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Design Risk Transfer Model of Public-Private Partnerships - Decision Path: The Case of Hydropower Generation in Uganda

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Abstract:
The motivation of the study was to explore the risks associated with PPP models implemented in Uganda's hydropower with the aim of designing the most appropriate PPP model for hydropower dams. Based on a systematic review of the literature, industry reports and official documents, this paper reveals that the Government of Uganda made a deliberate attempt to adopt PPPs in the electricity sector but faced construct project risks. The outcome of our investigation confirms that the build–own–operate–transfer has been used utilizing of design-bid-build (DBB) contracting method for hydropower dams that has attracted construction design risks, with limited attempt to manage such risks. To reduce risks, the findings of our study recommend for the need to bundle the Design-Build (DB) functions, thus, resulting in the selection of a design-build-own-operate-transfer (DBOOT) model that has the potential to reduce design risks when implementing PPPs in the generation of electricity. By proposing DBOOT that is aligned with the DB contracting approach, governments can ensure optimal risk transfer to special purpose vehicles while mitigating cost, time, and schedule extensions.

Keywords: design risk, public-private partnerships, design-build, design–bid–build, electricity.

公私合作风险转移模型设计——决策路径：以乌干达水力发电为例

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摘要：
该研究的动机是探索与乌干达水电实施的购买力平价模型相关的风险，旨在为水电大坝设计最合适的购买力平价模型。通过对文献、行业报告和官方文件的系统回顾，本文揭示了乌干达政府有意在电力部门采用购买力平价，但面临建设项目风险。我们的调查结果证实，水电大坝采用“设计-投标-建造”(DBB)承包方式的“建设-拥有-运营-移交”已引起建设设计风险，但管理此类风险的尝试有限。为了降低风险，我们的研究结果建议需要捆绑设计-构建(DB)功能，因此，选择了设计-构建-拥有-运营-转移(启动)模型，该模型有可能在发电中实施购买力平价时降低设计风险。通过提出与DB合同方法相一致的启动，政府可以确保将风险最佳转移到特殊目的工具，同时降低成本、时间和进度延期。

关键词：设计风险、公私合作、设计-建造、设计-投标-建造、电力。

1. Introduction

Citizens demand that governments deliver services. From transport, water supply, waste management to energy, citizens require that government not only deliver quality but also free services. If they are required to pay, then the services must be affordable. Affordability enables industries to derive economies of scale while equally according citizens access and affordable public goods and services to serve their economic and social needs. In the developing world, but largely in Africa, electricity access and tariffs have remained a challenge (Onyeji et al., 2012). Due to the COVID-19 pandemic, the demand for electricity is estimated to have decreased by 4%, but that demand for global energy in 2021 is expected to increase by 4.6%, with emerging markets and the developing world constituting 70% of the expected growth in demand for energy (International Energy Agency, 2021).

To resolve the problem in the energy sector, governments have taken several steps to increase accessibility, but affordability in most countries remains a challenge. Various attempts have been made to increase electricity access across the world. Due to the high cost of grid solutions, governments in the developing world have adopted off-grid solutions as an alternative solution for widening electricity access. However, it is noted that hybrid energy options are not more sustainable cost-wise since off-grid solutions are associated with high maintenance costs if maintenance services are to be sourced outside the rural and remote areas (Reiche et al., 2000). Other options to increase energy access include adopting public-private partnerships (PPPs). PPPs are loosely defined as “cooperative institutional arrangements between public and private sector actors” (Hodge & Greve, 2007, p. 545). Broadbent and Laughlin (2003) view PPPs as a new public management tool. They define PPPs as part of the agenda of increasing private sector participation in delivering public services.

Wettenhall (2003) consistently opines that PPPs have been widely accepted due to perceived efficiency benefits in service provision, creating a new and extended public organization by stretching its boundaries. Based on such thinking, in this paper, we visualize PPPs as part of a network constituting the public and private sector actors, formulated to improve public services' delivery efficiency and effectiveness. The social network theory is adopted to guide the study. In line with the view of Liu et al. (2017), we argue that forming networks constituted of both public and private actors leads to the subduing of individual limitations. When the public sector combines with the private sector, opportunities are created to derive the efficiency and effective delivery of services.

Existing studies have revealed that when parties band together to form a network, they achieve objectives that they would not have been able to achieve while operating independently (Turrini et al., 2010). Provan et al. (2007) postulated that understanding the manner in which the outcomes of a network are achieved requires knowledge of network evolution and network player interactions. Additionally, Meier and O'toole, Jr. (2001) stated that the success of networks depends on the state of managerial strategies that are designed and implemented to govern the network alliance. Similarly, the energy sector in Uganda has PPPs to support electricity access and improve quality of electricity in Uganda (Kabanda, 2014; Atmo & Duffield, 2014). The welcoming of PPP in Uganda aligns well with the government’s aim to boost the energy capacity and attract the private sector to invest in the Ugandan economy.

