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# Cross-sectional comparison of public-private partnerships in transport infrastructure development in Nigeria

## 1. Introduction

Infrastructure has long been identified as a catalyst for economic growth. The demand for infrastructure development and the maintenance of existing infrastructure caused by economic growth and population increase has in many instances, overtaken the capacity of national governments to provide the necessary finance (Howes and Robinson, 2005). The estimates of investment needs for global infrastructure development ranges as high as US\$3 trillion per year, of which approximately US\$1 trillion per annum needs to be spent in developing countries (World Economic Forum, 2010). Howes and Robinson (2005) asserted that the estimate for developing the Asian region ranges from US\$1 to US\$2 trillion, US\$600 billion for Latin America while Eastern Europe and Africa also need heavy capital infusions for infrastructure development. The inadequacy of infrastructure in Africa is widely recognised, particularly in Sub-Saharan Africa (SSA). The finance required to raise infrastructure to a reasonable level within the next decade is estimated at US\$93 billion per year in Sub-Saharan Africa (World Bank, 2011).

Nigeria is one of the key economies in the Sub-Saharan Africa, having one of the fastest growing populations of about 150 Million. However, the state of infrastructure challenge is enormous. This becomes acute with the transport sector comprising roads, rails, airports, seaports and the country requires US\$10 billion annually for the next ten years to achieve the infrastructure requirements (Sanusi, 2012). Also, Nigerian government budget deficits and the inefficient management of large infrastructure projects and services within the public sector are some of the reasons why the traditional procurement method of funding public infrastructure projects through fiscal budgets is increasingly considered unviable (Alitheia, 2011). The Nigerian government in recognition of the large investment required for infrastructure provision and upgrading necessitated the government to put in place an enabling environment to drive private sector participation in infrastructure provision (Alli, 2006). In order to attract private sector finance for infrastructure provision, led the Nigerian government to establish the Infrastructure Concession Regulatory Commission (ICRC) law in 2005 (Ahmed, 2011; World Bank, 2011). The ICRC law provided the legal and institutional framework for PPPs to operate successfully in the country (Ahmed, 2011).

Thus, the recent government agenda indicates that infrastructure development is gaining momentum with up to 51 infrastructure projects being undertaken through PPPs between 1990 and 2009 (Vetiva, 2011). Most of these PPP projects started within the last five years with the transport sector being the major beneficiary, where about 24 PPP projects were undertaken within the sector between 2005 and 2009. In 2013 and 2014, about 66 PPP projects were in the pipeline (ICRC, 2014). This is similar to what is happening in Europe. For instance, Roumboutsos (2015) stated that the transport sector has taken extensive advantage of the PPP delivery model in Europe. Moreover, in a globalising world, there is a considerable interest in identifying CSFs that made PPP projects successful. This triggered a number of researchers toward identifying CSFs that are responsible for the successful implementation of PPP projects in different countries (see Tiong, 1996; Qiao *et al.*, 2001; Li *et al.*, 2005a; Zhang, 2005; Dulaimi *et al.*, 2010; Chan *et al.*, 2010; Ismail and Ajija, 2011; Cheung *et al.*, 2012; Babatunde *et al.*, 2012; Gupta *et al.*, 2013; Zou *et al.*, 2014; Osei-Kyei and Chan, 2015; Babatunde *et al.*, 2016) among others. Few researchers have also identified the means of measuring project success in PPPs (see Liyanage and Villalba-Romero, 2015).

In spite of these studies on CSFs for PPP projects very few studies attempted to identify CSFs for PPP infrastructure projects in the transport sector using multiple case study approach in developing countries, especially in Nigeria. It is against this backdrop that this study employed a multiple case study approach to identify CSFs for PPP projects in transport sector comprising road, airport, and seaport. Considering this phenomenon from multiple case studies will provide richer and more practical knowledge of CSFs for PPP projects in the Nigerian transport sector and developing countries at large.

## 2. Literature review

### 2.1. Procurement methods in use

The development of infrastructure in Nigeria has primarily been through the traditional form of the contract awarded by national, regional, and local governments through budgetary allocations (AfDB, 2010). Babatunde *et al.* (2010) concluded that both the traditional and non-conventional procurement methods are currently embraced for delivering of transport infrastructure projects in Nigeria. For instance, Babatunde *et al.* (2010) found that approximately half (48.08%) of infrastructure projects are executed using variants of traditional procurement method, 32.69% are through variants of PPPs, and 19.24% are executed through design and build method. It can be deduced that the procurement methods in use are still much of variants of the traditional method. This is corroborated by several researchers in Nigeria that found the variants of traditional procurement method as most prevalent methods of executing construction projects in Nigeria (see Idoro *et al.*, 2007; Ojo, 2009; Dada, 2013). In spite of the fact that the traditional method has been criticised for what are regarded as its shortcomings over time, its continued dominance in the procurement of both private and public works in Nigeria remains paradoxical (Dada, 2013). For example, a survey conducted in the year 2000 revealed that before 1999, Nigeria was losing an average of US\$270 million annually through various kinds of manipulations of the procedure for award and execution of public contracts (Wahab, 2000). These manipulations are in the forms of inflating the contracts costs, use of contracts system to divert public funds to private pockets, award of contracts for non-existent projects, use of inexperienced contractors, over-invoicing, influence peddling, award of contracts to friends, relations, and family members, and award of contracts without adequate planning and budgetary provisions (Wahab, 2000).

