Selvanesan, H., Kulathunga, U. and Wijayasiri, M.P.A.P., 2025. Identifying and quantifying the challenges of Sri Lankan public-private partnerships: A sentiment analysis approach. In: Waidyasekara, K.G.A.S., Jayasena, H.S., Wimalaratne, P.L.I. and Tennakoon, G.A. (eds). *Proceedings of the 13th World Construction Symposium*, 15-16 August 2025, Sri Lanka. pp. 801-813. DOI: https://doi.org/10.31705/WCS.2025.60. Available from: https://ciobwcs.com/papers/

IDENTIFYING AND QUANTIFYING THE CHALLENGES OF SRI LANKAN PUBLIC-PRIVATE PARTNERSHIPS: A SENTIMENT ANALYSIS APPROACH

Hirusheekesan Selvanesan[1], Udayangani Kulatunga[2] and M.P.A.P. Wijayasiri[3]

ABSTRACT

Public-Private Partnerships (PPP) could be a suitable approach to cater the demand for infrastructure and the need to attract foreign investment in Sri Lanka, as it recovers from its worst economic crisis. However, the success rate of PPPs both locally and globally, is diminishing. Regardless, there is dearth of academic literature, especially empirical, done on Sri Lankan context to identify the challenges of PPPs that plague the PPP success rate. Accordingly, semi-structured interviews were held among the experts of Sri Lankan PPPs to identify the challenges of PPPs in Sri Lanka. Subsequently, considering the need to identify the most pressing challenges through a ranking system, while addressing the limitation of lack of PPP experts in Sri Lanka to gather adequate data to conduct a statistical analysis, Sentiment Analysis was done on the descriptions of each challenge, using pre-trained BERT model. The sentiment analysis provided numerical rating on the negativity of each challenge, to rank them. From the interviews, it was identified that Sri Lankan PPPs are being plagued by challenges like High Bureaucracy, Political Instability, Lack of Experts, and Lack of Co-ordination among Stakeholders, amidst others. Among them, it was identified from the sentiment analysis that Lack of Adequate Financial and Technical Capacities, Lack of Transparency and Corruption, and Lack of Legal/Regulatory Frameworks for PPPs are the most critical issues. Furthermore, this study explores the suitability of sentiment analysis and adopting BERT as a substitute for statistical analysis in studies where the responses are restricted by contexts and circumstances.

Keywords: *BERT; Opinion Mining; Public-Private Partnerships; Sentiment Analysis; Sri Lanka.*

1. INTRODUCTION

Over the past decades, the demand for infrastructure has increased exponentially to cater the public's needs. In contrast, the public funds that should be utilized to develop infrastructure remain unchanged, if not shrunk (Lembo et al., 2019). This prompts the resource-constrained governments to look for innovative solutions to redress the

[1] PhD Candidate, School of Architecture and Civil Engineering, The University of Adelaide, Australia, hirusheekesan.selvanesan@adelaide.edu.au.
[2] Professor, Department of Building Economics, University of Moratuwa, Sri Lanka, ukulatunga@uom.lk.
[3] Senior Lecturer, Department of Computer Science and Engineering, University of Moratuwa, Sri Lanka, adeeshaw@cse.mrt.ac.lk.

investment shortfall in these infrastructure demands. Public-Private Partnerships (PPPs) incepted as one of such solutions (Bao et al., 2023). PPPs are "a long-term contractual arrangement between the public and private sectors where mutual benefits are sought and where the private sector engages in designing, building, finance, maintain and operate infrastructure assets and related services and/or puts private finance at risk" (World Bank, 2014). On several occasions, when the efforts and resources of governments to induce infrastructure development are insufficient, PPP models have been accentuated to harness the technical superiority and effectiveness of the private sector to commission, design and build a construction project (Sehgal & Dubey, 2019). Due to these, PPPs are popularly practiced in several regions, from developed to developing countries across sectors like roads, ports, and waste management (Aerts et al., 2014; Dabarera et al., 2019).

For the Sri Lankan economy and sectors related to infrastructural development, the need for infrastructure has been ever-increasing (Jayasinha et al., 2021). Hence, PPP could be a viable solution to cater for its infrastructure demands. The end of the war in the late 2000s projected the country towards developing its economy and infrastructure. The huge inflow of foreign investments and support strengthened the country's service sector, with tourism at the forefront. The trend continued till the end of the last decade before the pandemic, and the consequent economic crisis hit the country (Hirusheekesan & Satanarachchi, 2021). While the developments have slowed down, there are signs of improvements, and the government is focused on reviving the crisis-hit construction and tourism industries. At this juncture, PPP could be used to tap into the private sector's economic and technical superiority to cater the demand for social infrastructure and attract foreign exchange to the country. Nevertheless, the success rate of PPPs is diminishing globally (Eshun et al., 2021; Vale de Paula et al., 2025), which is the case in Sri Lanka as well (Fernando et al., 2025; Weththasinghe et al., 2016).

