

PRIVATE SECTOR INVOLVEMENT IN INFRASTRUCTURE DEVELOPMENT PROJECTS THROUGH PUBLIC-PRIVATE PARTNERSHIPS: A CASE STUDY OF ROAD INFRASTRUCTURE IN GHANA

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ABSTRACT

Governments in most developing countries face the challenge to meet the growing demand for new and better infrastructure projects and services. As available funding from the traditional sources and capacity in the public sector to implement many of these projects are limited, governments have found that partnership with the private sector is a viable alternative to increase and improve the supply of infrastructure project and services.

Several reasons account for the growing collaboration with the private sector in developing and providing infrastructure services. They include increased efficiency in project delivery, operation, management, availability of additional resources and advanced technology from the private sector to mention a few. There is increasingly a growing belief that public-private partnerships in infrastructure development such as roads, hospitals, energy, water supply, etc. could lead to technical, economic and managerial efficiencies while at the same time relieving poorly resourced private sector. In Ghana, road infrastructure development is seen as a poverty reduction strategy which has a direct link to all the sectors of Ghana's economy (James, 2009). Road transport falls under infrastructure development and has the multiplier effect in creating wealth. Yet, little attention is given to the involvement of the private sector in the road infrastructure development in Ghana.

The purpose of this study is the assessment of the level of involvement of the private sector in the development of road infrastructure in Ghana. Evaluate technical and economic efficiencies of applying the PPP approach in road infrastructure projects, identify constraints and formulate recommendations for current and future implementation. To achieve this purpose, data was collected from government agencies and private sectors contractors involved in both PPP and non-PPP road projects.

The analysis of the data reveals that government of Ghana remains the main funding source for the road projects since the application of PPP is relatively a new concept. The study reaffirms that PPP remains one of the viable solutions for government funding of infrastructure projects such as roads even though there exist no solid legal and regulatory frame work for PPP implementation in Ghana. The study also found that PPP application in the road sector will lead to higher technical efficiency and to some little extent economic efficiency if the right environment is created with the elimination of the identified constraints. Constraints such as weak private sector to support PPP, high cost of road projects, high risk profile of Ghana, lack of legal and regulatory frame work, high implementation cost due to feasibility studies and difficulty of cost recovery to be among the major constraints hampering the smooth implementation of road PPP projects in Ghana.

Key Words: Public-Private Partnership, Involvement, Infrastructure Development, Technical, Managerial, Economic, Efficiency

INTRODUCTION

The private sector is part of the economy which is run by private individuals or groups, usually for profit making motive, and independent of the state. The opposite is the public sector made of enterprises that are part of the state and are regarded as part of the voluntary sectors of the economy (Zheng, 2007). A blend of these two is what is now known as Public-Private Partnership (PPP). Governments in most developing countries face the challenge to meet the growing demand for new and better infrastructure projects and services. As available funding from the traditional sources and capacity in the public sector to implement many of these projects are limited, governments have found that partnership with the private sector is a viable alternative to increase and improve the supply of infrastructure services. The partners in a Public-Private Partnership (PPP), usually through a legally binding contract or some other mechanism, agree to share responsibilities related to implementation and/or operation and management of an infrastructure project. Governments worldwide have increasingly turned to the private sector to provide infrastructure services in all spheres of the economy that were once delivered by the public sector alone. Reasons often adduced for these trends include:

- Increased efficiency in project delivery, operation and management noted for the private sector
- Availability of additional resources to meet the growing needs of investment
- Access to advanced technology (both hardware and software) among others.

Public-private partnership (PPP) in infrastructure is a relatively new experience in most developing countries of the Asian, Africa and Pacific regions. Although many governments have considered various steps to promote PPPs in their countries, lack of capacity in the public sector remains one of the major problems in implementing PPP projects. Few countries have established institutional arrangements and developed manuals and resource materials in support of PPP development and for the capacity-building of their public officials. In the absence of such established institutional arrangements and resource materials, public officials face difficulties in project development and implementation, and the general public can have many misunderstandings about PPPs (UNESCAP, 2011).

Road infrastructure development in Ghana is seen as a poverty reduction strategy which has a direct link to all the sectors of Ghana's economy (James, 2009). Road transport falls under infrastructure development and has the multiplier effect in creating wealth. Transportation facilitates; the movement of people, goods and services within the country. It lubricates other sectors such as tourism, mining, health, trade, education, agriculture, and energy. Road infrastructure is one of the fundamental factors predetermining the efficiency of transport activities. Therefore, an efficient road infrastructure network is a necessary requirement for an accelerated development of any economy.

PROBLEM STATEMENT

In Ghana and in many other African countries governments' budgetary constraints and insufficient tax collections are impacting on the governments' ability to fund large projects beyond the stimulus packages, which have placed further strain on national finances. In addition, there seems to be many challenges to the management of financing by the public sector due to administrative bottlenecks, huge bureaucracy, inadequate managerial and technical capacity and conflict of interests among other hindrances. As a result, new and innovative Public-Private Partnership (PPP) structures are needed to make infrastructure development projects work.

The contribution of infrastructure to economic growth is immeasurable and is well recognized both in academic and policy debates and circles. Roads are Africa's dominant mode of transport and carry over 90% of traffic. Basic transport infrastructure and affordable transport services are indispensable in Africa so as to provide the populations with effective access to social services and in order to unlock the continent's investment potential. From 1964 to 2003, World Bank infrastructure projects generated a higher social rate of return in transport than in any other sector (Carole et. al, 2008).

