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Ensuring operational performance for promoting sustainable practices in Public Private Partnership (PPP) projects in the UK

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A great deal of focus has been placed by different governments on their construction industries as it is known for being a large polluter of the planet, as well as being a huge consumer of energy and emitter of carbon. The research was completed by investigating major PPP themes related to UK (namely, challenges to UK construction, operational performance of PPP projects, and drivers of PPP projects). To ensure enough participants were reached, the snowball sampling technique was used to collect data from 156 industrial professionals. Relative importance index (RII) analysis was performed to check the ranking of the factors, and to determine the significance of each factor. This analysis revealed a large significance on time and cost management issues within the challenges to UK construction section. Sustainability presented highly significant results relating to modern methods of construction like BIM as well as the use of modern schemes such as the PF2 (Private Finance 2) scheme. This was also found to be an important factor in the operational performance of PPP projects as well as resolving financial and fiscal issues within the public sector. This research can support public and private sectors to develop advanced collaborative networks to boost productivity.

Key Words: Private Public Partnership, Sustainable Practices, Operational Performance, Construction Projects, United Kingdom

Operational Performance in PPP Projects

Operational performance is defined by Azim and Ahmed (2015) as the "measurable aspects of the outcomes of an organization's processes, such as reliability and production cycle time". To ensure operational performance of a project, there must be a presence of various success factors to streamline the process. Haryati and Habib (2018) conducted a study on the critical success factors of PF2 projects in the UK. They discovered that there were 26 success factors that could influence the operational performance of PPP projects under the PF2 scheme. These were split into 5 sections. The sections, and an example of a success factor under that section, has been highlighted below:

- Political environment and regulatory - Favourable legal framework
- Economic factor - Available financial market

- Collaborative working relationship - Shared authority between the public and private sector
- Project management - Appropriate risk allocation
- Skills, experience, and competency - Continued use and growth of technology and modelling systems

The legal framework is crucial in ensuring success of projects, attracting the private sector, and ensuring economic growth. Risk management systems are also instrumental and should be put in place and abided by to ensure operational performance. This also encapsulates the shared authority dynamic of both sectors.

Continued use and growth of technology transfer and modelling systems is extremely important not only in PPP projects but also in the overarching construction industry. From the years 2013 to 2015, the percentage of contractors in the UK at a high level of BIM integration increased from 28% to 66%. At the same time construction gains increased by around 6% in 2014 and 8% in 2015 (Autodesk, 2015). Whereas the BIM adoption in UK has surpassed the 73% as per the BIM report 2020 (Graham, 2021). This statistic clearly illustrates the importance of continued use and investment in BIM to improve the profitability and economic sustainability of the industry. The profitability improvements caused by using BIM mostly include time saving methods. There are however BIM tools that can help save money in the earliest stages of a project's life. These include tools to accurately record and calculate budget and spending, this improves profitability as there will be fewer mistakes in documentation and the budget will be accurately laid out, thus removing the risk on overages later down the line and saving money (Landform surveys, 2021). There is a huge importance of using BIM in PPP projects in the UK. This is because in today's modern industry, there is a need for a great deal of information transfer and collaboration. BIM can aid in collaboration between sectors and influence the working relationship between the two. If the relationship is streamlined and the communication is efficient and accurate the overall operational performance of the project will be optimised (Haryati and Habib, 2018).

The availability of the current financial market is important in encouraging operational performance within PPP projects. If the financial market is in a good place, it acts as an incentive to the private sector to take an interest and invest into PPP projects (Akintoye et al., 2001b). One way to make the financial market accessible is to tie the finance provider into the consortium or SPV (special purpose vehicle) (Li et. al, 2005). An SPV is a legal entity whose purpose is to carry out a specific temporary task whilst separating itself from the original firm, thus isolating the firm from a large amount of financial risk (Gomez and Gambo, 2016). A steady and predictable financial market reduces risks for the private sector which further entices them to collaborate on large projects.