In addition, Jin and Doloi (2007) asserted that the conventional provision of infrastructure funded by the government has led to inefficiencies and subjected infrastructure development to the availability of government funds. Public infrastructures delivered through the traditional procurement have faced some challenges. These include: persistent cost overruns; construction delays; poor workmanship; contractor claims for additional payment; operational performance shortfalls among others (Flyvbjerg *et al.*, 2003; Van Wee, 2007; Siemiatycki, 2009). Further, Flyvbjerg (2007) and van Wee (2007) averred that poor outcomes occur in the traditional model of infrastructure delivery due to inappropriate allocation of risks among the parties involved. Gidado (2010) claimed that the public sector lacks skill and expertise to develop solely infrastructure, most especially transport infrastructure in Nigeria. Thus, the inadequate capacity in managerial and technical expertise in the public sector is continuously hindering the ability of the Nigerian government to meet her transport infrastructure requirements. This accounts for the failed; abandoned or collapsing infrastructure in many parts of the country and made it more difficult by competing for demands from other sectors for government's limited resources (AfDB, 2010).

Therefore, the development of a good transport infrastructure is characterised by significant investment requirements. Thus, to avoid cost and time overrun, and benefit from innovative project structuring and implementation strategies, private sector participation in the development of transport infrastructure is extremely critical (Ernst and Young, 2012). Many studies have been conducted regarding governments' inability to raise massive funds for large-scale infrastructure projects that can be mitigated by private participation (Cheung *et al.*, 2009). The only approach to addressing this challenge is to facilitate the increase of private provision of transport infrastructure projects through PPPs. For instance, PPP forms of procurement are recognised as an effective way of delivering value-for-money in public infrastructure or services (Li *et al.*, 2005b). Moreover, PPP seeks to combine the advantages of competitive tendering and flexible negotiation, and also allocate risk on an agreed basis between the public and private sectors (Li *et al.*, 2005b). Akintoye *et al.* (2011) asserted that PPP is commonly used to accelerate economic growth, development and infrastructure delivery, and to achieve quality service delivery and good governance. It is against this backdrop that many scholars across the globe advocate for PPPs in procuring transport infrastructure projects that provide synergy for both public and private sectors.

## **2.2. Current state of infrastructure in the Nigerian transport sector**

The state of Nigeria's infrastructure, especially in the transport sector has been a subject of debate by stakeholders in the economy in recent times (Lucas, 2011). For instance, Nigeria currently has a total road network of 194,200 kilometres which comprise 34,123km federal roads, 30,500km state roads, and 129,577km local government roads (Vetiva, 2011). Only about 30% of Nigeria's 194,200 km total road network is paved, relative to an average of 70% and 58% for frontier and emerging markets respectively (Ahmed, 2011; Vetiva, 2011; Sanusi, 2012). The gap is wider when compared with advanced economies with an average paved road network of 100% (Vetiva, 2011). Thus, there is a great opportunity for road infrastructure development in Nigeria, given that approximately 70% total road network is unpaved and perhaps un-motorable. In Nigeria, road development has historically been the government's responsibility. Recently, the private sector through PPP is beginning to participate in road infrastructure development.

Deficiency in rail infrastructure is even worse, as Nigeria's existing 3,500km rail network is grossly insufficient (AfDB, 2010). Rail transportation is generally in a dilapidated state and most of the available wagons and locomotives are defective and in poor conditions. This mode of transportation currently accounts for less than 1% of the land transportation in the country; thereby, putting the roads under significant pressure from heavy haulage (Vetiva, 2011). In the last four years, the government appears to have taken major steps in developing rail transportation by commissioning several projects in rail construction. In addition, despite the improvement made over the last 10 years in airport infrastructure, particularly Nnamdi Azikwe airport Abuja and Muritala Mohammed Airport Terminal 2 (MMA 2) Lagos, airport infrastructure in Nigeria cannot be compared to few selected African countries, especially Egypt and South Africa. For example, Nigeria has four international airports (out of 22 airports) and South Africa has three international airports. Based on 2009 figure, South Africa's Johannesburg airport and Egypt's Cairo airport had annual passenger traffic of about 16 million and 14 million respectively compared to combined annual passenger traffic of about 10.2 million for Nigeria's four international airports (Vetiva, 2011).

The infrastructure availability in the Nigerian transport sector compared to few selected countries is presented in Table I as follows:















**Case study 2:** In 2003 the federal government chose to rebuild the old domestic airport terminal that was gutted by fire in 2000 through the PPP initiative. The contract was awarded to Bi-Courtney Limited an indigenous company on a build, operate and transfer (BOT) basis. The BOT contract agreement was originally signed in April 2003 between the federal government, represented by Federal Airports Authority of Nigeria (FAAN) and the concessionaire. The contract comprises an airport terminal building, a multi-storey car park, an apron and other ancillary facilities on a land area of 20,000m<sup>2</sup>. In June 2004, a supplementary agreement was signed, in which the construction period was increased from 18 to 33 months. In February 2007, an addendum agreement was also signed. Thus, the concession period was extended from 12 to 36 years. The concessionaire invested about US\$250 million on the construction of MMA2 and most of the funding comes from six local banks in Nigeria. The construction of MMA2 completed and commissioned on 7 April 2007 and flight operations commenced on 7 May 2007. Presently, MMA2 is the first BOT project of its magnitude in the area of infrastructure development which was completed successfully by a Nigerian company. After the completion of MMA2, there has been a substantial improvement and increase in the number of passengers, and aircraft movement. For instance, the existing survey shows that after the commissioning of MMA2 in 2007, the total passengers started increasing by almost a million in every year and a significant increase in total aircraft movements as at today.

