

Analysis of Strategic Issues Underpinning the Innovative Financing of Infrastructure within Developing Countries

Edward Badu¹; De-Graft Owusu-Manu²; David J. Edwards³; and Gary D. Holt⁴

Abstract: Infrastructure deficit is inextricably linked to funding availability, especially in developing countries. Innovative financing (IF) can be beneficial in helping combat such deficit. Strategic issues underpinning IF of Ghanaian infrastructure projects are identified and analyzed. The study's empirical aspect employs structured interviews and a questionnaire survey to accrue data from project implementation agencies relating to infrastructure IF. Factor analysis establishes those variables from among the large number studied that measure similar underlying dimensions. Three strategic IF issues are identified and explained: (1) appropriateness of the financing method, (2) pricing and management of the financing method, and (3) sustainability of the financing method. Infrastructure development stakeholders in developing countries may benefit from the findings through greater appreciation of IF sources and techniques. Suggested future research includes detailed exploration of IF barriers and comparative critical appraisal of similar research studies at the international level. DOI: 10.1061/(ASCE)CO.1943-7862.0000641. © 2013 American Society of Civil Engineers.

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Introduction

Infrastructure deficit is a global issue, but its impact is felt most in developing countries [Ngowi et al. 2006; United Nations Economic Commission for Europe (UNECE) 2008]. The African continent is at the forefront of infrastructural development needs and confronted with large investment deficits (Foster et al. 2009). This manifests itself in congested roads, poorly maintained recreational facilities, and deteriorated public and other infrastructure assets (UNECE 2008). Socioeconomic benefits from well-maintained infrastructure are profound; they help stimulate a prosperous economy and improve citizens' quality of life. However, competition for scarce resources within a developing economy means that infrastructure expansion and maintenance is increasingly difficult to fund (U.S. Department of Transportation 2002; Ploeg and Casey 2006; Foster 2008; D. Platz, Working Paper, United Nations Department of Economic and Social Affairs, 2009).

As infrastructure demand increases, its investment drivers vary between countries (Foster 2008). Within developed economies, infrastructure development focuses on upgrade, but emerging

economies like India and developing countries like Ghana urgently need new infrastructure to underpin economic growth (Abadie 2008). The Organization for Economic Cooperation and Development (OECD) estimates that required investment in road, rail, telecoms, electricity, and water infrastructure will reach US\$71 trillion by 2030. This figure does not include investment in seaports, airports, and social infrastructure but still represents approximately 3.5% of global gross domestic product (GDP) to 2030 (Abadie 2008). Growing worldwide infrastructural demand puts intense pressure on public budgets, especially in countries with fiscal deficits (Foster 2008).

In Ghana, the problem is exacerbated by rapid urbanization, population growth, and shortfalls in fulfilment of pledges from development partners [Ghana Poverty Reduction Strategy (GPRS) 2003]. Ghanaian financial institutions provide high-interest short-term loans, but these are unsuitable for infrastructure financing. This issue is compounded by the global economic crisis, which has reduced capital flows to developing countries by approximately 50% (Owusu-Manu and Badu 2009) and the fact that most Ghanaian infrastructure is financed by foreign institutions (Caspary 2009). The World Bank advocates mobilization of domestic funds for infrastructure investment (Dirie 2005), but the Ghanaian central government has urged local authorities not to overrely on the common fund and instead encourages innovative revenue mobilization for this purpose. For instance, a strategy to encourage metropolitan, municipal, and district assemblies (MMDAs) to increase their internally generated funds (IGFs) is to increase the common fund's margins for those with high IGFs, while introduction of the GETFund (US\$750 million 10-year bonds issued in 2007) and recent interest in public-private partnerships (PPPs) are further evidence of Ghana's pursuance of innovative financing (IF) solutions. Unfortunately, efforts to date fall short of meeting the nation's infrastructure challenges (GPRS 2003).

Over the last two decades, a concerted effort throughout developing countries has sought increased infrastructure development through IF mechanisms (Ngowi et al. 2006). However, strategic issues and success in securing IF are not fully understood.

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To address this, the present study explores strategic issues pertinent to infrastructure IF in the developing country of Ghana. The aim of this case study is to provide business imperative insights to potentially increase both efficiency and viability of IF mechanisms. Products of the study may contribute to formulation of policy to enhance infrastructure capacity in developing countries. Other beneficiaries might include project managers and developers, whose knowledge of clients' finance is key to successful drafting and management of infrastructure contracts.

IF: Definition and Description

IF is entrenched in extant literature, but its formal definition is less frequent and sometimes inadequate (Ploeg and Casey 2006). IF is broadly recognized to embrace tools and techniques that supplement traditional financing sources and methods, and is defined by the World Bank as “involv[ing] combining available financial instruments into a new package or using them in a new context or setting . . . to . . . generate additional development funds by tapping new funding sources . . . enhance the efficiency of financial flows, by reducing delivery time and/or costs . . . [and] make financial flows more results-oriented, by explicitly linking funding flows to measurable performance” [World Bank Group (WBG) 2011, p. 1].

Its effective application requires a potential development to be cross referenced with available IF tools in order to recognize synergy (U.S. Department of Transportation 2002; Cohen 2002). Project characteristics are critical to determining appropriate IF tools (N. Mor and S. Sehrawat, Working Paper, Institute for Financial Management and Research, Chennai, India, 2006)—in part because tools are not mutually exclusive (Atkinson 2003; Cardone and Fonseca 2006)—so achieving synergy in their combination is a strategy in itself. IF applicability is conceptualized in Fig. 1 in which the base of the pyramid represents the majority of (tax-supported) projects that do not generate revenues. For these, IF can enhance flexibility and maximize resources, and various fund management techniques—such as advance construction (O'Neill 1998) and tapered grant-supported debt service (Hines and Thaler 1995)—may help progress them to construction more swiftly (Hines and Thaler 1995; O'Neill 1998). Ploeg and Casey (2006)

argued that aside from fund management, such projects are prime candidates for debt instruments in which future apportionments are used to pay debt service and other related costs.