As highlighted by the Organization for Economic Co-operation and Development (OECD)'s African Economic Outlook (AEO) 2005-06, improved transport infrastructure has already accelerated many African countries' progress towards reaching the Millennium Development Goals. For example, according to the two recent influential studies (Sachs et. al, 2004) and the United Nations Economic Commission for Africa (2005) - identifying significant infrastructure expenditure needs in sub-Saharan Africa, their estimate of annual needs range from 9 to 13 percent of GDP for at least the next 10 years.

However, given the stringent budget constraints that many developing countries faced in recent decades, very few can afford to allocate the necessary resources to infrastructure. PPPs are seen as key to Government's economic reform agenda and strategy to increase private sector involvement in infrastructure and public service delivery. Adoption of PPP approach reflects the desire to improve the quality, cost-effectiveness and timely provision of public infrastructure and services in Ghana. However in Ghana, private participation in infrastructure development to date is mainly in the form of divestitures and focuses on almost entirely telecommunications and energy industries. In effect, little attention is given to the involvement of the private sector in the road infrastructure development in Ghana.

This study is conducted in order to assess the level of involvement of the private sector in development of road infrastructure out of which appropriate measures shall be recommended in order to promote public-private partnership.

RESEARCH QUESTIONS

The main research questions were;

1. To what extent is the private sector involvement in road infrastructure in Ghana?
2. What are the various financing options available on road infrastructure projects?
3. Is it economically feasible to apply PPP approach to implementing road infrastructure projects?
4. What are the economic benefits of implementing road projects through PPP?
5. Is it technically efficient to apply PPP approach to implementing road infrastructure projects?
6. Is it allocative efficient to apply PPP approach in implementing road infrastructure projects in Ghana?
7. What are the constraints in applying PPP approach to road construction projects in Ghana?

RESEARCH OBJECTIVES

Main Objectives

The main objective of the study is to evaluate the impact of Public-Private Partnerships (PPP) on the road sector projects in Ghana. This means whether the Public-Private Partnership initiatives could be one of the best approaches to achieving effectiveness, efficiency and quality of work when it comes to the implementation of public infrastructure projects such as roads.

Specific Objectives

1. To determine the extent of PPP involvement and the financing options available for the road infrastructure projects in Ghana
2. To determine the economic efficiency which includes technical and allocative efficiency of applying PPP approach to road infrastructure projects
3. To identify the main constraints in applying PPP approach to road infrastructure projects in Ghana
4. To delineate policy directions that will eliminate the constraints in the application of PPP on road infrastructure projects in Ghana.

HYPOTHESIS OF THE STUDY

Null Hypothesis: H_0 : Public-Private Partnerships (PPP) approach has no positive economic impact on road infrastructure development in Ghana:

Alternative Hypothesis: H_1 : Public-Private Partnerships (PPP) approach has a positive economic impact on road infrastructure development in Ghana.

SIGNIFICANCE OF THE STUDY

Knowledge generated would be useful to government agencies such as Ghana Highway Authority, the Ministry of Roads and Highways as well as researchers, NGO's, Projects Managers and other organizations and stakeholders that are interested in the development and

management of road infrastructure in particular, other public infrastructure and the overall economy in general. The findings would have value for policy makers who are interested in attracting private sector finance and expertise in infrastructure and more specifically in roads. In addition, it would reveal the hidden challenges and prospects that road sector faces in terms of managements and finances available.

LIMITATIONS OF THE STUDY

The research was limited to only one sector of PPP that is the road sector and comparison of major road projects in Ghana. This is because the organizational and operational structures of almost all projects are uniform because they are guided by the same legislations. Also infrastructure projects in African countries have almost the same characteristics and therefore taken a sample size of 50 road engineers/contractors and 50 staff of Government agencies directly related to road infrastructure development will be representative enough to make inferences. Bureaucratic nature of secondary data collection at government ministries and departments limited this study to available information only.

REVIEW OF RELATED LITERATURE

Governments around the world have been using the private sector to build and maintain roads, schools, harbours, railways etc. (Shah, 2005:139). Public and private sector normally come together with legal binding document to develop and/or improve the infrastructure in the country. Modern public-private partnerships (PPPs), characterized by joint planning, joint contributions, and shared risk, are viewed by many development experts as an opportunity to leverage resources, mobilize industry expertise and networks, and bring fresh ideas to development projects. Partnering with the private sector is also widely believed to increase the likelihood that programs will continue after government aid has ended.

From the private sector perspective, partnering with a government agency can bring development expertise and resources, access to government officials, credibility, and scale (Marian Leonardo Lawson, 2011). Usually, the government sets the quality and quantity requirements, and allows private partners to design and build the assets and services aspects (Corner, 2006). Public private partnership is an arrangement where the private sector supplies infrastructure assets and services that traditionally have been provided by the government (IMF, 2006).

There is no precise definition of PPP, as there are differences in understanding of the concept. The private entity becomes the long term provider of service while government becomes the purchaser of the services (Grout, 2003; Ahadzi). Private partner is not a vendor, contractor, grantee, or government-funded implementer, but rather, ideally, an equal partner invested in every stage of the partnership activity (Marian Leonardo Lawson, 2011). PPPs potentially bring the efficiency of business to public service delivery and avoid the politically contentious aspects of full privatization. PPPs allow governments to retain ownership while contracting the private sector to perform a specific function such as building, maintaining and operating infrastructure like roads and ports, or providing basic services like water and electricity.

