the current approaches in the community management. Based on our study, sustainable community-based water project requires internal cooperation as well as external assistance (Barnes *et al.*, 2011; Harvey and Reed, 2007; Rondinelli, 1991; Whittington *et al.*, 2009).

3.2.1. Internal Cooperation

Community-based units (CBUs), are the community units responsible for managing daily operational mandates for the implemented project. Each project CBU unit consists of 8 to 10 members elected annually by the community based on gender as well as tribal considerations.

Table-2. Major criteria correlations

Variables	Technical	Social	Finacial	organisational	overall sustainability	Months of operation
Technical	**1**					
Social	**0.756**	**1**				
Finacial	0.472	0.042	**1**			
organisational	-0.563	-0.171	-0.212	**1**		
overall sustainability	**0.761**	**0.734**	0.607	0.052	**1**	
Months of operation	-0.007	-0.244	0.528	0.072	0.171	**1**

**Values in bold are different from 0 with a significance level alpha=0,0*

The responsibilities of the CBUs were described in a community Act, which also includes annual meetings with the community to review reports, budgets and to discuss projects constraints. In most projects, no such meetings were held for two years now. Besides, many of the committee members whose have either tribal or financial influence placed themselves in the committee (especially the chairperson).

Such approaches inside the CBUs have led to a deterioration in the relationship between the community and the CBU members and drastically affected the projects' performance. Interviews with community members projects have reflected that, in most cases, although the project has delivered the water consistently to beneficiaries, community members show dissatisfaction of the CBU members management attitude. This deficiency in internal community management has also been reflected by Peter and Nkambule (2012), reflecting the need for external support to monitor and evaluate CBUs performance and to follow up the meetings conducted with the community.

3.2.2. External Assistance

Although community participation and management seems to be a useful tool for sustainable rural water resources management (Dube, 2013; Kamruzzaman *et al.*, 2013; Marcus and Onjala, 2008), the perceptions of community participation and community management still confusing for some stakeholders and needs to be defined. According to Harvey and Reed (2006) "Community participation is a prerequisite for sustainability i.e., to achieve efficiency, effectiveness, equity and replicability but community management is not". Community participation is a consultative empowerment process designed to establish communities as effective decision-making entities (i.e. community involvement throughout the project cycle). Community management can be viewed as a form of community participation., where Community management is a bottom-up development approach whereby community members have a say in their own development and the community assumes control – managerial, operation, and maintenance responsibility – for the water system (Doe and Khan, 2004).

In the current study, it was observed that most of the sustainability related problems were mainly due to poor community management. According to Harvey and Reed (2006), most of the projects related to the community management do not occur immediately after the commissioning of the improved water supply facility, but sometimes later within 1-3 year, which is similar to the projects' age subjected to the assessment in the current study.

There are many reasons behind the community failure in managing water supply projects, and these reasons differ from one community to another and from one project to another. But in the current investigation, the most common reasons for the struggling communities in managing their water facilities in a sustainable manner can be summarized as follows:

- The lack of contact between the communities and external agencies (e.g. local authorities, NGOs. etc) or even the implementing agency after implementation.
- Lack of proper and/or enough training programs for the communities to manage their project's financial issues or for proper operation and maintenance of the water facilities.
- Communities are financially unable to do major maintenance, and external financial sources are still in need in most cases.
- Lack of transparency and accountability of the community organization charged with managing the water facility, which leads to loss of trust and respect of the general community and subsequently less participation in managing the facility.