The project encountered few challenges. These include: (i) after being awarded the contract, the concessionaire faced significant challenges in securing financing and had to start construction without a long-term financing agreement in place. It was in March 2007 that the concessionaire secured a US\$150 million part-financing from a consortium of six banks for the completion of MMA2; (ii) on the operations side, some airlines were reluctant to move from the International Terminal; and (iii) there have been disputes between the parties and claims of breach of contractual rights. For example:

*“Claims: As at June 2010, Federal Airports Authority of Nigeria (FAAN) claims that concessionaire owes the government US\$6.7 million (mainly 5% of annual turnover), and concessionaire also claims that FAAN owing them US\$73 million (mostly proceeds from the operations at the General Aviation Terminal (GAT) in Lagos)”* (Ahmed, 2011).

The main lessons learnt are:

- The importance of having an agreed financial model and long-term financing in place at the outset of the project.
- The initial bidding process also points to the importance of managing politicians’ expectations and setting realistic goals regarding timelines.
- The difficulty of enforcing contractual agreements (e.g. the contract has a clause assuring that all scheduled domestic flights in and out of FAAN’s airports in Lagos shall operate from the new terminal during the concession period, FAAN continues to operate the old domestic terminal (GAT)).
- Any conflict of interest faced by the government puts significant pressures on the ability of the private sponsor to recover its investments and thus placed the financial viability of the project at risk.

**Case study 3:** Since the inception of seaports in Nigeria by the colonial masters in 1921, no systematic process for their re-development had been put in place until the current concession programme of port reforms started in 2000. The concession brought into existence the current

set of private port operators in Nigeria. The concession of Nigerian ports gained global credibility with the involvement of the World Bank, CPCS Transcom (of Canada) and Royal Haskoning (of Holland) as project monitors, concession bid managers, and consultants respectively (Fivestar Logistics, 2008). In 2001, the federal ministry of transport through the World Bank Public Private Infrastructure Advisory Fund raised funds and commissioned Dutch consultants Royal Haskoning to do a 'Ports Modernisation Project Study'. Following the submission of the Royal Haskoning reports' and extensive consultations with maritime stakeholders, and recommendation of the project monitors (i.e. CPCS and World Bank), a consensus was reached upon the strategy for reforming and modernising Nigeria's seaport system (Bert, 2008). It is against this backdrop that "landlord port model" was adopted for Nigeria seaports.

The 'landlord port model' entails that the public sector is responsible for port planning and regulatory tasks (related to safety, security and environmental), and maintains ownership of port-related land and basic infrastructure. On the other hand, the private sector is responsible for marine and terminal operations, construction, cargo handling operations, dock labour management, purchase and ownership of superstructure and equipment (Nigerian Ports Authority Brand Manual, 2005). In view of this, the bureau of public enterprise (BPE) engaged CPCS Transcom to evolve the legal and regulatory framework for the series of transactions, to prepare the restructure and concession plans and to assist in the bidding process. Before the concession in 2006, there are eight major ports in Nigeria. The concession of the ports was completed in 2006 after an international competitive bidding process (Bert, 2008). This led to the emergence of 26 port terminals carved out for competitive bidding in eight ports to include Apapa, Tin Can Island, Lilypond and Kirikiri all in Lagos, Port Harcourt, Calabar, Warri, and Koko. The concession took effect in 2006 and the port terminals were handed over to their successful bidders, except five (out of 26) port terminals that were handed over in 2007. Moreover, 11 (out of 26) port terminals concessions were located in Lagos. The concession periods for the 26 port terminals ranged between 10-25 years. After the concession in 2006, the Nigerian ports witnessed a rapid transformation. There is a remarkable increase inward and outward cargo movement during the post-concession era. For example, four years after the concession of Apapa-Lagos container terminal, delays for berthing space has dwindled, shipping lines congestion surcharge was reduced, and savings to government is estimated at US\$200 million a year among others.

The lessons learnt to include:

- There is a need to create an independent regulator that can monitor, resolve disputes, regulate pricing and competition, and allow the NPA to focus on its core obligations as a landlord.
- The importance of establishing legal and institutional frameworks for private participation. For instance, the concession contracts between government agencies and private investors must be underpinned by a strong legal framework to ensure transparency and sustainability.
- There is a need for host government agencies to work closely with international institutions and independent advisors to devise the concession model and to outline the concessions process. As international technical support is an effective way to ensure that best practices are implemented, most especially in developing countries.



which determined the success of PPP projects (Chua *et al.*, 1999; Rouboutsos, 2010; Vanelander *et al.*, 2014). Table VII revealed that government involvement by providing guarantees, political support, and project economic viability are CSFs common to the three PPP transport case studies. These three CSFs associated with PPP project characteristics to include political leadership, economic environment, adequacy of funding, site limitation and location, and project size (Chua *et al.*, 1999). It can be deduced that the three aforementioned CSFs are combined to determine the success of any typical PPP transport project infrastructure development. This implies that PPP transport project success can be better assured if these three CSFs are present. For instance, the identification of government involvement by providing guarantees as one of the three common CSFs is connected to the large investments required in the execution of PPP transport infrastructure projects, which the host government (i.e. central, regional or local) needs to provide guarantees in form of loans or grants to reduce the heavy financial burden on the part of the concessionaires, particularly in developing countries.