Development in road infrastructure creates opportunities for people to access various economic and social resources. Transportation facilitates the movement of people, goods and services

within the country. It provides service to other sectors such as tourism, mining, health, trade, education, agriculture, energy among others (James, 2009).

The 1990s have seen the establishment of public private partnership PPP as a key mechanism of public policy across the world (Osborne, 2000). During post world war two, the majority of government s both in the developed and developing countries entrusted the delivery of public infrastructure and services to the state own monopolies or other public sector / government departments (Grimsey, 2002; Harris, 2003). According to Peter, (2005) PPPs in Africa over the last 15 years are mixed and that, the process is complex, and governments should not expect PPPs to be a total solution to Africa's infrastructure development. PPPs have become a regular practice across the diverse sectors of government service provision stretching from construction of roads, telecommunication networks, prisons, hospitals, schools, universities, to managing these facilities. They are increasingly becoming the preferred method of procuring infrastructure and public services by government (Grimsey, 2002).

Types of PPP

Depending on government's objectives the methods of private sector involvement come in different forms. According to Angleoha (2003), Private-Public Partnerships in road infrastructure development may take several forms. They include:

Build-Operate and Transfer (BOT) or Build Transfer Operate (BTO) System.

In this arrangement, the private partner develops the project to the agency or public agreed upon specifications, operates the facility for a specified period according to the terms and conditions of the agreement and transfers the facility to the agency or public in accordance with the concession agreement. In most cases, the private sector provides all the financing for the facility or substantial part in which case the length of the contract must be sufficient to enable the private partner recover a reasonable size of the return, if not all, on the investment through user charges in the form of road tolls.

BOT annuity-based PPP projects

Under this form, the concessionaire is responsible for constructing and maintaining the project facility. The amount of income collected by the concessionaire is not directly related to the usage level of the project. In the context of highway projects, the amount of income is not by direct reference to the number of vehicles using the highway. Instead, the risk that traffic, and consequently user fees, may be lower than expected is borne by the concessionaire alone.

BOT toll-based PPP projects

In order to reduce the dependence on its own funds and to promote private sector involvement in developing projects, the Government can award some highway projects on a toll basis. In this case, the concessionaire is responsible for constructing and maintaining the project as well as being allowed to collect revenues through tolls during the concession period. After the expiry of the concession period, the project is transferred back to the Government.

Build-Own-Operate (BOO) System.

In this case, the contractor constructs and operates a facility without transferring ownership or legal title to the agency or public. It will appear that this system may not be well acceptable to the general Ghanaian populace since road infrastructure is generally viewed as a national asset. This practice does not really exist in Ghana (Angleoha, 2003).

Buy, Build and Operate (BBO) system.

With this system, the government sells the asset to private investors. The investors then develop, repair, expand and rehabilitate the asset to make it more profitable. Example of such a case in Ghana is the sale of the State Transport Corporation (STC) to Vanef STC, a private company. (Angleoha, 2003).

Design-Build-Finance-Operate (DBFO).

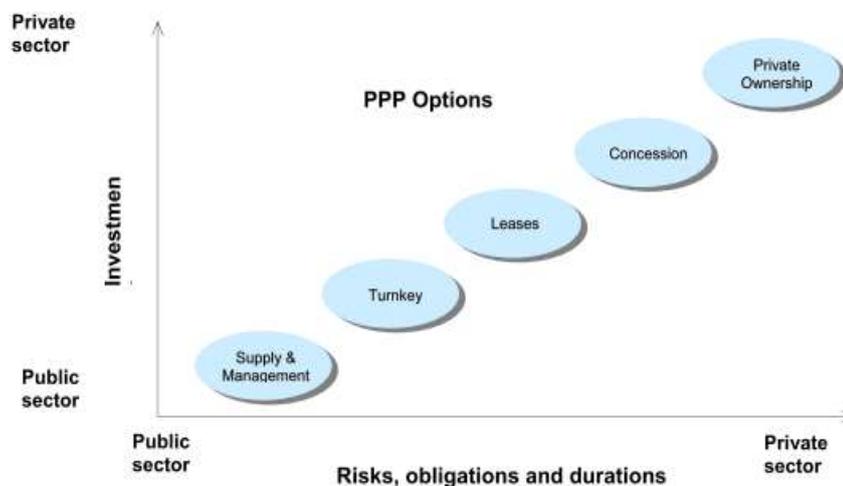
Under this arrangement, tolls are not to be collected on DBFO projects. Instead, the government will pay an agreed amount for each vehicle that uses the road over a period of up to thirty years. This practice is called “*shadow tolling*”. It can speed up project completion by facilitating the overlap of the design and construction phases of road construction.

Turn-Key PPP Projects.

Under this form of PPP, financing and ownership of the facility can either rest with the public or private partner. The public agency might provide all the funds, with the associated costs and risks, and an independent investor handles the initial operations and later hands over for use. Alternatively, the private party might provide the financing in anticipation to operate the facility to recover the returns or for a specific payment of the financing from the public or agency over a specified agreed period or on certification of good work done (Angleoha, 2003).

Investment in PPP is best explained in the Figure 1 below:

Figure 1. Basic features of PPP models



Source: A Guidebook on Public-Private Partnership in Infrastructure, Abdul Quium (2011).

Peter (2005) in his review of eight case studies (which draw lessons from PPPs in toll roads, ports, prisons, telecommunications, eco-tourism and water and electricity provision) states that those partnerships that have been most successful in Africa have been characterized by thorough planning, good communication, strong commitment from both parties and effective monitoring, regulation and enforcement by government. The review also intimated that the issue of pricing in PPPs is crucial both to avoid political fall-out and to ensure the viability of the contract for business.

