

Innovative Financing Mechanisms for Delivering Sanitation Infrastructure

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Abstract

The study identifies four traditional sanitation financing methods through the use of debt, budgetary allocations, donor funds and community-based organizations. Essentially, public private partnerships (PPPs) and private finance initiatives (PFIs) are the most significant innovative financing approaches among fifteen instruments studied. Subsidies, grants and guarantees were also observed to rank as being important and could be useful in enhancing market efficiency. The application of microfinance and leasing instruments appears interesting and worthy of further research. The findings suggest a growing shift from government supply of sanitation resources to a demand-side approach of private provision. As a contribution to knowledge, the study suggests potential tools that could improve sanitation infrastructure financing and delivery in Ghana. Further research could focus on producing evidence on the true workings and impact of these innovative financing approaches in industry.

Keywords: sanitation, infrastructure, innovative financing, Ghana

1. Introduction

The Millennium Declaration confirmed United Nation members' commitment to help the poorest in society to achieve a better quality of life by 2015 (World Bank, 2003). Enshrined within this commitment are the Millennium Development Goals (MDGs) that are defined by time-bound common goals and targets. To foster progress, monitoring is conducted through a set of 21 measurable and time-bound targets and 60 indicators addressing extreme poverty and hunger, education, women's empowerment and gender equality, health, environmental sustainability and global partnership. Sanitation is a key benchmark for measuring environmental sustainability, and the aim to halve the proportion of people without sanitation by 2014 has received scant attention in Sub-Saharan Africa (United Nations, 2013). The most recent cholera outbreak in Ghana recorded 10,000 cases and over 100 deaths (at a death rate of 1.5%) and demonstrated woeful performance in tackling this major health issue. Globally, an estimated 2.5 billion people do not have access to adequate sanitation infrastructures (World Bank, 2003). In developing economies, maintaining existing sanitation infrastructure systems and extending services to new populations pose acute financial and management challenges (Center For Strategic and International Studies, 2009). However, the welfare implications of sanitation are enormous in terms of economic gains and improved services to millions of Africans (Banerjee and Morella, 2011). In Ghana, sanitation is further compounded by rapid urbanization, associated population growth and shortfalls in financial pledges from development partners (World Bank, 2003). Yet, according to Tremolet, *et al.*, (2010), financing must at least double year-on-year to achieve the MDGs water and sanitation targets.

A systemic issue relates to traditional financing methods used, for example, public financing has proven to be unsustainable, oversized and inefficient (Asare and Frimpong, 2013; Badu, *et al.*, 2012; Sihombing, 2009). To forestall future epidemics, innovative financing solutions have evolved from the private sector. These innovations offer better financial systems suited to devolved services, and provide options for low-income service users and communities (Tremolet, *et al.*, 2010). In recognizing this potential, the public sector is leveraging their resource to create private sector investment opportunities aimed at delivering public sanitation infrastructure via public private partnerships (PPPs) (Arboleda and Abraham, 2006). Despite the role of innovative financing in securing socio-economic and environmental benefits, very little is known about innovative sanitation financing as a

product, process and institutional innovation. This paper therefore focuses on exploring product innovation in sanitation infrastructure financing and seeks to determine whether such approaches may alleviate the sanitation infrastructure development issue within Ghana. The paper is delineated into five sections: i) background; ii) literature review of the tools and constraints used in sanitation infrastructure financing; iii) research methodology; iv) survey data analysis and discussion; and v) recommendations.

1.1 Sanitation Infrastructure Financing: Current Tools

Sanitation infrastructure financing derives from three main sources: government budgets, development agencies (bilateral, multilateral, and NGOs) and domestic-based private operators (Tremolet, *et al.*, 2010); albeit government budgets have been the primary source. This is because the consumption of sanitation is non-rivalrous, non-excludable and associated with externalities beyond private procurement because it benefits the health and welfare of all in society (SuSanA, 2008). Economic benefits of sanitation have been dominated by convenience time savings, representing 90% of the total economic benefit, followed by 8% for productivity gains, and 2% for health care cost savings (Hutton, *et al.*, 2007a; 2007b). For every 10% increase in female literacy (due to increased school attendance where proper sanitation facilities exist), a country's economy could grow by 0.3 percent (Dollar and Gatti, 1999).

Public financing of sanitation infrastructure conventionally takes two major forms, directly from government taxes and subsidized user-fees and indirectly from donors (mostly foreign) in middle- and low-income countries respectively (Hall and Lobina, 2012). For instance, Water Aid stated in 2002 that domestic public sector investment accounted for 70% of sector financing, whereas external aid 20%, international private 7% and domestic private sector investments a mere 3% (Annamradju, *et al.*, 2002). Two main complementary infrastructure types constitute governments' sanitation budget: soft and hard sanitation infrastructure. In most advanced economies, the application of technology to the soft-hard infrastructure marriage has led to the development of smart sanitation infrastructure, which is in most developing economies found in some modern private properties.