1.1. Uganda: History and Trends in the Electricity Sector

Upon gaining independence in 1962, Uganda inherited electricity assets from the colonial administration. During the colonial period, the Nalubaale Dam was constructed with the purpose of serving colonial interests. Post-independence, more households and industries were built, and this led to an increased demand for electricity. From the 1970s, the demand for electricity declined due to the political instability that slowed production. From the year 1986, however, successive governments embarked upon attempts to increase access to electricity. This choice was driven by the global recognition of electricity as a key catalyst to economic and social transformation (Vagliasindi & Besant-Jones, 2013).

From 2006 to 2012, the country faced electricity blackouts that significantly disrupted a number of economic activities and the general social wellbeing of citizens. To manage this challenge, the government of Uganda—under the Electricity Regulatory Authority—awarded licenses combined with power purchase agreements (PPAs); the aim of this decision was to boost electricity production with the ultimate objective of improving electricity access. In developing countries, governments engaged private sector actors under PPAs to increase production capacity; this decision was chiefly a result of budgetary limits (Naiga & Karobwa, 2020). For instance, some actors were engaged to produce electricity from diesel, which was perceived to be expensive (Naiga & Karobwa, 2020). The awarding of concessions under PPP arrangements was also taken into consideration. An example of this can be seen with the Bujagali Hydropower Dam project, which is widely recognized as one of the most popular PPP models in Uganda (Amonya, 2018).

1.2. Public-Private Partnerships in Uganda's Electricity Sector: The Case of the Bujagali Hydropower Dam

The Bujagali Hydropower Dam is located in Jinja District, Uganda in East Africa. The dam was constructed through a PPP arrangement, and it continues to be managed under the same arrangement. The Special Purpose Vehicle (SPV) implementing the PPP is Bujagali Energy Limited (BEL). The project, deemed the 'deal of the year' in 2007, achieved financial closure during that year; it was ultimately commissioned in 2021. The project was conceived as a result of blackouts that occurred from 2005 to 2012 (Kabanda, 2014). The project is considered to have been the largest project with a pooled financing structure for an independent hydropower initiative in Uganda. It lies on the Nile River—the longest river in Africa—and originates in Uganda. Prior to 2012, the government of Uganda had been subsidizing electricity for consumers, and the need arose to develop cost-reflective tariffs for the country with the Bujagali Dam. The dam was expected to contribute an extra 250 megawatts (MW) of electricity with 5 turbines producing 50 MW each (African Development Bank, 2008). A diagrammatic illustration of the structuring of the dam and key stakeholders' roles and responsibilities is highlighted in Figure 1.

Figure 1. Bujagali concession (International Finance Corporation, 2022)

In Uganda, the build-own-operate-transfer (BOOT) PPP model has remained the most popular PPP in Uganda (Kabanda, 2014). The government of Uganda provided the design from which BEL was given concession under the BOOT. The model was applied to the building, owning, operating, and eventual transferring of the operation of a 250 MW hydropower dam at Bujagali. Under this concession, it is expected that Bujagali Energy Limited (BEL) will use the BOOT model to manage the dam for 33 years, extended from the initial timeframe of 30 years (Electricity Regulatory Authority, 2018). The objective of the extension is said to be related to the need to reduce tariffs. This is intended to be done through renegotiation of the terms of the loans with financiers of the SPV, and the decision is supported by the Government of Uganda. Like any other PPP, the SPV registered under the project is Bujagali Energy Limited (BEL). BEL is a private limited company formed from a consortium of partners in order to implement the dam project. Under the concession, a power purchase agreement (PPA)—particularly one that provides guaranteed demand for the electricity produced at the dam—was signed by BEL and the Government of Uganda (Electricity Regulatory Authority, 2018).

Empirical studies have indicated that the HEP Dam faced a range of challenges from the onset. Luwa (2007) observed that the PPP project failed to meet acceptable environmental social impact requirements. As such, the Bujagali HEP has consistently been critiqued for delivering electricity based on an unreasonable tariff, resulting in the question of why this was considered to be the best policy direction. Other challenges associated with the project include land compensation disputes, poor communication, and a number of climate change issues (Luwa, 2007). Other study critiques have been directed toward the design issue (Kabanda, 2014); while the government provided the design, it was allegedly exposed to design effects. As such, existing studies point to the ills of the design-bid-build contracting model adopted. The critique of unbundling can be understood through the review of the economics of bundling lens discussed below.

