Critical Success Factors (CSFs) for Ensuring Bankable Completion Risk in PFI/PPP Mega Projects

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Abstract

This study investigates project financiers' perspectives on the bankability of completion risk in Private Finance Initiatives and Public Private Partnerships (PFI/PPP) mega projects. Using a mixed methodology approach, focus group discussions with financier stakeholders in UK's PFI/PPP industry were used to identify 23 criteria relevant for evaluating completion risk in funding applications. These criteria were put in a questionnaire survey to wider audiences of financiers of PFI/PPP projects in the UK. Series of statistical tests were performed, including Reliability Analysis, Kruskal-Wallis Non-Parametric Test, Descriptive Statistics, Principal Rank Agreement Factor (PRAF) and Regressions Analysis. After identifying 21 reliable criteria influencing the bankability of completion risk, the general agreement of three major financier stakeholders (Senior Lenders, Equity Financiers and Infrastructure Financiers) on all the criteria were examined through Kruskal-Wallis test and PRAF. A regression model, constructed and validated with input from another team of expert financiers, revealed five key criteria influencing the bankability of completion risk in PPP mega projects. These include (1) Construction contractor with years of experience of successful completion of mega projects, (2) Construction Contractor's financial strength, (3) Existence of Tried-and Test Technology for the construction of project, (4) Availability of Independent Technical Consultant (ITC) and (5) Existence of Fixed Price Turn Key (FPTK) construction contract. The research findings will provide PFI/PPP contractors and clients with valuable strategies for satisfying financiers' requirements in delivering large-scale Infrastructure PPP projects.

Keywords: *Bankability; Risk; Public Private Partnership (PPP); Private Finance Initiatives (PFI); Mega Projects; Financiers' Perspective.*

Background

Private Finance Initiatives and Public Private Partnerships (PFI/PPP) in mega projects has received increased global attention since the last decade (Kennedy, 2015, Sainati *et al.,* 2017; Owolabi *et al.,* 2018). With increasing scope and size of civil engineering infrastructures, project finance has gradually entered the "tera era" where projects worth trillions of dollars ($) are being delivered across Europe, America and some emerging economies (Flyvbjerg, 2014). According to Flyvbjerg (2014), the annual total global spending on mega projects currently ranges between US$6 trillion to US$9trillion (representing 8% of global GDP). Mega projects are described as multi-billion dollar large-scale projects, involving multiple stakeholders within governments and private sectors (Giezen *et al.,* 2015). From sectors such as energy to water, mining, information technology, urban regeneration, etc., these new-breed of capital-intensive projects are seen as the promise of the future (Boateng *et al.,* 2015; Grabovy and Orlov, 2016). However, like most complex and large-scale infrastructure projects, a major concern for stakeholders, especially project financiers on PPP megaprojects is the bankability of completion risk (Fithali and Ibrahim, 2015; Moser, 2016). By bankability here, we refer to the willingness of lenders to finance a project after due consideration of its risks and returns (Delmon, 2015).

Completion risk, which also refers to project delay or time overrun in many studies, may be described as the risk that a project may not be completed to time, specification and within agreed budget (Gatzert and Kosub, 2016; Budaya, 2018; Song *et al.,* 2018). According to the February 2016 report of McKinsey Consulting on global construction productivity, completion risk remains the key driver of cost overrun in most construction and engineering projects, with 77% of mega projects delayed by at least 40% of the time. Similar report from KPMG's 2015 Global Construction Industry Survey also suggested that, only a quarter of construction projects, out of a sample of 109 construction organisations came within 10 percent of their initial deadlines; with delay dispute claims averaging a staggering US$46million (Lepage, 2017). In the context of PPP mega-projects, the recent European Court of Auditors' report of 2018 also gave a damning verdict of excessive schedule delay in most EU-led PPP projects; with seven out of nine mega-projects (worth €7.8billion) exceeding deadlines by up to 52months and resulting in massive cost overrun.

From project financiers' perspective, the adverse impact of delay in PPP projects can be damaging and far-reaching (Domingues and Zlatkovic, 2015). According to Morrison (2016), asides the effect of cost overrun, completion risk can result in difficult issues such as delay in realisation of project's operating

revenue, longer debt service repayment period and distorted financing arrangements with project lenders. Other implications of delay in PPP include liquidated and ascertained damages; accumulated interest on project loans, undue lock-down of lenders' investment among others (Hodge and Greve, 2017; Owolabi *et al.*, 2018). As such, given the high-risk profile of most PPP mega-projects especially at the construction phase *(see Fig. 1 for Risk Profile of PPP Projects during Project Life Cycle)*, the limited recourse nature of its financing (Aladağ and Işik, 2017), vis-à-vis bank's relatively limited in-house technical skills needed for accurate estimation of project delay during funding appraisal (Chowdhury *et al.,* 2015; Kumar *et al.*, 2018), a key decision for lenders which is often overlooked in most PPP literature is, how do financers' evaluate and determine whether the risk of project incompletion is acceptable/bankable to them? (Özdemir, 2015).

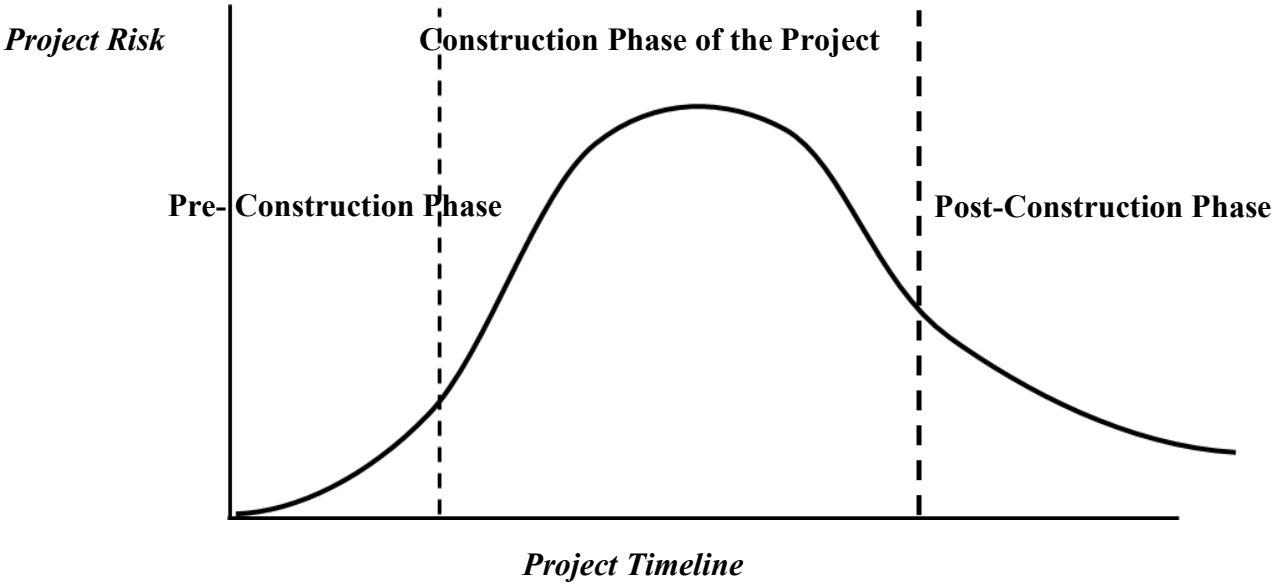

Fig.1 Risk Profile of PPP Project during Project Life Cycle

Recent review of PPP literature has uncovered a dearth in studies on completion risk evaluation, especially from project financiers' perspectives regarding completion risk. For instance, whilst many studies have explored risk assessment and modelling in PPP, most views have often focused on client, project sponsors and contactors' perspectives (kennedy, 2015; Amidu, 2017; Song *et al*., 2017; Budayan, 2018), with limited concern for bankability of risks (Fathali and Ibrahim, 2015; Moser, 2016). Although, Critical Success Factors (CFS) for PPP is also a common theme within this research domain, however, articles on CSFs often emerge with the aim of identifying generic drivers of PPP in different climes, without in-depth attention to completion risk evaluation and its impact on financiers' investments (Wibowo and Alfen, 2015; Osei-Kyei, and Chan, 2015; Liu et al., 2016; Chou and Pramudawardhani, 2015; Osei-Kyei and

126 Chan, 2017). Other similar studies on PPP have also concentrated on examining comparative analysis of
127 PPP performances across nations like China, Australia, UK, Indonesia including Singapore and Turkey
128 among others (Chou and Pramudawardhani, 2015; Liu et al., 2016; Van den Hurk et al., 2016). In addition,
129 existing studies on schedule delay in PPP have been described as too fixated on identifying causative
130 factors of time and cost overrun and are believed to be too deterministic in approach (Owolabi et al., 2018;
131 Kokkaew and Chiara, 2010; Kokkaew and Wipulanusat, 2014). According to Ortiz-Pimiento and Diaz-
132 Serna (2018), current perspectives on delay in PPP projects are mostly contextualised to different
133 countries and often emerge from the perspectives of other PPP practitioners except project financiers.
134 Although, there appears a growing increase in the studies on mega-projects (Giezen et al., 2015; Kennedy,
135 2015; Larsen *et al.,* 2015; Aladağ and Işik, 2017), most of the literature are either centred on exploring
136 Mega-project as a concept (Flyvbjerg, 2014; Mok et al., 2015; Hannan and Sutherland, 2015), not focused
137 on PPP contexts (Boateng *et al.,* 2015; He *et al.,* 2015) or concentrating on sector-specific performance
138 evaluation as well as complexities associated with such large-scale projects (Hannan and Sutherland,
139 2015; He et al., 2015; Aladağ and Işik, 2017; Lundrigan et al., 2015). In most instances, literature on mega
140 projects have prioritised investigating few isolated case studies of projects without much attention to the
141 financial impact of the delay on project financiers (Hannan and Sutherland, 2015; Lundrigan et al., 2015;
142 Brooks and Rich, 2016).
143
144
145 Nevertheless, despite the contributions of the above studies, there is currently a clear and noticeable gap
146 in knowledge, indicating that most studies have overlooked project financiers' perspectives to the pre-
147 contract evaluation of completion risk in PPP mega-projects, especially as it affects the efforts to raise the
148 much-needed debt capital that is critical for its successful delivery. This study therefore emerged as a very
149 significant contribution to the literature within engineering and construction PPP domain. The study
150 addresses practitioners' concerns over lack of clarity regarding lenders views on critical risk
151 and other factors influencing financiers' decisions when determining whether risks are
152 bankable/acceptable in a PPP funding deal. This lack of insight from lenders' frame of mind
153 has been highlighted as one of the key reasons why many laudable potential PPP projects have
154 not seen the light of the day due to poor financial structuring (Moser, 2015; Amidu, 2017). But,
155 more importantly, with the unceasing dismal reputation of the construction industry on time
156 and cost performance, especially in mega-projects. As well as the increasing loss of motivation
157 for long-term infrastructure financing by many project lenders, better understanding of
158 bankability of risks and its structuring are critical for construction and engineering
159 practitioners, for convincing financiers and winning funding approval PPP projects.