Soft infrastructure refers to the policies, laws, agreements, regulations, capacity building and advocacy that facilitate the design, financing and development of hard sanitation infrastructure; where the latter is the physical

edifice and systems. Usually the quality of the delivered hard infrastructure reflects the inherent quality of the soft infrastructure. Minh and Hung (2011) argued that governments in developing countries tend not to see improved sanitation as a necessary condition of economic development or source of improved welfare. Hence, the need to formulate appropriate policies, laws and regulations that will deliver efficient hard sanitation infrastructure which has hitherto been neglected and under-funded. Tremolet, *et al.* (2010) states that National Governments and Official Development Assistance (ODA) have invested more heavily in water than in sanitation, while the sector as a whole only attracts about 5% of total ODA money. Water and sanitation also have a relatively low priority in Poverty Reduction Strategy Papers (PRSPs) (*ibid.*). Government investment in water and sanitation in many poor African countries lies between 1 and 2% of GDP (Fonseca and Cardone, 2006). This paper postulates that apposite soft infrastructure is as fundamental to sustainable hard and smart infrastructure delivery as to the development of appropriate financing mechanisms.

In consonance with inadequate soft sanitation infrastructure, financing appears as the major constraint to hard sanitation infrastructure delivery. In an earlier report, World Bank (2003) identified three constraints of sanitation infrastructure delivery, namely: i) inappropriate institutional frameworks and financing policies that result in ineffective and inefficient use of existing resources; ii) inadequate public resources to meet the costs of sustained enhanced coverage; and iii) limited public benefit from increased coverage and existing sanitation services. Recent studies confirmed that enormous funding gaps exist and contemporary receipts, savings and central government transfers do not match finance needed for large-scale infrastructure projects (Kehew, *et al.*, 2005; Ngowi, *et al.*, 2006; Martell and Guess, 2006; Beck, *et al.*, 2007; Platz, 2009; Badu *et al.*, 2012). For instance, the Deputy Minister for Rural Development and Environment of Ghana, Mr. Elvis Afriyie Ankras reveals that: *“though the Ministry has developed the required policy and implementation framework to resolve the poor sanitation setback in the country, the problem of funds and capacity building mechanisms for its implementation is slowing its implementation”* (Government of Ghana, 2011). Adequate financing requires adequate costing (Dijk, 2008; 2003). When reoccurring and capital costs including maintenance, capacity building and policy development are not accounted for in budgets, then systems cannot be properly maintained, replaced or expanded. Soft services such as capacity building and policy development are often unfunded, leaving utilities and governance organizations short of

skills and resources (*ibid.*). Further, loans contracted using concessionary terms from developed nations attract high interests that further limit a developing country's ability to finance infrastructure. An attempt to overcome these issues, led to grants and gifts donations in the form of installations and equipment from development partners. However, such capital is often oversized, poorly maintained and not operated to capacity; thus, often proving as a curse contrary to its intended blessing. Figure 1 presents a theoretical framework for traditional sanitation infrastructure financing tools and is based upon the review of extant literature.

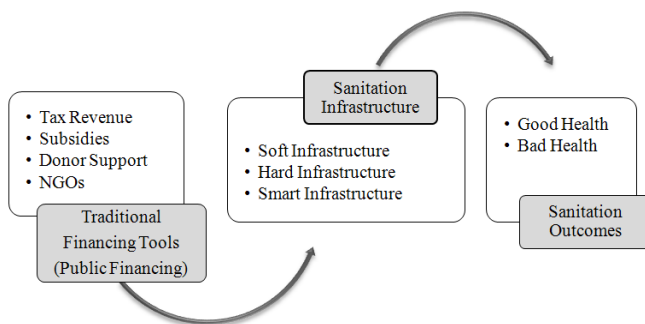


Figure 1. Theoretical Framework for Traditional Sanitation Infrastructure Financing

1.2 Innovations in Sanitation Infrastructure Financing

Innovation in the context of this research relates to new approaches to design and business models (OECD, 2005). The act of innovation represents a process of *creating* a new product or service, technological process and organization, or *enhancement* of such (Ramadani and Gerguri, 2010). Miller (1986) defines financial innovation as something that produces economic growth in excess of what would otherwise occur. This encapsulates acts of creating and then popularizing new financial instruments as well as new financial technologies, institutions and markets (Lerner and Tufano, 2011). By this characterization, product innovation as a type of financial innovation involves the introduction of new client-focused products or services which are created to meet market needs (Bátiz-Lazo and Woldesenbet, 2006; Bank for International Settlements, 1986). For instance, in a survey of innovative financing products for water and sanitation infrastructure delivery, Tremolet, *et al.*, (2010) identified a range of techniques available including micro-financing, revolving fund, seed finance and output based aid. As demand-

oriented products, such innovations extend choice to customers or improve the efficiency of supply (Schrieder and Heidhues, 1995).

The impulse to innovate has usually stemmed from market inefficiencies including incomplete markets, agency concerns and information asymmetries (Tufano, 2003). In earlier studies, regulations and taxes (Miller, 1986) as well as technological advances (Merton, 1995) were identified as triggers of innovative financing. Recently, Tremolet, *et al.*, (2010) opined that decentralization of governance and the raising of awareness about development targets (such as the MDGs) have been causes of innovation. Not only does innovation expand market reach, it also enhances the sustainability of institutions and their outreach to the poor (Schrieder and Heidhues, 1995). This signifies progress that secures real social benefits and allows for risk pooling through the financial system (Shiller, 2013). Figure 2 presents a conceptual framework for innovative sanitation infrastructure financing tools.