1.3. Theoretical Lens: Economics of "Bundling" or "Tying"

Popular in the USA, the concept of "bundling" is associated with pricing and design. Carlton and Waldman (1998) refer to bundling as "tying," implying that in markets, the term is used by sellers of products who may not sell a product unless the buyer purchases another product from them. The motive for bundling is usually recommended because efficiency benefits can be derived from the bundling practice. According to Kühn et al. (2005), the bundle should be characterized by non-abuse of market power, complementary advantage, and asymmetry stretch of the product line length.

In the energy sector, bundling and unbundling have

been associated with the functions of players in the sector (Eakin & Faruqui, 2000; Falchetta et al., 2021). Unbundling in the electricity sector resulted in the separation of functions such as generation; transmission and distribution. Each respective function resulted in the emergence of state-owned firms: Uganda Electricity Distribution Company Limited (UEDCL)-Distribution, Uganda Electricity Generation Company Limited (UEGCL), and Uganda Electricity Transmission Company Limited (UETCL)-Transmission. Unbundling in the electricity sector took either a horizontal or vertical integration approach. As indicated by Chimbaka (2016), horizontal integration resulted in the creation of entities performing a similar role; for example, it is argued that in Zambia, India, and the Gambia, horizontal integration was popular in delivering the distribution mandate. For instance, in Gujarat, 4 SOEs were created to distribute electricity (Chimbaka, 2016). Vertical integration involves the unbundling of generation, transmission, and distribution. Countries such as Uganda, Tanzania, and South Africa are rated popular with vertical unbundling (Vagliasindi & Besant-Jones, 2013).

While bundling in markers from an economics perspective aimed to deliver efficiency, in public management studies and especially the electricity sector, it is largely assumed that unbundling delivers efficiency. In this study, we adopt the concept of bundling from a contract or concession contracting perspective. The study utilizes this approach to design the most appropriate PPP model for managing design challenges associated with PPP build–own–operate–transfer (BOOT) projects. We combine existing economics of bundling and unbundling by economists and as adopted in the energy sector to assess the benefits and limitations of unbundling of design-build concession functions. This study is guided by the questions listed below:

i) What are the PPP models implemented in Uganda?

ii) What challenges are faced in implementing PPP models in Uganda's hydropower sector?

iii) What is the most appropriate PPP model for improving the competitiveness of the hydropower generation in Uganda?

2. Data and Methods

2.1. Data Collection

This study adopted a case study research strategy, qualitative approach, and interpretative research paradigm. The study relied on both primary and secondary data sources for data collection. Clearance was sought from the Uganda National Council for Science & Technology (UNCST) prior to conducting data collection. Once the clearance was granted, the interviews commenced. The objective of the interviews and focus group discussions was to investigate the views and perceptions of targeted stakeholders in the public, private and third sector practitioners, namely contractors, civil society, citizens, and contractors and informants from the SPV. Furthermore, the academia were involved since they are involved in undertaking research in procurement of PPPs and also doubled as users of electricity. While the study targeted 35 respondents, 31 participants responded to the interviews representing an 89% response rate.

With 31 respondents, we experienced both data and thematic saturation, as voices of participants indicated no emerging trends, nor new data. When faced with such situation, it is recommended that the study scales down on the number of respondents in the study (Green & Thorogood, 2018; O'Reilly & Parker, 2013). This approach of stopping the journey too early in collecting data is validated by the view that qualitative inquiry has more to do with richness of data rather than how the adequacy of the numbers of sample size is reached (Kuzel, 1992). With regard to data collection from secondary data sources, a number of challenges and strategies associated with BOOT were identified. The challenges cited in BOOT projects tend to result in risks that manifest due to schedule overrun and or cost overrun. The identification of challenges resonates as a core design issue of any PPP procurement. To manage challenges and risks associated with BOOT PPP in the hydropower sector, systematic risk management approach was adopted. This started with identification of risks and their assessment and development of strategies to manage the risks.

2.2. Characteristics of the Respondents

Table 1 summarizes the characteristics of the organization from which the respondents of the study were drawn.

Table 1. The respondents of the study (The authors, 2019)

Identifier	Name of the organization from which the study participants were drawn	Familiarity with Bujagali PPP HEP	Stakeholder influence/interest
A	Ministry of Energy, Natural Resources and Mineral Development	Very familiar	Energy policy design and implementation
B	Ministry of Finance Planning and Economic Development	Very familiar	Coordination of PPP Policy
C	Private Sector Foundation of Uganda (PSFU)	Very familiar	Bulk users of electricity
D	Uganda Rural Electrification Agency	Very familiar	In charge of rural electrification projects