Additionally, whilst this study acknowledges that bankability varies and may involve broader macro-economic conditions such as economic and political stability of project's host nation, legal and regulatory conditions, including more generic factors such as reliable public sector, experienced private sector party, smart financing structure, etc. However, this study is only limited to investigating how completion risk in mega PPP projects can be made bankable/acceptable to project lenders at the financial engineering and appraisal stage, by focusing on specific bankability requirements (See Fig. 2 below for the Main Focus of the Study). Hence, the central hypothesis behind this study is that, "there are some critical bankability criteria that strongly influence financiers' decision when evaluating the risk of incompletion in PPP mega-project deals". "And that, perspectives on these critical factors may vary across different financier participants."

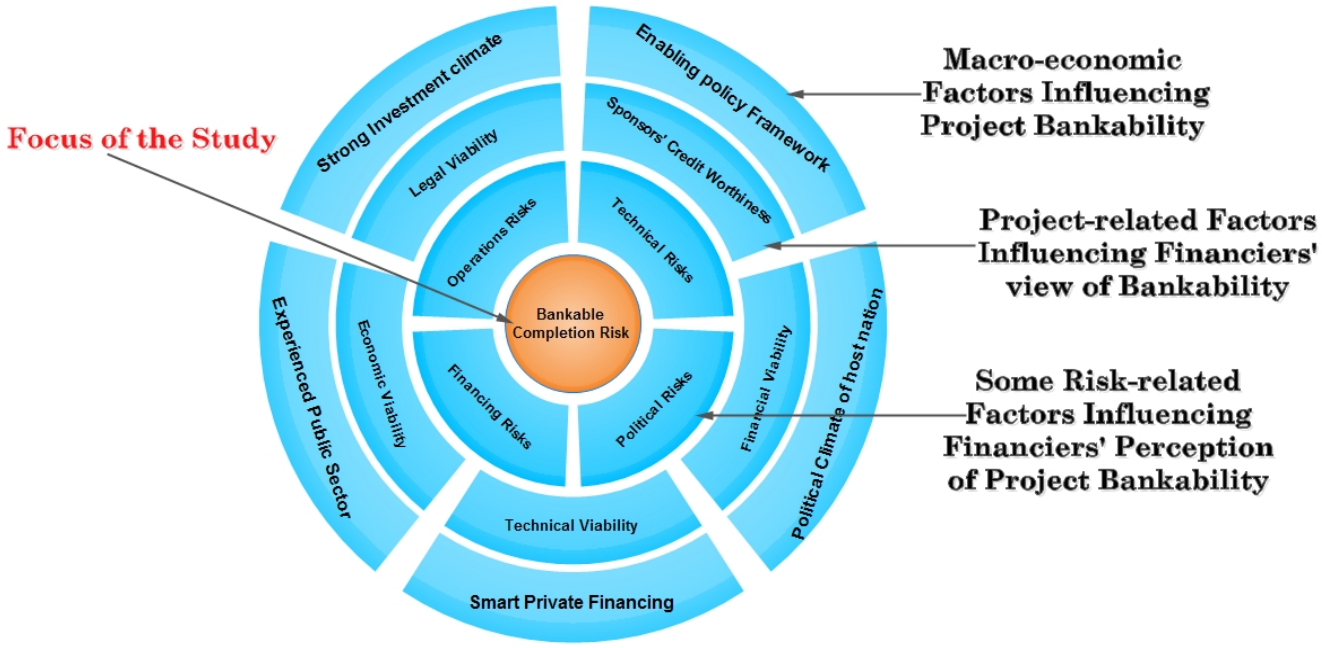

Fig.2 Main Focus of the Study

Therefore, the overall aim of this study is to examine the perspectives of project financiers' in the UK on the essential criteria for evaluating bankability of completion risk in PFI/PPP megaprojects. Based on the above aim, the objectives of the study include:

1. To identify top-ranked criteria influencing the bankability of completion risk in funding applications for PPP megaprojects.

2. To compare perceptions and understand patterns of agreement on the identified bankability criteria among various financial stakeholder groups (senior lenders, infrastructure financiers, and equity financiers).
3. To identify the key criteria influencing the bankability of completion risk in funding applications for PPP megaprojects based on the perception of the three stakeholders.

This paper is laid out in the following order. The next section of the paper is the literature review section and examines completion risk and its drivers in PPP mega projects. This is then followed by the methodology section, which employs mixed methodological approach (Focus group and questionnaire survey to UK project lenders and other project finance experts) towards examining the phenomenon. Immediately after the methodology section is the qualitative data analysis; which was carried out using thematic analysis. This is then followed by quantitative data analysis of questionnaires distributed to project lenders and other project finance experts in the UK. Following the data analysis section is the discussion of major findings within the study. The implications of the research findings for construction and engineering practitioners, especially those involved in PFI/PPP projects were also discussed. The final section concludes the paper.

Completion Risk in PFI/PPP Mega Projects and Bankability

Risk analysis and management is an essential part of decision-making process for funding Private Finance Initiatives and Public Private Partnerships (PFI/PPP) projects (Aladağ, and Işik, 2017). Al Bahar *et al.* (1990) define risk as: "The exposure to the chance of occurrences of events which may adversely or favourably affect project objectives as a consequence of uncertainty". According to Moser (2016), although, every human activity is, to an extent, characterised by various forms of risks. However, modernisation has brought the delivery of more complex and large-scale projects, thereby resulting in increasing potential for risks to project stakeholders (Delmon, 2015). Going by these perspectives, one of the most critical risks in PPP projects is the risk that a project may not be completed, in spite huge capital investments involved (Xu *et al.,* 2015). To most project participants, especially the financiers, funding a project with unbankable completion risk represents a plunge down the abyss (Moser, 2016).

Speaking generally, the riskiest stage of project undertakings in PPP arrangements is the construction phase (Budayan, 2018; Owolabi *et al*., 2018). According to Owolabi *et al*. (2018), various forms of risk events often account for the high-risk profile of PPP projects at the construction stage. These risks in most cases pose threats to project completion. Studies such as Amoatey et al. (2015); Larsen et al. (2015); Liu et *al.* (2016); Budayan, (2018); Owolabi *et al*. (2018) among others have identified factors that may cause

project incompletion, including extreme or poor weather condition, poor design of project, cost overrun, delayed access to project site, etc. (See Table 1. Below for factors that may influence project incompletion at the construction stage).

Considering the nature of these risks factors and the huge uncertainty they bring into projects' construction processes, financiers are often much more careful in providing financial backing, even if the project is lucrative from a commercial point of view (Mills, 2010). In addition, the poor reputation of the construction industry for coping with construction-related risks suggests the need for more rigorous financing considerations from the financiers' point of view (Zou et al., 2007; Le-Hoai et al., 2008). However, in spite numerous researches on completion risk analysis in PPP projects (Kokkaew and Chiara, 2014; Bing et al., 2005; Owolabi *et al.,* 2018; Zhang, 2007; Tam and Fung, 2008), financiers' perspectives on key criteria influencing bankability of completion risk PPP megaprojects remain unexplored. For instance, in a recent review literature on delay in PPP projects, Budayan (2018) examined the perception of consultants, project sponsors and public sector on causes of delay in BOT projects in Turkey, by relying on Analytical Hierarchical Process (AHP). The study identified "certainty in political and governmental issues" and "reduction in design changes" as key factors to consider for minimising completion risk in Turkish PPP projects. Similarly, Song *et al.* (2017) identified factors responsible for completion risk and early termination of PPP contracts in China, with "government decision error" and "government payment default" seen as the most factors influencing PPP project completion in China. Also, in another related study, Owolabi *et al.* (2018) examined a big data analytics approach to predicting completion risk in large portfolio of PPP projects by comparing the predictive power and accuracy of five big data algorithms. These include, Linear Regression, Random Forest, Support Vector Machine, Regression Trees, and Deep learning, with the study suggesting Random forest as the best algorithm. Other related studies such as Larsen et al. (2015); Amoatey et al. (2015); Perera et al. (2016), Ortiz-Pimiento and Diaz-Serna, (2018) and Kokkaew and Wipulanusat (2014) have also examined other issues relating to delay in PPP projects. However, despite the significant contributions of the above literature on delay in PPP literature, most of these studies have not emerged from project financiers' perspectives.