Empirical Studies on the impact of PPP on projects

A number of studies have explored the impact of private participation on various outcomes, most prominently service delivery and cost. Davis (2005) reviews private-sector participation in the water supply and sanitation sector, and shows that the gains achieved by these PPPs are achieved through unpopular strategies such as retrenchment and tariff increases. Another relevant study by Galiani et al (2002) reviews the impact of privatization of the Argentinean water industry on infant mortality rates (as a proxy for water quality). The study finds that private participation had a large positive impact on the reduction of infant mortality (and enhancement of the water quality) in Argentina. Although these studies explore the direct impact of private participation in infrastructure, they do not address the indirect impacts (such as on managerial capacity).

A sizeable literature has explored the changing nature of public sector responsibilities in response to private participation (from “rowing” to just “steering”). Examples include Brooks et al (1984), Hanrahan (1983), Fortin and Hassel (2000), and Salamon (2002). Many of these studies have suggested the need for expanding public sector contract management expertise; we hope to add to this literature by exploring if the public sector can still have a “rowing” role in future.

Another study significant of mention in this literature review is the work done by Thillai Rajan et al, (2010). Their research was on PPPs in road renovation and maintenance: a case study of the East Coast Road project. The study was conducted in India. The main objective of their study was to highlight the suitability of using PPPs for road renovation and maintenance projects. The study uses a case-study approach. The East Coast Road project was chosen for the study because it was the first project in India to use PPP for road renovation and maintenance, and being the first project of its kind, the case was of general public interest.

The major finding of this study was that risk levels in Rehabilitate, Improve, Maintain, Operate and Transfer (RIMOT) projects were lower than Greenfield BOT projects. The study justified that in areas like renovation and maintenance, PPP structures can bring many advantages over traditional procurement methods.

Although this study was limited to single case study, it did not only add to existing literature on PPP but shows that PPP is always better in terms of advantages. However, due to this limitation, they recommended more such case studies to evaluate their relevance for infrastructure development, particularly in developing countries. The practical implication of their study was that PPP structures can be useful for renovating and maintaining the existing roads.

From the above we can identify a number of gaps in the literature in relation to this study: Firstly, previous studies on public sector capacity have focused mainly on the governing and regulating functions of the public sector; the capacity of delivering and managing assets (specifically infrastructure) has not been adequately addressed. In particular, no viable metric exists to assess managerial capacity as we define it. Secondly, although the impacts of private participation on service delivery and cost have been explored, the impact on managerial capacity has not received similar attention. Lastly, although the development literature has identified the possibility of a “dependency trap” in terms of multi-national assistance, this concept has not been broadened to consider the effects of private participation. The subject matter in the current study is positioned to contribute to addressing these knowledge gaps.

Economic efficiency

Economic efficiency is the basic objective involved in cost recovery among income distribution which the public referred to as *savings* (Gittinger, 1982). This means that for a project to recover cost and generate income, it must be able to use resources for production without waste. Understandably, economic efficiency is just the attainment of maximum output from the combination of a given set of resources. The higher the level of output, the higher the levels of efficiency assuming other factors remain constant. In other words, improved efficiency implies getting a higher output from the same inputs used by allocating them in a prudent way. A production system is described as efficient if it leads to appropriate combination of resources effectively (Ikililu, 2007).

Economic efficiency is achieved when both technical and allocative efficiency is attained (Adesina and Djato, 1997). Technical efficiency is the ability to obtain the highest amount of output with a given amount of inputs whilst allocative efficiency refers to allocation of resources in profit – maximizing sense at which marginal value products of resources are equal to their prices (Yotopoulos and Nugent’s, 1976, Weir, 1999). It is argued that, efficient utilization of capital is attained when marginal productivity is equated to marginal cost of capital services.

Theoretical background of measurement of project efficiency

Measurements of economic efficiency of enterprises vary significantly according to each researcher’s outlook. The literature on efficiency offers three basic forms of efficiency; technical, allocative, and economic efficiencies. Economic efficiency is a combination of technical and allocative efficiency (Adesina and Djato, 1997; Weir, 1999). Technical efficiency is defined as the ability to achieve a higher level of output, given a similar level of production inputs. Allocative efficiency on the other hand shows the extent to which a project make efficient decisions by using inputs up to the level at which their marginal contribution to production value is equal to the factor cost.