Continuation of Table 1

E	Uganda Electricity Generation Company Limited (UEGCL)	Very familiar	Issue licenses for hydropower generation, involved in providing guarantee for supply through power purchase agreements (PPAs) and contracting authority for Bujagali Dam Project
F	Uganda Electricity Distribution Company Limited (UEDCL)	Very familiar	Possess mandate for bulk electricity distribution
G	Uganda Electricity Transmission Company Limited (UETCL)	Very familiar	Possess mandate for bulk electricity distribution
H	Public Procurement & Disposal Authority (PPDA)	Familiar	Oversee public procurement activities
I	Electricity Regulatory Authority (ERA)	Very familiar	A government agency that regulates, licenses, and supervises the generation, transmission, distribution Purposive sampling - 1106 Sale, export, and importation of electrical energy in Uganda, the third-largest economy in the East African Community Involved in tariff review and approval and negotiations
J	Hydropower users	Not familiar	Consumers of electricity
K	Uganda Hydropower Association	Very familiar	Lobbying and Advocacy
L	UNREEA	Very familiar	Involved in Advocacy and lobbying for the energy sector
M	Public-Private Partnerships Unit	Very familiar	Technical Coordinator of PPPs in Uganda
N	Public Enterprises Restructuring &. Divestiture (PERD)	Very familiar	Implementers of government privatization and divestiture agenda
O	Representative Karuma Dam Contractor	Very familiar	EPC Contractor at Karuma Dam
P	Bujagali Energy Limited	Very familiar	SPV
Q	Members of Uganda Manufacturers Association	Familiar	Utilizing hydropower
R	Institute of Procurement Professionals of Uganda (IPPU)	Familiar	Association of procurement professionals and those in practice in Uganda, interacting with PPP procurement, especially procurement of transaction advisory services
S	Lecturers on procurement, energy, urbanization, and electricity	Familiar	Knowledge on use of electricity
T	Office of the President	Very Familiar	PPPs and traditional procurement perceptions on service delivery

2.3. Response Rates

While 35 participants were targeted, 31 participants responded to the interviews. This represents an 89% response rate. The interviews were stopped due to the saturation effect. Acceptable response rates in social research have been recommended in existing studies 20% and above, Malhotra and Grover (1998), 30% to 70% (De Vaus & De Vaus, 2013), 50% (Cycyota & Harrison, 2006), 80% (De Vaus & De Vaus, 2013). Largely, all participants were familiar with the Bujagali project. Since they were selected based on that criteria, we asked questions:

- Are you aware of the Bujagali project?;
- What PPP models are implemented in Uganda's Hydropower Subsector?;
- What PPP model is implemented at Bujagali?

Based on the answers provided, we concluded that the respondents were familiar and very familiar with the PPP project. Respondents that are rated as very familiar provided clear answers that were consistent with findings from documents review. Participants rated familiar were not sure of the type of PPP model implemented at Bujagali HPP.

2.4. Empirical Data from Interviews and Focus Group Discussion

The interview guide was developed to support the interviewing process. Questions for the guide were formulated based on themes and trends in the literature on PPP models used in Uganda. The main purpose of the interview guide was to collect background information about participants. The second part was mainly designed to obtain feedback on their experiences and viewpoints on implementing Bujagali Hydropower Dam under a BOOT arrangement. While the project is located in Jinja Eastern part of Uganda, the participants were dispersed. Appointments were sought from participants prior to the interview. In some cases, the interview guide was issued to participants prior to the actual interview. Interviewees were requested to consent after being assured of anonymity to avoid harming their personality or character. Participants were also informed that they had a right to withdraw from the interview at any one time. A focus group discussion was held. For avoiding bias, a business journalist familiar with the work of PPPs was identified and briefed about the areas of discussion and expectations. The principal investigator and data research assistant took notes from the focus group discussions. As the principal investigator took notes, he kept coming in to guide where the need arose to clarify some matters and viewpoints. The findings from the interview and focus group discussion are discussed in the following section.

3. Analysis and Discussion of the Findings

3.1. Current Status Quos of Key PPP Models Implemented in Uganda's Energy Sector

Most studies on PPPs have focused on PPP models, challenges affecting PPPs, critical success factors for PPPs, and PPPs in infrastructure. Others have moderately focused on education, health care service delivery, telecommunications, waste management, and transport. While attempts have been made to guide the adoption of PPPs in the hydroelectricity energy subsector, barriers exist on the studies aimed at providing a starting line for the most appropriate PPPs in the hydroelectricity energy subsector. By listening to voices, reviewing the literature on PPPs and a series of documents, this study has found some light in answering the question "What is the most appropriate PPP model for improving the competitiveness of the hydroelectricity subsector in Uganda?". In asking study questions, we probed study participants to reveal PPP models currently being implemented in Uganda in the sector. We further identified existing weaknesses within existing PPP models implemented in the subsector as we asked questions on what needs to be improved to close the mentioned gaps. We also shared with our participants some models that have been implemented elsewhere in the hydro energy subsector.