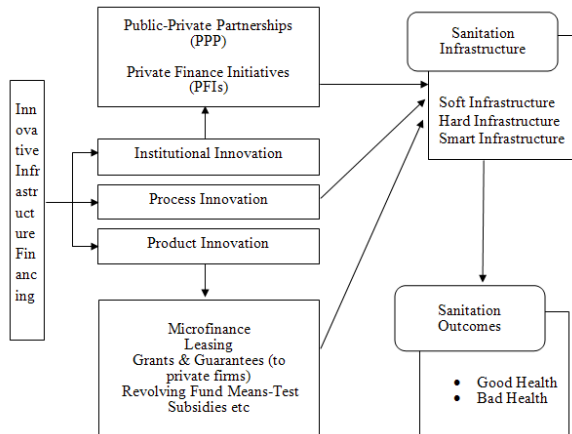


Figure 2. Conceptual Framework for Innovative Sanitation Financing Tools

2. Methodology

A quantitative research method using two main processes was adopted for this study. First, a critical review of extant literature sought to discover innovative financing approaches employed to deliver sanitation infrastructure. Second, a semi-structured survey was distributed to relevant agencies and corporations engaged with sanitation within the Kumasi

Metropolitan area in Ghana. They included: the Waste Management Department (KWMD) of the Kumasi Metropolitan Assembly; Zoomlion Ghana Ltd; Asadu Limited; Aryetey Brother Company Limited (ABC); Waste Group Ghana Limited (WGG); Sak-M Company Limited (SAK-M); Meskworld Limited (ML); Vemark Environmental Services, and the Kumasi Waste Management Limited (KWML).

2.1 Kumasi Sanitation Infrastructure Profile

Kumasi is the capital of the Ashanti region of Ghana and with a population of just over two million is the second-largest city in the country. Figure 3 illustrates that whilst the majority of residents use either public toilets (38%) or household water closet facilities (25%) – a total of 36% still use either unhygienic bucket latrine system, raw sewerage pit latrines or use themselves indiscriminately (Kumasi Metropolitan Assembly, 2006). The storm water drainage system is an open sewer, which discharges into the Subin, Aboabo, and Sissai rivers (*ibid*). The principal generators of industrial wastewater are: i) breweries and a bottling company, and the Kumasi Abattoir that between them generates about 1,510 m³ of untreated effluent daily. Light industrial activities also generate a significant amount of waste oil and leachate respectively adding to environmental degradation (*ibid*). The current domestic waste generation in Kumasi is 1000 tonnes per day which is handled by both public and private waste collection organizations.

2.2 Research Instrumentation and Sampling

Primary data on current sanitation infrastructure financing tools (including both traditional and innovative approaches) and constraints to financing were collected using snowball sampling. The questionnaire administered was designed to include close-ended questions, open-ended questions and scaled response questions. The survey achieved a 100 percent response rate: 15 questionnaires were distributed and all retrieved; this was due to follow up telephone calls made. However, there were missing values in some completed questionnaires hence, the reason for any differences in frequencies quoted in the analysis section.

The perception of respondents about their associated relative importance of financing approaches was measured using a Likert item. Sequentially, the respondents were asked to rate the level of significance from 1 to 5, where 1 represents not significant and 5 represents very significant. Since respondents were classified as public or private institutions, the use of different financing approaches was likely. However, the convergence of a

financing approaches indicative of the significant and popularity of that particular instrument. The convergence of a financing approach is an independent random variable; where the use of a financing instrument by the private sector does not influence its use by the public sector and *vice versa*. Preceding from this argument, the independent group sample t-test procedure (which assumes that variances of the populations from which different samples are drawn are equal) was conducted to establish the possibility of significant variation in the financing approaches used by private and public sector organizations.

The t-test procedure was conducted using Levene's test to assess the equality of variances for a variable calculated for two or more groups (Levene, 1960). If the resulting *P*-value of Levene's test is $p = <0.05$, the obtained differences in sample variances are unlikely to have occurred based on random sampling from a population with equal variances (Coates, 2001; Field, 2005a). Thus, the null hypothesis of equal variances is rejected and it is concluded that there is a difference between the variances in the population. Therefore, the null hypothesis (H_0) for the independent t-test is that the population variances of the financing approach used by the private sector and public sector are equal.

$H_0: \sigma_1 = \sigma_2$ (Variances of the two groups are equal)

$H_a: \sigma_1 \neq \sigma_2$ (Variances of the two group are not equal)

The mean score index within a descriptive statistical framework was mainly used in analyzing the data. The minimum required population means score was set at 3.5 (Ahadzie, 2007).

3. Results and Discussions

3.1 Data Analysis

Table 1 presents the descriptive statistics of the independent t-test. In almost all cases, nine private sector firms and six public institutions responded to the inquiry about their approach to financing sanitation infrastructure delivery. For the use of donor funds and non-governmental organization, five out of six public institutions responded, while seven out of nine private institutions use community-based organizations. This suggests slight variation in the use of those financing approaches by the respondents. The standard deviation

and standard error measures of variability further corroborate this observation. This is not only common between public and private institutions but also among the financing approaches used. Conversely, the means of financing approaches appear generally stable, suggesting that financing approaches could be the same across both private and public sector institutions. Almost all the variables have sample mean values above the accepted population mean of 3.5.