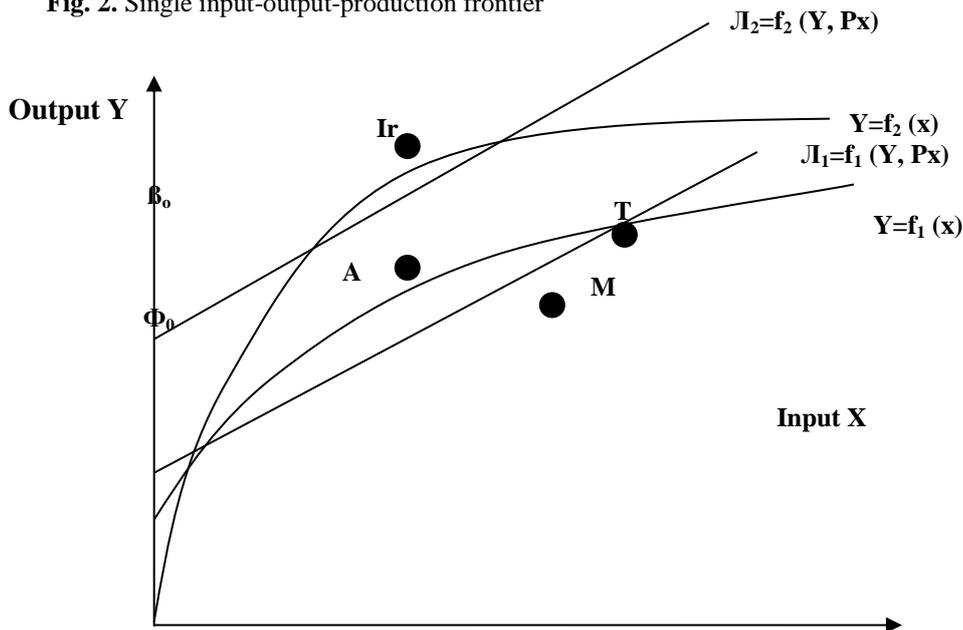
A project is technically more efficient if it is possible to raise output, without increasing the use of at least one input (Ikililu, 2007). Allocative efficiency on the other hand is achieved when the cost of producing a given output is lowest.

There are several reasons why a project may be economically inefficient. They include: inappropriate timing of inputs mainly due to lack of information on the availability of inputs, poor choice of an input–output combination which does not maximise profits and institutional constraints to cite a few.

There are two important ways in which PPP may increase project output: PPP may cause movement towards the production frontier, in the case of technical efficiency, or movement along the frontier to a profit maximising point, in the case of allocative efficiency, or an outward shift in the production frontier resulting from introduction of new techniques or inputs or a special type of allocative efficiency.

This is best explained considering the Figure 2 below:

Fig. 2. Single input-output-production frontier



Source: Adopted from Ikililu, 2007.

A project operating at point **M** is neither technically nor allocatively efficient. This is because the project is operating below the production curve, but if the enterprise moves to point **T** on the production frontier, only technical efficiency is achieved. Further movement to point **A** on the production frontier makes the project achieve allocative efficiency. A shift in the production frontier as a result of introduction of technology and new management such as PPP and computers in production is shown by movement from point **A** to point **Ir**. At point **Ir**, both the profit and output increases further with higher efficiency (Ikililu 2007). Therefore PPP projects could be efficient by using effective implementation technology, access to cheap labour, business advice and private sector business-driven expertise, social monitoring and hence operating on a higher, production frontier ($Y=f_2(x)$).

RESEARCH METHODOLOGY

Data Collection, Sampling Size and Sampling Technique

Both qualitative and quantitative data were collected from primary and secondary sources. Secondary data were collected from Ministry of Roads and Highways, Ghana Highway Authority, Department of Urban Roads, and Feeder Roads. Primary data were also collected from 50 road engineers and or road contractors. Other stakeholders such as donor partners, example World Bank, and European Union were consulted through information on their web sites.

Method of Data Analysis

Data collected were analysed using descriptive statistics such as percentages, tables, charts, sums, means, minimum and maximum values, variances, standard deviations, etc. In addition comparison of efficiency of PPP road project and non PPP road projects was conducted whose theoretical frame work is explained next.

Theoretical Framework on Determination of economic efficiency

The study runs two regression models for the selected road projects from which regression analyses were conducted. The resource efficiency of the projects is measured using expected income and benefits and the factors of production. Marginal value product (MVP) of the inputs on the projects is used as the basis to determine the efficiency levels. Three functional equations (i.e. linear, semi-log, and double log) were tried by Ordinary Least Squares (OLS) and the best linear functional form selected based on the explanatory power (R^2 square), signs and the statistical significance of the estimated regression coefficients.

The intercept of these equations represent the technical efficiency. Comparing road project with PPP and that without PPP also implied comparing their technical efficiency. If the intercept of PPP is greater than that without PPP, then it is concluded that PPP brings about technical efficiency.

Using a Cobb-Dougllass production function, a model is specified as:

$$TVO = f (, TL, V L , VCL, V HL, I, (Demographic, Dummy variables))$$

Where: Tvo denotes total value output (in GH¢) or a series of ones (1) or zeros (0) at the end of the projects. The output was obtained by estimating the expected income and benefits that will accrue from each selected road project. However due to the difficulty of getting financial figures for PPP projects, respondents were asked to award one (1) if they think a particular type of project was greater in value than the other, otherwise zero (0). A series of “1s” and “0s” were then used in the regression analysis as a proxy for total value of each project. V TL = total amount of loan accessed for the selected road project, VL = Value of labour used for the project which is divided into value of Hired Labour (VHL) and value of Communal labour (VCL), and I = Value of interest charged on the loans for the projects. The demographic variables are: the age (A) of the projects which measures the durability. The dummy variables are: Acceba = this measures the access to technical advice. One (1) if a project has 100% access and zero (0) otherwise (25%, 50%, 75%). First order derivative of the equations of the function gives the marginal value product as shown below:

$$MVP_i = \frac{\partial TVO}{\partial \text{val input}_i}$$

Where MVP_i is the marginal value of the “i”th project; Val input_i; denotes input of the “ith” Project and ∂ denotes change. Therefore the coefficients of the function are the respective marginal value products from which both technical and economic efficiency can be determined.