3.2. PPP Models Implemented in Uganda's Hydropower Subsector

Electricity stakeholders were asked a question related to PPP models implemented in Uganda. These stakeholders included Uganda's electricity agencies: UETCL, UEGCL, UEDCL, REA, and ERA. From our analysis, we noted that the agencies were created due to unbundling, a reform in the electricity sector that resulted in the split of the functions of regulation, generation transmission, and distribution. In recent decades, we noted that REA was created to expand rural access to electricity. We further deduced from the interviews that UEDCL, the distribution agency, awarded a 20-year concession to Umeme Uganda Limited to distribute and manage the distribution network under a management concession that possesses characteristics of a PPP that will expire in 2025. Additionally, it was confirmed through our interview with the electricity regulator ERA that Bujagali is indeed a PPP and is being implemented under a build–own–operate–transfer model. We further noted that other contracting routes had been implemented, with characteristics of the PPPs. However, they may not have necessarily been implemented according to the existing national PPP policy 2010 and PPP Act 2015.

Some local studies have characterized such contractual arrangements of similar nature across other sectors as PPPs. This view was confirmed by the PPP Unit and PERD, arguing and sharing mixed thoughts on whether arrangements that do not follow procedures as laid out in the national PPP Policy and Act should be regarded as PPPs. While the initial part of the study was conducted in 2019, a recent uptake on the PPP Unit website reveals that all PPP contractual arrangements entered before enactment and passing of the PPP Policy and Act are not captured as PPPs. Notwithstanding, based on the theory of PPPs, the study claims that since Bujagali and other PPPs possess features widely acknowledged by other government agencies and the World Bank (Hodge & Greve, 2007), the paper reviews such existing concessions as PPPs. The study's empirical and secondary findings indicate that PPPs have been implemented in Uganda's hydropower subsector. It is shown that a range of PPP models has been implemented in the subsector. Notably, the BOOT, Operate and Maintain Distribution Management concessions, and IPP concessions are frequently mentioned, and their application in Uganda's energy sector is summarized in Table 2.

Table 2. Notable PPPs models implemented in Uganda's hydropower energy subsector (The authors, 2021)

Notable Special Purpose Vehicles in the energy sector	Type of PPP Model	Nature of Activity	Generation capacity (mw)	Name of Project	Factors influencing the choice of PPP model type
Bujagali Energy Limited	Build-own-operate-transfer (BOOT)	Generation	250	Bujagali HPP	Financial constraints on financing the development of the dam project
Eskom	Operate and Maintain	Generation	200	Nalubaale Hydro Dam	Government constructs the dam and passes the function of operating and maintaining to concessions
			183	Kira Hydro Dam	
Umeme Uganda Limited	Distribution Management Concessions	Distribution	Not applicable	Umeme Uganda Limited	Government leases infrastructure to manage and distribute electricity. Targets are given in terms of power loss reduction, power extension, efficiency, among others
Independent Power Producers (IPPs)	Design-Build-Finance-Operate/IPP Power Producers	Generation	Equal or less than 20M`W	Rwimi, WENRECO, AEM Mpanga, Elgon Hydro Uganda Limited, Hydro Uganda Limited, Kasese Cobalt Company Limited, Tibet Hima, Muvumbe Power, Maji Power Buyoye Limited, Kabalega Hydro	Private actor designs, constructs, and maintains a dam either on a cost-plus incentive contract or sales power to the government based on the power purchase agreement. Power is bought off at a price that includes cost and profit.

Table 2 highlights a range of PPP models implemented in Uganda's hydropower sector. The notable concessions that illuminate PPP models implemented in the hydropower sector are BOOT,

distribution management concession, DFBO. While BOOT has been implemented with high-capacity dams, IPP concessions structured in the form of DBFO have been implemented with low capacity (equal to or less than 20 megawatts) dams. The most popular green field PPP concession has been acquired by distribution management concession with Uganda's Umeme Uganda Limited that distributes power to Uganda's premium territory, accounting averagely for 90% of the connected customers in Uganda. Similarly, respondents from electricity agencies reveal that an Operate and Concession (O&M) has been implemented with Eskom at Nalubale and Kira Dam at Own Falls Dam. The O and M concession respondents from the UEGCL argue to have kept the generation at moderately stable levels but with limited effort in investing in O & M assets as prescribed by the concession. The respondents point to the limits created by the way concession terms were designed.

Reflecting on agency theory restraints, the study concludes that the state of existing terms of the O&M concessions could be attributed to information asymmetry that tended to resonate with PPP concessions and their associated negotiation. Existing studies opine that information asymmetry refers to a situation where the more knowledgeable party uses it to their advantage (Albertus, 2019; Xiong et al., 2018). In such a case, the more knowledgeable party uses the information to cause an information irregularity. This situation allows the stronger party to subdue the party with less information in counteracting the claims from arguments by the much more knowledgeable party. In most cases, government entities and personnel have found themselves in a weaker position and, in such a dilemma, design clauses that may not favor the interests of government and its citizens in the medium- and long-term perspectives.