The pyramid's midsection represents projects that can be partially financed with project-related revenues, but may also require public assistance to achieve financial viability (so-called “blended infrastructure”). IF strategy in this paper encompasses various types of low-interest loans, loan guarantees, and other credit enhancements to national, regional, and local projects (U.S. Department of Transportation 2004; Ploeg and Casey 2006). Such credit programs are designed to assist large-scale projects of regional or national significance that might otherwise be delayed or abandoned because of their risk, complexity, or cost (U.S. Department of Transportation 2004; Ploeg and Casey 2006). The pyramid peak represents the small number of projects able to secure private capital financing without government assistance (self-financing infrastructure), and this category's strategy focuses on appropriate pricing (U.S. Department of Transportation 2004). The most effective IF solutions are those that push tax-supported infrastructure into the blended or self-financing categories, which in turn help avoid tax increases or the issue of new debt to fund shortfalls (Cohen 2002; Ploeg and Casey 2006).

IF tools and institutional arrangements as augmentations to traditional finance can enhance funding effectiveness and bridge investment gaps (U.S. Department of Transportation 2004) by maximizing ability to leverage future revenue streams, attract new sources of investment, and accelerate project completion (Ploeg and Casey 2006). IF calls for the use of demand management strategies, which according to the OECD (2007, 2008) should manage rapidly growing infrastructure requirements without expanding supply (i.e., keeping demand for infrastructure in check). However, Fig. 2 shows that demand is set to expand significantly, driven by major factors of change such as global economic growth, technological progress, climate change, urbanization, and increasing congestion (OECD 2006; Wijers 2010).

Numerous IF options are charted within the literature including PPPs, municipal bonds, and direct access to international development agency funds (Dirie 2005). A review of recent works (Cohen 2002; Semler 2005; Nichol 2007; Nicolosi 2009) broadly categorized IF under three themes: (1) adaptation, in which an existing funding tool is used differently (Cardone and Fonseca 2006;

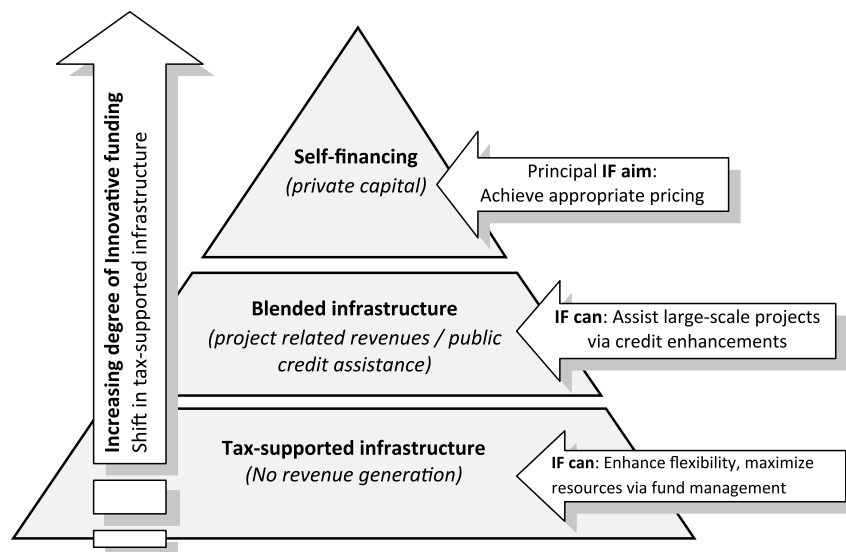


Fig. 1. Applicability of particular IF tools (adapted from U.S. Department of Transportation 2004)