Also, the political support being identified as a CSF from the three PPP transport case studies (see Table VII) indicates that a successful PPP transport project requires strong political leadership. For example, transport infrastructure PPP project contracts have frequently long life cycles of over 25 years and are exposed to various exogenous changes arising from the political sphere. However, lack of political support can doom a PPP transport project. Against this backdrop, strong political support is needed to increase developmental assistance, and capacity building for the successful implementation of PPP transport infrastructure projects. In the same vein, project economic viability as a CSF common to the three PPP transport case studies (see Table VII) shows that the three PPP transport case studies are bankable to attract both the local and international lenders/financiers. This proved that these three PPP transport case studies have the potential that the concessionaires would recoup their financing before the concessions agreement expire, thus providing good investment opportunities to the concessionaires.

In addition, Table VII revealed that appropriate risk allocation and risk sharing, and strong and good private consortium are CSFs in both case study 1 (i.e. concession of Lekki-Epe Expressway) and case study 3 (i.e. concession of seaports). These two CSFs are connected with the contextual aspects of PPP project to include: (i) the contractual arrangement comprised PPP model adopted, contract award method, and equitable risk allocation; (ii) attributes of project participants encompassed the competency of the private sector to undertake PPP projects in a competitive environment, and capabilities of public sector authorities involved in PPP projects; and (iii) interactive processes, which refer to the communication, planning, monitoring and control, and project organisation to facilitate effective coordination throughout the PPP project life cycle. In this regard, in case study 1, the PPP model adopted is Build-Operate and Transfer (BOT) method, and in case study 2 the "Landlord port model" is used. Thus, in achieving equitable risk allocation, the attributes of PPP project participants and interactive processes among the PPP stakeholders play a vital role. For instance, the project participants, particularly the private sector comprised the concessionaires, consultants, contractors and financials in case study 1 and case study 2 are foreign investors, international construction firms, and foreign banks/lenders. It is on this premise that it is not surprising that the two aforementioned CSFs were achieved in case study 1 and case study 2. Therefore, it is evident that the success of any PPP transport infrastructure project is largely dependent on the maturity and competency of the stakeholders in both public and private sectors involved in transport PPP contractual arrangement.

Consequently, Table VII revealed 10 CSFs in the case study 1 (i.e. concession of Lekki-Epe Expressway), four CSFs in case study 2 (Muritala Mohammed Airport, MMA2), and eight CSFs in case study 3 (concession of Seaport Terminals). This study, therefore, found that CSFs vary according to specific PPP transport infrastructure project. It can be deduced that the difference in the number of identified CSFs in the case study 1-3 resulting in different levels of success rate achieved in these three PPP case studies. This difference is not surprising considering the variations in the conditions of respective PPP transport projects to include the type of transport project, PPP models, contract award criteria, ways of funding the project, and stakeholder involvement (see Table V for details). These factors are inherent to specific transport sub-sectors that may contribute to the success of the project. In this study, the three PPP case studies comprised road, airport, and seaport act as modes in transport networks, their functions are broadly similar, but their economic and institutional structures are significantly different. Thus, it is evident that the variability of PPP structures within each mode of transport, suggests that PPP project stakeholders, PPP project characteristics, PPP arrangements, and PPP policy of the host country have the greatest influence on CSFs for specific PPP transport infrastructure projects. It is believed that these study findings will improve understanding of the particularities of the various PPP transport sub-sectors, particularly the roads, airports, and seaports.

## 5. Conclusion

It is evident that many public transport infrastructure projects are delivered through PPPs in the last two decades. The identification of the specific critical success factors (CSFs) for these PPP transport projects implementation is crucial. Considering the vast majority of previous related studies focused on the CSFs for general implementation of successful PPP projects. It is against this backdrop that this study assessed, identified and compared specific CSFs in the three PPP transport infrastructure project case studies comprised road, airport, and seaport in Nigeria. In achieving this, a set of 26 success factors were identified from the significant literature, which was used to design a case study protocol using FMEA method. Based on the foregoing, FMEA technique was used to assess the criticality of identified 26 success factors in the three PPP case studies. Thus, using similar CSFs provided a uniform basis and allowed like-for-like comparison between the three PPP case studies. In addition, personal observations and review of documentary reports were conducted in each case study to unfold the characteristics of events, and to describe the process of project conception and delivery, which led to drawn the lessons learnt in the three PPP project case studies.

The study revealed a total of 13 CSFs which are peculiar to the successful realisation and delivering of PPP transport infrastructure projects in Nigeria. The identified CSFs slightly varied within the three PPP case studies. For instance, 10 CSFs were identified in the concession of the road; four CSFs in the concession of the airport; and eight CSFs in the concession of the seaport. This implied that the success of any PPP transport infrastructure project is largely dependent on the ability of stakeholders involved in PPP contracts to successfully managed the entire 13 CSFs identified in the three PPP transport project case studies. Further, the difference in the number of CSFs identified in each PPP case study could be attributed to the variations in the conditions of respective PPP transport project; thus resulting in different degrees of success attained in each case study. In addition, the study found that government involvement by providing guarantees, political support, and project economic viability as CSFs common to all the three PPP transport case studies. This implied

that PPP transport project success can be better assured if these three CSFs are present. It further implied that these three CSFs are the bedrock for successful implementation of PPP transport infrastructure projects in Nigeria and developing countries at large.

This study is not without limitations. First, although the study findings are robust yet it cannot be generalised to the entire population of PPP transport projects. Hence, further study using the findings of this study as the basis utilising quantitative technique are required to create a set of CSFs specific to PPP transport infrastructure projects. Second, the use of three PPP transport case studies and structured interviews of stakeholders from both public and private sectors could be enhanced in future work, as having more case studies and interviewees may enrich the findings. Despite its limitations, this present study provides more insights and useful information for the government and private sector concerning the important factors that need to be emphasised in ensuring the successful implementation of PPP transport projects in developing countries as a whole.