Similarly, Osei-Kyei and Chan (2015) in a study on PPP in Ghana, conducted a review of literatures on CSFs for implementing PPP projects. The study uncovered top CSFs for PPP application to include risk allocation and sharing, strong private consortium, political support,

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Table 1: Factors Influencing Completion Risk in Mega PFI/PPP Projects

No	Factors Influencing Completion Risk in Mega PFI/PPP	Literature Sources
1	Defective design of project	Davis et al. (1989); Burati et al. (1992); Gransberg and Molenaar (2004).
2	Projects' cost overrun	Kaming et al., (1997); Dikmen et al., (2007); Flyvbjerg et al., (2004); Semple et al. (1994)
3	Ground conditions (geology/ground water)	Sanger and Sayles (1979); Van Staveren (2006); Fookes et al., (1985); Kangari (1995)
4	Cost/impact of delay	Yang and Wei (2010); Odeh and Battaineh (2002); Assaf et al. (1995); Le-Hoai et al. (2008)
5	Building area	Ching (2014); Allen and Iano (2011); Tolman (1999)
6	Sub-standard subcontractors	Eccles (1981); Odeh and Battaineh (2002); Errasti et al., (2007)
7	challenges with innovation in construction techniques	Tatum (1987); Harty (2005); Tatum (1989); Bossink (2004)
8	Extreme or poor weather	True (1998); Kaming et al., (1997); Moselhi et al., (1997); Odeh and Battaineh (2002)
9	Delayed access to project site	Fan et al. (1989); Mustafa and Al-Bahar (1991); Sun and Meng (2009)
10	Material and equipment shortage	Baloi and Price (2003); Kittusamy and Buchholz (2004); Teizer *et al.* (2010)
12	Site safety and security	Mohamed (2002); Tam *et al.* 2004; Fung et al. (2010); Carter and Smith (2006)
13	Bankruptcy of construction firm	El-Sayegh (2008); Russell and Jaselskis (1992); Ling and Hoi (2006); Dissanayaka, and
14	Delay in project start up	Bing *et al.* (2005); Aibinu and Jagboro (2002); Sun and Meng (2009); Tiong (1990)
15	Poor maintain of construction technology	Hendrickson and Au (1989); Rousseau and Libuser (1997); Shen et al. (2007); Tam and Fung
16	Delay or failure to secure necessary planning permits	Ng and Loosemore (2007); Mezher and Tawil (1998); Ahmed *et al.* (1999); El-Sayegh (2008).
17	Delayed dispute resolution	Robinson and Scott (2009); Javed et al. (2013); Tam et al. (2004)
18	Inaccuracy of construction material estimates	Zou et al. (2007); Le-Hoai et al. (2008); Baloi and Price (2003); Shane et al. (2009)
19	Defective work and mistakes	Kangari (1995); Dikmen et al., (2007); Flyvbjerg et al., (2004); Kaming et al., (1997); Moselhi et
20	Changes in government regulations/ tax rate changes	El-Sayegh (2008); Russell and Jaselskis (1992); Kangari (1995); Bossink (2004)
21	Natural Disaster	Gransberg and Molenaar (2004); Odeh and Battaineh (2002); Assaf et al. (1995)

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community/public support and transparent procurement. In another related study, Liu *et al*. (2016) conducted a comparative analysis of critical success factors (CSF) influencing the efficiency and effectiveness of the tendering process for PPPs in Australia and China. Using literature review, interviews and survey, the study unravelled robustness of business case development, quality of project brief among others, as key factors determining efficient and effective PPP tendering process. Wibowo and Alfen (2015); Chou and Pramudawardhani (2015) and Osei-Kyei and Chan (2017) have also all identified critical drivers of PPP in Indonesia, Ghana, Singapore and Taiwan respectively. However, despite the efforts of these various studies, project financiers' perspectives to completion risk in mega PPP deals remain a noticeable gap in literature, which many studies have overlooked, and is therefore being considered in this study.

Methodology

To ensure in-depth understanding of the research phenomenon while also facilitating its wider applicability, this study adopted exploratory sequential mixed methodology approach to research. With this strategy, initial exploration of the phenomenon through qualitative research approach was followed with a quantitative approach. According to Creswell and Clark (2017), a sequential mixed method is suitable where a phenomenon is yet to be conceptualised, adequately explored in the literature or is being examined in a context whose research questions are unknown. In this regard, the qualitative phase of the study involved focus group interviews with experienced financier stakeholders involved in Private Finance Initiatives and Public Private Partnerships (PFI/PPP) megaprojects in the UK. This exploratory approach was adopted to identify a broad range of criteria influencing the bankability of completion risk and to confirm the generalisability of the criteria. The focused interviews also enabled the research team to explore in-depth understanding and perceptions of key financial stakeholders, i.e., senior lenders, equity financiers, infrastructure financiers, and hedge fund managers on the factors influencing bankability of completion risk in PFI/PPP funding applications. Considering the need for information-rich participants (i.e. financiers with prior experience in PFI/PPP project financing deals), the study employed purposive sampling strategy to select the interview participants. Patton (1990) described purposive sampling method as a non-probabilistic sampling with which the researcher carefully selects information-rich cases or participants by relying on well-thought out selection criteria. This sampling method allows the researcher to use his or her judgement to make decisions on the suitability of research participant, based on their richness in terms of information, the information need of the research and the nature if the research questions (Suri, 2011).

As agued by Moustakas (1998), in conducting a robust qualitative enquiry using interviews, a minimum of 5 and maximum of 25 interviews may be suitable. Relying on this perspective, this study conducted five (5) focus group interviews with financiers who boast vast experience in structuring PFI/PPP loans. While the focus group interviews facilitated data collection within a shorter time-frame from participants who inter-subjectively build on one another's perspectives (Lederman, 1990), exploration of commonly shared views of the participants regarding the phenomenon was also facilitated. A total number of nineteen (19) participants were involved in the five focus group interviews, with all having an average of 12.4years of experience in PFI/PPP financing. The focused interviews were moderated by an experienced researcher who was able to explore various perspectives to issues determining the bankability of construction and completion related risks in PFI/PPP project appraisals. The entire focus group interviews lasted an average total of 34.5minutes. Additionally, all the discussions were tape-recorded and transcribed using Nvivo10 software. This software allowed the creation of various nodes which aided the coding of emergent themes from the data transcript. After thorough analysis, the study identified 23 relevant bankability criteria used by financiers to decide the bankability of completion risk in PFI mega projects.

The second phase of the study involved quantitative data collection. As part of the objective of the study, which aimed at confirming the wider applicability of the research findings, the 23 bankability criteria identified through focus group interviews were put together in a questionnaire survey. The survey was designed to generate more reliable findings from wider audiences of project financiers and other subject matter experts in UK's PFI/PPP industry. Using a random sampling technique, a list of 225 financial, contracting and consulting firms were identified and collated from the PFI/PPP projects' database provided by the HM Treasury. This list comprised hedge funders, pension fund administrators, project finance consultants, senior lenders, infrastructure financiers, equity investment firms, etc. However, before distributing the questionnaire, the research team conducted a pilot study to ensure the adequacy of the research instrument. The pilot study involved four senior lenders (members of staffs of banks) and one academic in the UK who all volunteered to evaluate the questionnaire. Their average experience in project finance was 6.5years. The two major feedbacks, which include rephrasing of questions and re-scaling of questions not answered as expected, were carried out. In developing the final questionnaire, participants were asked to rank each bankability criterion in the questionnaire based on their perceived significance in influencing financiers' consideration for completion risk in PFI/PPP mega project appraisal. This was carried out on a five-point Likert scale, where 1 represented "Not Important" and 5, "Most Important".

After that, a large-scale distribution of the questionnaires was conducted. This was done via email with 185 questionnaires distributed to senior lenders, equity investment firms, infrastructure financiers, hedge fund managers, etc. Each questionnaire was accompanied with a letter of introduction/statement of intent to introduce respondents to the study, including its aim and objectives. Several reminder emails, which lasted a period of 1-year, 7months, between January 2016 and July 2017 were sent to the respondents. Out of the 185 questionnaires distributed, 109 were returned, representing 58% rate of return. This rate of return was considered suitable for analysis given the claim by Oyedele (2012) who argued that any survey return rate that is lower than 30 to 40% might be regarded as biased and of little significance. Additionally, six (6) out of the 109 questionnaires returned were found to be incomplete and so were considered unsuitable for analysis. These were immediately removed, leaving us with 103 usable questionnaires from senior lenders, infrastructure financiers, hedge fund managers, equity financiers, etc. Out of the 103 questionnaires, 43 represents senior lenders, 21 were equity financiers, 34 were infrastructure financiers while 5 were hedge fund managers (see Table 2 for Demographics of Survey Respondents)

Table 2: Demographics of Survey Respondents

Variables	Sample Size
Total Number of Respondents	103
Type of Organisation	
▪ **Senior lenders (Staff Members of banks)**	43
▪ **Infrastructure Financiers**	34
▪ **Equity Financiers**	21
▪ **Hedge Fund managers**	5
Years of Experience in PPP Project Finance	
▪ **<1**	5
▪ **1-5**	18
▪ **6-10**	33

All the participants have an average of 10.9 years in PFI/PPP megaprojects both in the UK and internationally. With the aid of SPSS, the results of the questionnaire survey were analysed. Statistical tests such as, Reliability Analysis, Kruskal-Wallis Non-Parametric Test, Descriptive Statistics, Principal Rank Agreement Factor (PRAF) and Regressions Analysis were carried out on the data.

Data Analysis

Qualitative Data Analysis

In order to analyse the qualitative data collated from focus group interviews, a thematic analytical approach was adopted for the study. Being a content-driven technique, thematic analysis enables exhaustive comparison of all segments of qualitative data to identify relationships and structures among

342 recurring themes (Aronson, 1995; Braun et al. 2014). Using Nvivo 10, the focus group interviews with
343 participants were transcribed, while the interview transcripts were printed out and proofread for errors and
344 possible omissions. Thereafter, initial coding of the data was carried out by considering the descriptive
345 terminologies used by interviewees during the focus group discussions. This helps to improve the
346 dependability of the analysis as suggested by Kerr and Beech (2015). The thematic analysis was then
347 carried out using a structured coding scheme to unravel the various issues relating to bankability of
348 completion risk in funding applications for Private Finance Initiatives and Public Private Partnerships
349 (PFI/PPP) megaprojects. The coding scheme focuses on three main areas namely, sources, context and
350 theme category. While the source identifies the discussant, who initiates the transcript segment, the theme
351 category summarises the important issues discussed within the quotation segment. Table 3 below shows
352 the example of the quotation classification based on coding scheme.