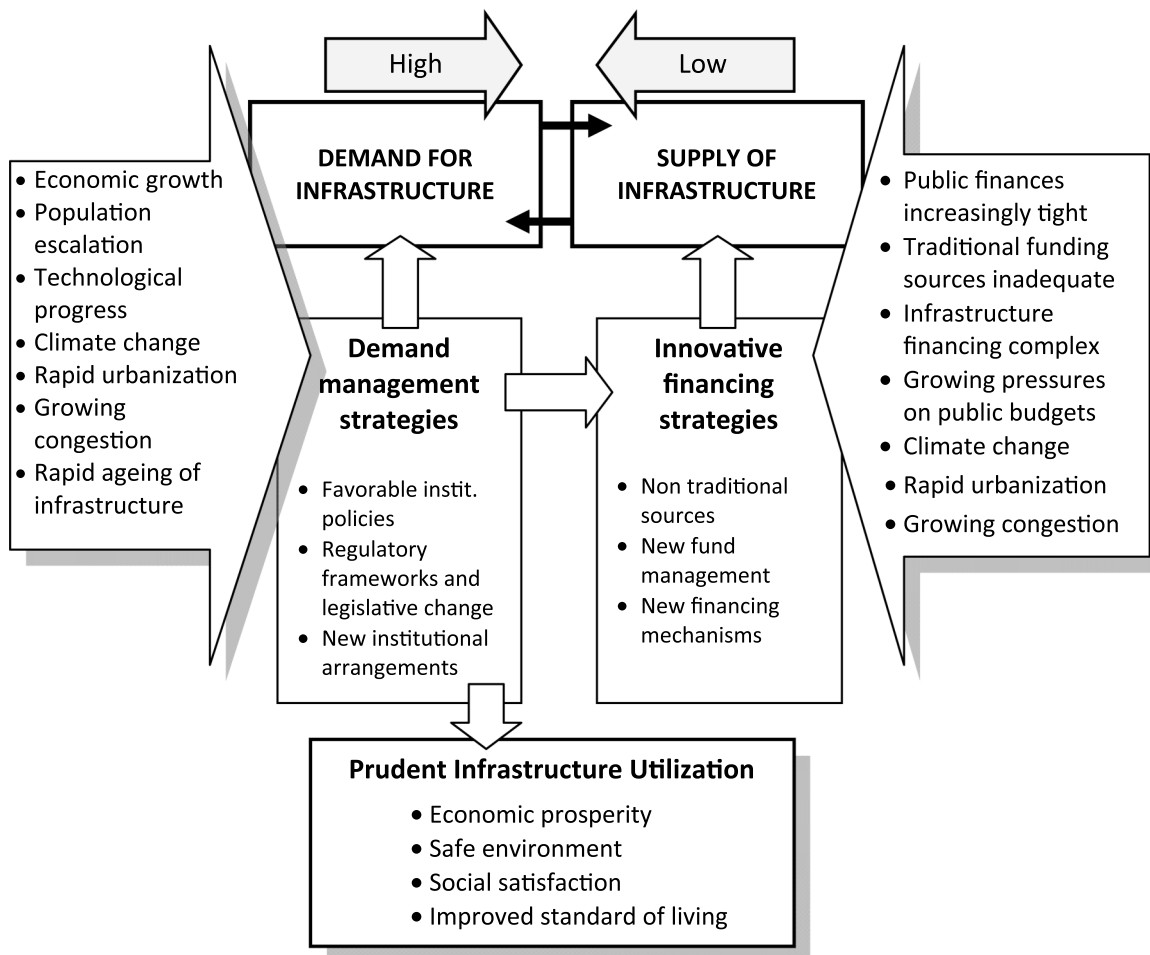


Fig. 2. Dynamic environment of innovative financing

Sihombing 2009); (2) invention, which employs new financing tools and mechanisms (U.S. Department of Transportation 2004); and (3) expansion, whereby familiar methods of financing, funding, and delivery are applied to different types of infrastructure (Nichol 2007; U.S. Department of Transportation 2006). IF thrives where the main objective is to effectively provide the right amount of infrastructure at optimal cost (Ngowi et al. 2006). The majority of IF programs are enabled by legislative changes (National Conference of State Legislatures 2007) such as in the case of PPPs (Dixon et al. 2005). Some recent examples of successfully completed IF infrastructure have included use of:

- Tax increment financing, in which the difference in baseline taxation and that of an improved property level of taxation goes to district administrators for investment, as was used to improve traffic and public infrastructure in Chicago (National Association of Homebuilders 2011);
- Private-public partnership between Lagos State Government, The African Development Bank, and private sector financiers to upgrade the Lekki-Epe Expressway toll road, Nigeria's largest PPP initiative as of 2010 (Brixiova et al. 2011); and
- Syndicate loan contract, in which a hostel with capacity to accommodate 7,000 students valued at GH¢32 million (US\$20 million) was delivered to the University of Ghana, for which the university secured funding with the rental revenue as collateral and financing was provided by the government and the Ghana Commercial Bank.

Infrastructure IF: Specific Case of PPPs

A PPP is a contract between the public and private sectors in which the latter assumes substantial financial, technical, and operational risk in the design, financing, building (or refurbishment), and operation of a project (Farlam 2005). It combines public need with private capability and resources to create market opportunity through which need is satisfied and profit is generated. Intrinsic within a PPP is the notion that the public sector acquires infrastructure through a long-term financial commitment to a private vendor. PPPs incorporate shared risk, shared profits, and reward allocation (Ploeg and Casey 2008). That is, risks and profits are shared between the public and private sectors, while reward allocation is related to the amount of risk and responsibility adopted by either party.

PPP projects usually commence with a government decision to build (or refurbish) an infrastructure asset, followed by decisions on when, where, and performance specifications for quantity and quality (Townsend 2005). For smaller projects, the government usually facilitates the partnership by identifying private partners to assist with the whole development life cycle (Farlam 2005), at which juncture the government's role subsequently changes to that of a regulatory and monitoring capacity. For larger projects, the public and private sectors create a new stand-alone business corporation commonly called a special purpose vehicle (SPV) whose *raison d'être* is to arrange design, financing, construction, ownership, and operation of the asset (Ploeg and Casey 2006, 2008). Various

Table 1. Benefits, Success Factors, and Challenges of PPPs

Dynamic factors	Measurable factors	Sample literature sources
Benefits	Maximization of value-for-money; Use of private sector expertise and innovation; Appropriate risk transfer; Access to increased capital; Efficiency gains; Delivery of projects on time; Delivery of better quality projects; Cost effectiveness; Performance-related payments; and Competition and price certainty.	Trujillo et al. (1997); Cohen (2002); Farlam (2005); Semler (2005); and N. Mor and S. Sehwat, Working Paper, Institute for Financial Management and Research, Chennai, India (2006).
Success factors	Effective monitoring and performance reviews; Thorough planning; Good communication; Strong political commitment; Legal and regulatory framework; Tariff sustainability; Proper allocation of risk; Institutional capacity; Accountability and transparency; Project selection; Competitive environment; Realistic expectations; and Expertise and experience.	Trujillo et al. (1997); Cohen (2002); Farlam (2005); Semler (2005); N. Mor and S. Sehwat, Working Paper, Institute for Financial Management and Research, Chennai, India (2006); Ploeg and Casey (2006); Moszoro and Krzyzanowska (2008); Mensah (2008); Porter (2008); Thay (2008); and Cohen (2010).
Challenges	High transaction costs; Corruption incidence; Resistance from stakeholders; Complex and demanding contracts; Limited capacity of public agencies; Need for changes in policies and regulatory framework; Lack of bankable projects; Private sector not always being efficient; Loss of public accountability and transparency; and Difficulties in optimal allocation of risk.	Trujillo et al. (1997); Cohen (2002); Farlam (2005); Semler (2005); N. Mor and S. Sehwat, Working Paper, Institute for Financial Management and Research, Chennai, India (2006); Ploeg and Casey (2006); Moszoro and Krzyzanowska (2008); Mensah (2008); Porter (2008); and Thay (2008).

commentators align to the view that PPPs dominate infrastructure IF and are often therefore perceived as a panacea to the financing problem (Cohen 2002; Semler 2005; N. Mor and S. Sehwat, Working Paper, Institute for Financial Management and Research, Chennai, India, 2006; Ploeg and Casey 2006, 2008; Nichol 2007; Nicolosi 2009).

Accordingly, PPPs are an innovative solution to realizing strategic issues of enhancement of government financing capacities, improvement of public investment efficiency, and the harnessing of consumer-orientated management expertise (Farlam 2005). They are innovative in this context because the private sector replaces public sector infrastructure finance (Farlam 2005), so instead of being the exclusive financier, owner, operator, manager, and provider, the public role facilitates, regulates, and guarantees provision (Porter 2008; Mensah 2008). Funding is securitized by revenue generated as well as the asset, and because there is little recourse to the assets of the various corporations or governments involved, such financing relies exclusively on the project's viability (Ploeg and Casey 2006). Table 1 highlights principal PPP benefits, success factors, and challenges as determined from the literature.