Based on the findings of this study, the following policy recommendations are proposed:

- To improve the successfulness of using PPPs for the transport infrastructure projects, it is recommended that PPP stakeholders in transport infrastructure projects development should focus their attention, priorities, and leadership in managing the specific CSFs identified in this study in achieving value for money.
- Due to the difficulty in PPP project preparation within the government team, the public procuring agencies should engage a transaction advisory team/ independent advisors to devise the concession model and to outline the concessions process, particularly in developing countries. This will ensure that best practices are implemented and it will induce confidence in both local and foreign investors for investing in developing countries' PPPs market.
- With respect to the protest to pay tolls in PPP road project (i.e. case study 1), it is vital to inform, involve, and include the diverse stakeholders at very early stage of PPP project development. Through and detailed consultations with relevant stakeholders, such as relevant communities or users, media, labour unions, and special interest groups among others become imperative, so that desired outcomes are better captured.
- In light of the likely issues on PPP transport project affordability, a detailed feasibility study and value for money assessments need to be undertaken before proceeding with a PPP. The important role of an affordability analysis is highlighted for PPP transport projects owing to the large investment required for the provision of transport infrastructure projects.

It is believed that, this study is not only fills the knowledge gap by identifying specific CSFs for PPP transport infrastructure projects in Nigeria and developing countries at large, but is also provided a list of CSFs that could be used to develop metrics and standard for measuring maturity levels of public and private sector organisations involved in PPP transport infrastructure projects implementation. This would provide a roadmap for improvement process in PPP transport infrastructure projects; thus enhancing the success rate of PPP transport projects in developing countries. Therefore, further study should be conducted to widening the understanding of specific CSFs to PPP transport projects implementation in different countries, using a comparative approach. The findings emanating from this study prove to be more reliable as they come about not merely from a secondary data investigation but rather from field work approach which involved getting stakeholders share their true practical experiences.



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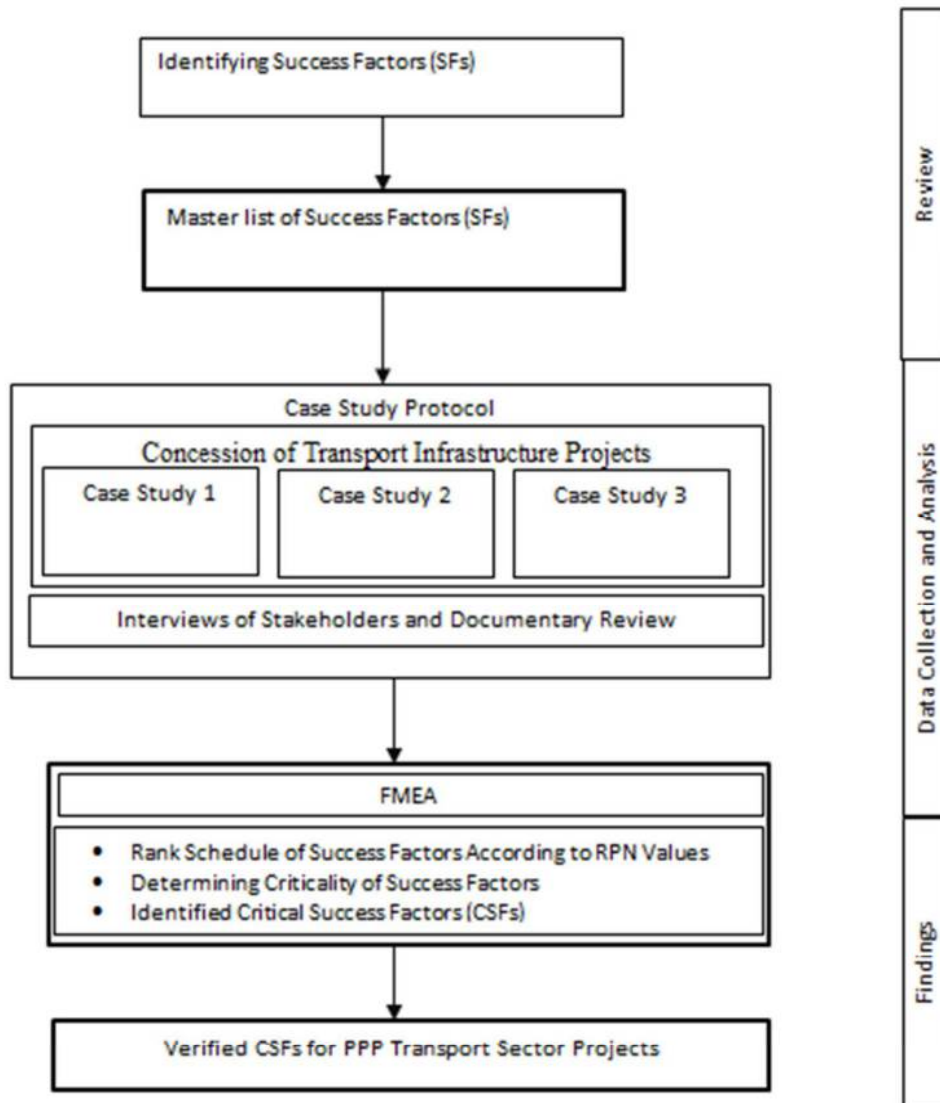
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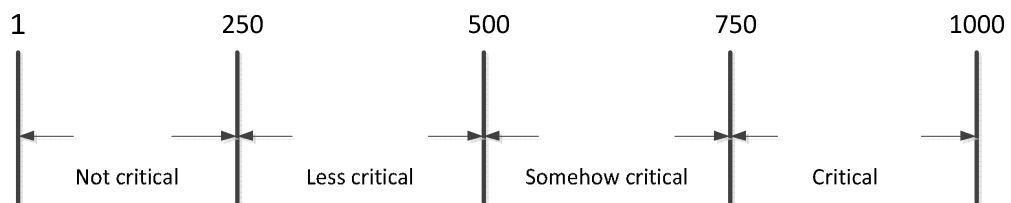