Hence, it is essential for the academics and practitioners of PPPs in Sri Lanka to venture on finding the challenges that prevents the successful implementation of PPPs. However, unfortunately, a preliminary search in the SCOPUS index with the search string *("Challenges" OR "Barriers") AND "Public-Private Partnerships" AND "Sri Lanka"* on 1st March 2025 yielded no relatable documents while a similar broader search on Google Scholar retrieved Weththasinghe et al. (2016), a study done almost a decade ago, exploring the challenges of Sri Lankan PPPs, yet again, using a literature review. Additionally, there are also articles that discuss the challenges pertaining to specific domain of PPPs in Sri Lanka. For instance, Thennakoon et al. (2025) discusses the challenges of implementing unsolicited proposals in Sri Lanka, Kavinda and Gallage (2024) explores the challenges in selecting PPPs as a procurement option for Sri Lanka, and Kim et al. (2019) briefly discusses PPP challenges on a surface-level, amidst its broader discussion. However, this is still a dearth of articles that holistically focus on the challenges of Sri Lankan PPPs and consequently ranking them.

This calls for studies that use empirical methods to identify the challenges of PPPs in Sri Lanka. Additionally, merely identifying the challenges may not be entirely fruitful since some of them may not really be critical while the rest might demand immediate attention. Hence, it is also necessary to rank the identified challenges by using any quantitative methods, which would provide more pragmatic insights to the academics and practitioners.

Based on this, this paper aims to study the research question "What are the most challenging barriers of Public-Private Partnerships in Sri Lanka" endeavouring to provide not only qualitative insights, but quantitative insights as well, to deliver the most pressing challenges of PPPs in Sri Lanka.

2. RESEARCH METHOD

This study aims to identify the challenges of the Sri Lankan PPPs and rank them to recognize the most pressing issues of the sector. To achieve this, it was decided to initially conduct a literature review/interview to identify the challenges of Sri Lankan PPPs or PPPs in general, and then to rank them using a quantitative method. However, as mentioned in the earlier section, the number of studies done in relevance to the Sri Lankan context is minimal. Additionally, it was also realized in the preliminary levels of this study, that most of the Sri Lankan PPPs have been progressed only up to the conceptual and feasibility study level and has not been materialised towards the construction and operational phases. The pandemic and economic crisis in 2022 aggravated the situation, with no visible infrastructure PPP project being commenced from the start of this decade. This led to a serious dearth of experts in Sri Lankan infrastructure PPPs, who have involved in two or more phases of projects. The lack of extensive literature negated the possibility of literature review to identify the challenges, and even if made possible through reviewing articles from other context, the lack of possible respondents eliminated the possibility of traditional quantitative methods for ranking.

Under this backdrop, to resolve the impossibility of literature review, it was decided to conduct semi-structured interviews among the PPP experts in Sri Lanka, to qualitatively identify the challenges of Sri Lankan PPPs. Also, the anticipated data saturation would ease the impact of lack of experts in the data collection processes. Accordingly, 7 interviews were carried out as shown in Table 1.

Subsequently, the data derived from the interviews were analysed using Sentiment Analysis. Sentiment analysis, is a sub-field of Natural Language Processing (NLP) (Ramezani, 2025), which is in turn, is a domain of artificial intelligence that enables computer to understand, interpret, manipulate and generate human language (Chandra et al., 2025). Sentiment Analysis in essence, is the process of capturing the diverse sentiment information expressed natural language texts (Tao et al., 2025). It is also known as Opinion Mining, focusing on detecting, extracting, and classifying sentiments from texts.

Sentiment analysis methods could essentially be categorized into two methods as, lexicon-based or unsupervised machine learning, supervised machine learning, and with the possibility of combining the two methods (D'Andrea et al., 2015). Unsupervised machine-learning/Lexicon-based methods use sentiment lexicon, which are a set of words that contains sentiment words coded with, among other things, as positive, negative, or neutral, along with their level of strength or intensity, as the main tool for analysis. Meanwhile, in supervised machine learning, a model is first trained with some data that have already been labelled to the categories and then the model is tested by providing some sample data as input to the model for doing the analysis based on the prior training given (Samal et al., 2017). Sentiment analyses are predominantly used in identifying public sentiments on various subjects like mental health, drug reviews, e-commerce products, customer review, stock market sentiment, political views and movie reviews among others (Chandra et al., 2025; Ramezani, 2025; Tao et al., 2025).