353 **Table 3: Sample of Classification based on the Coding Scheme**

No.	Quotation	Source	Theme Context	Theme category
1.	*"In most cases, big construction firms with vast experience and financial strength are often the brain behind such projects. But the important thing is to have a competent contractor with good track record."*	Discussant 4	Experienced construction contractor should be engaged	Construction Contractor Competence
2.	*"There are definitely a host of risk mitigations strategies that can be used to sway project financiers. You need to identify the right ones for your negotiations, and it all depends on how much you intend to convince the financiers of the viability of the project".*	Discussant 17	Construction& Completion risk must be mitigated	Robust Risk Mitigation Strategies

3.	*"The important issue is, get a good construction contractor, and tie him to a performance contract so that he can be held accountable."*	Discussant 13	Much will be required of the contractor regarding performance	Performance-driven Penalties and Incentives
4.	*"In the case of such complex engineering projects, you need a strong procurement contract to deliver within time and budget. Every single contract clause is essential, and you need the construction contractor to agree to some commitments in terms of risk and the*	Discussant 1	A good procurement contract is essential	Strong Construction Procurement Contract

At the end of the qualitative data analysis, the study identified 23 criteria relevant for appraising the bankability of completion risk in PFI/PPP mega project deals (see Table 4 for bankability Criteria for Evaluating Construction Risk in PFI/PPP Loan Applications).

Completion Risk Bankability Framework

Based on the identified criteria for evaluating bankability of completion risk in Private Finance Initiatives and Public Private Partnerships (PFI/PPP) mega projects, the study developed a qualitative framework. The framework is thus presented in Fig 3 below.

Quantitative Data Analysis:

The quantitative phase of the data analysis was carried out using SPSS. Although few alternative statistical approaches were considered for this study i.e. the use of Significance-Index method in place of Mean-Test for descriptive statistics, Factor Analysis for identifying key underlying structures in the dataset, as against multiple linear regression analysis. However, the researcher was more concerned with adopting approaches that best deliver the objectives of the study. Hence, the quantitative data analytical techniques employed in this study include Reliability Analysis, Descriptive Statistics-Mean Test, Kruskal Wallis, Principal Rank Agreement Factor (PRAF) and Regression Analysis. Below is a brief description of these statistical techniques and the various hypotheses behind their application in the study:

375 Table 4: Criteria for Evaluating the Bankability of Construction & Completion Risk in PFI/PPP Project Loan Applications

	Bankability Criteria for Evaluating Construction & Completion Risk in PFI/PPP Project Loan Applications	Focus Groups				
		1	2	3	4	5
	Construction Contractor's Competence					
1	*Existence of Tried-and Test Technology for the construction of project.*	✓	✓	✓	✓	✓
2	*Construction Contractor's liability insurance cover*		✓		✓	✓
3	*Construction contractor's years of experience of successful completion of mega projects*	✓	✓	✓	✓	
4	*Construction Contractor's financial strength*	✓	✓	✓	✓	✓
5	*Existing cost liability or debt commitments of the project to other creditors different from the lender*	✓		✓	✓	
	Robust Risk Mitigation Strategies					
6	*Pre-Completion Guarantee or Full Financial Guarantee from the sponsor at construction stage*	✓	✓	✓	✓	✓
7	*Delay in start-up insurance to prevent cost and time-overrun*	✓	✓			✓
8	*Existence of bank-financed construction cost overrun facilities*	✓		✓		✓
9	*Contingent equity contribution from the project sponsors in case of cost overrun*	✓	✓	✓	✓	
10	*Debt Buy Out arrangement*	✓	✓	✓	✓	
11	*Full injection of equity funds by project sponsors at the start of the construction phase*		✓	✓		
	Strong Construction Procurement Contract					
12	*Construction contractor to accept "Single -Point Responsibility" on other project subcontractors*	✓	✓		✓	
13	*Construction subcontract must represent very high value to the subcontractor*	✓	✓		✓	✓
14	*Construction contractor to accept Full Technology Wrap for the proper functioning of all project assets after construction*	✓	✓	✓	✓	✓
15	*Availability of Independent Technical Consultant (ITC)*	✓	✓	✓	✓	
16	*Fixed Price Turn Key (FPTK) contract*	✓	✓	✓		✓
17	*Project contract to introduce benchmarking arrangements*		✓	✓		✓
18	*Contractor must accept exceedingly high liability caps*		✓		✓	
	Performance-based Contract (Incentives and Penalties)					
19	*Construction contractor to must deliver exceedingly high performance and retention support*	✓	✓	✓		
20	*Contractor must handle the construction program and schedule in a conservative way*	✓	✓	✓		✓
21	*Contractual commitment to project's output specifications and deliverables*	✓		✓	✓	
22	*Existence of clearly stated and objectively testable construction completion test requirements*		✓	✓		✓
23	*Existence of liquidate damages for construction performance failures*	✓	✓	✓	✓	✓

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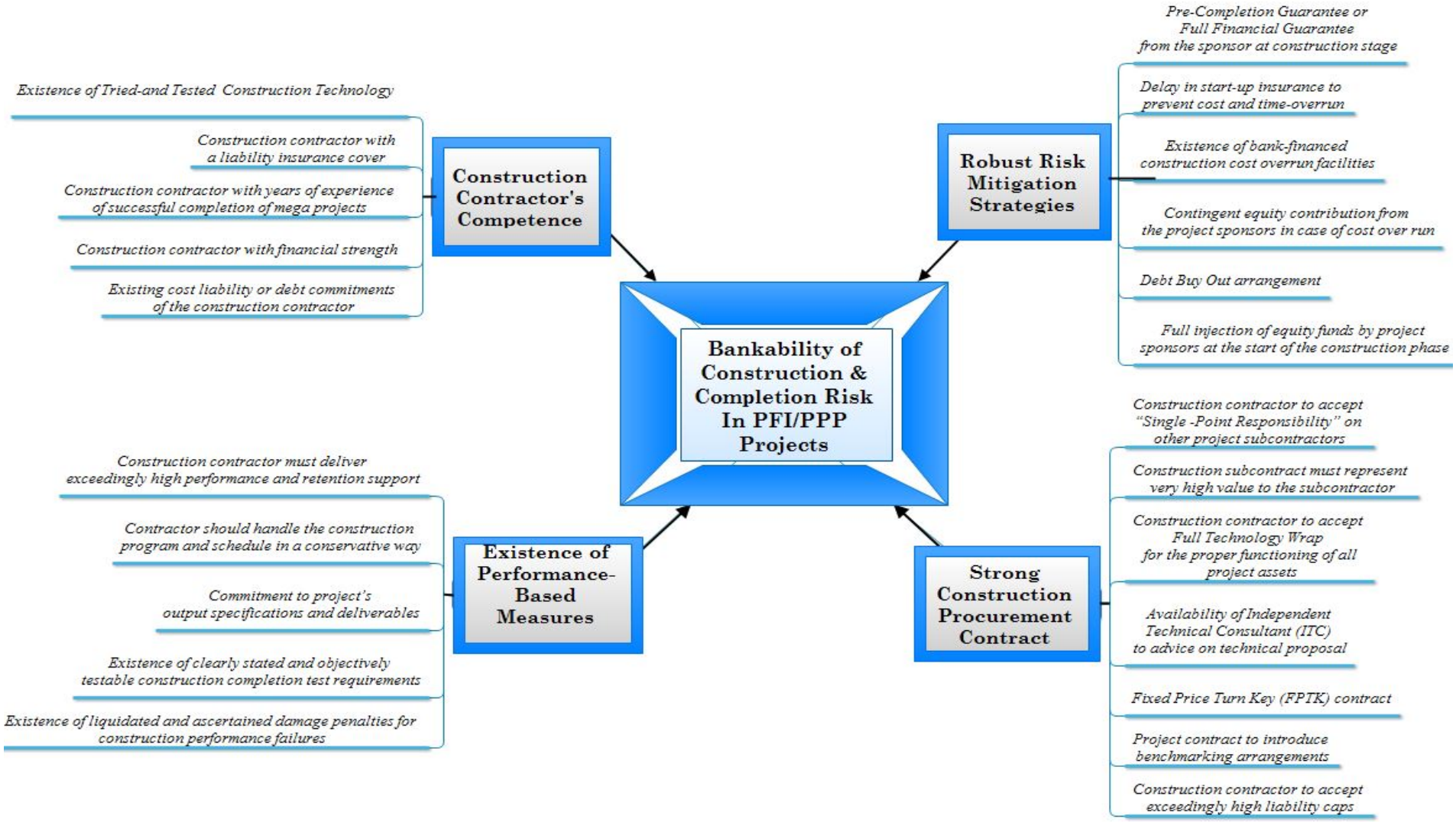

Fig. 3 Framework for evaluating the bankability of construction and completion risk in PFI/PPP mega projects

1. Reliability analysis: is a statistical approach used in examining the consistency of the measurement Likert scale used in the questionnaire, with the construct that is being measured. In this study, we employed reliability analysis to confirm whether all the criteria identified for evaluating completion risk truly measures the construct they are expected to measure. The rule of thumb for reliability analysis is, since Cronbach's alpha coefficient is usually between 0-1, any value between 0.7 upward is considered a good reliability of the data (Oyedele, 2013). Hence, we adopt the following null and alternative hypotheses below.

   H0: All identified bankability criteria for evaluating completion risk are true measures of the construct.

   H1: Not all the bankability criteria for evaluating completion risk are true measures of the construct.