PPP Structure and Sustainability

In 1992, the then chancellor of the exchequer, Norman Lamont, announced the launch of the private finance initiative (PFI) (Allen, 2003). This set out a framework for a close relationship for the public and private sectors to collaborate on large government projects using the skills and finance from the private sector. The private sector was wary of the PFI scheme as it required a large capital investment up front and entailed a long and bureaucratic tendering process (Pretorius et al., 2008). Since the scheme was set up in a way to optimise collaboration, project performance, and to increase business profit for the private sector, it quickly became the priority in procuring NHS projects (Pollitt, 2002). The PFI scheme was continually optimised and improved, resulting in 780 projects recorded with a value of over £53 billion by the end of 2005 (Toms et al, 2009). Despite the PFI schemes success, it was drawing criticism by the late 2000's. this is due to the biased evidence used to argue in favour of the scheme (Pollock et al., 2007). The conclusion drawn by the criticism was that the PFI scheme was

more expensive than it needed to be. The House of Commons (2011) drew the following conclusions:

- The use of PFI has the effect of increasing the cost of finance for public investments as the financing costs of PFI are typically 3-4% over that of government debt.
- In comparison to government's bond, the interest rate at that time was around 4%, compared to rates of around 8.5% on private borrowing.
- In the case PFI's inefficiency, for the same present value of finance-related payments, the government could have secured 71% more investment by borrowing on its own account.

As a result of these conclusions, it was decided that the PFI scheme could be further optimised to improve economic sustainability and operational performance of the projects being undertaken. Thus, the PF2 scheme was introduced in December 2012 (National audit office, 2018). The PF2 scheme was aimed at speeding up the tendering and procurement process while making the venture cheaper for the public and private sector. Under this scheme, the public sector would invest 10%-39% more equity into the project as to limit the amount being paid back to the private sector post construction. This way, the public sector becomes an equity stakeholder/ co investor, this minimises the conflict of interest from the private sector being investors and procurers (Haryati and Habib, 2018). Haryati and Habib (2018) Discussed a range of issues with the former PFI scheme and suggested a series of reforms adapted from HM Treasury (2012); and House of Commons (2014). These reforms include using public sector finance to invest in the projects, rather than borrowing from the private sector. The equity invested from the public sector allows for saving money through lower interest rates from the government. Another reform was also cut down substantially. The tendering process being cut down to a maximum of 18 months allows for not only the steady growth of projects but also attracts potential contractors who may have been discouraged by the lengthy process. Both factors influence social and economic sustainability by promoting growth and economic stability. The other reforms including transparency, flexibility, and accountability allows for a more amicable working relationship between the public and private sectors and promotes growth of future projects as well as improving overall operational performance of future projects.

Methodology

The data for this research was collected in a systematic manner utilising a questionnaire survey and then represented quantitatively as data on a spreadsheet. The information was gathered using a technique known as "snowball sampling." This method involves collecting information from a single participant, who then distributes the survey to others in his or her organisation or area of effect. This method is then repeated, exponentially growing the sample group over time. Because of the large number of potential responses from a small number of respondents contacted, this sampling strategy was used. This increases the likelihood of obtaining results from many people, hence boosting the data's quality and reliability. This sampling strategy also allows the survey to reach people you might not have otherwise been able to reach, such as large corporation directors and CEOs (Miller, 2003). This resulted in a more meaningful data collection, as well as added the ability to add experience to the potential respondents. The respondents were selected based on their previous job experience and present or previous sector of work. These responders were identified online, in places like LinkedIn, where a search for "construction manager" or "Construction Director" turned up a slew of industry insiders who could be easily contacted.

Emailing several construction companies and requesting industry personnel to complete and, of course, pass on the survey was another option that was used. The questionnaire survey was constructed to validate and investigate the themes and factors discussed in the literature review. This questionnaire aided in analysing the research topic by investigating the sustainability of the construction sector and linking it to the PPP structure. It also evaluated the critical success factors which ensure operational performance of the scheme. The questionnaire was constructed with

demographic questions, and research specific questions. The questionnaire was split into categories: briefing, demographic, and research specific questions. The research specific questions were designed to be answered in a five-point Likert scale. This scale presented in Table 1 was used to quantify the answers given by the responses.