Decision rule: A project is said to be allocative efficient (price efficient) if the marginal value product of each input is equal to its marginal factor cost (unit price). This is expressed as

$MVP = P_i$, where P_i is the price of the “ith” input. Therefore the allocative index (K) is given by $K = MVP_i/P_i$. The allocative efficiency index is a measure of efficiency in resource use. An input is over utilized if $K < 1$ and underutilized if $K > 1$. Absolute allocative efficiency is achieved if $K = 1$ and at that point, both technical and allocative efficiency would be achieved and there would be no constraints in the use of resources (Onyenwaku, 1997). Two road projects, one with PPP management and the other without were compared. The assumptions underlying this analysis are that, road projects are implemented with profit maximizing motive, within a competitive market, and the marginal value products of the inputs are positive.

Constraints Identification

To identify the constraints in PPP application, road contractors, Ministries and government agencies in the road sector and community members were asked to list and rank the constraints they have with the use of PPP through the questionnaires and separate group discussions. The ranking ranges from 1 to 3 starting from the most pressing ones first. The corresponding suggested solutions were ranked alongside. The responses were analysed using the Kendall’s ranking and coefficient of concordance. The Kendall’s approach is used to rank a given set of constraints from the most pressing one to the least. The Kendall’s coefficient of concordance, W, determines the degree of agreement among respondents between the constraints. Even though the SPSS does the computation, the basic mathematics of the process is given below:

Let $T =$ sum of ranks of each ranking, $M =$ number respondents on the project, $n =$ number of constraints $W_c =$ calculated coefficient, therefore the formula for concordance (W) is given by:

$$W = \frac{(\sum T^2 - (\sum T)^2) / n / n}{M^2 (n^2 - 1) / 12}$$

The maximum variance of T is given by $T = M^2 (n^2 - 1) / 12$

The null hypothesis that was tested is that: there is no agreement between the rankings of the constraints confronting PPP application in the road sector as against the alternative that there is agreement in the rankings. The coefficient of agreement is tested in terms of the F distribution.

The F ratio is given by $(M-1)/W_c / (1-W_c)$ degree of freedom for the numerator and $(n-1) - (2/M)$ is the degree of freedom for the denominator. The limit for W is between 0 to 1 and therefore cannot be negative. The decision rule is that if $W = 1.00$, there is perfect agreement among the respondents, but if $W = 0.00$, there is zero agreement among the respondents.

EMPIRICAL RESULTS AND DISCUSSION

Introduction

The objective of this study is to analyse the economic, technical, feasibilities of using public-private partnership approach in road infrastructure development in Ghana. In pursuing this objective the study compared road projects without PPP and those with PPP approach through a regression analysis. It also compared the efficiency levels of PPP road projects and non PPP road projects in Ghana.

Demographic characteristics of respondents

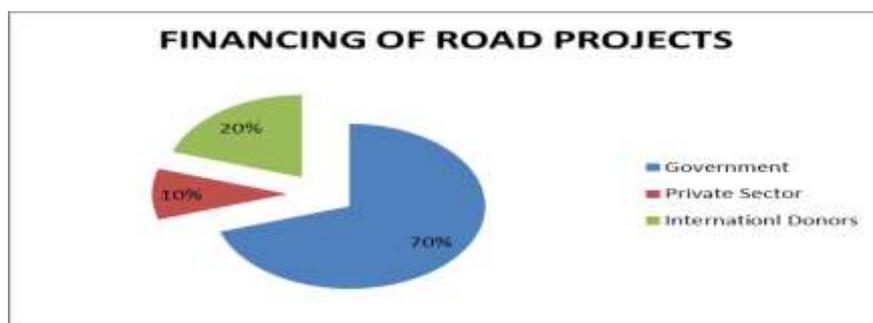
Out of a total of 60 respondents given questionnaires 50 filled and returned the questionnaires. Forty two out of the 50 respondents were male whilst the remaining eight were female. Six respondents were within the age bracket 18-30, Forty two were within the age group 41- 50 years, whilst the remaining two were aged 51 years and above. Ten respondents were educated to the master's degree, 30 had a first degree, and 10 had other lower forms of education.

Extent of PPP involvement in road infrastructure projects

To achieve the above objective, a question was first asked to solicit the opinion of the respondents as to whether the financing of road projects in Ghana was adequate or not. As expected an overwhelming 100% indicated that financing of road infrastructure in Ghana is totally inadequate. This is also confirmed by the 2013 budget statement that Ghana faces an infrastructure (including roads) funding gap of USD 1.5 billion a year.

On the sources of funding, the results indicated that, Government still remains the sole financier of road infrastructure projects as seventy (70%) of respondents (35) support the view that the main source for financing road infrastructure development in the country should be the government shown in figure 3 .

Figure 3.0: Financing of Road Projects



This study also supported the fact that the best method of financing road infrastructure is through private sector participation (PPP) as 60% (30) of respondents chose PPP as the best form of financing road infrastructure in contemporary Ghana.

The main bottleneck in applying PPP in road projects is the lack of legal frame work to draw up the modalities for the smooth implementation of PPP. Again this was supported by the fact that 100% (50) top executive of road sector administrators interviewed stated that they have not sighted any legal policy document for the implementation of PPP in Ghana. According to them the PPP road projects implemented so far are done without credible law backing it.

In gauging the perception of respondents on how long Ghana started applying PPP in road projects, majority (90%) of the respondents indicated that Ghana started applying PPP in road sector for about two years now. Information from Project Appraisal Report-PAR (2010) documents from African Development Bank indicated that PPP started in Ghana since 2008. This indicates that the application of PPP in the road sector in Ghana is still at the embryonic stage.