Although the implementing agencies have followed the participatory approach, their conception misunderstanding was mainly reflected by the huge expansion in implementing the projects and the focusing on the physical implementation with little attention towards communities' preparations and training. This is because communities' participation involves mobilizing a community to become positively involved in the planning and implementation of the water project, and later to get trained for managing the facility. This takes a considerable time and should not be rushed otherwise the communities will become less motivated (Batchelor *et al.*, 2000). Besides, there is a lack of mutual understanding and cooperation bridges between the communities and the other external institutions especially the governmental authorities which are needed for sustainability requirements (Rondinelli, 1991; Whittington *et al.*, 2009). This is because the governmental authorities as well as, in some cases the donating agencies, have a common misconception that these services can be autonomously managed by the local communities

which is always not the case (WHO and UNICEF, 2000). This misconception might be due to that the governmental authorities and/or the supporting agencies do not understand the needs of the communities for such a supporting system, or they do not have a conceptual model on how to structure and organize this support system. In the water projects investigated in the current study, understanding the importance of support system after the projects phase out is existing, but the mechanisms and the tools for accomplishing this at the right time were lacking. While the governmental authorities step aside, leaving the service delivery and support to be carried out by the external agencies and their interference is only for consultation when needed. Such attitude has been reported in different developing countries especially in the sub-Saharan Africa (Colin, 1999; Harvey and Reed, 2007). It is worth mentioning that the local NGOs are excluded from this equation, and their role in communities support is still negligible. Since the 1990s, there is a number of rural water supply projects that are incorporated demand-driven and community management model, although few of these projects planned for such a post-project back-up for the communities (sometimes it is called post-construction support – PCS). However, many studies revealed the importance of such PCS mechanisms (Lockwood, 2000; Prokopy *et al.*, 2008).

The communities' external support by the local institutions is an important issue to address. Although the community participatory approach gained much attention in the last decade, there is still need to focus more practically on the sustainability of the implemented projects and to design backup models and implement mechanisms to assure that the service delivered will verify the minimal sustainability goals – continuation. The different types of support implementation mechanisms can be done through institutional collaborations. Collaborations are influenced by several factors such as the existence of relationships -informal linkages between stockholders- and partnerships -formal linkages between stakeholders for the purpose of achieving certain goals (Busenberg, 2000; Lockwood, 2000; Selin and Chevez, 1995; Tucker, 2004; Turner, 1999a;1999b; Zanetell and Knuth, 2002). Such informal relationships and/or formal partnerships were not adequately and efficiently available in the projects assessed in the current study, where other stockholders were not actively involved in the projects cycles. Such ignorance of the other stakeholders and/or other goals interested parties gave them a feel distance and resulted in weakening further collaborations during the phase out of the projects. Therefore, the inclusion of other stockholders from the beginning of the project cycle is necessary.

The community management backup model should at least focus on the following aspects:

- Projects monitoring and evaluation.
- Communities' Capacity building.
- Financial and technical interventions.

On the other hand, private sector participation (PSP) models could be an alternative solution and were proposed by many researchers to bridge the community management – sustainability gap (Bakker, 2008; Barnes *et al.*, 2011; Gleick and Ajami, 2014). The application of such models varies from one situation to another, and further investigations are required before adopting such models.

4. Conclusion

Questioning the feasibility of community-based water projects and the sustainability status under the community management was investigated in the current study. It was clear that the willingness of the community to be positively involved and/or participate with their facilities and manpower in water projects planning and implementation in rural areas were not enough for assuring the sustainability of these projects. There are still limitations in Sudan with the current community -participatory and community-based developmental approaches in terms of post implementation community-service management. According to the present study, these limitations were mainly related to organizational and financial aspects. Although most of the studied community-based water projects showed high community participation during the project planning and implementation phases, this motivation started to decline after the project phase out and to handle the service to the community. This is mainly because the communities felt that these projects' management responsibility is bigger than their capacities especially if they are not supported and trained. Therefore, there is a need to develop models and mechanisms for supporting and backing up the communities in managing their projects after their implementation. Besides, it is clear that the community-driven water projects are still in the government's back yards i.e. the government should back up these communities technically and financially when needed. This backup mechanism should involve all stakeholders (i.e. governmental institutions, funding agency, NGOs, privet sectors, etc) and it should not be time limited to assure the projects sustainability and achieve the Developmental Goal addressed by the United Nations.

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