Yet, the qualitative dataset that were collected from interviews were still inadequate to conduct a traditional supervised machine learning method, which is, training a model based on the available data. Meanwhile, the dictionaries and corpora available for lexicon-based methods simply conduct the analysis based on the words present, which are finite and do not have the ability to understand the context (D'Andrea et al., 2015). Hence, the accuracy of results stemming from lexicon-based approaches will be less since they do not have the capacity to analyse complex sentences, which will be the type of data collected from the interviews, and to understand the highly specific context of PPP.

BERT, which stands for Bidirectional Encoder Representations from Transformers, is a model for NLP developed by Google that learns bi-directional representations of text to significantly improve contextual understanding across many different tasks (Devlin et al., 2019). This has made it strong for significantly understanding contexts and analyse complex sentences. In essence, BERT is a pre-trained large language model, which can be further fine-tuned to suit different applications (Lee & Lee, 2024). Accordingly, BERT has diverse applications areas such as automatic answering of questions, machine translations, fake review detection, grammatical error detection and correction etc., among which sentiment analysis too is a popular area (Cicekyurt & Bakal, 2025; Mushtaq et al., 2025). Accordingly, it was decided to adopt BERT for the sentiment analysis in this study, due to the possibility to tap into the powerful and versatile pre-trained model, even with using small dataset. Studies like Perski et al. (2017), Xie et al. (2023) and Gatto et al. (2022) have also previously used BERT to conduct sentiment analysis on data collected from relatively small number of interviews like 10 or 12.

Accordingly, this study adopts a qualitative method, through semi-structured interviews, and a quantitative method, via sentiment analysis, to identify and rank the challenges of Sri Lankan PPPs.

3. RESULTS AND DISCUSSION

3.1 RESPONDENTS OF THE INTERVIEWS

The respondents considered for this interview are those who can be categorised as "experts" in the domain of PPPs in Sri Lanka. As discussed earlier, the number of experts in PPPs in Sri Lanka is minimal due to several reasons. Hence, professionals with experience working at any phase of a Sri Lankan infrastructure PPP project are considered experts. However, care was also taken to identify respondents with at least five years of experience in their respective professions, though it does not necessarily have to be in PPP. This was done assuming that being considered an expert, their perceptions will be more accurate and relevant to the context, with substantial experience in their respective fields.

Accordingly, owing to the lack of professionals with working experience in Sri Lankan PPPs, it was decided to consider professionals with at least five years of experience in their respective fields and have been involved in at least one phase of an infrastructure PPP.

During the interviews, data saturation occurred with the fifth respondent. However, a couple of more interviews were conducted to validate the collected data and ensure saturation. This early saturation could be attributed to the less maturity of Sri Lankan PPPs, and similar thoughts were shared among the experts regarding challenges like

transparency, accountability, political instability etc. This also indicates the gravity of such issues and the necessity to address them head-on.

The profile of the respondents has been provided in Table 1.

Table 1: Profile of the interview respondents

Respondent No.	Experience in years	Experience in PPPs
R1	10	A Quantity Surveyor involved in a PPP housing project from its inception to the procurement phase.
R2	17	A Quantity Surveyor involved in a PPP housing project during its design and construction phases.
R3	20	An Economist currently serving as a director of a government institution, involved in the assessment, awarding and procurement of PPP proposals.
R4	15	A Civil Engineer involved in the initial assessments and feasibility studies of PPP projects.
R5	35	A Chartered Quantity Surveyor and academic with over 17 years of experience in PPP and procurement
R6	16	An Accountant with experience in public finance management and serving in procurement entities, procurement committees, technical evaluation committees etc.
R7	17	A Quantity Surveyor with experience in Procurement and Contract Management

3.2 RESULTS FROM THE INTERVIEWS

When considering the barriers put forward by the interviewees, all the respondents mentioned the Lack of Transparency and Corruption associated with PPPs. R1 introduced this, as he mentioned, *"the transparency index of Sri Lanka is very less when compared to its South Asian Counterparts"*. According to the respondents, the corruption and lack of transparency initially stem from the procurement and contract awarding stages in PPP. R3 indicates several occasions where he has experienced corruption and manipulation during the procurement phase firsthand. He points out that bid value is usually overstated and sometimes awarded to a private partner with no prior similar or experience. R3 states counter-intuitively, *"To be honest, we actually need a little bit of corruption or, in other words, incentives for the people at the top for a PPP proposal to proceed further. Maybe in some European countries where the corruption level is zero, we can expect the corruption to be eliminated. However, it is very difficult in Sri Lanka to remove corruption completely. We may have to learn to deal with it and somehow proceed with the project further."* For R4, corruption comes in the form of manipulation of bid values and awarding to companies that can provide some sort of incentive to those at the decision-making level. R5 also agreed with the statement of R1, saying *"I don't want to mention it, but as we all know, there is a level of corruption involved in the PPP projects"*. While R6 agreed with the above statement, R7 cited this as one of the two significant barriers to PPP in Sri Lanka.