2. Descriptive statistics: the use of descriptive statistics in this study was focused on identifying the top-ranked financiers' criteria for evaluating construction and completion risk in funding applications for PFI/PPP megaprojects. A mean ranking approach was adopted in this case with top-ranked criteria arranged based on their mean coefficient (between 0-5).

3. Comparison of groups: Comparison of ranking among respondent groups was carried out using Kruskal-Wallis test of significance. Being, a non-parametric statistical approach, Kruskal-Wallis test examines the statistical differences in opinion among two or more independent groups in a study (Fowler *et al*. 2013). In this study, we examined whether all the three categories of respondents (Senior Lenders, Equity Investors, and Infrastructure Financiers) perceived the criteria similarly or differently, based on their respective ranking in the questionnaire. Hence, the following null and alternative hypotheses below were developed:

   H0: There is no differences in research participants' perception of all the identified bankability criteria similarly.

   H1: There is a difference in research participants' perception of all the identified bankability criteria similarly.

4. Principal Rank Agreement Factor (PRAF): using the PRAF, the study quantitatively measures the general agreement pattern in the ranking of each criterion among all the financier stakeholders that comprises senior lenders, equity financiers, and infrastructure financiers. Hence, the null hypothesis suggests "any criterion on which respondents have a strong agreement, will have a high PRAF score. But a low PRAF score indicates disagreement among the respondent groups on the criterion".

5. Regression modelling: With regression analysis, relationship between a dependent variable and independent variables (predictors) can be estimated. Hence, regressions analysis facilitates understanding into how changes in predictors influence the dependent variable (Field, 2005). The statistical hypothesis in this study's regression analysis follows the regression rule of thumb. That is, since R^2 (regression coefficient) usually ranges between 0 and 1, and a higher R^2 value indicates how well the model fits/predicts the observed data. Any model with the highest R^2 value is selected as the right regression model for the study.

After thorough arrangement of data into SPSS, the study started by conducting reliability analysis on the data set. According to Faravelli (1989), when analysing a survey data conducted with Likert-scaled questionnaires, a reliability analysis is essential to ascertain the internal consistency of variables being analysed. The formula for reliability analysis can be mathematically represented thus,

$$\alpha = \frac{N^2 \overline{COV}}{\sum_{i=1}^{N} S_i^2 + \sum_{i=1}^{N} COV_i} \qquad \ldots . (1)$$

Reliability analysis helps discover whether the scales used in measuring the various bankability criteria can consistently and truly reflect the construct it was intended to measure (Huang *et al.,* 2006). As argued by Field (2005), in a reliable data, the rule of thumb in Cronbach's Alpha (α) coefficient is often between 0 and 1. However, George and Mallery (2003) argued that a coefficient value of 7 is much acceptable, while a value of between 7 and 8 indicate strong internal consistency of the data set. Based on results from the analysis, the overall Cronbach's Alpha (α) coefficient for this study is 0.851 (see. below Table 5 for results of the statistical test). This suggests a very strong internal consistency and overall reliability of the bankability criteria identified in the study. Going further, to uncover whether all the bankability criteria in the study are truly contributing to the internal consistency of the construct, "Cronbach's alpha if item deleted" shown in column three of Table five was examined. According to Field (2005), any criterion no

446 **Table 5: Criteria for Evaluating the Bankability of Completion Risk and Associated Statistical Results**

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CR.	Criteria Influencing the Bankability of Completion Risk in funding Applications for PFI/PPP Mega Projects	Reliability [a]	Non-Parametric Test Kruskal-Wallis		Financier Stakeholders' Descriptive Statistics					
		Cronbach's α If Item Deleted	Chi Square	Asymp. Sig. [b]	Senior Lenders Mean	Senior Lenders Ranking	Equity Financiers' Mean	Equity Financiers' Ranking	Infrastructure Financiers' Mean	Infrastructure Financiers' Ranking
CR1	*Existence of Tried-and Test Technology for the construction of project.*	*0.737*	1.693	0.429	4.45	3	4.28	3	4.2	9
CR2	*Construction Contractor's liability insurance cover*	*0.718*	0.387	0.824	4.16	7	4.14	4	4.37	7
CR3	*Construction contractor's years of experience of successful completion of mega projects.*	*0.827*	1.686	0.43	4.65	1	4.86	1	4.47	4
CR4	*Construction Contractor's financial strength*	*0.721*	1.61	0.447	4.63	2	3.99	7	4.81	1
CR5	*Existing cost liability or debt commitments of the project to other creditors different from the lender*	*0.772*	2.962	0.027***	3.06	22	2.53	22	2.78	20
CR6	*Pre-Completion Guarantee or Full Financial Guarantee from the sponsor at construction stage*	*0.632*	0.565	0.754	3.91	12	3.45	16	3.56	17
CR7	*Delay in start-up insurance to prevent cost and time-overrun*	*0.738*	1.363	0.506	3.67	18	3.05	20	3.7	15
CR8	*Existence of bank-financed construction cost overrun facilities*	*0.819*	2.523	0.283	3.92	11	3.66	12	4.55	2
CR9	*Contingent equity contribution from the project sponsors in case of cost over run*	*0.829*	3.336	0.281	4.27	4	3.79	10	4.03	11
CR10	*Debt Buy Out arrangement*	*0.711*	1.724	0.422	3.81	13	3.58	15	1.85	23
CR11	*Full injection of equity funds by project sponsors at the start of the construction phase*	*0.842*	0.122	0.941	3.94	10	3.87	9	4.15	10
CR12	*Construction contractor to accept "Single -Point Responsibility" on other project subcontractors*	*0.852**	0.03	0.99	3.55	20	3.66	12	3.59	16
CR13	*Construction subcontract must represent very high value to the subcontractor*	*0.835*	2.944	0.229	3.72	16	1.54	23	3.99	12
CR14	*Construction contractor to accept Full Technology Wrap for the proper functioning of all project assets after construction*	*0.815*	2.541	0.001***	3.69	17	3.76	11	3.5	18
CR15	*Availability of Independent Technical Consultant (ITC)*	*0.843*	2.392	0.189	4.22	5	4	6	4.51	3
CR16	*Fixed Price Turn Key (FPTK) contract*	*0.849*	1.978	0.372	4.2	6	4.37	2	4.22	8
CR17	*Project contract to introduce benchmarking arrangements*	*0.839*	1.017	0.601	2.53	23	3.42	17	2.84	19
CR18	*Contractor must accept exceedingly high liability caps*	*0.857**	5.473	0.065	3.53	21	3.41	18	2.46	22
CR19	*Construction contractor to accept exceedingly high performance and retention support*	*0.791*	0.362	0.835	3.77	14	3.14	19	3.87	14

CR20	*Contractor must handle the construction program and schedule in a conservative way*	*0.802*	14.373	0.001***	3.56	19	3.62	14	2.56	21
CR21	*Contractual commitment to project's output specifications and deliverables*	*0.636*	6.08	0.048	4.02	9	3.9	8	4.46	5
CR22	*Existence of clearly stated and objectively testable construction completion test requirements*	*0.801*	2.967	0.227	3.75	15	3.03	21	3.88	13
CR23	*Existence of liquidate damages for construction performance failures*	*0.783*	1.96	0.375	4.09	8	4.07	5	4.42	6

448 *Cronbach's Alpha (a) Reliability Coefficient for the study is 0.851; CR = Criteria;*

449 *Significance at 95% Confidence Level=0.05%; Reject the null hypothesis where a criterion is below 0.05*

450

contributing to reliability of the data will have a higher reliability coefficient compared to the overall reliability of the data (0.851). This suggests that such criterion with higher value if deleted, would increase the overall reliability of the entire data set (Santos, 1999). Using this rule as a yardstick, the null hypothesis was confirmed on all the criteria except only two criteria, CR 12 and CR18, which were identified to have values higher (0.852 and 0.857) than the overall reliability coefficient of the study. The two criteria are ***CR12***=*Single -Point Responsibility from the main contractor to be responsible for other subcontractors and* ***CR18***= *Construction contractor to accept exceedingly high liability caps*. These criteria were identified not to be contributing to internal consistency of the data and so were considered unreliable and subsequently deleted. On this regard, we were left with 21 reliable criteria influencing the bankability of completion risk in PFI project deals.

Non-parametric Test (Kruskal-Wallis One-Way ANOVA)

After establishing the reliability of all the criteria included in the questionnaire survey through Cronbach's Alpha Reliability Analysis, the study proceeded to examine whether the three major financier stakeholders (Senior Lenders, Equity Investors, Infrastructure Financiers) surveyed viewed all the criteria in the same way or differently. Given that the data is considered not to be normally distributed, a non-parametric statistical analysis known as "Kruskal-Wallis one-way analysis of variance" was employed. This tests the null hypothesis that is, no statistically significant differences exist in the perception of the three stakeholders on the 21 remaining criteria. Based on this hypothetical assumption, where a criterion has a significance level less than 0.05, the null hypothesis is rejected. As shown in the fifth column of Table 5. Three out of the 21 criteria, representing 14.28% of the entire criteria, were perceived differently by the three stakeholders, with their significant level falling below the decision rule (0.05). These include ***CR14***= *Contractor's acceptance of Full Technology Wrap for proper functioning of all project assets after construction,* ***CR20***= *Contractor must handle the construction program and schedule in a conservative way and* ***CR5***= *Existing cost liability or debt commitments of the project to creditors different from the lenders*. The implication of this result is that the stakeholders demonstrate general agreement in their perception of 85.71% of the criteria (3 out of 21 reliable criteria). This therefore means that, though there are differences in perception of the various criteria among the stakeholders, as explained by the pattern in which they have ranked them, these differences seem to be unusually low across the entire criteria. As such, the entire data from the surveyed respondents remain very useful in helping to understand patterns of agreement among the stakeholders. To investigate this, the study adopted Principal Rank Agreement Factor (PRAF) represented in Section 4.2.2 below. Additionally, the data was later used to develop a

regression model to identify the main drivers of bankability of completion risk in funding applications for PFI/PPP megaprojects, based on the views of all the three stakeholders.