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## List of Figures



**Figure I.** Research methodology chart      **Key:** FMEA-Failure Mode and Effect Analysis



**Figure II.** Criticality scale

**Legend**







**Figure III.** Financial structure of the concession of Lekki-Epe Expressway at financial close  
 (Source: Lekki Concession Company (LCC), 2008, p. 21).

## List of Tables

**Table I.** Infrastructure availability in few selected countries

Nation	Population (millions)	Area (Km <sup>2</sup> )	Stock infrastructure		
			Rails (km)	Roads (km)	*Airports
Netherlands	16.72	41,543	2811	135,470	22
Brazil	179.10	8,514,877	28,875	1,751,868	718
Turkey	96.81	783,562	8,697	426,951	90
India	1166.08	3287,263	63,327	3,316,425	251
Nigeria	140.00	923,768	4,500	194,200	22

Note: \*Paved civil commercial airports (Adapted from AfDB, 2010)

**Table II.** Methodology for comparing PPP transport infrastructure projects

No.	“the eight “Ws” characteristic	Description
1	What	This describes the nature of the transport project to be undertaken by the PPP, in terms of its physical characteristics (including PPP arrangement and the level of temporary monopoly that it is able to exercise), functions, and size within the transport network.
2	When	This refers to the maturity of the investment.
3	Where	This is principally describes the geographical locations of the PPP transport project.
4	Why	This search is initiated for the underlying motivation for proceeding with a PPP; a way of funding the investment or delivering a service; and PPP award criteria.
5	Whole	This expresses the vulnerability of the investment/PPP transport project to macro-economic and social influence.
6	Who	This describes the initiating public sector authority including level of government (i.e. central, regional, or local) in terms of decision and regulating ability.
7	Whom	This reflects the private sector that is able to undertake the business development in a competitive environment.
8	Which way	This refers to the key characteristics of the PPP contractual agreement including risk transfer and (re-)payment schemes etc.

(After, Rouboutsos 2010; Vanelslander *et al.*, 2014)

**Table III.** Summary of selected literature on success factors for PPP projects

Ref. code	Success factors	References
SF01	Transparency in the procurement process	Jefferies <i>et al.</i> , 2002; Li <i>et al.</i> , 2005a; Chan <i>et al.</i> , 2010; Cheung <i>et al.</i> , 2012; Gupta <i>et al.</i> , 2013.
SF02	Competitive procurement process	Jefferies <i>et al.</i> , 2002; Li <i>et al.</i> , 2005a; Chan <i>et al.</i> , 2010; Cheung <i>et al.</i> , 2012; Gupta <i>et al.</i> , 2013.
SF03	Good governance	Frilet, 1997 ; Qiao <i>et al.</i> , 2001 ; Li <i>et al.</i> , 2005a; Ismail and Ajija, 2011.
SF04	Well organized and committed public agency	Boyfield, 1992; Stein, 1995; Jones <i>et al.</i> , 1996 ; Li <i>et al.</i> , 2005a.
SF05	Social support	Frilet, 1997 ; Li <i>et al.</i> , 2005a.
SF06	Shared authority between public and private sectors	Stonehouse <i>et al.</i> , 1996 ; Kanter, 1999 ; Li <i>et al.</i> , 2005a; Chan <i>et al.</i> , 2010.
SF07	Thorough and realistic assessment of the cost and benefits	Brodie, 1995; Qiao <i>et al.</i> , 2001; Li <i>et al.</i> , 2005a.
SF08	Favourable legal framework	Jones <i>et al.</i> , 1996 ; Li <i>et al.</i> , 2005a; Ismail and Ajija, 2011; Cheung <i>et al.</i> , 2012.
SF09	Project technical feasibility	Tiong, 1996 ; Qiao <i>et al.</i> , 2001 ; Li <i>et al.</i> , 2005a.
SF10	Appropriate risk allocation and risk sharing	Grant, 1996 ; Qiao <i>et al.</i> , 2001 ; Li <i>et al.</i> , 2005a; Zhang, 2005; Cheung <i>et al.</i> , 2012.
SF11	Commitment and responsibility of public and private sectors	Stonehouse <i>et al.</i> , 1996 ; Kanter, 1999 ; Li <i>et al.</i> , 2005a; Ismail and Ajija, 2011; Cheung <i>et al.</i> , 2012.
SF12	Strong and good private consortium	Tiong, 1996 ; Birnie, 1999 ; Jefferies <i>et al.</i> , 2002 ; Li <i>et al.</i> , 2005a; Dulaimi <i>et al.</i> , 2010; Cheung <i>et al.</i> , 2012.
SF13	Government involvement by providing guarantees	Stonehouse <i>et al.</i> , 1996 ; Zhang <i>et al.</i> , 1998 ; Kanter, 1999 ; Qiao <i>et al.</i> , 2001 ; Li <i>et al.</i> , 2005a; Zhang, 2005; Chan <i>et al.</i> , 2010; Cheung <i>et al.</i> , 2012.
SF14	Multi – benefits objectives	Grant, 1996 ; Li <i>et al.</i> , 2005a.
SF15	Political support	Zhang <i>et al.</i> , 1998 ; Qiao <i>et al.</i> , 2001 ; Li <i>et al.</i> , 2005a; Zhang, 2005; Dulaimi <i>et al.</i> , 2010; Chan <i>et al.</i> , 2010.
SF16	Stable macroeconomic conditions	Qiao <i>et al.</i> , 2001 ; Li <i>et al.</i> , 2005a; Chan <i>et al.</i> , 2010; Cheung <i>et al.</i> , 2012.
SF17	Sound economic policy	EIB, 2000 ; Li <i>et al.</i> , 2005a; Ismail and Ajija, 2011.
SF18	Availability of suitable and adequate financial market	Akintoye <i>et al.</i> , 2001 ; Qiao <i>et al.</i> , 2001 ; Jefferies <i>et al.</i> , 2002 ; Li <i>et al.</i> , 2005a; Chan <i>et al.</i> , 2010; Ismail and Ajija, 2011.
SF19	Technical innovation and technology transfer	Qiao <i>et al.</i> , 2001 ; Chan <i>et al.</i> , 2010; Cheung <i>et al.</i> , 2012.