Comparison of Efficiency

Discussion of regression results

This section discusses the efficiency of resource use on PPP road projects and non-PPP road projects using a Cobb-Douglas production function, estimated in the double log form. The production functions estimated using Ordinary Least Squares (OLS) are summarised in Table 1.0. Examining the model for PPP road projects shows that the explanatory power is 77% and the F statistic is at one percent level of significance (Table-1.0). Except family labour, hired labour and communal labour were highly significant with the expected *a priori* signs. That is, the more labour applied on road projects the higher the total output. However family labour is found to be significant but negative meaning possibly, over utilization of family labour. The value of capital had the expected sign but not significant for non PPP projects. It however had a negative sign for PPP road but significant. Even though this result is inconclusive, it is generally accepted that the higher the loan amount the more the output of the project. The inconclusive regression results with respect to capital could be probable due to the proxy use for the total value of output.

Comparatively, the model for non-PPP road project shows an R^2 of 12.9 % and an F statistic at one percent level of significance. Here family labour was found to be highly significant with a positive relationship. That is, the higher the family labour the more project output.

Table 1.0 Estimated production function for Road Projects

Dependent Variable: Total Value of Output (TVO) of a project in the public eyes:

VARIABLES	PPP ROAD PROJECT		NON-PPP ROAD PROJECT	
	Coefficients	t-statistics	Coefficients	t-statistics
Intercept	22.65	2.04*	14.79	6.06***
Value of family labour	-0.172	-2.1*	0.249	2.224***
Value of communal labour	0.283	3.02***	0.26	0.240
Value of hired labour	0.49	6.21***	-0.143	-1.32
Duration of projects	-0.165	-0.75	0.055	0.53
Value of Capital	-1.08	-5.0***	0.25	0.23
Access to technical advice	1.02	2.03*	-0.03	-0.190
Interest Rate	-0.175	-0.79	-0.158	-3.42***
R-square	0.889		0.253	
Adjusted R square	0.765		0.129	
F-statistics	7.148***		2.03*	
Included observations	18		50	
Sample	50		50	

Source: Regression results (2013). Note: *** denotes 1% level of significance. ** =5% level of significance * = 10% level of significance.

Comparison of Technical and Allocative efficiency

This section compares the technical and allocative efficiencies of the regression results for the two groups of road projects. The null hypothesis of the study is that PPP road projects in Ghana will not bring any significant improvement in the technical and allocative efficiencies against the alternative that it will. Technical efficiencies (intercept term) are all positive and significant

(Table 2.0). The intercept of PPP road project is significantly greater than that without PPP road project (+22.65 > +14.79). This could be attributed to the combination of several technological packages between the private and the public sector. It also confirms the majority (90%) of the respondent view that PPP does not only combine expertise from Government sector without that of the private sector, but also ensures available technical advice to the road projects.

In all cases, the constants were positive and significant for both projects and at the same time, at least one explanatory variable in each case was significantly different from zero. The implication is that the two groups of projects are characterised by factor-biased (non-neutral) production function with PPP having a significantly higher technical efficiency. This meets the a-priori expectation that PPP road projects have a positive impact on the level of technical efficiency. Therefore, the null hypothesis is rejected in favour of the alternative that PPP road project has a significant higher technical efficiency.

Allocative efficiency

The validity of the hypothesis that PPP road project has a higher allocative efficiency than non PPP road projects was tested using the regression results. The allocative efficiency parameters derived in Table 4.2, indicated that, labour, (family, hired and communal) were all over utilized in both PPP road projects and non PPP road projects. The results however indicate that PPP road projects could achieve economic efficiency in applying credit as compared to over utilization of Capital by non PPP road projects. The over utilization of capital in road projects without PPP is attributed to corruption and undercutting in the award of government contracts without involving the private sector making most contracts not transparent enough. Another reason could be that because government does not pay contractors on time, the interest on loans and over estimation of project requirements overstretch the capital requirements of most government projects.

Table: 2.0 Estimates of sample means, Marginal value products (MVP), and allocative efficiency indices.

VARIABLES	PPP ROAD PROJECT	NON PPP ROAD PROJECT
Sample means (value in GH¢)		
Family labour	65280	64520
Communal labour	47940	36080
Hired labour	117200	88600
Capital (Credit or loan injection)	411,096	402,840
Output	3960600	2095000
Marginal Value Product (MVP)		
Family labour (GH¢ man- day)	0.09	«
Communal labour (GH¢ man- day)	-0.24	«
Hired labour (GH¢ man- day)	0.013	-0.122
Capital (Credit)	0.442	0.404
Marginal Factor Cost (MFC)		
Family labour (GH¢ man- day)	5.00	5.00
Communal labour (GH¢ man- day)	3.00	3.00
Hired labour (GH¢ man- day)	5.00	5.00
Capital(Credit)%	0.34	0.54
Allocative efficiency indices ($k = MVP/p = MVP/MFC$)		
Family labour	0.02	«
Communal labour	-0.08	-0.0244
Hired labour	0.0026	0.0244
Capital (Credit)	1.300	0.748

Source: Computed from Survey data (2011) « = Estimates were not derived because the regression coefficients were not statistical significant.

In relative terms, communal labour was more over utilized on non-PPP road project whilst on PPP road projects, hire labour was over utilized. Because of the insignificant and pervasive signs of the parameters, effective comparison could only be made for communal and hire labour. This is contrary to our *a priori* expectation.