Additionally, only R1 and R3 were able to provide solutions to address the issue of corruption and transparency in Sri Lankan PPPs. They both agreed on an accountable

system with an independent audit for the PPP processes undertaken. R1 contemplates, *"We have to have some sort of a transparent system in our PPP processes, specifically in the procurement phase"*.

Another challenge that goes closely with corruption and lack of transparency is the high level of Political Interference and Resistance. R1 first put forward this, which was agreed by R3 as well. R3 stated that whenever a project proposal does not agree with the personal agent of ministers or politicians, it will be shoved under the shelf. He recalled a situation where a PPP proposal was assessed and approved in haste just because a person in power wanted to get the project running while he was still in office. R4 encountered an issue when opposition parties brought a bad reputation to his company during their election campaign. He said, *"There was this foreign company which also submitted a proposal along with us. Though we quoted a higher price than them, we won the bid since we have prior experience and technical capacity to undertake the project. However, the opposition parties during their propaganda blamed some corruption in the procurement processes, citing that the bid has not been offered to the lowest bidder without considering the factors of prior experience and technical capacity."*

Another challenge in Sri Lankan PPPs that could result from the above two challenges in the Diminished Investor Confidence. R2 mentioned that the economic crisis and the Sri Lankan reputation for less transparency has reduced the overall confidence of the investors, and they are predominantly reluctant to partner with the public sector. R5 agreed with this statement, adding that corruption could also be a significant contributing factor to this.

High Bureaucracy and the Complexity of Approval Processes for PPPs are also considered as a significant challenge by the experts. R1 stated, *"If we are to launch a project, we must get so many approvals for various government agencies"*. R7 added to this, *"Sometimes, even we don't know how many agencies are there to get approval from, and sometimes our proposal will get rejected or we have to repeat the entire process, just because the decision-makers decide that our proposal should be approved from a new agency, that may not even have been in the process earlier"*. Similarly, R2 stated that it is very difficult to do business with the public sector for a private company, due to the high level of bureaucracy and fragmentation involved. He stated, *"As a private company we must safeguard our reputation as a customer-friendly organization. However, if we are to partner with the government, we will have to stick to their rigid system and processes, and we end up ruining our reputation with the customers. This was mainly because of delays created by the complex processes of government."* R3, R5, and R7 also mentioned a similar situation when working with the government.

This led to another key barrier put forward by R1, which is the Lack of Co-ordination among the Stakeholders involved. R7 also mentioned that *"The complex processes in the government side have made the communication among the stakeholders difficult and it has led to lack of co-ordination among them, which could also lead to less trust"*. A similar perception was provided by R1 as well.

Another challenge prevalent regarding the government is Political Instability. The constant change of power resulted in continuous alteration of the policy directions, often resulting in the abrupt halt of PPP endeavours. While R5 vaguely mentioned this, R3 was very critical towards this barrier. R3 noted that there is no continuity or long-term plan for PPP in Sri Lanka, mainly because of this constant see-saw of power. He also lamented

that the segregated efforts and institutions created by the different parties in power have resulted in personnel with no continuous exposure to PPP or experience working over a full project lifecycle.

Another key challenge that was cited as significant is the Lack of Legal or Regulatory Framework for PPPs in Sri Lanka. This was a considerable challenge for R1, as he mentioned, *"Since there is no legal demarcation of what PPP is and what it constitutes, there are so many discrepancies among the proposed projects. Some projects are not even a PPP in actuality but are considered as PPP due to its lack of definition and legal demarcation."* He also mentioned about the intellectual property rights of private partners, specifically during the unsolicited proposals. Since the proposals will be circulated among several entities, he stressed the importance of securing the private partner's intellectual property rights. According to him, it will encourage the private partners to partner with the government without much worry. Similarly, R6 and R7 also mentioned this as a significant challenge. R6 cited the absence of legal or regulatory frameworks for PPP as a significant hindrance to appraising and progressing novel PPP arrangements without any delays.

Going on the same thought, experts also pointed out the Lack of Guidelines for PPP as one of the significant barriers to PPP in Sri Lanka. R1 revealed, *"The absence of clear framework and guidelines for PPP has resulted in professionals and public sector officials having no idea on their roles and responsibilities in a PPP project"*. He rigorously recommended forming laws and government documents containing guidelines for carrying out PPP projects in Sri Lanka. R6 vehemently blamed the outdated guidelines prevalent in the Sri Lankan public sector. He mentioned, *"the guidelines followed by the government were created in 1998 with an amendment in 2006, which is way outdated compared to the current systems in other countries. In fact, the 1998 guideline does not even have the word PPP, but we use it for PPP procurements. This is highly disadvantageous, given the need for innovative PPP mechanisms to cater for the current infrastructure needs in Sri Lanka amidst its economic crisis."* R7 mentioned this lack of guidelines as a contributing factor towards corruption since R7 viewed corruption breeds if processes are not backed by strong legal cover or guidelines.