Financier Stakeholders' Descriptive Analysis

To quantitatively designate the top-rated criteria among the three stakeholders, the study adopted mean ranking approach using SPSS, as represented in columns 6 to 11 of Table 5. Based on the descriptive statistics results, the top-five rated criteria from senior lenders' perspectives are as follows: CR3= Construction contractor with years of experience of successful completion of mega projects, CR4= Construction Contractor with financial strength, CR1= Existence of Tried-and Test Technology for the construction of project, CR11= Contingent equity contribution from the project sponsors in case of cost over run, CR15 =Availability of Independent Technical Consultant (ITC).

The top five criteria from the perspectives of Equity financiers, as represented in Table 5 include, CR3= Construction contractor's years of experience of successful completion of mega projects, CR16= Existence of Fixed Price Turn Key (FPTK) construction contract, CR1= Existence of Tried-and Test Technology for the construction of project, CR2= Construction Contractor's liability insurance cover, and CR23= Existence of liquidate damages for construction performance failures. Going further, the top five rated criteria for evaluating the bankability of completion risk from the perspective of the infrastructure financiers include CR4= Construction Contractor with financial strength, CR8= Existence of bank-financed construction cost overrun facilities, CR15= Availability of Independent Technical Consultant (ITC), CR3= Construction contractor with years of experience of successful completion of mega projects, and CR21= Contractual commitment to project's output specifications and deliverables (See Table 5 above).

However, it is important to note that, out of all the criteria, CR3= Construction contractor with years of experience of successful completion of mega projects; CR1= Existence of Tried-and Test Technology for the construction of project and CR5=Existing cost liability or debt commitments of the project to other creditors different from the lender were identified to be common and rated similarly by both the senior lenders and the equity financiers. This result (CR3) suggest that engaging an experienced construction contractor with good record of successful projects execution was critical to mitigating completion risk in mega projects, and therefore a key criterion for financiers' consideration. In the same view, the implication of stakeholders' agreement on CR1 confirms studies such as He *et al.* (2015) and Xu *et al.* (2015) who argued that experimenting with state-of-the-art construction technology on large-scale projects is a requisite for failure as such technology may be difficult to repair in the event of machinery breakdown. In

addition, stakeholders' agreement on criterion CR5 is perfectly in line with Delmon (2015) who highlighted excessive financial burden as one of the many causes of insolvency in construction firms. From the stakeholders' view, the possibility that such construction contractor will liquidate while project is ongoing portends enormous risk to project completion and financiers' investment.

Principal Agreement Rank Factor (PRAF)

As part of the objective of this study, it was important to examine the degree to which the three financier stakeholders agree on the significance of each criterion, based on their rankings of the 21 remaining criteria. In order to achieve this objective, a Principal Agreement Rank Factor (PRAF) and Rank Agreement Factor (RAF) were adopted. This is in line with previous studies such as Chan and Kumaraswamy (2002), Usman et al. (2012), Ubani and Ononuju, (2013), Oyedele et al. (2015) who have quantitatively examined pattern of agreement in ranking of factors among diverse stakeholders. RAF and PRAF can be mathematically computed as:

$$RAF = \frac{\sum SEI}{N} \quad (2)$$

$$PRAF = \frac{RAF_{max} - RAF_i}{RAF_{max}} \times 100\% \quad (3)$$

The PRAF for all the completion risk bankability criteria were computed using Equation (2) and (3).

Based on the equation, RAF_{max} is the maximum *RAF* of all the criteria RAF_i is the RAF for criteria i, N is the number of criteria being ranked, which are 21 and $\sum SEI$ is the sum order of ranking for Senior Lenders, Equity Financiers, and Infrastructure Financiers. By principle, a higher PRAF value indicates more agreement among the stakeholders with respect to a criterion, as against when the PRAF is low. Hence, a PRAF of 100 suggest strong agreement while zero indicates complete disagreement among the financier stakeholders. On the other hand, the Rank Agreement Factor (RAF) could be > 1, with a higher value indicating more disagreement in ranking. In this regard, a RAF of zero suggests excellent agreement, more than a RAF of 1 or 2. Results from this statistical analysis can be seen in Table 6 below, which presents the pattern of agreement in ranking of the 21 criteria among the three financier stakeholders (Senior Lenders, Equity Financiers and Infrastructure Financiers) that were surveyed.

548 In line with the null hypothesis on PRAF, result of the analysis as shown in Table 6 above revealed, seven
549 key criteria influencing the bankability of construction and completion risk in PFI/PPP mega projects, all
550 with high PRAF score. These criteria were identified as:

551 - *CR3 = Construction contractor's years of experience of successful completion of mega projects.*
552 - *CR4 = Construction Contractor's financial strength*
553 - *CR15 = Availability of Independent Technical Consultant (ITC)*
554 - *CR1= Existence of Tried-and Test Technology for the construction of project.*

555 **Table 6: Principal Agreement Rank Factor (PRAF) among Senior Lenders, Equity Financiers and Infrastructure Financiers**

No	Criteria Influencing the Bankability of Completion Risk in funding Applications for PFI/PPP Mega Projects	Senior Lenders	Equity Financiers	Infrastructure Financiers	Sum of Ranking	RAF	PRAF	Ranking Order
CR3	*Construction contractor's years of experience of successful completion of mega*	1	1	4	6	0.29	89.29	1
CR4	*Construction Contractor's financial strength*	2	7	1	10	0.48	82.14	2
CR15	*Availability of Independent Technical Consultant (ITC)*	5	6	3	14	0.67	75.00	3
CR1	*Existence of Tried-and Test Technology for the construction of project.*	3	3	9	15	0.71	73.21	4
CR16	*Existence of Fixed Price Turn Key (FPTK) construction contract*	6	2	8	16	0.76	71.43	5
CR2	*Construction Contractor's liability insurance cover*	7	4	7	18	0.86	67.86	6
CR23	*Existence of liquidate damages for construction performance failures*	8	5	6	19	0.90	66.07	7
CR21	*Contractual commitment to project's output specifications and deliverables*	9	8	5	22	1.05	60.71	8
CR8	*Existence of bank-financed construction cost overrun facilities*	11	12	2	25	1.19	55.36	9
CR11	*Full injection of equity funds by project sponsors at the start of the construction*	10	9	10	29	1.38	48.21	10
CR9	*Contingent equity contribution from the project sponsors in case of cost overrun*	4	10	17	31	1.48	44.64	11
CR10	*Debt Buy Out arrangement*	13	15	18	46	2.19	17.86	12
CR19	*Construction contractor to accept exceedingly high performance and retention support*	14	19	14	47	2.24	16.07	13
CR6	*Pre-Completion Guarantee or Full Financial Guarantee from the sponsor at*	12	16	20	48	2.29	14.29	14
CR13	*Construction subcontract must represent very high value to the subcontractor*	20	13	16	49	2.33	12.50	15
CR5	*Existing cost liability or debt commitments of the project to other creditors different*	17	22	11	50	2.38	10.71	16
CR17	*Project contract to introduce benchmarking arrangements*	23	9	19	51	2.43	8.93	17
CR22	*Existence of clearly stated and objectively testable construction completion test*	15	21	16	52	2.48	7.14	18
CR7	*Delay in start-up insurance to prevent cost and time-overrun*	18	20	15	53	2.52	5.36	19
CR14	*Construction contractor to accept Full Technology Wrap for the proper functioning*	22	11	21	54	2.57	3.57	20
CR20	*Contractor must handle the construction program and schedule in a conservative*	19	14	23	56	2.67	0.00	21

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557

- *CR16 = Fixed Price Turn Key (FPTK) contract*
- *CR2 = Construction Contractor's liability insurance cover*
- *CR23 = Existence of liquidate damages for construction performance failures*

Multiple Linear Regression Model

After identifying the reliable and top-rated criteria based on the perceptions of respondents across the three stakeholder groups surveyed, the study proceeded to unravel the key drivers of bankability for completion risk in funding applications for Private Finance Initiatives and Public Private Partnerships (PFI/PPP) mega projects. To realise this objective, the study constructed a linear regression model. This approach became necessary based on the proposition that one or more criteria (independent or explanatory variables) will hugely correlate with the response variable (dependent variable), which is "bankable completion risk". The response variable was therefore measured in the questionnaire by asking respondents to indicate the extent to which they believe each criterion contributes towards achieving a bankable completion risk in funding applications for PPP megaprojects. The mathematical formula for a regression model is:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_1 + \beta_3 X_3 + \cdots + \beta_i X_i + \epsilon \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

However, with the 21 bankability criteria for evaluating completion risk representing independent variables, the regression model for the study is thus expressed as:

$$BCR = \beta_0 + \beta_1 CR_1 + \beta_2 CR_2 + \beta_3 CR_3 + \cdots .. + \beta_i CR_i + \epsilon \ldots \ldots \ldots (5)$$

Where BCR_i= value of response dependent variable (Bankability of Completion risk), β_0 = is the intercept term and is constant, β_1 is the coefficient of the first criterion (CR1), β_2 is the coefficient of the second criterion (CR2), β_3 is the coefficient third criterion (CR3), β_i is the coefficient of the i criterion CR, while ϵ is the mean-zero random error term (the difference between the predicted and actual value of $BCCR$ for the ith respondents. Through the aid of SPSS, a step-wise model was performed on the data. Table 7 show the summary of the model that contains five possible models and their associated predictors. The third column shows R^2, which is often referred to as coefficient of determination and suggests the correlation between the observed values of $BCCR$ and the predicted values of $BCCR$ in the regression. As a rule, R^2 usually ranges between 0 and 1, and a higher value reflects how well the model predicts the observed data. Considering that Model 5 shows the highest R^2 value (in line with the regression hypothesis), it is therefore selected as the most suitable regression model for this study. With a R^2 value of 0.632, this indicated that the model is capable of predicting 63.2% of the variability in the dependent variable. As such, the model is appropriate for predicting the bankability of completion risk in funding application for PPP mega projects.