Table 1
Formulation of Questionnaire

Factor	Questions	Theme	Source(s)
Challenges to UK construction	14	Skilled worker shortage Time management issue Overrunning costs Cost management Technological advancements Productivity on site Cost affecting economic stability Reliance on importation Procurement issues caused by COV-19 and Brexit Waste and pollution issues not being improved	(Opoku and Ahmed, 2014); (Sarhan and Fox, 2012)
Drivers of PPP projects	7	Level of risk to environmental and economic sustainability Legal framework supporting PPP Support from current financial market The need for MMC & BIM in construction Communication between sectors Effectiveness of legislative requirements	(Doloi, 2012); (Robinson and Scott, 2009)
Operational performance of PPP projects	8	Effectiveness of voluntary agreements PF2 scheme improving risk management PF2 scheme improving sustainable practices PPP resolving fiscal issues Reduction of cost within construction projects Creating collaborative networks between sectors	(Yurdaku et al. 2022); (Chou and Pramudawardhani, 2015)

Results and Discussion

Analysis of Data

The research specific questions were split into sections. These are: Challenges to UK construction, performance of PPP projects, and Drivers of PPP projects. Each section was analysed separately as there are both limiting factors and success factors so, to gain a better understanding of the importance of each section and the questions within it. The RII of each question was used to analyse the importance and significance of each question and then was ranked based on its RII value. The RII was calculated by using the following equation.

$$RII = \frac{\mathrm{Ni1} \times 1 + \mathrm{Ni2} \times 2 + \mathrm{Ni3} \times 3 + \mathrm{Ni4} \times 4 + \mathrm{Ni5} \times 5}{(\mathrm{Ni1} + \mathrm{Ni2} + \mathrm{Ni3} + \mathrm{Ni4} + \mathrm{Ni5})\mathrm{A}}$$

where RII= Relative importance index for each question, Ni1= number of responses as “Strongly Disagree”, Ni2= number of responses as “Disagree”, Ni3= number of responses as “Neutral”, Ni4=

number of responses as “Agree”, Ni5= number of responses as “Strongly Agree”, and A= highest weight of Likert scale (5 in this case). RII is an important tool to determine the relative significance of each question and to analyse the answers the participants have given. Khaleel and Nassar (2018) listed the following guidelines to determine the significance of the results depending on the RII value. 10.0 ≤ little significance ≤ 20.0, 20.0 ≤ some significance ≤ 40.0,
40.0 ≤ average significance ≤ 60.0, 60.0 ≤ high significance ≤ 80.0, and 80.0 ≤ very high significance ≤ 100.

Analysis of Challenges to UK Construction

Table 2 below shows the RII numbers of the questions asked in the category “challenges to UK construction”.

Table 2
RII values of Challenges to UK construction

Factor	1	2	3	4	5	RII	Category Rank
Challenges to UK construction						0.848168	
I believe that there is a shortage of skilled and experienced workers in construction	0	0	2	87	67	0.883333	5th
I believe that there are time management issues in the construction industry	0	0	3	56	97	0.920513	2nd
Construction projects often overrun	1	0	2	35	118	0.944872	1st
I believe that cost is not managed properly within construction projects	1	0	68	38	49	0.771795	12th
Costs often overruns in construction projects	0	0	4	120	32	0.835897	10th
I believe that construction projects struggle with productivity	0	2	3	53	98	0.916667	3rd
I believe that lack of technological advancements is a limiting factor in the construction industry	0	4	4	91	57	0.857692	7th
I believe that material costs create unstable economic patterns within construction projects	1	0	108	25	22	0.685897	14th
I believe that there is a large reliance on imported materials in construction	0	0	65	49	42	0.770513	13th
I believe that the UK has faced difficulties caused by covid-19 and Brexit with relation to procurement shortages	0	0	2	115	39	0.847436	8th
I believe that the above shortages will continue to affect the construction industry into the future	0	1	42	56	57	0.816667	10th
I believe that there are sustainability issues in the UK construction industry that are not being improved	0	2	18	79	57	0.844872	9th
I believe that there are waste management issues in the UK construction industry	0	0	2	76	78	0.897436	4th
I believe that there are water and air pollution issues in the UK construction industry	0	0	3	87	66	0.880769	6th