Table 1. Current Financing Approaches to Sanitation Infrastructure Delivery in Ghana

Current Financing Approaches	Type of organization/agency respondent works in	N	Mean Score	Std. Deviation	Std. Error Mean
<i>Debt</i>	<i>public</i>	6	3.00	0.894	0.365
	<i>private</i>	9	2.56	1.667	0.556
<i>User fees</i>	<i>public</i>	6	3.67	1.033	0.422
	<i>private</i>	9	4.67	0.500	0.167
<i>Credit</i>	<i>public</i>	6	4.17	0.408	0.167
	<i>private</i>	9	4.22	1.093	0.364
<i>Loans and grants</i>	<i>public</i>	6	4.17	1.169	0.477
	<i>private</i>	9	3.89	1.167	0.389
<i>Budgetary allocations</i>	<i>public</i>	6	4.67	0.516	0.211
	<i>private</i>	9	3.89	0.782	0.261
<i>Donor fund</i>	<i>public</i>	5*	3.80	1.095	0.490
	<i>private</i>	9	2.67	1.000	0.333
<i>Foreign aid</i>	<i>public</i>	6	4.17	0.983	0.401
	<i>private</i>	9	2.67	1.000	0.333
<i>Non-governmental organizations</i>	<i>public</i>	5*	4.00	1.225	0.548
	<i>private</i>	9	2.22	0.441	0.147
<i>Community-based organizations</i>	<i>Public</i>	6*	3.67	1.506	0.615
	<i>Private</i>	7*	2.57	1.134	0.429

The contrasting characteristics of the sample means and standard deviations suggest that further tests are required. Table 2 shows the results of the Levene's test for the independent samples t-test procedure. As expected, the P-values for the different sanitation infrastructure financing approaches are not statistically significant, suggesting equality of variances. The variances for user fees are however, statistically significant with a P-value of 0.025 compared with the 0.05 significance level. Thus, the use of user fees varies considerably between private and public institutions, with the former most likely to be the major user of user fees because of the need for profitability.

3.2 Discussion of Levene's Test Results

The results of the Levene's test for equality of variance (2-tailed) as presented in Table 2, indicates no differences in most of the financing approaches used by both the private sector and public sector. In other words, there is a convergence in most of the instruments used by the private sector and private sanitation management firms in financing sanitation infrastructure in Ghana. For instance, the p-values for six of the instruments (as reported in Table 2) including: *debt*, *credit*, *loans and grants*, *budgetary allocations*, *donor funds* and *community-based organizations* are higher than the significance level of 0.05; that is 0.563, 0.908, 0.659, 0.053, 0.73 and 0.163 respectively. On the contrary, three of the financing instruments tested significant, with p-values below 0.05. They include funds from *non-governmental organizations* (0.002), *foreign aid* (0.013) and *user fees* (0.025). A comparison of the mean scores for the public sector and private sector usage of these financing instruments are generally consistent with the results from the Levene's test. The mean scores for public and private usage of *debt* are 3.00 and 2.56 accordingly. While *credit* mean scores were 4.17 and 4.22 for the public sector and private sector respectively, *Loans and grants* mean scores were 4.17 and 3.89 correspondingly. The public and private mean scores for *budgetary allocations*, *donor funds* and *community-based organizations* differ largely by more than half a mean score compared with the mean scores for *debt*, *credit* and *loans and grants*. Thus, the ranges of *budgetary allocation* mean score, *donor fund* mean score and *community-based organization* mean score between the public sector and private sector are 0.78, 1.13, and 1.10 respectively. Despite these slight variations, the standard errors of the means are similar and support the statistical evidence from the Levene's test. However, since the p-values for *budgetary allocations* (0.053) and *donor funds* (0.073) vary slightly from the significance level of 0.05, their statistical significance given a larger sample size may be true.

These results suggest that there are *systematic* and *unsystematic* sanitation infrastructure financing approaches adopted by both the public sector and private sector waste management firms. Systematic financing approaches are common and generally applicable to both the public sector and private sector. In summary, these approaches are six in number and include the use of *debt*, *credit*, *loans and grants*, *budgetary allocations*, *donor funds* and funds from *community-based organizations*. *Debt*, *credit* and *loans* could technically be considered as one and the same because they involve the use

of borrowed funds. For this reason, there are four unique systematic sanitation financing approaches. On the other hand, unsystematic approaches are unique and sector-specific; and could be a major source of innovation. These approaches include the use of funds from *non-governmental organizations, foreign aid* and *user fees*. For the purpose of this study, *non-governmental organizations* generally provide direct interventions in many forms ranging from the extension of only technical assistance to a mixture of technical assistance and extension of foreign bodies to Ghana.

Since the millennium, the opportunity to make a profit has encouraged local governments to contract or partner private firms in the management and financing of public sanitation infrastructure. For instance, Zoomlion Ghana Limited (ZL), Aryetey Brother Company Limited (ABC), Waste Group Ghana Limited (WGG), Sak-M Company Limited (SAK-M), Meskworld Limited (ML) and Kumasi Waste Management Limited (KWML) are all examples of private waste management firms which did not exist before the millennium. In both the house-to-house and communal solid waste collection models of waste management, the payment of user fees by households is not uncommon. The three unsystematic sanitation financing approaches are most likely to be private sector instruments. User fees undoubtedly are a major innovation in the waste management industry and for that matter sanitation infrastructure financing.