Methodological Approach

The principal research aim was to better understand business imperatives that can potentially increase both efficiency and viability of IF mechanisms within developing countries. This positioned the

study within a philosophical tradition while encapsulating ontological, epistemological, and axiological concepts [cf. Collis and Hussey (2003), Creswell (1994), Thurairajah et al. (2006), and Dainty (2007)]. Philosophical concerns are important in research enquiry because they shape the choice of research instruments (Christou et al. 2008), and in this instance they considered the contrasting implications of positivist and interpretivist standpoints (Dainty 2007; Christou et al. 2008). Epistemologically, the research adopted a positivist approach, assuming that knowledge is established through the accumulation of verified facts (Bryman 2004) and that identification and analysis of strategic IF issues must be objective and replicable. Thus, the research takes a realist ontological view because strategic issues exist as external concepts beyond the researchers' influence. Taking account of the previous information, a mixed research design incorporated both inductive and deductive reasoning.

Identification of Strategic Issues

Initially, an extensive critique of the literature identified a disparate range of strategic issues affecting the selection and use of IF for infrastructure development. This knowledge was augmented through interviews and consultations among experts to verify understanding of the issues identified and highlight key IF concerns (generally and especially within the developing countries context) that may not have become visible from the literature. For instance, issues regarding the sustainability of IF strategy over the longer

Table 2. Brief Descriptions of Strategic Issues

Strategic issues	Brief description	Source
1. Revenue potential	Effective utilization of limited resources; ability of project to generate enough revenue to service its debt and meet investment needs while making good use of existing multilateral channels to target financing of infrastructure investments at lower transaction costs	Hecht et al. (2010)
2. Diversification	Process whereby financial service providers try to differentiate their products and services, responding to swift or gradual changes in global financial landscape; implementation of new product, service, organizational form, or processes that effectively reduce costs and risks	Ho (2004)
3. Issues of how funds are spent	Instituting appropriate mechanisms to ensure transparency and accountability in funds disbursement; ensuring funds reach frontline service providers; avoiding pilfering	Osei-Tutu et al. (2010)
4. Sustainability of the strategy in the long run	Managing resources and waste; looking at opportunities and risks posed by industry partners; sustainability strategy will enhance revenue generation; engage effectively with key stakeholders; promote innovation; reduce costs; manage risk	Suresh (2004)
5. Strategies for allocation of funding	Methodology for designing most rational allocation of funds and aligning these to the right project and national development goals; funds' allocation strategies should allow funds predictability and harmonize execution of planned programs and budgets	Ploeg and Casey (2006)
6. The principle of cost recovery from users	Setting required fees and user charges to recover full cost of the investment in accordance with existing mandatory and discretionary regulations	R. Kranton, Working Paper, World Bank, Washington, DC (1990)
7. Demand management	Economic term, refers to management of the distribution and access to goods and services on the basis of needs, and thus the drafting of policies to control consumer demand for infrastructure utilization through the use of interest rates, taxation, and public expenditure	Renwick and Archibald (1998)
8. Capacity to overcome cash flow shortages	Designing the revenue generation stream of the IF mechanism in a way that ensures liquidity while providing continuous flow of cash to meet both short- and long-term financing needs	Owusu-Manu and Badu (2011)
9. Viability of sources of financing	A thorough elaboration of the legislation aimed at identification of legal means of mobilizing sufficient income (funds) to meet operating payments, debt commitments, and, where applicable, allow growth while maintaining service levels	Cohen (2010)
10. Appropriateness of project type	Matching a suitable IF technique to an appropriate investment project with sustained tangible and intangible outcomes	Shenhar and Wideman (1997)
11. Legal and regulatory implications	Appropriation of investment funds in compliance with existing mandatory and discretionary legal regulations that ensures transparency and accountability	Beck et al. (2005)
12. Governance and institutional capacity issues	Effective governance and well-functioning institutional environment (formal laws, regulations, procedures, as well as informal conventions, customs, and norms) that supports infrastructure management, finance and cost recovery; an enabling institutional environment is crucial for a governance regime but has broader implications for innovative financing mechanisms	Meijerink et al. (2007)
13. Ease of compliance	Ease of the IF mechanism in mobilizing funds in accordance with existing laws to sustain confidence in its administration	OECD (2004)

term and how IF funds are best invested rarely surfaced from the literature but were identified through the expert consultation process. Table 2 lists 13 variables selected as key to the study, along with a short description of each and references for further information. A questionnaire survey (elucidated subsequently) was then designed taking account of how these underlying measures apply themselves to infrastructure IF in practice.

Data Collection and Instrumentation

Since the drafting of its PPP policy framework in 2009 and subsequent establishment of a PPP advisory unit within the Ministry of Finance and Economic Planning, Ghana has witnessed a proliferation of PPP projects. Attempts at quoting specific figures may be misleading due to a paucity of data, but the survey revealed that all 27 MMDAs in the Ashanti Region (from which the sample were drawn) have initiated a variety of PPP projects covering, e.g., market infrastructure, community centers, and public sanitary facilities. This research therefore focused on the local government level because in Ghana the district assemblies are responsible for provision of local infrastructure (Malcolm and Braimah 2004). The Ashanti Region was targeted because it is second to the country's capital city Accra in terms of size and population (Ayisi 2000;

Ahadzie 2007) and represents the largest number of districts and development projects. Accordingly, it provided the best opportunity to target knowledgeable survey participants.

A purposive sampling technique was adopted. This involved conscious selection of participants in this instance because they exemplified the phenomenon of interest (IF) in a particular way (through profession and experience). Purposive sampling may be considered to introduce bias in contrast to, for example, random sampling, but it is acceptable to employ such a method where the former population characteristics of exemplification apply [see Matsumoto and van de Vijer (2010), p. 109–111]. The population was defined as all senior management personnel (including finance officers, planning officers, and engineers) in each of the 27 MMDAs within the Ashanti Region. These were targeted because of their experience in the financing and provision of infrastructure at the local level. Sample size might be criticized, but it represented a significant proportion of the population under study.