592

Table 7: Regression Model Summary

Model	R	R^2	Adjusted R^2	Std. Error of the Estimate	Change Statistics			Durbin-Watson	ANOVA	
					R^2 Change	F Change	Sig. F Change		F	Sig.
1	.575[a]	.331	.320	.513	.331	29.202	.000	1.830	29.202	.007[b]
2	.706[b]	.498	.481	.449	.167	19.300	.000		28.780	.005[c]
3	.733[c]	.537	.512	.435	.039	4.768	.033		22.022	.004[d]
4	.756[d]	.571	.541	.422	.035	4.585	.037		18.701	.003[e]
5	.795[e]	.632	.568	.409	.032	4.421	.040		16.759	.001[f]

Dependent Variable: Achieving bankable completion risk in funding proposal for PPP Mega Projects

a. Predictors: (Constant), CR1.

b. Predictors: (Constant), CR3, CR1, CR22

c. Predictors: (Constant), CR16, CR14, CR10.

d. Predictors: (Constant), CR4, CR23, CR3, CR2

e. Predictors: (Constant), CR3, CR4, CR1, CR15, CR16.

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594

Q Table 8: Regression Model Results

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	β			Tolerance	VIF
Constant (Dependent variable)	3.09	0.52		4.17	0.013		
CR3. Construction contractor with years of experience of successful completion of mega	0.43	0.08	0.57	5.404	.000	.839	2.191
CR4. Construction Contractor with financial strength	0.36	0.09	0.41	2.620	.001	.952	2.124
CR1. Existence of Tried-and Test Technology for the construction of Project	0.28	0.11	0.34	2.070	.003	.877	1.177
CR15. Availability of Independent Technical Consultant (ITC)	0.25	0.07	0.27	2.141	.004	.845	1.050
CR16. Existence of Fixed Price Turn Key (FPTK) construction contract	0.21	0.04	0.23	3.897	.023	.734	1.000

595 ***Dependent Variable:*** *Achieving bankable completion risk in funding proposal for PPP Mega Project*

596 Going further, other criteria that confirm the model accuracy include the adjusted R^2, the Durbin-Watson
597 test, standard error of estimate and the significance level of the *F* statistics. According to Field (2005), the
598 Adjusted R^2 is a measure of how well the model is capable of generalising beyond the available data, which
599 in ideal situations, should be equal or close to the R^2 values. This difference, which indicates a loss in
600 predictive power of the model, is small in this model showing a value of 0.064 (0.632 – 0.568). This
601 suggests a 6.4% less variance in the outcome and as such, indicates the model has a good cross-validity. The
602 standard error of estimate is the measurement of the accuracy of predictions that is made with a model or a
603 measurement of errors in predictions. In a good model, the relationship between the explanatory variables
604 and the outcome is expected to be perfect, thereby indicating less error by being closer to zero. Based on
605 analysis in this study, the model with the standard error value that is closest to zero is model 5 with a value
606 of 0.409. This confirms the predictive power of the model. In addition, as suggested by Engle and Yoo
607 (1987), any two predicted observations should show uncorrelated and independent errors. In this study,
608 Durbin-Watson statistics test was therefore used to examine these correlations. According to Hill and Flack
609 (1987), the recommended value for these correlations vary between 0 and 4, with a value of 2 indicating
610 uncorrelated residuals and are thus a good model. In this study, the Durbin-Watson test value, as shown in
611 Table 7 is 1.830, which can be approximated to two. This therefore indicates the absence of autocorrelation.
612 Lastly, ANOVA in this study also helps confirm whether the model perfectly fits the data examined and
613 should have a recommended value of less than 0.05 at 95% confidence interval. Table 7 confirms the fitness
614 of the model 5 with a value of 0.01.
615
616 After confirming the model fitness and predictive accuracy, the study proceeded to identify the key criteria
617 predicting bankability of completion risk in funding application for PPP megaprojects. In this regard, model
618 5 indicates that there are five best criteria that a necessary for ensuring bankability of completion risk from
619 financiers' perspective, out of the 21 criteria analysed. It is important to note that these 21 were the reliable
620 criteria identified after conducting reliability analysis on the 23 criteria that were put in the questionnaire to
621 project financiers. These five criteria are therefore referred to as the critical success factors for ensuring the
622 bankability of completion risk in funding application for PFI/PPP megaprojects. They comprise:
623 - CR3=Construction contractor with years of experience of successful completion of mega projects
624 - CR4=Construction Contractor with financial strength
625 - CR1=Existence of Tried-and Test Technology for the construction of project
626 - CR15=Availability of Independent Technical Consultant (ITC)
627 - CR16=Existence of Fixed Price Turn Key (FPTK) construction contract

628 Going further, the study proceeded to check for the significance of these five criteria using the t-test
629 significance value for each criterion, as well as the collinearity statistics, as demonstrated in Table 8 above.

By rule, any criteria showing a significance level of 0.05, is considered to be making significant contribution to the model (Field, 2005). As such, the closer a value is to 0, the higher the significance of such criteria. Based on evidences from our model, all the five criteria have values, which are less than 0.05. As shown in Table 8, CR3=Construction contractor with years of experience of successful completion of mega projects shows the highest significance value at 0.00, while CR14. Existence of Fixed Price Turn Key (FPTK) construction contract shows the least significance at .023 respectively. The collinearity statistics estimates the existence of any significant relationship among the criteria, which may weaken the model. This can be confirmed via the variance inflation factor (VIF), which should not be more that 5 and the tolerance statistic which works with VIF and should not be less than 0.2. Based on this model, all the VIF statistics are between 1.0 and 2.1, which is less than 5, while all the tolerance statistics are above 0.2, as shown in Table 8. The results therefore confirm the absence of multicollinearity among the predictors/criteria.

With values from unstandardized coefficient as shown in Table 8 above, the optimum regression model, which demonstrates mathematically, the statistical correlation between bankability of completion risk and associated key success factors is therefore re-written as:

$$\mathbf{Y = 3.09 + 0.43\,(CR3) + 0.36\,(CR4) + 0.28\,(CR1) + 0.25\,(CR15) + 0.21\,(CR16) + \epsilon_i} \qquad \mathbf{(6)}$$

Model validation

As a part of the research, it was important to confirm the validity of this model on a real life PFI/PPP project case study. As such, using snowball sampling method, a team of financier experts in a reputable financial institution in the UK was approached. The team comprised three senior financial risk analysts, six credit risk analysts, two infrastructure lending officers, three senior managers, and one head of structured finance. This makes 15 financier experts with all having an average of 13 years' experience in international project financing. This team was approached to examine the relevance of the developed model to a specific PPP mega project they have been involved. Using one-page questionnaire survey, the experts were asked to rank the five critical success factors based on the extent to which they contributed to their due diligence appraisal on completion risk in the chosen PPP mega project. The team chose a University Student Housing PPP project valued at US$1.4 billion. This project, located in one of Europe's capitals, was to provide 842 additional bed spaces for students and will operate under a 40-year concession plan. The project, whose construction phase lasted a period of 36 months and was completed in 2011, is currently in operation.

14 out of the 15 distributed questionnaires were returned making 93.33% response rate. The respondents' ratings of the five critical success factors in the questionnaire were extracted and inputted in the regression model (see Eq. 6). The overall success in achieving bankable completion risk in funding applications for PPP mega projects was then mathematically calculated. Using Spearman rank correlation non-parametric statistics, the association between two datasets measured on ordinal scale was compared. Here, the model-computed score was compared to the ratings given by the 14 respondents. The strength of association in correlated items is usually indicated in values between -1 to +1 (MacFarland and Yates, 2016). With the aid of SPSS, the correlation coefficient for the data showed 0.735, with a significance level of 0.0315 at 99% confidence interval. This result suggests a positive relationship between the ratings of the financier experts and the model-computed scores. Based on this evidence, the model is therefore considered a strong predictor and the five criteria were important for ensuring a bankable completion risk in funding applications for PFI/PPP mega projects.

Discussion of Findings

Based on evidences as reflected in Table 8 above, the *Construction Contractor' years of Experience of Successful Completion of Mega Projects* was considered the most important bankability criteria for lenders in evaluating completion risk in PPP loan applications. As argued by Flyvbjerg (2014), during construction stage of projects, two important risk factors to stakeholders, including lenders are cost and time overrun. Many existing studies have identified various reasons why construction projects often overshoot budget and timeline (Song 2017; Perera *et al.,* 2016; Budayan, 2018). Some of the factors include but not limited to inaccuracy of materials estimates, unpredictable weather, inadequate planning, inaccurate prediction of equipment production rates, skill shortages, complexity of project, inflationary material cost etc. (Larsen et al., 2015; Amoatey, 2015; Budayan, 2018; Owolabi et al., 2018). However, according to Kaming et al. (1997), contractor's lack of project type experience is one of the most crucial factors that may hinder successful delivery of projects within expected budget and timeline. This is so because, previous projects' experience tends to result in contractor's better understanding and capability to deal with the inherent dynamics and risk factors which may pose a danger to successful project delivery (Hakeem *et al.,* 2018). As a result, given that projects are usually front-loaded with regards to funds at construction stages, combined with associated huge loan drawdowns; the risk to lenders investments at such stage can be enormous. As such, project banks will require a proven and tested construction contractor with similar project experience and capacity to deliver the project, if bankability is to be achieved.