Table 2. Independent Samples Test for Current Approaches to Financing Sanitation Infrastructure

Current approaches to financing sanitation infrastructure delivery in Ghana		Levene's Test for Equality of Variances					t-test for Equality of Means				
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference		
									Lower	Upper	
Debt	Equal variances assumed	10.509	.006*	.594	13	.563	.444	.749	-1.173	2.062	
	Equal variances not assumed			.669	12.633	.516	.444	.665	-.996	1.885	
User fees	Equal variances assumed	2.700	.124	-2.326	13	.025	-1.000	.396	-1.855	-.145	
	Equal variances not assumed			-2.206	6.584	.066	-1.000	.453	-2.086	.086	
Credit	Equal variances assumed	5.022	.043*	-.118	13	.908	-.036	.471	-1.073	.962	
	Equal variances not assumed			-.139	10.933	.892	-.056	.401	-.938	.827	
Loans and grants	Equal variances assumed	.000	.988	.451	13	.659	-.278	.615	-1.052	1.607	
	Equal variances not assumed			.451	10.853	.661	-.278	.616	-1.079	1.635	
Budgetary allocations	Equal variances assumed	.008	.929	2.133	13	.053	.778	.365	-.010	1.566	
	Equal variances not assumed			2.320	12.993	.037	.778	.335	.054	1.502	
Donor fund	Equal variances assumed	.355	.562	1.967	12	.073	1.133	.576	-.122	2.388	
	Equal variances not assumed			1.913	7.732	.093	1.133	.593	-.241	2.508	
Foreign aid	Equal variances assumed	.093	.765	2.864	13	.013	1.500	.524	.369	2.631	
	Equal variances not assumed			2.875	11.004	.015	1.500	.522	.352	2.648	
Non-governmental organizations	Equal variances assumed	2.427	.145	4.017	12	.002	1.778	.443	.813	2.742	
	Equal variances not assumed			3.135	4.585	.029	1.778	.367	.279	3.276	
Community based organizations	Equal variances assumed	2.501	.142	1.496	11	.163	1.095	.732	-.516	2.707	
	Equal variances not assumed			1.462	9.226	.177	1.095	.749	-.593	2.784	

3.3 Enablers of Mechanisms for Sanitation Infrastructure

From Table 3, most variables have mean values above the test mean of 3.5 apart from one which recorded 2.80. The standard deviations are less than 1.0 signalling that, there is little variability in the data collected and consistency in agreement among the respondents. The standard errors were closer to zero suggesting that the sample chosen is an accurate reflection of the population. Therefore, it is reasonable to consider these instruments as the innovative finance mechanisms that could improve sanitation infrastructure delivery in Ghana.

Table 3. Descriptive statistics

<i>Innovative Finance Mechanism</i>	<i>N</i>	<i>Mean</i>	<i>Std. Deviation</i>	<i>Std. Error Mean</i>
<i>Promoting sector reforms - decentralization linked mechanisms</i>	15	4.53	0.640	.165
<i>Promoting sector reforms - special-fund related mechanisms</i>	15	4.40	.828	.214
<i>Promoting sector reforms - programmatic approaches</i>	15	4.13	.640	.165
<i>Leveraging additional resources - private sector participation and investment (PPP, PFI)</i>	15	4.53	.516	.133
<i>Leveraging additional resources - local investments through local credits markets</i>	15	3.73	1.100	.284
<i>Leveraging additional resources - enhancing households and community resources</i>	15	4.27	.594	.153
<i>Improving pro-poor subsidies - subsidies for access to sanitation</i>	15	4.13	1.060	.274
<i>Improving pro-poor subsidies - improving cross-subsidies through tariffs</i>	15	4.20	.941	.243
<i>Improving pro-poor subsidies - Output-based aids</i>	15	3.93	1.100	.284
<i>Microfinance</i>	15	3.40	1.242	.321
<i>Cost recovery tariffs</i>	15	3.93	1.033	.267
<i>Guarantee facility</i>	15	3.73	1.033	.267
<i>Grants</i>	15	3.87	.743	.192
<i>International donor finance</i>	15	3.67	1.047	.270
<i>Leasing</i>	15	2.80	1.373	.355

The Mean Score Ranking Index presented in Table 4 provides an indication of the level of significance of these innovative sanitation financing mechanisms. It may not necessarily reflect the extent of usage but could also be interpreted as the degree of acceptance of these mechanisms in industry as innovative. In other words, the index could be considered as a perception index about potential innovations in sanitation financing. A critical look at these innovative financing mechanisms reveals that they are market-oriented tools. This reflects a shift from a supply-oriented system where the government produces, distributes and consumes these sanitation resources to a demand-oriented system, where the government acts as facilitator and enabler of the market. For instance, leveraging additional resources from the private sector through Public Private Partnerships (PPP) and Private Finance Initiatives (PFI) ranked the most significant. These mechanisms could be appropriate for promoting public sector reforms and empowering local governments to be financial autonomous, which could facilitate the decentralization of governance and reduce the burden on the Central Government to fund sanitation infrastructure delivery.

3.4 PPP and PFI Engagements

PPPs and PFI combine the capital and expertise of the private sector with the management and oversight of the public agency to provide these services. PPPs can effectively finance, manage and operate projects, while minimizing taxpayer costs and risks. Although PPPs are not likely to replace traditional financing, it is generally recognized that they offer a long-term sustainable approach to improving infrastructure, enhancing the value of public assets, and making better use of taxpayers' money. This provides some good evidence of recent government policy to engage the private sector as the engine of growth, since government resources mainly from taxes are limited and inadequate to afford the luxury of having to be the major and direct provider of infrastructure in Ghana.