A self-administered structured questionnaire accompanied by a cover letter was used to collect data [cf. Saunders and Thornhill (2008)]. The questionnaire comprised three sections, of which the first two acquired information regarding respondents' profiles and experiences of infrastructure financing and provision (to establish the reliability of data). In the third section, respondents were

invited to assign an importance rating to 13 strategic issues (listed in Table 2 and discussed in detail subsequently) by asking “How would you rate the importance of the following strategic issue in innovative financing of infrastructure projects in Ghana?” Each rating was measured using a 5-point Likert scale, where 1 = not important, 2 = less important, 3 = quite important, 4 = important, and 5 = very important [cf. Dillman (2007)]. The cover letter explained the rationale for the research work, gave assurances of confidentiality, and provided full contact details for participants who sought any additional clarification either on the study or the questions posed.

Of the 81 questionnaires distributed, 61 (75%) were completed and returned—a high response attributed to adherence to two principles enshrined in Dillman (2007): (1) mitigating any aspect of the survey that could negatively affect quality or quantity of response (Wahab 1996), and (2) designing the survey in detail and using an administrative plan. The survey took approximately 10 weeks and during this period, follow-up reminders were made to the sample via telephone calls, e-mails, and personal visits (which also contributed to the 75% response rate). During these reminder sessions, any queries on questionnaire clarity were also resolved.

Analytical Method: Factor Analysis

Given the number of variables involved, factor analysis was used to establish which of these could be measuring aspects of the same underlying dimensions. The application of factor analysis to explore patterns of interrelations between variables and to reduce them into a more easily interpreted framework is well entrenched within the methodology literature and it was on that basis that the method was selected in this paper (Gorsuch 1983; Field 2000, 2005b; Ahadzie 2007). Child (1990) and Kline (1994) expounded two types of factor analysis—exploratory and confirmatory—by indicating distinctions between them. Exploratory factor analysis is appropriate for establishing constructs or dimensions that might account for an observed set or pattern of correlations. It is useful for prioritizing underlying factors, though it does not actually explain them (Child 1990; Field 2005b). Conversely, confirmatory factor analysis checks the validity of derived factor constructs against a hypothetically predetermined, but unproven, target set. Because no predetermined set of factors is applied in this paper, the decision to use principal component analysis (PCA) can be justified. This is because PCA is best suited to detect underlying dimensions and complex structure within variables of related attributes (Field 2005b), as was the aim in this study.

Analysis and Discussion of Results

Credible respondents place confidence in survey data. Credibility in this study was taken as respondents’ profession and experience, defined as professional background, number of years within practice, and duration of involvement in the provision of IF infrastructure. The assumption here, all other things being equal, is that such experience provided direct positive influence on individuals’ ability to reliably answer the questionnaire. Among the respondents, 82% held more than 5 years of such experience, half held 6 to 10 years, 20% held 11 to 15 years, and 10% had in excess of 15 years. These characteristics were considered appropriate to the accrual of reliable data for this research.

Preliminary Assessments

Preliminary examination tested whether sample size was appropriate for factor analysis (Field 2005b) using the Kaiser-Meyer-Olkin

(KMO) measure of sampling adequacy. This produced a KMO statistic of 0.844. The KMO statistic ranges between zero and 1 (Field 2005a), where zero indicates that the sum of partial correlations is large relative to the sum of correlations and hence PCA is likely inappropriate (Gorsuch 1983). A KMO value close to 1.00—as in this instance—signals that patterns of correlation are relatively compact and that PCA should yield reliable factors (Kline 1994; Field 2005b). The Bartlett test of sphericity established potential correlations; its sphericity value of 484.3 indicated that the population matrix is not an identity matrix (i.e., in which all the elements of the diagonals are one and all off-diagonals are zero) (Field 2000, 2005a). Gorsuch (1983), Child (1990), and Kline (1994) state that a KMO value of more than 0.50 is regarded as adequate to sample size, so both the KMO test and Bartlett’s test confirm this. In line with Field’s (2005b) recommendation, reliability of the survey instrument was also tested using Cronbach’s alpha to ensure that the scale consistently reflects the construct it is measuring. The result at 0.76 is above the recommended threshold of 0.50, suggesting reliability of the research instrument.

Table 3 is a correlation matrix of strategic issues based on the conventional assumption that such correlations result from variables sharing common underlying factors (Field 2005a). Highly correlated variables (with coefficients approaching 1.0) indicate strong associations and are likely influenced by the same factors. Those that are less correlated indicate weak associations and are likely influenced by different factors (Field 2005b). The matrix shows that IF strategic issues share some underlying relationships and that clusters do exist. For instance, the correlation coefficient between revenue potential and legal and regulatory implications (elucidated later) was 0.69. By extension, it could be inferred that appropriate legal and regulatory implications affect the ability of the IF mechanism to generate, maintain, and sustain revenue. However, the dearth of well-coordinated legal and regulatory governance systems has been linked to developing countries’ inability to effectively mobilize revenue. Similarly loaded on Component 1, revenue potential is also correlated with strategies for allocation of funding ($r = 0.67$). This confirms that the potential of IF to generate revenue is directly related to the allocation of funds methodology and should allow for funds predictability as well as availability. Also loading on Component 1, strategies for allocation of funding correlated with appropriateness of project type ($r = 0.67$). This infers that the ability to design an IF mechanism and appropriately match it to the project is essential in attaining sustainable outcomes. Loading on Component 2, the principle of cost recovery from users correlated with demand management and capacity to overcome cash flow shortages ($r = 0.70$ and 0.67 , respectively). The latter variable also correlated with ease of compliance ($r = 0.69$).

The next stage of analysis determined communality eigenvalues. Communality explains the total amount an original variable shares with all other variables included in the analysis and is very useful in deciding which variables to finally extract in the varimax rotation and determining sample size adequacy (Field 2000, 2005b). Normally, communality values (eigenvalues) of more than 0.50 at the initial iteration indicate that the variables are significant and should be included in the analysis, or otherwise removed. Other researchers conclude that variables with communality extraction values of more than 0.50 explain the relative importance and appropriateness of the measure (Gorsuch 1983; Child 1990; Field 2005a). As Table 4 demonstrates, all variables obtained extraction values of greater than 0.60, which is substantially higher than the conventional value and signaled that the next stage of analysis could commence.