In conclusion, applying PPP in road projects leads to more technical efficiency and almost economic efficiency in allocating credit. Therefore on the basis of this, the null hypothesis that PPP does not have any significant effect on the technical and allocative efficiency is rejected in favour of the alternative that PPP application in road construction has a significant impact on the efficiencies in Ghana. The finding that PPP leads to technical efficiency is in line with UNESCAP (2011) assertion that PPP leads to increased efficiency in project delivery, and operational management. This is because of the availability of additional resources to meet the growing needs of investment in the road sector and access to advanced technology (both hardware and software).

Constraints in applying PPP in road projects

The Kendall's statistics (Table 2.0) is less than one indicating no agreement among the ranking. This is because the PPP road projects have different problems as compared to non-PPP road projects. Based on this ranking the most pressing problem is weak private sector in Ghana to support PPP followed by high cost of road projects in Ghana and high risk profile of Ghana (Table 2.0).

Lack of strong private sector in Ghana is considered by respondents as the major stumbling block to the smooth implementation of PPP in the road sector. The private sector is bedevilled with numerous problems ranging from lack of capacity to lack of credit to undertake large infrastructure projects such as roads. This is compounded by the fact that illiteracy rate is high and most businesses are not registered.

Table 3.0 Constraints provided and rank by respondents in Ghana road sector

CONSTRAINTS	MEAN RANK	RANKS
Weak private sector in Ghana	5.56	1
High cost of road projects	5.69	2
High risk Profile	6.18	3
Lack of legal and regulatory frame work	6.30	4
High implementation cost due to feasibility studies	6.55	5
Difficulty of cost recovery	6.61	6
Lack of political guarantees to investors	6.74	7
PPP contracts are mostly complex and demanding	6.80	8
Poor capacity of the regions to handle their own projects	6.86	9
High corruption in the public sector	6.86	9
Lack of adequate incentives and penalties for PPP	6.92	11
High labour unrest in Ghana	6.92	11
TEST STATISTICS		
N	50	
Kendall's W	0.0770	
Chi-Square	82.1702	
Df	11	
Asymp. Sig.	.0000	

Combining these results with the separate group discussion delineated other constraints that are worth mentioning. The other constraints are: lack of legal and regulatory frame work, high implementation cost due to lack of feasibility studies, difficulty of cost recovery, lack of political guarantees to investors among others.

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The importance of road infrastructure in the development of Ghana's economy cannot be over-emphasised. Road Infrastructure has a multiplier effect on the other sectors of the economy. It is the prime responsibility of Governments to provide the necessary infrastructure including road to facilitate the socio-economic development of the country. However, it is becoming increasingly clear that government funding of road infrastructure is inadequate. As a result governments have found that partnership with the private sector is a viable alternative to increase and improve the supply of road infrastructure. In searching for solution to the large infrastructure road sector deficit, governments are inviting the private sector through PPP. However will this PPP yield to higher efficient use of resources? This study with the sole aim of assessing the impact of PPP on road sector in terms of technical and allocative efficiency will help find answers to this and other questions on PPP.

SUMMARY OF FINDINGS

The study set out to determine the extent of PPP involvement in road infrastructure. Ghana implementation of PPP in road infrastructure projects is still at the embryonic stage. The search

for alternative funding in the road sector emerged from the fact that government alone cannot continue to fund such high capital projects because government funding is woefully inadequate. The study also established that PPP remains one of the viable solutions for government funding of infrastructure projects such as road projects even though there exist no solid legal and regulatory frame work for PPP implementation in Ghana.

Another major finding of the study is that PPP application in the road sector will lead to higher technical efficiency and to some little extent economic efficiency if the right environment is created with the elimination of the identified constraints.

The constraints that affect the smooth implementation of PPP application in road projects in Ghana include:

- weak private sector to support PPP
- High cost of road projects and
- High risk profile of Ghana.

CONCLUSION

Based on the above-mentioned findings the following conclusions were arrived at. First and foremost, Government financing of road projects in Ghana is inadequate. This inadequacy in road financing often leads to government paying of huge sums of arrears every year to road contractors. There is therefore the need for the government to look for other sources of funding in order to increase the revenue base for the financing of road projects. One striking method the government can adopt to address this is to partner with the private sector in the provision of road infrastructure (PPP). However the private sector in Ghana is not strong enough to handle these challenges both in capital, managerial, and institutional base.

The study also concluded that it is more technically efficient to carry out PPP projects in the road sector of Ghana economy even though the tendency to over utilize labour is always there. Therefore government must fundamentally improve the systems for dealing with the private sector to realize the efficiency and effectiveness gains that these partnerships promise. Therefore for a successful partnership between Government and the private sector, the environment should be characterised by thorough planning, good communication, strong commitment from parties and effective monitoring, regulation and enforcement by government.

RECOMMENDATIONS

After a cautious and detailed analysis of the research findings, the following recommendations are made:

- Road infrastructure plays a fundamental role in the socio-economic development of every country. Government should therefore give it the needed attention by doubling the funding which was found to be inadequate for the road sector.
- Government should speed up the implementation of PPP projects by providing the regulatory and legal frame work for its implementation.

- To address the issue of weak private sector that could champion the PPP programme, government needs to set up a special fund and advisory body for the private sector.
- In doing all this government should ensure that the bureaucracies and corruption that engulf the public sector is reduced drastically. This, the government can do by ensuring that those who engage in such practices are given punishments that are severe enough to deter others from engaging in similar practices.
- There should however be provisions in the agreement that will make it difficult for the private businessmen to exploit the general public.
- Since the study shows inconclusive results for economic efficiency using PPP, it is important to conduct further research using real figures without proxies to determine the economic efficiencies of applying PPP in the road sector.

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