This section contains a very high average RII of 0.848168 overall, this means that the questions on average in this section have very high significance, revealing that the challenges presented in this section have a large significance in the construction industry in the UK. The question in this section with the highest RII was "Construction projects often overrun" with a RII of 0.944872. this shows that, it is the opinion of the experts questioned in this survey, that construction projects in the UK overrunning is a large problem and presents itself as a major challenge to the industry. This is backed up by the fact that "I believe that there are time management issues in the construction industry" had the second highest RII. This further reinforces the importance of the subject of time management and time overrunning. In contrast, the lowest scoring RII question was "I believe that material costs create unstable economic patterns within construction projects". This shows that comparatively, cost fluctuation and economic stability is considered less important and a smaller challenge to UK construction, compared to time management. this can mean that it is more likely for a construction project to overrun on time however the material prices could fluctuate and cause cheaper procurement to aid in the overall project budget. The RII for this question was 0.685897. This represents a high level of significance notwithstanding the low rank. This shows that fluctuation of material price is still a challenge to the UK construction industry however it is a comparatively less important one in contrast to time and cost management. This research paper aims to investigate the success factors which ensure operational performance of PPP projects in the UK. Using the information from table 2 it is clear to see, that using proper time management can help in eliminating one of the most significant challenges to UK construction, thus boosting operational performance.

Analysis of Operational performance of PPP projects

Table 3 below investigates the factors involved in ensuring operational performance of PPP projects in the UK.

Table 3
RII values of Operational performance of PPP projects

Factor	1	2	3	4	5	RII	Category Rank
Operational performance of PPP projects						0.662981	
I believe that there are appropriate risk management frameworks in place in the public sector to mitigate economic and environmental risks	45	21	3	68	19	0.59359	5th
I believe that there are appropriate risk management frameworks in place in the private sector to mitigate economic and environmental risks	67	62	5	14	8	0.387179	8th
I believe that there is an appropriate legal framework to facilitate the operational performance of PPP projects	1	1	6	81	67	0.871795	4th
I believe that the current financial market facilitates operational performance of PPP projects	0	3	4	79	70	0.876923	3rd

I believe that there is a need for modern methods and techniques of construction (e.g., BIM, Lean, etc) and information sharing within the construction industry	0	2	2	79	73	0.885897	1st
I believe PPP leads to sufficient and effective communication between sectors	43	84	5	19	5	0.419231	6th
I believe that PPP legislative regulation has a positive impact on the construction industry in the context of sustainability	0	1	5	81	69	0.879487	2nd
I believe that PPP legislative regulation is widely accepted within the private sector	47	83	17	5	4	0.389744	7th

The overall RII for this section was 0.662981 showing that this section has high significance. The question with the highest significance was "I believe that there is a need for modern methods and techniques of construction (e.g., BIM, Lean, etc) and information sharing within the construction industry" with an RII of 0.885897 which means it has very high significance. The subject of MMC was covered in a previous section where it was discovered that MMC can boost the overall sustainability of the construction industry and it was discussed in the literature review how these methods can influence the sustainability of a project. This question highlights that the respondents believe that there is a need for MMC more specifically BIM, lean, and information sharing. This shows us that it is recognised that these methods can boost sustainability and operational performance and that there is a need for these methods in the industry. The question with the lowest RII in this section was "I believe that there are appropriate risk management frameworks in place in the private sector to mitigate economic and environmental risks" with an RII of 0.387179 meaning it has some significance. Compare this to the previous question "I believe that there are appropriate risk management frameworks in place in the public sector to mitigate economic and environmental risks" which had an RII of 0.59359 meaning it has average significance. It is clear to see that the respondents think that the risk management framework in the public sector is superior to the risk management framework in the private sector within the context of environmental and economic sustainability. This shows that the private sector could improve the overall operational performance and sustainability of PPP projects by improving its risk management frameworks to mitigate environmental and economic risks. Not only would this protect the private companies but also improve any given PPP projects' likelihood of success and performance.