Following construction contractors' project type experience, project banks consider the *Construction Contract's Financial Strength* as the second important criterion for completion risk bankability (see Table 8). This result confirmed evidences from studies such as Hoffman (2008) and Mills (2010) who argued that timely project completion at stipulated price requires construction contractor with strong financial resources needed to support contractual obligations relating to workmanship guarantees, liquidated damage payments, indemnities, etc. As highlighted by Bing et al. (2005) considering the complex and high-risk nature of Private Finance Initiatives and Public Private Partnerships (PFI/PPP) projects, the risk that insufficient fund may result in various counter-party challenges with the construction contractor is a threat to limited-recourse financing. According to Akintoye et al. (2003), the domination of PFI/PPP market by big construction firms is not unconnected to their huge financial and technical capabilities. With huge finance war-chest, big construction firms could cope well with the high cost of bidding and tendering exercise in PFI/PPP procurements (Robinson and Scott, 2009). This is quite important for project banks considering that only financially robust contractors can stay the course of the prolonged PFI tendering cost, timeline as well as have deep pockets to meet contractual obligations on the project.

Further evidences from the study also suggest that the third important criterion for evaluating the bankability of completion risk in PFI loan applications is the use of *Tried, Tested and Reliable Construction Project Technology* (See Table 8). According to Mills (2010), most project banks are often wary of investing in projects that propose a revolutionary project technology for the construction stage. This is because, in most cases, there is always a likelihood of inability to maintain or repair such technologies in case they break down. In other instances, such state-of-art technology might require engaging experts to drive its operations, which may further increase the cost of constructing the project (Hakeem *et al.,* 2018). As argued by Meng and McKevitt (2011), lenders are more interested in projects with tested and reliable construction technology that has good record of long operating hours and low-down times, as against latest technology whose operational capability is less known. Using tested construction technology thus gives more confidence to financiers concerning ability to forecast potential cost and time overrun on projects. From the perspective of Lim and Mohamed (1999), the fear that a project may not pass completion test is topical issue in construction risk due diligence appraisal. Mills (2010) argued that the construction delivery stage has significant impacts with respect to strategic issues on a project especially concerning profit margins and returns on investment for investors. As such, bankability can only be achieved where tested and tried project technology is made to drive the construction stage of PFI/PPP projects.

729 Going further, results shown in Table 8 reveal that the fourth important criterion for assessing the bankability
730 of completion risk in PFI/PPP loan applications is the *Availability of a Competent and Independent*
731 *Technical Consultant*. This evidence confirms findings from existing studies like Robinson and Scott (2009)
732 and Hakeem *et al*. (2018) who argued that providing technical due diligence on potential PPP project is
733 crucial towards the preparation of projects' business cases. According to Hoffman (2008), given the huge
734 risk associated with construction stages of projects, more rigour is usually applied towards technical due
735 diligence especially from lenders point of view. In most scenarios in PFI/PPP procurements, the project
736 consortium often comprised a construction firm who handles the project's technical development. This
737 construction contractor plays crucial role in providing technical details and analysis needed in projects'
738 business cases. However, in some circumstances, project banks often require an independent technical
739 consultant hired by the sponsors' team. The objective here is to have an independent consultant, who is
740 dispassionate about the project, to provide technical insights and recommendations on the technical
741 development plans of the project. Financiers will require the technical consultant to simulate various
742 scenarios, which may threaten the technical feasibility of the project (Mills, 2010). This approach often gives
743 many assurances to project banks concerning assessing the possibility of project completion.
744
745 Finally, the fifth important bankability criterion for assessing completion risk in project loan applications is
746 *Existence of Fixed Priced Turnkey Contract* (See Table 8 for results). Fixed Price Turnkey in PFI/PPP
747 project finance describes a procurement approach in which the construction constructor assumes the
748 responsibility of constructing a project in line with contractually stated output specifications, at a fixed cost
749 and within a determined timeline (Yescombe, 2013). Under a fixed price turnkey method, the construction
750 contractor cannot change the agreed price of the project. As such, the risks of cost and time overrun are
751 passed down to the contractor, who has the mandate to deliver the keys to the constructed facilities, to the
752 clients at the end of a stipulated construction period. As argued by Mills (2010), although, turnkey contracts
753 are very common in PFI/PPP procurements, not all projects are delivered using turnkey approach. A huge
754 number of PFI projects are still be constructed under a "Cost Plus Approach" in which the contractor charges
755 a construction cost with the addition of a profit margin or mark-up (Hoffman, 2008). One of the major put
756 off for most project banks in the cost-plus approach is that responsibility for managing cost and time overrun
757 are borne by the project sponsors as against the construction contractor. From financiers' perspective, this
758 method creates a moral hazard situation in that; the contractor has no incentive to ensure optimum
759 performance, which should forestall time and cost overruns and could as well as act indecently. As such,
760 most project banks favours fixed price turnkey method which allows the construction contractor take
761 responsibility for construction risks (cost, time overruns and technology risks), and thus ensure greater
762 commitment from the contract towards successful completion of the project.

Implication for Practice

This study has huge strategic implication for most construction firms especially at the management level. The enormous amount of time and cost overrun associated with mega-projects is such that, many construction firms have gone burst under its weight, particularly in the absence of adequate parent company support or risk guarantee. As a result, this study suggests contractors intensify their pre-contract efforts by putting together bankable completion risk in funding proposals, as against trying to simply accept the transfer of completion risk to them, which may prove more challenging to deal with considering the complexities in PPP arrangements. In addition, going by a thorough analysis of findings from this study, the various criteria influencing lender's decision on the bankability of completion risk may be put into two broad categories namely: contractor competency and a robust construction contract. These two factors are crucial towards successful delivery of Private Finance Initiatives and Public Private Partnerships (PFI/PPP) megaprojects in the UK construction industry. The UK construction sector is said to comprise big construction firms and micro-businesses, often referred to as Small and Medium Scale (SME) construction firms. While the big construction firms have dominated the construction sector by accounting for 55% of UK's built environments, the SME construction firms, which represents 96% of the industry have continued to play the second fiddle roles. This scenario has also translated in many PFI/PPP projects being executed by big construction contractors who play significant roles in setting up many Special Purpose Vehicles (SPVs), given their huge experience, expertise, and financial wherewithal. SME construction firms on the hand have been acting as sub-contractors on various projects and in many cases, restricted to small value projects. However, considering the government's sustained ambition to drive the procurement of critical infrastructures in the UK through private sector routes such as PPP, a good understanding of how SME construction firms can deepen their competencies will further position them for penetration into the project finance market. This can be achieved by collaborating with project sponsors who have experience in PFI/PPP megaprojects, to create a win-win relationship that will benefit each party. This mutual relationship will rub off on the construction contractor, as he benefits by being involved in strong mega projects that are implemented under robust construction contracts. The fixed price turnkey method, which is the popular procurement approach in PPP mega projects, is usually comprehensive in nature in terms of output specifications, availability requirements and various contractual details. As such, strong experience in the execution of such type of construction contracts will improve the profile of the construction contractors in terms of bankability. The implication of this study for construction contractors is also in terms of contract negotiations in PFI/PPP megaprojects. Evidences from the study show that, there is a trade-off relationship among some of the criteria influencing senior lenders' bankability decision on completion risk. Where a

796 contractor has "project type experience" with strong financial capacity and tested construction technology,
797 the existence of pre-completion guarantee can be negotiated as unnecessary, given the strong contractor
798 profile. In the overall, only a competent construction contractor working under robust construction contract
799 will be competent to serve the interest of project financiers and other stakeholders in the delivery PFI/PPP
800 mega projects.

801 ## Conclusion
802
803 This study adopted mixed methodological approach towards investigating the bankability of completion
804 risk in Private Finance Initiatives and Public Private Partnerships (PFI/PPP) mega project appraisal. Based
805 on evidences from the study constructed, five key criteria representing critical success factors (CFSs) were
806 identified to have significant influence on achieving bankable completion risk. These are (1) Construction
807 contractor's years of experience of successful completion of mega projects, (2) Construction Contractor's
808 financial strength, (3) Existence of Tried-and Test Technology for the construction of project, (4)
809 Availability of Independent Technical Consultant (ITC) and (5) Existence of Fixed Price Turn Key (FPTK)
810 construction contract. From the opinion of project financiers, these five criteria would be crucial for project
811 contractors and sponsors, if PFI/PPP mega projects' funding applications will be successful.
812
813 It is important to note that, most project banks have little knowledge of top-level technical details of complex
814 projects, which is typical with PPPs. As such, financiers' risk aversion is often very high, especially when
815 bankability of completion risk element in funding proposals cannot be sufficiently justified. This has led
816 many PPP funding applications being turned completely down by financiers. In PFI/PPP mega projects,
817 which is also the case in other types of project procurements, competency of the construction contractor and
818 robust construction contracts are crucial to the roles played by construction contractors. Construction
819 contractors' negotiations must also take cognizance of bankability requirements, which may need to be
820 traded-off with other risk mitigation strategies in the contracts. These requirements must be adequately
821 negotiated to relieve the construction contractor of cumbersome contractual obligations, which may become
822 a source of challenge in the near future.
823
824 This study contributes to knowledge with the identification of key bankability criteria that can help
825 construction contractors and PFI project sponsors to fulfil the bankability requirements for completion risk
826 in PFI/PPP megaprojects. Considering that most large-scale mega projects are usually non-investment grade
827 due to their high-risk profiles, which creates financing challenges, the findings of this study provides
828 valuable resource to stakeholders towards winning banks' funding approval. Although this study

829 specifically centres on bankability criteria for evaluating completion risk in PFI/PPP megaprojects,
830 additional empirical studies are needed to examine what constitute bankability and the various criteria for
831 other project risks in PFI/PPP such as operations, legal, concession, political, currency, counter party risks,
832 etc. It will also be very pertinent to examine the perspectives of contractors and project sponsors on factors
833 militating against the bankability of PFI/PPP projects within the UK construction industry. Evidences from
834 this study were limited to the UK PFI/PPP and construction industry. As such, the findings should be
835 interpreted within this context. Studies focusing on country-specific factors that influence bankability of PPP
836 projects in other geographical locations will also be crucial for future research. This will help to contextualise
837 bankability of projects based on the public procurement climate in such nations.

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