3.3. Diagnosis of the Challenge Faced in Procuring PPPs and Construction Projects for Dams in Uganda Using the Design-Bid-Build Contracting Lens and Comparative Stakeholder Analysis

Below, this section analyzes findings on the challenges largely faced in the energy subsector.

Table 3. Stakeholder perceptions on challenges faced by PPPs in the electricity sector in Uganda (The authors, 2021)

		Challenges faced by PPPs in the hydropower sector	**Description of Challenge**	**Category of Respondent that provided feedback**
Systematic challenge category				
Special Purpose Vehicle	Bujagali Energy Limited	1. Tariffs remain high	Only 1.5 million customers connected out of approximately 44 million	Government of Uganda, UEDCL, private sector, and consumers
	Bujagali Energy Limited	2. Design risk	Geological shocks discovered during the construction, affecting time, cost, and schedule	Ministry of Finance Planning and Economic Development, Ministry of Energy and Mineral Development and Contractors
	Bujagali Energy Limited	3. Disregard of social bonds in resettlement plans	Resistance of PAPs to relocate, causing some project delays	Project Affected Persons (PAPs)
	Umeme Limited	4. Perceived unfair contract terms, i.e., rate of return at 20%	Perceived to be a critical aspect responsible for high electricity tariffs	Ministry of Finance Planning and Economic Development, Academia
	General	5. Technical and non-technical losses	The average age for replacement is 30. Uganda transmission infrastructure is one of the causes of technical losses	Unbundled utility agencies
Specific PPP project challenges encountered (at any stage of project-before or now or future)				
Special Purpose Vehicle	Umeme/Bujagali	6. Political risks	Government's negative talk about PPPs, the threat of renationalization	Academia, Private Sector Players
	Umeme Uganda Limited	7. Perceived unaffordable tariffs	Limited demand due to unfavorable tariffs	Consumers, private sector

In Table 3, we collected the study participants' views to establish the challenges faced by Bujagali HPP. While the study was focused on Bujagali, participants did not hesitate to give their opinions on Umeme concession. This trend is perhaps due to the view that Bujagali and Umeme concessions remain the notable PPP concessions in Uganda. The project-affected persons argue that the failure to integrate their social bond investment over time and apply a costing framework to the resettlement package alongside including the aspect of social ties in resettlements is viewed as disturbing to them and affects their decision to move.

From the perspective of contractors and policymakers at the Ministry of Finance Planning and Economic Development, the design-bid-build approach resulted in geological risks that affected time, scope, and schedule extensions. The analysis of the interviews with contractors and government officials within electricity agencies indicates that design risk is considered the most popular challenge. For instance, a participant remarked*:*

"In this case, the government developed the design, and when the company was contracted to construct, they found a big rock that the designers had not seen nor anticipated. This caused delays and extra costs to

the contractor that should have been excluded in the tariff" (Official, Government Electricity Agency, 2018).

Respondents argue that, with separating design and build, the geological shock was encountered when huge geological constraints were encountered at the dam construction site. This trend of view is further noticed in the focus group discussion. In the discussions, participants, largely academicians and electricity consumers, acknowledged design risk in construction projects. In this case, the green filed PPP projects were concessioned under the BOOT model. Meng et al. (2011) report design risk in projects, where the DBB approach is used in procuring contractors. These findings are in line with the existing studies by Ameyaw et al. (2017), revealing that although BOOT has been internationally implemented, it is prone to design risks. Participants from the policy-making arm and private sector argue that while the Bujagali PPP and Umeme concessions are synonymous with Uganda's and regional PPPs, agencies generally suggest that the two notable PPP concessions have supported the country to increase access to electricity, but the tariffs remain high.

This view is consistent with assertions from the users of electricity at the domestic and industrial level. Recently, a review of media reports also indicated that the political arm of the government was highly concerned with such high tariffs associated with the Umeme concession. A recent study by Public Services International indicated the same, suggesting that while political statements and users point to a high tariff, it is the technocrats that mislead the politicians in agreeing to the adoption of such PPP model. From the electricity regulators perspective, ERA recognizes that while tariff could be high, PPP projects like Bujagali have enabled Uganda to reduce load shedding, thus improving installed capacity, which was Uganda's biggest challenge. To confirm the challenge, members of the private sector indicated that historically, the challenge was electricity access and quality. Since this has been resolved, it is important to focus on reducing the tariffs. Notwithstanding, Yescombe and Farquharson (2018) further opined that while reliability has improved, the availability of power generated is in excess of 99% of Uganda's electricity needs.