Analysis of Drivers of PPP projects

Table 4 is named "drivers of PPP projects". This section was aimed at discovering the factors which drive PPP projects and ensure their performance.

Table 4
RII values of Drivers of PPP projects

Factor	1	2	3	4	5	RII	Category Rank
Drivers of PPP projects						0.791941	
I believe that voluntary agreements from the private sector improve environmental sustainability through PPP based sustainable construction projects	1	0	4	92	59	0.866667	2nd

I believe that voluntary agreements from the private sector improve economic sustainability through PPP based sustainable construction projects	0	2		298	54	0.861538	3rd
I believe that the use of the PF2 scheme has improved PPP projects in terms of risk Management	1	0		791	57	0.860256	4th
I believe that the use of the PF2 scheme has improved PPP projects in terms of sustainability	1	0	6	119	30	0.826923	5th
I believe that the use of PPP projects aids in resolving fiscal issues within the public sector	1	1	8	69	77	0.882051	1st
I believe that the use of PPP projects helps reduce cost for both sectors	2	2	74	71	7	0.701282	6th
I believe that the use of PPP helps to create collaborative networks between private and public parties	1	77	51	18	9	0.544872	7th

The overall RII for this section was 0.791941 meaning this section has a high level of significance. The question with the highest RII was “I believe that the use of PPP projects aids in resolving fiscal issues within the public sector” with an RII of 0.882051 this factor is one with High significance. This shows that PPP projects can aid in the economic state and sustainability of the public sector and can promote economic growth by resolving fiscal issues. The 2nd highest RII was the question “I believe that voluntary agreements from the private sector improve environmental sustainability through PPP based sustainable construction projects” with the RII of 0.866667. This shows that not only does the PF2 scheme and PPP project philosophy aid in economic growth and sustainability, but it also helps promote environmental sustainability. The question in this section with the lowest RII number was “I believe that the use of PPP helps to create collaborative networks between private and public parties” with an RII value of 0.544872 which shows average significance. this result shows that the communication between the sectors when it comes to PPP projects is lacklustre. This can relate to some previous responses which highlight the need for MMC and BIM which could aid in creating creative networks and communication links between the public and private sectors. This is a critical success factor within the projects and should be improved to boost operational performance.

Conclusion

The research analysed the current practices and issues in the UK construction industry within the context of sustainability. This factor found large significance within utilising the skills and capital from the private sector to push for the implementation sustainable practices within projects. Another subject with substantial significance in this factor was the use of modern methods of construction to bolster and boost the current construction practices used today. The success factors of PPP projects were also split into 2 sections including operational performance of PPP and drivers of PPP. It was made clear that modern methods of construction are imperative within ensuring operational performance of these projects by utilising methods such as BIM and Lean construction. It was also found that the most significant factor which drives PPP projects is the resolution of fiscal and financial issues within the public sector. From this research it is possible to conclude that to ensure operational performance of PPP projects it is imperative to continue research and development of modern methods of construction as well as implementing BIM into the standard practices of the project. This can aid in the time, cost, and sustainable efficiency of a project and aid in promoting

high quality work. It is also important to remember that at the heart of these projects there is a large focus on the financial benefit to the public and private sectors.
The public sector must be able to resolve fiscal issues by continuing the project and the financial market must be accessible and stable to attract the skills and capital from the private sector.