This lack of guidelines for PPP leads to another challenge for Sri Lankan PPPs, which is the Lack of Awareness or Knowledge on PPP projects. R2 asserted that the lack of awareness of PPP, even among government officials, has made it difficult for private companies to partner with them. *"I think, since they (government officials) do not have much awareness or knowledge on PPPs, they tend to view us (private partner) as more a contractor than a partner. The idea of working together towards a common goal is not there with them."* He also mentioned that *"there are lots of last-minute changes in the procedures since the government officials themselves do not have much idea on PPP processes. This was exceedingly difficult for us since sometimes it damages our reputation with the customer."* Additionally, R3 and R6 blamed that most of the government officials do not possess adequate knowledge of PPP. For R3, *"this was highly unfavourable to the public sector, because the private sector usually comes up with innovative PPP arrangements and project types, to which the public sector is not ready to fit in, due to the lack of knowledge and awareness"*. He even blamed that some of the top-level personnel in the monitoring institutions for PPP in Sri Lanka do not have prior experience or knowledge on PPP. R6 mentioned that *"None of the government officials have proper knowledge or know-how of PPPs. Because of this, they think PPP is complex*

and takes up a lot of resources and time. Hence, they are reluctant towards going for a PPP and discourage it most of the time." R1 and R3 proposed awareness programs, books, and educational programs for concerned professionals from the private and public sectors. R1 contemplated the possibility of tertiary educational programs for the relevant professionals and PPP being included in the undergraduate curriculums of the appropriate professions.

This led to the emergence of another challenge: the Lack of PPP Experts in Sri Lanka. R3 mentioned, *"There are no strong personnel in both government and private sector to initiate a rigid PPP mechanism and proceed with it. Especially when we talk about innovative mechanisms, it is really difficult to find relevant people in Sri Lanka."* Similarly, R6 stated, *"The situation in the Sri Lankan PPP sector is worrying because it is really hard to find at least one expert who has adequate knowledge and experience in working for the entirety of a PPP lifecycle"*.

In a different domain, R1, R3, and R5 referred to the Difficulty in obtaining Adequate Long-term Financing as another critical challenge in the Sri Lankan PPP sector. According to them, the current economic crisis and Sri Lanka's history of abruptly halting projects and partnerships for political reasons have diminished investor confidence, making it difficult for the public sector to source financing. R5 mentioned that *"PPPs require long-term financing and that cannot be brought in by a single partner. Most of the time it will be difficult. So, obtaining long-term financing is a concern."* Also, R3 stated, *"In times when the government must fund a part of the project, they will fund it for a while and once they ran into any financial issues, they will say that they can't fund the project anymore. This will create an unforeseen burden on the private partner and diminish the confidence they have in the government."* Similar thoughts were shared by R1 as well.

Another key challenge discussed by the experts is the Lack of Return on Investment (ROI) for PPP projects in Sri Lanka. For R4, it would be very difficult in Sri Lanka to make the project profitable only from the tariffs collected by the services provided, to which R5 added the recent tax increases contribute even more. R4 mentioned that *"it would take at least 20-30 years to recover the investment, which is even more uncertain, given the political and financial dynamics of the country"*. He also proposed that the government provide some sort of financial relief for private partners in this context, which would encourage them to partner with the government.

The last challenge discussed by the experts is the Lack of Financial and Technical Capacities in Sri Lanka. While a part of it is already discussed from the perspective of government institutions, this challenge is based on the private sector. R4 mentioned *"Most of the contractors in Sri Lanka do not possess the adequate financial or technical capacity to carry out a major PPP development. Even in our case, we partnered with four other major construction companies in Sri Lanka to create a joint venture, with which we bid for the project."* This emphasizes Sri Lankan contractors' lack of technical or financial capacity to face the technical challenges of PPPs head-on. R5 agreed with this and added that even the local banks, as standalone entities, may find it challenging to provide such a significant long-term funding project, signifying local stakeholders' lack of financial capacity.

3.3 RESULTS FROM THE SENTIMENT ANALYSIS

Subsequently, a sentiment analysis was conducted on each challenge of PPP identified from the interviews and their descriptions provided by the experts. The aggregated and average negativity scores of each PPP challenge, resulted from the sentiment analysis on their descriptions have been tabulated in Table 2.