Project-affected persons (PAPs) in the study indicated that while resettlement plans were designed and executed, the designers and implementers, like in other projects of such nature, tend to ignore the societal bonds and networks that reside among the communities to be resettled. A participant noted that over the years he has invested in creating networks that such projects do not think about when designing resettlement plans. By failing to incorporate such issues in the resettlement plans, PPP projects of such nature risk facing delays that arise because of "resistance to move." In a similar view, a member of academia in the focus group discussion noted that society makes people bond with time and use their financial resources to invest in each other. Disregarding the element of social bonds and its costs exposes re-settlers to huge costs and disturbance.

Table 2 further indicates that political statements tend to jeopardize the investment in PPPs according to the private sector community. While financiers of PPPs desist from the outright mention of this view, the existing literature by key financiers of PPPs points to the same view. Notwithstanding, academicians indicate that when political outbursts against PPPs increase, foreign direct and local investors tend to rate PPPs as having high risk.

Since the design challenge was the most popular, we reviewed existing studies associated with assessing and procuring projects similar to Bujagali. This was achieved by reviewing design-bid-bid and design-bid approaches for PPP and construction projects, literature, and documents. We found the DB and DBB approaches commonly used in construction projects. Since the Bujagali Dam projects involved design and construction functions, the review of the experience of DB and DBB is adopted to arrive at the most appropriate model for PPP projects of such nature.

3.4. Synthesis of Design Risk with the Design-Bid-Build (DBB) and Design-Build (DB) Lens

Existing studies indicated that design–bid–build had been implemented for construction projects. Having originated in the USA, the design-build contracting route is considered the most popular in constructing projects with a value higher than USD 50 million (Federal Highway Administration, 2006). The approach has been deemed to provide a more efficient approach to contracting.

Traditionally, design-bid and design approaches have been adopted in traditional procurement and the PPP environment in most countries (Figure 2).

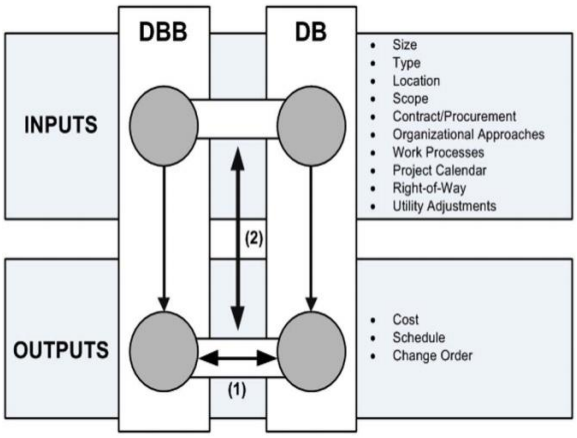

Figure 2. Design-bid and design approaches adopted in traditional procurement and the PPP environment in most countries (Shrestha et al., 2017)

Existing studies indicate that two separate suppliers are hired in two steps. Firstly, a supplier, usually a consultant, is hired to provide architectural designs. Upon approval of the design, another supplier known as a contractor is then hired to construct a facility based on the design provided and approved by the consultant. A contract supervisor is also hired to provide oversight supervision to the contractor hired to execute the

design. Figure 2 shows that the measures against which DB and DBB are compared in terms of performance are cost, schedule, and change order. Change order relates to the project scope. These measures form the output.

On the contrary, with a design-build (DB) arrangement, a supplier is hired to provide a design and deliver the design (Chakra & Ashi, 2019). The two approaches have been used for some time. While DBB was traditionally adopted for procuring construction works, DB has lately gained prominence. The reason behind the increasing adoption of DB could be due to its attempt to the certainty it provides. While studies on comparing DBB and DB are limited to Uganda, there has been an attempt elsewhere to compare the two approaches (Table 4).

Table 4. Diagnosis of the challenge faced in procuring PPPs and construction projects for dams in Uganda using the design-bid-build contracting lens

Authors	Methods	Size of sample	Type of Project	Size of Project (USD)	Key findings
Shrestha et al. (2017)	DB	4	Road highway	USD 50 billion to USD 1.3 billion	Cost increment for the DB project was higher than that for DBB by 9.6%
	DBB	7	Road highway		
Warne (2005)	DB	39	Accommodation facility	USD 83 million to	Price certainty for DB was assured, with 76% of DB projects completed ahead of schedule
	DBB	21	Accommodation facility	USD 1.3 billion	
Ibbs et al. (2003)	DB	407	Industrial buildings	USD 5 million to	Schedule creep was 2.4% less of DBB while price increment was 7.8% higher in DB than DBB
	DBB	24	Buildings	USD 50 million	
Hale et al. (2009)	DB	14	Accommodation	N/A	Cost growth and all schedule-related metrics for DB are higher than for DBB
	DBB	38			
Konchar and Sanvido (1998)	DB	155	Industrial and Building	N/A	Unit cost was 6%, and the cost growth was 5.2%, 2.4% less than the cost growth of DBB
	DBB	116			
Songer et al. (1996)	DB	6	Navy Child Care facilities	N/A	Cost growth for DB was higher than for DBB
	DBB	6			
CII and NIST (2002)	DB	210	Industrial buildings	N/A	DB projects were completed in lesser schedules
	DBB	406			