Table 3. Correlation Matrix

Variables	Revenue potential	Diversification	How funds are spent	Strategy sustainability	Allocation strategies	Cost recovery from users	Demand management	Overcome cash flow shortage	Viability of finance sources	Project type appropriateness	Legal and regulatory implications	Governance and institutional issues	Ease of compliance
	1	2	3	4	5	6	7	8	9	10	11	12	13
1	1.00												
2	0.51	1.00											
3	0.59	0.40	1.00										
4	0.40	0.46	0.47	1.00									
5	0.67	0.41	0.49	0.31	1.00								
6	0.40	0.44	0.41	0.46	0.31	1.00							
7	0.37	0.40	0.45	0.51	0.31	0.70	1.00						
8	0.38	0.46	0.46	0.41	0.27	0.67	0.57	1.00					
9	0.47	0.44	0.48	0.41	0.51	0.49	0.52	0.35	1.00				
10	0.46	0.23	0.40	0.24	0.67	0.18	0.37	0.25	0.47	1.00			
11	0.69	0.50	0.53	0.61	0.62	0.38	0.47	0.36	0.54	0.64	1.00		
12	0.47	0.41	0.62	0.64	0.53	0.47	0.53	0.57	0.56	0.53	0.60	1.00	
13	0.34	0.31	0.33	0.35	0.38	0.64	0.39	0.69	0.42	0.38	0.35	0.59	1.00

Table 4. Communalities

Variables (strategic issues)	Initial	Extraction
1. Revenue potential	1.000	0.678
2. Diversification	1.000	0.603
3. Issues of how funds are spent	1.000	0.563
4. Sustainability of the strategy in the long run	1.000	0.664
5. Strategies for allocation of funding	1.000	0.772
6. The principle of cost recovery from users	1.000	0.785
7. Demand management	1.000	0.623
8. Capacity to overcome cash flow shortages	1.000	0.774
9. Viability of sources of financing	1.000	0.532
10. Appropriateness of project type	1.000	0.817
11. Legal and regulatory implications	1.000	0.779
12. Governance and institutional capacity issues	1.000	0.688
13. Ease of compliance	1.000	0.822

Note: Extraction method was principal component analysis.

Extraction and Establishment of Underlying Constructs

Having satisfied necessary tests of survey instrument reliability, sample size adequacy, and population matrix, the next stage of analysis involved establishing underlying dimensions of the measures studied. Applying the latent root criterion, the analysis identifies two principal components (a single dominant component together with a secondary component of lesser significance) that together explain 70% of the total matrix variance (Table 5). The scree plot as presented in Fig. 3 supports the observation that three principal components account for the following proportions of the whole matrix variance: Component 1 (24.7%), Component 2 (23.5%), and Component 3 (21.6%). The cumulative proportion of variance criterion, which requires the extracted components to explain at least 50% of the variation, shows that the three extracted components cumulatively achieved more than the accepted conventional value of variation in the data set in almost equal proportions (signaling potentially equal contributions of the components). The other remaining 10 components (one would otherwise expect to obtain 13 components from a 13×13 matrix) are of no significance (Kline 1994; Field 2005a).

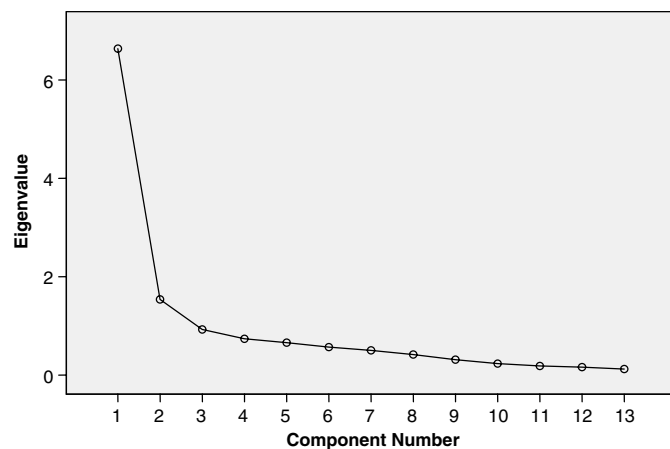
Subjecting the results to varimax rotation, the rotated component matrix (Table 7) also suggested three principal components akin to that of the component matrix (Table 6). Accordingly, Norusis (2000), Kline (1994), Field (2005b), Ahadzie (2007), and Owusu-Manu and Badu (2009) maintain that rotated factor solutions are best for interpreting results of PCA. Again, varimax (orthogonal) rotations was selected as suitable from the counter-part oblimin (oblique) rotations because the conventional rule states there was no established theoretical ground that suggested the factors might correlate.

The next step examined was for the presence of any complex structure among the variables, which are said to be present when a variable has a factor or component loading greater than 0.50 on more than one component (Kline 1994). Loadings express the influence of each original variable within the component. The factor loadings were again examined, this time to check for components that have only one variable loading on them. cursory inspection of Table 7 indicates that the three components had more than one variable loading on them, resulting in the keeping of all three. What remains is interpretation of the underlying dimension or construct of three principal components extracted. Based on critical examination of inherent relationships among the variables under each component, the following interpretation was made to represent their underlying dimensions: Component 1 was labeled appropriateness of the financing method, Component 2 was labeled pricing

Table 5. Total Variance Explained

Component	Initial eigenvalues			Extraction sums of squared loadings			Rotation sums of squared loadings		
	Total	Percent variance	Cumulative percent	Total	Percent variance	Cumulative percent	Total	Percent variance	Cumulative percent
1	6.636	51.044	51.044	6.636	51.044	51.044	3.221	24.775	24.775
2	1.538	11.829	62.873	1.538	11.829	62.873	3.062	23.554	48.329
3	0.927	7.133	70.006	0.927	7.133	70.006	2.818	21.677	70.006
4	0.738	5.675	75.681	—	—	—	—	—	—
5	0.659	5.066	80.747	—	—	—	—	—	—
6	0.569	4.375	85.122	—	—	—	—	—	—
7	0.502	3.861	88.983	—	—	—	—	—	—
8	0.417	3.209	92.192	—	—	—	—	—	—
9	0.313	2.410	94.602	—	—	—	—	—	—
10	0.234	1.797	96.399	—	—	—	—	—	—
11	0.185	1.423	97.822	—	—	—	—	—	—
12	0.161	1.238	99.060	—	—	—	—	—	—
13	0.122	0.940	100.00	—	—	—	—	—	—

Note: Extraction method was principal component analysis.