Table 2: Results of the sentiment analysis

PPP Challenge	Aggregated negativity score	Average negativity score
Lack of Legal/Regulatory frameworks and guidelines for PPPs	3.837	0.959
Political Interference and Resistance	2.964	0.988
Lack of transparency and corruption	3.923	0.981
Lack of adequate financial and technical capacities	3.987	0.997
Lack of co-ordination among stakeholders	0.998	0.998
High Bureaucracy	2.987	0.996
Lack of awareness and knowledge on PPPs	2.998	0.999
Lack of experts in PPPs	1.998	0.999
Suppressed ROI	2.974	0.991
Political Instability	1.934	0.967

4. DISCUSSION

Several challenges were put forward by the experts during the interview that hinder the performance of Sri Lankan PPPs. From the interviews, it was identified that challenges like lack of transparency and corruption, lack of legal/regulatory frameworks and guidelines for PPPs, and lack of adequate technical and financial capacities are more pressing issues. These were also mirrored in the results of the sentiment analysis, with lack of adequate financial and technical capacities having the highest aggregated negativity score among the challenges (3.987), closely followed by lack of transparency and corruption (3.923). These were also cited in articles such as Weththasinghe et al., (2016) and Wellsteed et al. (2019). These perceptions could also be the results of the economic crisis and ensuing fiasco of successive governments in recovering the economy, further fuelled by high level of corruption. As a consequent, it was learned that the above challenges discourage genuine and strong private partners from partnering with the government.

Tackling the above challenges would attract strong local and foreign partners, which would in turn, address other critical challenges regarding experts (1.998), suppressed ROI (2.974), awareness and knowledge (2.998) etc. Hence, by consulting with the experts, it is essential to address these critical challenges head-on, which will automatically nullify others. In addition, challenges such as bureaucracy, political interference and resistance, and political instability are mostly out of the hands of researchers or practitioners and for them to pacify, the current chaos in the macro-economic and political conditions of the country needs to be dealt with. Thus, it is more pragmatic to address the above-mentioned critical issues of PPP head-on, for the successful implementation of PPPs in Sri Lanka.

Another notable aspect from the results of sentiment analysis as observed from Table 2 is that, while the negativity scores were given for each sentence against 1, the average negativity scores of all the challenges traverse around 0.9, which suggests that while one challenge maybe relatively critical than the other, they all are equally important to be addressed as soon as possible.

Additionally, it is professed in this study that using BERT for Sentiment Analysis could be a viable method to quantify the qualitative results obtained from interviews, especially in cases where the data available are not adequate to conduct statistically sound quantitative analyses. As it was showed in Section 3.1, the number of respondents were seven, with having a total number of responses as challenges and their corresponding descriptions as 30. Such a lower number of responses will not be able to yield any statistically significant quantitative results. However, having a qualitative result, bolstered by a quantitative result, even less accurate would furnish the readers with actual impact of these challenges and how critical they are, according to experts.

Although with certain limitations as it would be discussed in the proceeding section, using a pre-trained model like BERT for sentiment analysis will eliminate several such limitations as its ability to understand complex sentences, relatively better grasp of context and ability to read sentences in both the directions, i.e. left-to-right and right-to-left. It should also be noted that a previous analysis was conducted by using lexicon-based approaches as well during the study. However, the results were not pertinent, with certain sentences with obvious negativity were given drastically lower scores. Hence, this would advocate BERT as a suitable tool for studies that struggle to quantify qualitative results, especially in cases like challenges, benefits, and applicability, to produce more refined results in addition to qualitative results. However, attention should be given to treat the results of sentiment analysis as a support and validation to the qualitative results, and not use it primarily to derive at conclusions, since they are merely the results of NLP which depends on several factors like the adopted model and richness of the data, and does not yield statistically significant results when compared to traditional statistical methods used in quantitative approaches.

5. CONCLUSION

It has been identified from this study that Sri Lankan PPPs are being plagued by several challenges such as High Bureaucracy, Political Instability, Lack of Experts, and Lack of Co-ordination among Stakeholders, amidst any others. Among them, it was identified from the sentiment analysis that Lack of Adequate Financial and Technical Capacities, Lack of Transparency and Corruption, and Lack of Legal/Regulatory Frameworks for PPPs are the most pressing issues that need to be addressed. However, the average negativity scores indicate that all the identified challenges are critical and needs to be dealt with head-on. Nevertheless, the interview results also indicate that addressing the former three challenges would automatically address several others like High Bureaucracy, Lack of PPP Experts and Suppressed ROI. Also, certain barriers demand system changes and stabilization of the country's economy which would linger for a while.

Albeit with certain limitations, this study also proposes and succeeds in using sentiment analysis as a partial substitute for statistical analysis in cases where the number of

responses are restricted by contexts and circumstances. It could be used in future studies that require quantitative analysis but unable to do so due to inadequate data.