In the PFI model, the private sector remains responsible for the design, construction and operation of an infrastructure facility. In some cases, the public sector may relinquish the right of ownership of assets to the private sector. Hence, the public sector purchases infrastructure services from the private sector through a long-term agreement. PFI projects, therefore, bear direct financial obligations to the government in any event. In addition, explicit and implicit contingent liabilities may also arise due to loan guarantees provided to the lenders and default of a public or private entity on

non-guaranteed loans. A PFI project can be structured on minimum payment by the government over a fixed contract tenure, or minimum contract tenure for a fixed annual payment, or a combination of both payment and tenure. In the PFI model, asset ownership at the end of the contract period is generally transferred to the public sector.

Table 4. Mean Score Ranking Index of Innovative Financing Mechanisms

	<i>Mean score index</i>	<i>Std. Deviation</i>	<i>Std. mean error</i>	<i>Ranking</i>
<i>Leveraging additional resources - private sector participation and investment (PPP, PFI)</i>	4.53	0.516	0.133	1 st
<i>Promoting sector reforms - decentralization linked mechanisms</i>	4.53	0.640	0.165	2 nd
<i>Promoting sector reforms - special-fund related mechanisms</i>	4.40	0.828	0.214	3 rd
<i>Leveraging additional resources - enhancing households and community resources</i>	4.27	0.594	0.153	4 th
<i>Improving pro-poor subsidies - improving cross-subsidies through tariffs</i>	4.20	0.941	0.243	5 th
<i>Promoting sector reforms - programmatic approaches</i>	4.13	0.640	0.165	6 th
<i>Improving pro-poor subsidies - subsidies for access to sanitation</i>	4.13	1.060	0.274	7 th
<i>Cost recovery tariffs</i>	3.93	1.033	0.267	8 th
<i>Improving pro-poor subsidies - Output-based aids</i>	3.93	1.100	0.284	9 th
<i>Grants</i>	3.87	0.743	0.192	10 th
<i>Guarantee facility</i>	3.73	1.033	0.267	11 th
<i>Leveraging additional resources - local investments through local credits markets</i>	3.73	1.100	0.284	12 th
<i>International donor finance</i>	3.67	1.047	0.270	13 th
<i>Microfinance</i>	3.40*	1.242	0.321	14 th
<i>Leasing</i>	2.80*	1.373	0.355	15 th

Note: Innovative financing mechanisms with mean scores below the hypothesized mean

3.5 Subsidies

Notably, the use of subsidies is a major enabling tools provided mostly by governments to households to improve their ability to afford and increase their consumption of market-provided sanitation goods and services. Often, a setback of market provision is low affordability levels since household incomes tend are low compared with the cost of goods and services. This constrains a household's ability to participate in the market and may be a major argument against the choice of the market as a provider and distributor of sanitation goods and services. Most importantly, low affordability levels coupled with the ever increasing cost of infrastructure delivery could drive out private investment, which is likely to contribute to the failure of government's policy on public private partnerships. In essence, subsidies are necessary to inject efficiency into the market. For instance, pro-poor subsidies specifically target the poor, who are normally price-out of the sanitation market. Cross-subsidization by way of charging the rich more and using the extra to subsidize the poor could inherently facilitate the efficient allocation and distribution of limited resources; thus, reducing wastage.

According to the World Bank, sanitation subsidies come in many forms including: subsidy for latrine construction, social subsidies, subsidized consumption in urban areas and subsidized access to piped networks. An example is the Ghana WASH Window of the Sustainable Water Fund (GWW-FDW): a Public Private Partnership (PPP) facility and an important part of the Ghana Netherlands WASH Programme (GNWP). The Ghana WASH Window offers a funding opportunity (up to 70% of the project value) that encourages joint initiatives by government parties, trade and industry and non-governmental organizations or knowledge institutions. The subsidy that can be applied for amounts from a minimum of EUR 500,000, and is restricted to a maximum of 10 million EUR excluding the own contribution (Netherlands Enterprise Agency, 2014).

3.6 Grants and Guarantees

Grants given by the state and other development partners to private sector firms in waste management could be very useful for setting up capital and working capital. Sanitation infrastructure like most other infrastructure is expensive to construct and often requires substantial capital mobilization. By providing grants to private firms, the state would be investing in efficient cost recovery systems, the benefits of which may not be achieved by state if

it provided such services by itself. For instance, guarantee facilities either provided by the state or private institutions enable waste management firms to have access to substantial credit needed for the development and operation of sanitation infrastructure from the financial system. This instrument serves as a default risk mitigation tool, interest rate reducer and credit enhancing mechanism.

3.7 Microfinance and Leasing

Microfinance and leasing for sanitation infrastructure delivery are relatively new concepts and are at present comparatively unpopular (according to their mean scores of 3.40 and 2.80 respectively). Although the financing sector has experienced the proliferation of microfinance institutions, their products have largely targeted poor households and individuals. Leveraging the microfinance concept to finance sanitation infrastructure may be useful for small-scale projects, where the lack of collateral may not be a restraint to credit access. At the household level, it is difficult to envisage the link between microfinance finance and consumption of sanitation goods and services. Leasing could be viewed in two respects. First, private waste management firms could finance the acquisition and or construction of sanitation infrastructure and lease subsequently to the government, community or households. For instance, mobile toilet facilities have recently become of common usage during events like funerals, entertainment and church gatherings. Secondly, sanitation infrastructure could be financed by investors and leased to private waste management firms for management.