**Fig. 3.** Scree plot for the strategic issues variables**Table 6.** Component Matrix

Strategic issues of innovative financing of infrastructure	Component		
	1	2	3
1. Revenue potential	0.736	-0.336	-0.154
2. Diversification	0.647	0.047	-0.427
3. Issues of how funds are spent	0.725	-0.116	-0.152
4. Sustainability of the strategy in the long run	0.688	0.121	-0.420
5. Strategies for allocation of funding	0.706	-0.487	0.191
6. The principle of cost recovery from users	0.709	0.531	0.029
7. Demand management	0.716	0.320	-0.084
8. Capacity to overcome cash flow shortages	0.698	0.512	0.156
9. Viability of sources of financing	0.724	-0.087	0.030
10. Appropriateness of project type	0.631	-0.496	0.416
11. Legal and regulatory implications	0.796	-0.353	-0.148
12. Governance and institutional capacity issues	0.823	0.015	0.106
13. Ease of compliance	0.666	0.365	0.496

Note: Extraction method was principal component analysis with three components extracted.

and management of the financing method, and Component 3 sustainability of the financing method.

Component 1—Appropriateness of the Financing Method

Principal Component 1 accounted for 24.7% of the total variance (Table 5), with five variables loading onto it with respective factor

Table 7. Rotated Component Matrix

Strategic issues of innovative financing of infrastructure	Component		
	1	2	3
1. Revenue potential	0.609	0.113	0.542
2. Diversification	0.180	0.221	0.722
3. Issues of how funds are spent	0.450	0.264	0.539
4. Sustainability of the strategy in the long run	0.155	0.300	0.742
5. Strategies for allocation of funding	0.835	0.132	0.240
6. The principle of cost recovery from users	0.058	0.791	0.395
7. Demand management	0.165	0.598	0.487
8. Capacity to overcome cash flow shortages	0.115	0.824	0.285
9. Viability of sources of financing	0.638	0.360	0.390
10. Appropriateness of project type	0.887	0.177	0.012
11. Legal and regulatory implications	0.659	0.137	0.571
12. Governance and institutional capacity issues	0.518	0.520	0.387
13. Ease of compliance	0.334	0.513	-0.014

Note: Extraction method was principal component analysis and the rotation method was varimax with Kaiser normalization. The rotation converged in six iterations. The bold indicates largest values.

loadings (eigenvalues) as follows: appropriateness of project type (88.7%), strategies for allocation of funding (83.5%), legal and regulatory implications (65.9%), viability of sources of financing (63.8%), and revenue potential (60.9%) (Table 7).

Appropriateness of project type is discussed among IF researchers as representing recognition of financing techniques suitable to type of project. Strategies for allocation of funding has also been described as the apportioning of funds. In this vein, Ploeg and Casey (2006) argued that it is politically easier to finance new development than maintenance work because people more readily appreciate new development. Thus, it is imperative to initiate, design, and develop projects that are consistent with the collective objectives of project stakeholders and financing requirements. Historically, projects are differentiated according to the industry to which they belong, size and complexity, organizational structure, and functional relationships involved (Shenhar 1993; Shenhar and Dvir 1996; Shenhar and Wideman 1997).

Consistent with Ploeg and Casey (2006), the key characteristics of infrastructure are critical to determining applicability and suitability of a particular IF tool. Similarly, IF researchers argue that legal and regulatory implications surrounding the financing tool consider whether the method shall require changes in legislation to pave the way for project implementation. Furthermore, market imperfections, such as those caused by underdeveloped financial

and legal systems, constrain a firm's ability to access external finance for investment projects (Beck et al. 2005). There are convergent views on how legal and regulatory systems affect financial markets' development, albeit many consider a country's legal system as the main determinant of external finance (Rajan and Zingales 1995; La Porta et al. 1998; Beck et al. 2005; Beattie et al. 2006). Legal protection for creditors (financiers) against any changes in legislation that might affect project delivery is usually relevant in situations of financial distress. Suresh (2004) argued that interim financial requirements should be considered when discussing the appropriateness of the project and financing method.

Viability of sources of financing refers to the ease with which IF can overcome legal, institutional, and political or other types of barriers that hinder project delivery (Dirie 2005; Ploeg and Casey 2006; Cohen 2010). Within the literature, revenue potential is interwoven between project revenue generation capacity in relation to cost, and is in tandem with the method's ability to meet financing needs at various politically acceptable rates. Project capacity to service its debts while making profit is hinged on its revenue generation capacity, which is fundamental in investment decisions. In deciding a project's appropriateness and financing method, other characteristics such as its potential to reduce costs, expedite project delivery processes, and achieve high revenue must also be considered. Within the context of investment decisions, projects perceived as low revenue generators may not merit financing.

Component 2—Pricing and Management of the Financing Method

The second principal component accounted for 23.3% of the remaining variation not explained by Component 1. There were five variables loading onto it: capacity to overcome cash flow shortages (82.4%), the principle of cost recovery from users (79.1%), demand management (59.8%), governance and institutional capacity issues (52.0%), and ease of compliance (51.3%) (Table 7). The capacity to overcome cash flow shortages is a core business imperative, requiring management of IF mechanisms to provide finances that avoid cash flow shortages. This is embedded within conventional business wisdom; liquidity is a primary focus for any business seeking sustainable growth (Owusu-Manu and Badu 2011, p. 66)

The principle of cost recovery from users considers how infrastructure users compensate the financing mechanism in proportion to their usage of it. This should be considered in the light of two complementary sets of cost recovery principles: (1) unit of demand (the criterion for selecting an appropriate unit of demand to which the infrastructure's cost or its growth can be appropriately allocated), and (2) cost attribution (principles that govern the proportion of infrastructure cost or its growth that is attributed to each unit of demand) (R. Kranton, Working Paper, World Bank, Washington, DC, 1990; Suresh 2004). The principle of cost recovery subtly interweaves with demand management. This sheds light on which method of infrastructure IF will promote efficient use of the asset. Within this context, pricing is normally used to regulate demand and check its unnecessary use, which, for example, may lead to frequent exertion of pressure on it and rapid deterioration. Consequently, governance and institutional capacity issues are required to support infrastructure management, finance, and cost recovery. However, it remains unclear whether institutions that implement and manage the financing mechanism have the capacity to do so; evidence suggests that many developing countries have limited capacity to address national financial shortages on their own.