Table 4 provides a comparative analysis of existing studies on DB and DBB contracting methods. Based on the comparative synthesis, it can be deduced that when a DB other than DBB is applied, the SPV and contracting authority can enjoy benefits such as on-time completion or minimum-time scheduling, scope and cost creep. Table 4 indicates that even when costs, time, and scope overshoot, the extent of variance is minimal with DBB compared to that with DB. For instance, in a comparative study, Konchar and Sanvido (1998) asserted that the unit costs were 6% higher for DBB than for DB projects. In the same study, costs increased by 5.2% for DBB compared to DB projects where costs increased by 2.4% (CII & NIST, 2002; Hale et al., 2009; Shrestha et al., 2017). In this case, contracting authorities using PPP models, such as BOOT and as applied to Bujagali Hydropower Dam and other similar projects, would benefit if they adopted DB rather than DBB. Based on existing evidence from empirical studies, better lead times, reduced exposure to design risk, and reduced cost escalation are likely to be expected with DB rather than DBB.

3.5. Towards an Appropriate PPP Model for Upstream Investment for PPP Using DB and DBB Analysis

By bundling design onto existing BOOT, a hybrid PPP model is derived. The hybrid model is the D+BOOT=DBOOT PPP Model. Under this model, the SPV is expected to provide an offer that includes the functions *design*, *build*, *own*, *operate*, and *transfer* over an agreed number of years to the contracting authority. A diagrammatic representation of the proposed DBOOT model is provided in Figure 3.

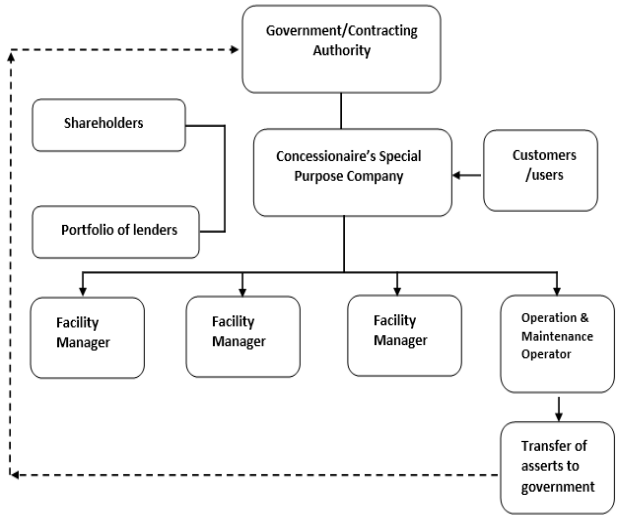

Figure 3. Design-build-own-operate-transfer (DBOOT) PPP model (The authors, 2019)

In this model, a government or contracting authority signs up a concession agreement with a special purpose company to design, finance, build, own, operate, and transfer a dam. The government entity should develop a feasibility study and an indicative design and invite potential bidders to provide a proposal to design, finance, build, operate, and transfer infrastructure (service) and transfer it back to the contracting authority after a given period of time ranging from 10 to 35 years. In this proposed PPP, the roles of the SPV must focus on DBOOT facility that could be a road, electricity

dam, or school.

4. Conclusion and Recommendations

The study reviewed models that have been implemented in the Uganda hydropower sub-sector. It illuminated some of the challenges that have been faced in the sector. The study also aimed at establishing the most appropriate PPP model for large Greenfield PPP projects in the energy sector. While challenges like high traffic, negative political statements of PPPs, and others are cited, the most popular challenge resonating with the PPP model type has been geological risk. This has been opined to emanate from the design question. Views from empirical and secondary evidence have been analyzed. Based on this analysis, we concluded that the government is exposed to geological risk, mainly because of splitting the *design* and *build* functions. Based on empirical studies and views from empirical dialogue, when the *design* and *build* are combined to give rise to the DBOOT PPP model and certainty, and savings on time, schedule, and cost scope can be achieved. In fact, since any cost borne by the SPV will be factored into price or user fees and in this case tariffs, some positive effect may be achieved for the electricity consumers.

As the model possessed characteristics similar to those of DBFO that tended to adopt DBB, it can be an appropriate model in providing hydroelectric power subsector services to the citizens in a more efficient, effective, and economical manner. In our DBOOT model, we champion combining the *design* and *build* functions. Therefore, the paper recommends adopting the DBOOT model, assuming that the threshold should be a high value defined by regulations. Capacity building and awareness campaigns should be undertaken. We propose developing standard guidelines, terms, and templates that should guide the choice and execution of the DBOOT.

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