Ref. code	Success factors	References
SF20	Effective management control	Chan <i>et al.</i> , 2010; Cheung <i>et al.</i> , 2012.
SF21	Consultation with end-users	Chan <i>et al.</i> , 2010; Cheung <i>et al.</i> 2012.
SF22	Appropriate project identification	Chan <i>et al.</i> , 2010; Cheung <i>et al.</i> , 2012.
SF23	Clear project brief and client requirements	Chan <i>et al.</i> , 2010; Cheung <i>et al.</i> , 2012.
SF24	Project economic viability	Zhang, 2005; Chan <i>et al.</i> , 2010.
SF25	Favourable investment environment	Zhang, 2005.
SF26	Good partners' relationship	Zhang, 2005; Chan <i>et al.</i> , 2010; Cheung <i>et al.</i> , 2012 ; Zou <i>et al.</i> , 2014

**Table IV.** Background information of interviewees from both public and private sectors in the three case studies

No.	Organization of Interviewees	Position of Interviewee	Years of Professional Experience of Interviewee
<b>Case Study 1: Concession of Lekki-Epe Expressway</b>			
1	Public sector: Contract Administration Unit	Team Leader	10 Years
2	Public sector: Legal and Risk Management Unit	Team Leader	12 Years
3	Public sector: Engineering and Construction Unit	Team Leader	9 Years
4	Private sector: Financial-Specialised/Project Financing Unit	Manager	16 Years
5	Private sector: Concessionaire- Procurement Unit	Team Leader	8 Years
6	Private sector: Consultant-Legal Advisor	CEO	15 Years
<b>Case Study 2: Concession of Muritala Mohammed Airport Terminal 2 (MMA 2)</b>			
7	Private sector: Financial-Project Financing Unit	Assistant Manager	11 Years
8	Private sector: Consultant-Project Manager	CEO	22 Years
9	Private sector: Consultant- Quantity Surveyor	CEO	27 Years
10	Public sector: Procurement Unit	Manager	24 Years
11	Public sector: Corporate Affairs	Assistant Manager	22 Years
12	Public sector: Legal and Risk Unit	Assistant Manager	20 Years
<b>Case Study 3: Concession of Seaport Terminals</b>			
13	Private sector: Project Consultant	Team Leader	12 Years
14	Public sector: Procurement Unit	Manager	24 Years
15	Public sector: Engineering Unit	Assistant Manager	21 Years
16	Public sector: Contract Administration Unit	Manager	25 Years
17	Private sector: Concessionaire -Engineering Unit	CEO	20 Years
18	Private sector: Concessionaire - Procurement Unit	Manager	18 Years

**Table V.** Summary of the case studies (Derived from documentary/archival data)

Project data	Case study 1	Case study 2	Case study 3
Project name	Lekki-Epe Expressway	Murtala Mohammed Airport (MMA2)	Seaport terminals
Total length in kilometre (Km)	Phase I- 49.5km & Phase II-20 km	-	-
PPP model	BOT	BOT	Landlord port model & ROT
Year of award	24 April 2006	April 2003	2004
Concession period	30 years	36 Years	10-25 years
Estimated project cost	US\$450 million	US\$250 million	US\$ 1.70 billion
Year of commissioning	July 2010 (Phase I)	7 April 2007	2006
Status of project	Operational	Operational	Operational
Operational start	December 2010	7 May 2007	2006
Method of payment	Toll-user-based	User based	User based
<b>Stakeholder involved</b>			
Public sector authorities	i. Lagos State Public Private Partnership Office ii. Ministry of Transportation	i. Federal Airports Authority of Nigeria (FAAN) ii. Ministry of Aviation iii. Infrastructure Concession Regulatory Commission (ICRC)	i. Bureau of Public Enterprise (BPE) ii. Federal Ministry of Transport iii. Nigerian Ports Authority
Concessionaires	i. Asset Resources Management (ARM Group) ii. Lekki Concession Company (LCC) as Special Purpose Vehicle (SPV)	Bi-Courtney Nigeria Limited	26 concessionaires- These include: i. AP Moller ii. ENL Consortium iii. Ecomarine Nig. Ltd among others
Financials/Banks	5 local banks & 2 foreign banks	6 local banks	World Bank Public Private Infrastructure Advisory Fund & Foreign Direct Investment (FDI)
Consultants	i. Aurecon ii. High-Point Rendell iii. Trinity International LLP & few local advisors	i. Spring Engineering Limited (project manager) ii. AOC Architect iii. BEE QUE (quantity surveyor)	i. CPCS Transcom (of Canada) ii. Royal Haskoning (of Holland) iii. World Bank (project monitors)
Contractors	Hitech Construction Company Ltd (main contractor)	Stabilini Visioni (main contractor)	-