5.1 LIMITATIONS AND FUTURE DIRECTIONS

The key limitations of the study remain in the results of the sentiment analysis, which are predominantly inherent to the method itself. The analysis was done using the pre-trained BERT model, which, though powerful, may lack in-depth knowledge on the context of PPPs and Sri Lanka. Furthermore, the data fed to the model were from the interview results done by people whose native language is not English, whereas the adopted model conducts its analysis in English. This may have compromised the accuracy of the results to an extent since the interviewees may have missed to use appropriate words to convey their sentiment. Hence, the results should only be used as a guide to bolster the interview results and not as a stand-alone result to derive at deep conclusions.

Going forward, studies based on quantitative approaches and case studies are recommended to validate the findings of this study, while empirical studies to assess the suitability of sentiment analysis to interpret data stemming from complex interview questions and developing a domain-specific model that could be adopted in studies of this sort are also encouraged.

6. ACKNOWLEDGEMENT

The writing of this paper is funded by the ARC Centre for Next-Gen Architectural Manufacturing.

7. DATA AVAILABILITY STATEMENT

The interview transcripts and codes used for the analysis will be made available upon request.

8. REFERENCES

Aerts, G., Grage, T., Dooms, M., & Haezendonck, E. (2014). Public-private partnerships for the provision of port infrastructure: An explorative multi-actor perspective on critical success factors. *Asian Journal of Shipping and Logistics, 30*(3), 273–298. https://doi.org/10.1016/j.ajsl.2014.12.002

Bao, F., Chen, C., Martek, I., Chan, A. P. C., & Jiang, W. (2023). Factors underpinning the successful return of public–private partnership projects to public authority: Assessing the critical success factors of the transfer phase of Chinese water projects. *Journal of Infrastructure Systems*, *29*(2), 04023015. https://doi.org/10.1061/jitse4.iseng-2084

Chandra, R., Zhu, B., Fang, Q., & Shinjikashvili, E. (2024). Large language models for sentiment analysis of newspaper articles during COVID-19: The guardian. *Applied Soft Computing*, *171*, 112743. https://doi.org/10.1016/j.asoc.2025.112743

Cicekyurt, E., & Bakal, G. (2025). Enhancing sentiment analysis in stock market tweets through BERT-based knowledge transfer, *Computational Economics,* 10901. https://doi.org/10.1007/s10614-025-10901-8

D'Andrea, A., Ferri, F., Grifoni, P., & Guzzo, T. (2015). Approaches, tools and applications for sentiment analysis implementation. *International Journal of Computer Applications*, *125*(3), 26–33. https://doi.org/10.5120/ijca2015905866

Dabarera, G. K. M., Perera, B. A. K. S., & Rodrigo, M. N. N. (2019). Suitability of public-private-partnership procurement method for road projects in Sri Lanka. *Built Environment Project and Asset Management*, *9*(2), 199–213. https://doi.org/10.1108/BEPAM-01-2018-0007

Devlin, J., Chang, M. W., Lee, K., & Toutanova, K. (2019). BERT: Pre-training of deep bidirectional transformers for language understanding. In J. Burstein., C. Doran., & T. Solorio (Eds.), *Proceedings of the 2019 Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies, Volume 1* (pp.4171–4186). Association for computational linguistics. https://doi.org/10.18653/v1/N19-1423

Eshun, B. T. B., Chan, A. P. C., & Osei-Kyei, R. (2021). Conceptualizing a win-win scenario in public-private partnerships: Evidence from a systematic literature review. *Engineering Construction And Architectural Management*, *28*(9), 2712–2735. https://doi.org/10.1108/ECAM-07-2020-0533

Fernando, P. G., Kulatunga, U., Thayaparan, M., & Hadiwattege, C. (2025). Reforming legal and regulatory structure of public–private partnerships in Sri Lanka. *Built Environment Project and Asset Management*, *15*(2), 211-227. https://doi.org/10.1108/BEPAM-05-2024-0139

Gatto, A. J., Elliott, T. J., Briganti, J. S., Stamper, M. J., Porter, N. D., Brown, A. M., Harden, S. M., Cooper, L. D., & Dunsmore, J. C. (2022). Development and feasibility of an online brief emotion regulation training (BERT) program for emerging adults. *Frontiers in Public Health*, *10*. https://doi.org/10.3389/fpubh.2022.858370.

Hirusheekesan, S. & Satanarachchi, N. N. (2021). Assessing the applicability of lean construction techniques in Sri Lankan construction sector. In N. Ekanayaka & A. Weerasooriya (Eds.), *Young Members' Technical Conference - 2021*, (pp.238 - 244). Institute of Engineers, Sri Lanka.