4. Conclusions and Recommendations

Adequate and efficient sanitation infrastructure is one of the measures of a country's level of development. Achieving proper sanitation a major target of the Millennium Development Goals has been difficult due to inadequate investment in the sector. Traditional sanitation infrastructure financing approaches usually through government taxes have proven limited and unable to deliver adequate sanitation goods and services. This has resulted in epidemics in recent times and many human lives lost. Current streams of financing approaches could be classified as systematic and unsystematic. The former refers to financing approaches that are common to all waste management firms, whereas the latter is firm-specific. Six of these approaches including; *debt, credit, loans and grants, budgetary allocations,*

donor funds and *community-based organizations* could be grouped as systematic, while three are systematic including *non-governmental organizations*, *foreign aid* and *user fees*. Since *debt*, *credit*, and *loans and grants* could be considered severally and jointly as the same instrument, four systematic sanitation financing instruments are effectively in use in Ghana. The argument for complementary sources of financing has prompted propositions in favor of radical innovation in the sector. Innovation within the sector is currently limited and restricted to emerging market-oriented instruments - given the adoption of liberalism in recent times. The study identifies fifteen types of innovation in use currently in the waste management industry. The government's new role in the market economy as facilitator and enabler of market has manifested in the use of PPIs and PFIs mainly to deliver sanitation infrastructure. These approaches require robust demand indicators such as compelling affordability levels. In this regards, subsidies of various kinds including cross-subsidies and pro-poor subsidies are considered by respondents as potential stimulants of demand. Grants and guarantee facilities could be an effective way to leverage the managerial competencies of private sectors firms to deliver public goods and services like sanitation privately. The application of the microfinance concept to sanitation infrastructure financing appears interesting and worthy of further research.

5. References

- Ahadzie, D.K., (2007). A Model for Predicting the Performance of Project Managers in Mass House Building Projects in Ghana. Unpublished Thesis (PhD). University of Wolverhampton, UK.
- Annamradju, S., Calaguas, B., and Gutierrez, E., (2002). Financing Water and Sanitation. Water Aid, United Kingdom.
- Arboleda, C.A. and Abraham, D.M., (2006). Evaluation of Flexibility in Capital Investments of Infrastructure Systems. *Engineering, Construction and Architectural Management*, 13(3): 254 – 274.
- Asare, B.E., and Frimpong, M.K., (2013). Public-Private Partnerships and Urban Sanitation: Do Expectations Meet Realities in Madina-Ghana? *Journal of African Studies and Development*, 5 (5): 113 - 124

Badu, E., Edwards, D.J., Owusu-Manu, D., and Brown, D.M., (2012). Barriers to the Implementation of Innovative Financing of Infrastructure. *Journal of Financial Management of Property and Construction*, 17(3): 253-273.

Banerjee, S.G., and Morella, E., (2011). *Africa's Water and Sanitation Infrastructure: Access, Affordability, and Alternatives*. Illustrated ed. *Directions in Developments* (Washington D.C): World Bank Publishing. Available at: <http://elibrary.worldbank.org/content/book/9780821384572> [Accessed February 21, 2014].

Bank for International Settlements, (1986). *Recent Innovations in International Banking*, Basel: Bank for International Settlements.

Bátiz-Lazo, B., and Woldensebet, K., (2006). The Dynamics of Product and Process Innovation in UK Banking. *Journal of Financial Services Management*, 1 (4): 400-421.

Beck, T., Demirgüç-Kunt, A., and Levine, R., (2007). A New Database on Financial Development and Structure. *World Bank Economic Review*, 14(1): 597-605.

Center for Strategic and International Studies, (2009). *Enhancing U.S. Leadership on Drinking Water and Sanitation. Opportunities within Global Health Programs. A Report of the CSIS Global Health Policy Center, September 2009 (Bliss Report)*. Available at: http://www.csis.org/files/publication/090924_Bliss_WaterHealth_Web.pdf [Accessed: February 23, 2013].

Coakes, S.J., Steed, L., and Ong, C., (2009). *SPSS: Analysis without Anguish: Version 16.0 for Windows*. London: John Wiley and Sons.

Dijk, M.P.V., (2003). *Liberalization of Drinking Water in Europe and Developing Countries*. Delft: UNESCO-IHE Institute for Water Education.

Dijk, M.P.V., (2008). Role of Small-Scale Private Operators in Water and Sanitation. In: *International Journal of Water*, 4 (3/4): 275-290.

Dollar, D., and Gatti, R., (1999). *Gender Inequality, Income and Growth: Are Good Times Good for Women? Working Paper Series no. 1*. Washington DC: The World Bank.

Drucker, P.F., (1998). *The Discipline of Innovation*. *Harvard Business Review*. Reprint Number 98604. November–December 1998.

Field, A., (2005). *Discovering Statistics using SPSS for Windows*, London: Sage Publication.

Fonseca, C., and Cardone, R., (2006). Cost Estimates, Budgets, Aid and the Water Sector: What's going on? An Analysis Illustrated with Data from 12 Sub-Saharan African Countries. WELL Briefing Note, September 2006. <http://www.irc.nl/page/32526> [Accessed on February 23, 2014].