**Table VI.** Summary of the assessment of criticality of success factors using FMEA technique in the three PPP cases studies

Success factors	Case study 1				Case study 2				Case study 3						
	Public		Private		Public		Private		Public		Private		Total		
	RPN	Av.	RPN	Av.	RPN	Av.	RPN	Av.	RPN	Av.	RPN	Av.	RPN	Av.	
Transparency in the procurement process	240	344	448	344	08	31	54	31	08	31	54	31	800	760	Critical
Competitive procurement process	336	420	504	420	32	86	140	86	32	86	140	86	810	765	Critical
Good governance	560	520	480	520	120	186	252	186	120	186	252	186	336	384	Less Critical
Well organized and committed public agency	240	232	224	232	294	252	210	252	294	252	210	252	384	360	Less Critical
Social support	180	250	320	250	150	183	216	183	150	183	216	183	336	294	Less Critical
Shared authority between public and private sectors	336	315	294	315	36	93	150	93	36	93	150	93	432	363	Less Critical
Thorough and realistic assessment of the cost and benefits	800	805	810	805	294	435	576	435	294	435	576	435	567	608	Somehow Critical
Favourable legal framework	648	774	900	774	60	114	168	114	60	114	168	114	630	635	Somehow Critical
Project technical feasibility	720	684	648	684	392	385	378	385	392	385	378	385	576	612	Somehow Critical
Appropriate risk allocation and risk sharing	800	805	810	805	144	195	245	195	144	195	245	195	810	805	Critical
Commitment and responsibility of public and private sectors	392	520	648	520	252	231	441	231	252	231	441	231	720	765	Critical
Strong and good private consortium	720	760	800	760	448	548	648	548	448	548	648	548	810	805	Critical
Government involvement by providing guarantees	810	805	800	805	720	765	810	765	720	765	810	765	720	760	Critical
Multi – benefits objectives	180	286	392	286	144	240	336	240	144	240	336	240	252	231	Not Critical
Political support	648	774	900	774	720	810	900	810	720	810	900	810	900	810	Critical

**Note:** FMEA- Failure Mode & Effect Analysis; RPN- Risk Priority Number; Criticality Scale: 1-250-Not Critical; 250-500-Less Critical; 500-750-Somehow Critical; 750-1000-Critical

Success factors	Case study 1				Case study 2				Case study 3			
	Public	Private	Total	Remark	Public	Private	Total	Remark	Public	Private	Total	Remark
	RPN	RPN	Av. RPN		RPN	RPN	Av. RPN		RPN	RPN	Av. RPN	
Stable macroeconomic conditions	180	280	230	Not Critical	120	392	256	Less Critical	384	576	480	Less Critical
Sound economic policy	252	336	294	Less Critical	96	210	153	Not Critical	280	336	308	Less Critical
Availability of suitable and adequate financial market	720	810	765	Critical	810	900	855	Critical	441	432	218	Not Critical
Technical innovation and technology transfer	720	810	765	Critical	120	280	200	Not Critical	504	648	576	Somehow Critical
Effective management control	504	720	612	Somehow Critical	96	315	206	Not Critical	504	648	576	Somehow Critical
Consultation with end-users	100	126	113	Not Critical	07	64	36	Not Critical	180	140	160	Not Critical
Appropriate project identification	800	720	760	Critical	810	720	765	Not Critical	441	504	473	Less Critical
Clear project brief and client requirements	504	336	420	Less Critical	63	120	92	Not Critical	336	432	384	Less Critical
Project economic viability	720	900	810	Critical	810	720	765	Critical	810	720	765	Critical
Favourable investment environment	648	720	684	Somehow Critical	729	648	689	Somehow Critical	640	567	604	Somehow Critical
Good partners' relationship	252	504	378	Less Critical	75	210	143	Not Critical	280	294	574	Somehow Critical

**Note:** FMEA- Failure Mode & Effect Analysis; RPN- Risk Priority Number; Criticality Scale: 1-250-Not Critical; 250-500-Less Critical; 500-750-Somehow Critical; 750-1000-Critical



**Table VII.** Identified CSFs in the three transport PPP case studies

Identified CSFs	Case study 1 (Road)	Case study 2 (Airport)	Case study 3 (Seaport)
Transparency in the procurement process			✓
Competitive procurement process			✓
Thorough and realistic assessment of the cost and benefits	✓		
Favourable legal framework	✓		
Appropriate risk allocation and risk sharing	✓		✓
Commitment and responsibility of public and private sectors			✓
Strong and good private consortium	✓		✓
Government involvement by providing guarantees	✓	✓	✓
Political support	✓	✓	✓
Availability of suitable and adequate financial market	✓	✓	
Technical innovation and technology transfer	✓		
Appropriate project identification	✓		
Project economic viability	✓	✓	✓