References

Allen, G. (2003). The private finance initiative (PFI). House of Commons Research Paper 01/117.
Autodesk. (2015). "Building on BIM". Available at: https://damassets.autodesk.net/content/dam/autodesk/www/campaigns/bim-constrction/fy15-aec- expand-construction-ebook-en-gb.pdf. Accessed: 10/03/2022
Azim, M., & Ahmed, H. (2015). Operational performance and profitability: an empirical study on the Bangladeshi ceramic companies. International Journal of Entrepreneurship and Development Studies (IJEDS), 3(1), 63-73.
Doloi, H. (2012). Understanding impacts of time and cost related construction risks on operational performance of PPP projects. International Journal of Strategic Property Management, 16(3), 316-337.
Graham, D. (2021). The rise of BIM in the UK. BIMTODAY, January 7, 2021.
Haryati, S.N., & Habib, A. (2018). Critical success factors and contractual risks for private finance 2 (pf2) projects implementing building information modelling (BIM). School of the Built Environment, The University of Salford Salford, UK. PP.17-34.
HM Treasury. (2012). "A New Approach to Public Private Partnership." Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/205112/pf2_infrastructure_new_approach_to_public_private_parnerships_051212.pdf. accessed: 20/03/2022
House of Commons. (2014). "Private Finance 2: Tenth Report of Session 2013-14. London: The Stationery Office Limited:.".Availableat: http://www.publications.parliament.uk/pa/cm201314/cmselect/cmtreasy/97/97.pdf. Accessed: 20/03/2022
Landform surveys (2021) 'does BIM really save money on capital projects?' available at: https://www.landform-surveys.co.uk/news/thoughts/bim-really-save-money-capital-projects/. Accessed: 10/03/2022
Li, B., Akintoye, A., Edwards, P.J., & Hardcastle, C. (2005). Critical success factors for PPP/PFI projects in the UK construction industry. Construction management and economics, 23(5), 459-471.
Miller, R. (2003). Sampling, snowball: accessing hidden and hard-to-reach populations. The AZ of social research: A dictionary of key social science research concepts, 274.
National Audit office. (2018). "HM Treasury, PFI and PF2" Report by the Comptroller and Auditor
Opoku, A., & Ahmed, V. (2014). Embracing sustainability practices in UK construction organizations: Challenges facing intra-organizational leadership. Built Environment Project and Asset Management, 4(1), 90-107.
Pollitt, M.G. (2002). The declining role of the state in infrastructure investments in the UK. In S. V. Berg, M. G. Pollitt & M. Tsuji (Eds.), Private Initiatives in 312 Infrastructure: Priorities, Incentives and Performance (pp. 67-100). Glasgow: Edward Elgar Publishing.
Pollock, A.M., & Price, D. (2008). Has the NAO audited risk transfer in operational private finance initiative schemes? Public Money and Management, 28(3), 173-178.
Pretorius, F., Chung-Hsu, B., Mclnnes, A., Lejot, P., & Arner, D. (2008). Project Finance for Construction and Infrastructure: Principles and Case Studies. Oxford, UK: Blackwell.
Robinson, H.S., & Scott, J. (2009). Service delivery and performance monitoring in PFI/PPP projects. Construction management and economics, 27(2), 181-197.
Sarhan, S., & Fox, A. (2012). Trends and challenges to the development of a lean culture among UK

construction organisations. In 20th Annual Conference of the International Group for Lean Construction, July 2009.

Toms, S., Asenova, D., & Beck, M. (2009). Refinancing and the Profitability of UK PFI Projects. In A. Akintoye & M. Beck (Eds.), Policy, Finance & Management for Public-Private Partnership (pp. 65-81). Oxford: Blackwell.

Yurdakul, H., Kamaşak, R., & Öztürk, T. Y. (2022). Macroeconomic drivers of Public Private Partnership (PPP) projects in low income and developing countries: A panel data analysis. Borsa Istanbul Review, 22(1), 37-46