Government of Ghana Website, (2011). Stakeholders Meet to Discuss Sanitation Problem. Government of Ghana. Available from: <http://www.ghana.gov.gh/index.php/news/general-news/4959-stakeholders-meet-to-discuss-sanitationproblem> [Accessed on February 23, 2014].

Hall, D., and Lobina, E., (2012). Financing Water and Sanitation: Public Realities. A Report for Public Services International for the 6th World Water Forum, Marseille, March 2012. Public Services International Research Unit (PSIRU).

Hutton, G., Haller, L., and Bartram, J., (2007a). Economic and Health Effects of Increasing Coverage of Low-Cost Household Drinking-Water Supply and Sanitation Interventions to Countries Off-Track to Meet MDG Target 10. Geneva: World Health Organization.

Hutton, G., Haller, L., and Bartram, J., (2007b). Global Costs-Benefit Analysis of Water Supply and Sanitation Interventions. *Journal of Water and Health*, 5(4): 481–502.

Kehew, R., Tomoko, M., and Petersen, J., (2005). Local Financing for Sub-Sovereign Infrastructure in Developing Countries: Case Studies of Innovative Domestic Credit Enhancement Entities and Techniques, Discussion Paper No.1, Infrastructure, Economics and Finance Department, World Bank, available at: [www.waterfinance.org/6_Local%20Financing%20For%20Sub Sovereign%20Infrastructure.pdf](http://www.waterfinance.org/6_Local%20Financing%20For%20Sub%20Sovereign%20Infrastructure.pdf) [Accessed February 20, 2011].

Lerner, J., and Tufano, P., (2011). The Consequences of Financial Innovation: A Counterfactual Research Agenda. *Annual Review of Financial Economics*, 3(1).

Levene, H., (1960). Robust Tests for Equality of Variances. In: *In Contributions to Probability and Statistics* (Olkin, I. ed.). Stanford University Press: Palo Alto, CA, 278–292.

Martell, C., and Guess, G.M., (2006). Development of Local Government Debt Financing Markets: Application of a Market-Based Framework. *Public Budgeting and Finance*, 26(1): 88-119.

Miller, M.H., (1986). Financial Innovation: The Last Twenty Years and the Next. *Journal of Financial and Quantitative Analysis*, 21(1): 459 – 471.

Minh, H.V., and Hung, N.V., (2011). Economic Aspects of Sanitation in Developing Countries. *Environmental Health Insight*, 5(1): 63-70.

Ngowi, A.B., Pienaar, E., Akindele, O., and Iwisi, D., (2006). Globalization of the Construction Industry: a Review of Infrastructure Financing. *Journal of Financial Management of Property and Construction*, 11(1): 45-58.

OECD, (2005). *Oslo Manual, Guidelines for Collecting and Interpreting Innovation Data*. 3rd Edition. Paris: OECD Publishing, 47-52.

Platz, D., (2009). Infrastructure Finance in Developing Countries the Potential of Sub-Sovereign Bonds. *Economic and Social Affairs, DESA Working Paper No.76ST/ESA/2009/DWP/76*, July, Available at: www.un.org/esa/desa/papers/2009/wp76_2009.pdf [Accessed on February 1, 2013].

Ramadani, V., and Gerguri, S., (2010). *Innovation: Principles and Strategies* [Online]. MPRA Paper No. 22267. Available at <http://mpra.ub.uni-muenchen.de/22267/>. [Accessed on September 29, 2014]

Schrieder, G., and Heidhues, F., (1995). Reaching the Poor through Financial Innovations. *Quarterly Journal of International Agriculture*, 34(2): 132-148.

Shiller, R., (2013). Capitalism and Financial Innovation. *Financial Analysts Journal*, 69(1): 21 – 25.

Sihombing, L.B., (2009). Financial Innovation for Infrastructure Financing. World Bank. Available at: [http://lnweb90.worldbank.org/exteu/SharePapers.nsf/0/EE62522278B178EA852574210020D196/\\$File/financial%20innovation%20for%20infrastructure%20financing.pdf?OpenElement](http://lnweb90.worldbank.org/exteu/SharePapers.nsf/0/EE62522278B178EA852574210020D196/$File/financial%20innovation%20for%20infrastructure%20financing.pdf?OpenElement) [Accessed on February 20, 2015].

SuSanA, (2008). *Towards more Sustainable Sanitation Solutions: SuSanA Vision Document*. Sustainable Sanitation Alliance (SuSanA). Available at: <http://www2.gtz.de/dokumente/oe44/ecosan/susana/susana-visionstatement-I-version-1.1.pdf> [Accessed on April 29, 2014].

Tremolet, S., Kolsky, P., and Perez, E., (2010). *Financing On-Site Sanitation for the Poor. A Six Country Comparative Review and Analysis*. Water and Sanitation Program: Technical Paper. WSP Sanitation Global Practice Team. January, Washington, DC; available at: http://www.wsp.org/sites/wsp.org/files/publications/financing_analysis.pdf [Accessed: June 2015]

United Nations, (2013). *The Millennium Development Goals Report 2013*. United Nations: New York.

World Bank, (2003). Meeting the Financing Challenge for Water Supply and Sanitation: Incentives to Promote Reforms, Leverage Resources, and Improve Targeting, Report for Water and Sanitation Program, available at: http://www.wsp.org/sites/wsp.org/files/publications/46200735636_MeetingFinancingChallenge. [Accessed on February 20, 2015]