Ease of compliance compares the extent to which individual methods of financing minimize evasion of the financing tool and help ensure efficient utilization of it (R. Kranton, Working Paper, World Bank, Washington, DC, 1990; Heggie 1991, 2003). The

issue of pricing projects rests upon the infrastructure's marketability and, to some degree, on the user profile. Marketability determines whether an asset can be self-financing (marketable) or whether government support through a tax subsidy is required (nonmarketable). Knowledge of how, to what extent, and the rate at which different socioeconomic groups within society will use an infrastructure asset is also an important consideration. Robust assessment will form the basis of any decisions on setting user fees. Often government officials and private lenders have different objectives, with the former seeking to assure public benefits and the latter looking to maximize profits. According to Cohen (2002), these are not necessarily incompatible, but they create the challenge of blending innovative public and private finances in ways that maximize overall returns. Researchers agree that the infrastructure's price should reflect the true cost through life-cycle costing. The issue of management can also be explained in terms of financial management expertise. According to Chism et al. (2010), ineffective control, accountability, and transparency measures are hurting the ability of governments to deliver infrastructure.

Component 3—Sustainability of the Financing Method

The third principal component—sustainability of the financing method—accounted for 21.6% of the remaining variation not explained by the first two components (Table 5) and had three variables loading onto it: sustainability of the strategy in the long run (74.2%), diversification of portfolio (72.2%), and issues of how funds are spent (53.9%) (Table 7).

Sustainability of the strategy in the long run is paramount to the realization of the project stakeholder's long-term strategic goals. Sustainability of infrastructure IF projects is argued in the context of stability and reliability of the technique adopted (Suresh 2004). In this context, researchers advocate the adoption of user fees based on the principle of life-cycle costing. Suresh supports this view and laid emphasis on the principle of full cost recovery for improving the sustainability of IF. This may suggest that providers should opt for user fees to manage infrastructure demand and to provide more sustainable alternatives. This was further summarized by Ploeg and Casey (2006), who concluded that allocation of the costs of infrastructure among a wider spectrum of users is critical to the attainment of sustainable investment. In a similar vein, diversification of portfolio has the capacity to bring in additional financing and boost resources from traditional sources. Issues of how funds are spent relates predominantly to transparency and accountability. Funds must satisfy infrastructure frontline service providers and as part of accountability avoid inappropriate fund disbursement.

Limitations and Context

The geographic focus of the research means that conclusions relate principally to Ghana and other developing countries of a similar nature. Results might vary if the same study were undertaken within a developed or developing country. Indeed, future work will aim to produce a comprehensive analysis that will compare and contrast with the findings of similar research work conducted and/or reapply this research within developed and developing countries. Such would elucidate on fundamental differences and similarities in government policy as well as provide an extended, and much needed, discourse on global approaches to IF.

Conclusions and Recommendations

Nations are turning to IF of infrastructure because traditional funding sources cannot satisfy demand. Consequently, huge (and

growing) infrastructure deficits pertain. Some IF studies have focused on addressing these deficits, but there is a dearth of research in this field relating to developing countries generally and the Ghanaian context specifically. Infrastructure demand is set to grow all over the world, but this is particularly so in developing countries because of factors such as global economic expansion, technological advancements, climate change challenges, the aging of existing fixed assets and increasing population and congestion. That traditional funding sources are inadequate and pressures on public budgets are increasing exacerbates infrastructure deficit. Inevitably, addressing the deficit demands innovative approaches, employing an array of tools and institutional arrangements as alternatives or augmentations to traditional funding options.

The primary aim of this study was to identify and analyze strategic issues relating to infrastructure IF to prescribe directions for policy improvement. Findings highlight three key underpinning factors: (1) appropriateness of the financing method, (2) pricing and management of the financing method, and (3) sustainability of the financing method. In practical terms, this means that when establishing IF responses to project delivery, it is important to assess whether the financing tool is appropriate to the context of the proposed application. Moreover, pricing and management of the financing tool must be achieved in a manner that will guarantee its sustainability in the longer term.

IF success factors should be considered together with both public- and private-sector participants of the IF arrangement and with potential infrastructure users. Drawing on these success factors, key questions need to be answered to attain a dynamic, efficient, and sustainable IF mechanisms. First, where will new sources of finance come from and what role will the private sector play? Second, how can the available infrastructure be managed effectively and efficiently? Third, how will the financial, organizational, institutional, and regulatory arrangements adequately respond to the complex challenges they might face? And are they sustainable over the longer term?

In providing solutions to the previous questions, governments need to complement the search for fresh capital sources with an array of other measures, including regulatory changes to encourage the emergence of new business models; development and integration of new technologies; the promotion of more competition in procurement and operation; legal and administrative changes to speed up planning, procurement, and implementation; application of new technologies and new schemes to enhance efficient use of infrastructures and better manage demand; closer international cooperation; improved security; and the underpinning of infrastructure design, financing, and funding with long-term strategic planning.

The planning, financing, and management of infrastructure will need to be supported by better basic tools. Also, information, data collection, research, and analysis need strengthening. Consequently, the criteria for sourcing infrastructure IF must take account of new or nontraditional sources of revenue, new financing mechanisms designed to leverage resources, new fund management techniques, demand management techniques, and new institutional arrangements. The identification of strategic issues therefore provides important guidelines to infrastructure providers and investors wishing to use or invest in infrastructure IF. The study's findings may help infrastructure providers to better appreciate the IF concept and advance their use of this approach. Future research may be required to assess the level of knowledge required by professionals underpinning optimal IF provision of infrastructure and prescribe areas for further education. Assessing how IF mechanisms affect achievement of project objectives would also complement existing knowledge in the field.

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