Jayasinha, U., Abeyanayake, S., Arangala, M., & Mushin, N. (2021). *Opportunities to protect public interest in public infrastructure : Review of regulatory frameworks in Sri Lanka*. Verite Research. Retrieved from https://www.veriteresearch.org/publication/opportunities-to-protect-public-interest-in-public-infrastructure-feb-2021/

Kavinda, S. A. C., & Gallage, S. D. (2024). Challenges for project selection and execution of public-private partnership projects in Sri Lanka. In Y. G. Sandanayake, K. G. A. S. Waidyasekara, K. A. T. O. Ranadewa, & H. Chandanie, (Eds.), *Proceedings of the 12th world construction symposium* (pp. 353-364). https://doi.org/10.31705/WCS.2024.28.

Kim, T., Lee, S. J., & Pradeep, M. (2019). Strengthening public-private partnership in Sri Lanka's infrastructure development project: The Colombo port case. *Asian International Studies Review*, *20*(1), 91–120. https://doi.org/10.16934/isr.20.1.201906.91

Lee, W., & Lee, S. (2024). Development of a knowledge base for construction risk assessments using BERT and graph models. *Buildings*, *14*(11), 3359. https://doi.org/10.3390/buildings14113359

Lembo, C., Fioravanti, R., Astesiano, G., Lohbauer, R., Barata, R., & Rosset, N. (2019*). Fundamental principles in PPP laws: A review of Latin America and the Caribbean.* Inter American Development Bank. https://doi.org/10.18235/0001694

Mushtaq, N., Ali, G., Muhammad, D., Malik, K., & Bukhari, A. (2025). BERT applications in natural language processing: A review. *Artificial Intelligence Review*, *58*, 166. https://doi.org/10.1007/s10462-025-11162-5

Perski, O., Blandford, A., Ubhi, H. K., West, R., & Michie, S. (2017). Smokers' and drinkers' choice of smartphone applications and expectations of engagement: A think-aloud and interview study. *BMC Medical Informatics and Decision Making*, *17*(1). https://doi.org/10.1186/s12911-017-0422-8

Ramezani, E. B. (2025). Sentiment analysis applications using deep learning advancements in social networks : A systematic review. *Neurocomputing*, *634*, 129862. https://doi.org/10.1016/j.neucom.2025.129862

Samal, B. R., Behera, A. K., & Panda, M. (2017). Performance analysis of supervised machine learning techniques for sentiment analysis. *Proceedings of 2017 3rd IEEE international conference on sensing, signal processing and security*, (pp. 128–133). IEEE. https://doi.org/10.1109/SSPS.2017.8071579

Sehgal, R., & Dubey, A. M. (2019). Identification of critical success factors for public–private partnership projects. *Journal of Public Affairs*, *19*(4), 1956. https://doi.org/10.1002/pa.1956

Tao, F., Wang, W., & Lu, R. (2025). A deep learning-based sentiment flow analysis model for predicting financial risk of listed companies. *Engineering Applications of Artificial Intelligence*, *150*, 110522. https://doi.org/10.1016/j.engappai.2025.110522

Thennakoon, P. N., Jayasena, S., Rathnasinghe, A. P., & Ekanayake, A. (2025). Regulatory framework for unsolicited PPPs in infrastructure developments: Barriers and strategies. *Construction Innovation*, Vol. ahead-of-print No. ahead-of-print. https://doi.org/10.1108/CI-08-2024-0257

Vale de Paula, P., Cunha Marques, R., & Gonçalves, J. M. (2025). Public–private partnerships in urban regeneration projects: The Italian context and the case of "porta a mare" in Livorno. *Buildings*, *15*(5), 1–22. https://doi.org/10.3390/buildings15050702

Wellsteed, A., Obias, P., Hauck, L., Hong, H., Kilroy, G., Gamo, N., Tirona, A., Ramos-Galacgac, C. G., & Garganta, I. (2019). *ADB support for public–private partnerships, 2009–2019*. Asian Development Bank. https://www.adb.org/documents/adb-support-public-private-partnerships-2009-2019

Weththasinghe, K., Gajendran, T., & Brewer, G. (2016). Barriers in proper implementation of public private partnerships (PPP) in Sri Lanka. In N. Singhaputtangkul (Ed.), *The 40th Australian universities building education association (AUBEA) 2016 conference*, (pp. 858-869). Central Queensland university.

World Bank. (2014). *Public-private partnerships reference guide V 3.0 (Vol. 2)*. www.pppnetwork.com

Xie, T., Ge, Y., Xu, Q., & Chen, S. (2023). Public awareness and sentiment analysis of COVID-related discussions using BERT-based infoveillance. *AI*, *4*(1), 333–347. https://doi.org/10.3390/ai4010016