

Public Procurement Procedure and Project Implementation for the Digital Age: A Sri Lankan Perspective

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Abstract: Procurement of information systems (IS) is a complex process since they could range from off-the-shelf standard products to highly customized systems. The dynamic nature and rapid development in the IS sector often make their procurement to be incompatible with the traditional red tapes and the procedural approach in public procurement methods. This study focuses on identifying the gaps between the two domains and the ways to overcome the challenges with the aim of making necessary recommendations to public IS procurement processes. The Modified Delphi method is adopted as the primary research technique. In the first Delphi round, interviews were conducted with a selected portion of an expert panel. Interview questions were formulated using problems identified by conducting a literature survey. Expert opinions on the solutions to the listed problems and issues they encountered in their careers, were then formulated into a close-ended questionnaire for the second Delphi round in which the entire panel of experts generated a set of recommendations to overcome challenges identified in the first Delphi round. The recommendations were categorized under tender specifications, bid-evaluation criteria, government regulations, project management, collaboration among procurers and bidders, and competence of procurers. The recommendations were ranked and listed based on their level of importance for presentation. The findings of this research can be adopted to improve the existing

public procurement procedure and project implementation in the IS domain.

Keywords: Public procurement, Information systems, Delphi method

1. Introduction

An increasing number of e-governance projects are implemented in developing countries that promise greater efficiency in public sector activities. However, 35% of these projects are total failures, 50% are partial failures, and only 15% are successful (Heeks, 2003). These failures result in high, direct and indirect costs to the world's poor countries (Twizeyimana and Andersson, 2019). It has been identified that making improvements in ICT infrastructure can help avoid failure in e-governance implementation (Napitipulu et al., 2018). However, as very few public entities can develop their own solutions, public procurement is the primary method of acquiring ICT infrastructure for the public sector (Moe, 2014). Meanwhile, acquisition of information systems has proved to be challenging due to its complex nature (Moe, Newman, and Sein, 2017). Therefore, using a complex process like public procurement to purchase such systems has made public procurement of information systems an area that requires further research (Moe, 2014). Studies conducted in several countries have helped identify the challenges stakeholders face in the public procurement of IS. For example, procuring entities face the challenge of developing clear, uncomplicated, and precise requirements (Ziemba and Oblak, 2013).

However, receiving detailed specifications limits the supplier's opportunity to show quality, as suppliers are compelled to operate in an unyielding environment (Riihimaki and Pekkola, 2021). Additionally, public institutes find it difficult to procure a complex information system under the strict regulations that govern them (Moe, Newman and Sein, 2017) and such regulations make the procurement process complex and costly (Boonstra and Offenbeek, 2017). Poor change management, poor risk management, lack of top management support, lack of a project management methodology, and low competence of procurers are also identified as challenges related to public procurement of IS. (Allane et al., 2015; Obwegeser and Muller, 2018).

Nevertheless, there is a lack of research in identifying solutions to overcome the challenges stakeholders face in the public procurement of IS. Moreover, existing research in this area is from studies conducted in other countries. Therefore, it is imperative to identify whether the public procurement of IS in Sri Lanka also faces similar challenges as in other countries, and recommendations should be made to overcome such challenges. Therefore, the following research problem will be addressed in this research.

What are the recommendations to overcome the challenges in the existing public procurement procedure of information systems?

A. Research Objectives

The following will be the objectives achieved in this research to address the above research problem.

- i. To find similarities between the challenges faced globally and locally in the public procurement of information systems.
- ii. To identify the recommendations to overcome the challenges in the existing public procurement of information systems.

- iii. To weigh and prioritize the identified recommendations to improve their practical value.

2. Methodology and Experimental Design

The nature of the research topic called for a research method that can evaluate opinions of experts on the public procurement of IS. The Delphi method has the key characteristics of anonymity, the use of an expert panel, and controlled feedback. It is built on the basis that there is more validity to a group opinion than to an individual opinion. Furthermore, the Delphi technique intends to achieve consensus among a set of experts on an issue where no agreement has previously existed (Keeney, Hasson and Mckenna, 2010). In addition, it is a common modification of Delphi to use a structured questionnaire as the first round after an extensive study of literature (Hsu and Sanford, 2007). Considering the limited resources at hand, this Modified-Delphi technique was used as the primary research method in this study.

A. First Delphi Round/ Pre-survey

First, a comprehensive literature survey on the existing studies identified the problems procuring entities and bidders face in the procurement of IS for the public sector. As all the literature sources were from foreign studies, a pre-survey for the research was formulated to identify whether the same problems and factors also affect public procurement of IS in Sri Lanka. This pre-survey was also used as the first Delphi round. It was conducted through interviews with standardized open-ended questions using only a selected portion of the expert Delphi panel. Questions were designed in such a manner that,

- i. Experts had to talk about their level of experience.
- ii. Experts had to brainstorm and identify limitations in the existing public procurement procedures and mention preferred changes.

- iii. Experts were guided to identify problems faced under different aspects of public procurement of ICT infrastructure as identified through the literature survey, namely, tender specifications (TS), bid-evaluation criteria (BEC), government regulations (GR), collaboration among procurers and bidders (CAPB), project management (PM) and competence of procurers (COP). Thereafter, they had to come up with recommendations to overcome the problems faced under each category.
- iv. If the experts had encountered partial or total failure in projects they had done, they had to identify the reasons behind.

Pre survey and the first Delphi round were combined due to two reasons. The first reason being highlighting the problems and simultaneously asking for solutions proved to be effective. It was understood that it was an excellent platform to motivate the experts to brainstorm and produce solutions to the problems listed in the interview questions. Experts tended to express their ideas about possible solutions to the listed problems even before they were expected to do so. The second reason is to avoid panellists becoming frustrated and distracted due to being asked to comment on a similar topic multiple times. Doing so might make them lose interest in participating and view research-related activities as a waste of time. After a qualitative analysis, the recommendations generated in round 01 were used to formulate the questionnaire for Delphi round 02.

B. Second Delphi Round

The questionnaire was designed under the main categories identified through the literature survey. There were another five questions under the "General" category to understand the general perspective of the experts. Recommendations given by the experts in Delphi round 01 to

overcome challenges were listed under each main category. There were 36 recommendations in total in the final questionnaire and it was electronically distributed among the entire panel of experts. Responses to these recommendations were gathered using a five-point Likert scale from strongly disagree to strongly agree. The level of consensus was pre-defined at 70% and was identified as a solid cut-off point (McKenna, Hasson and Smith, 2002). Delphi rounds were concluded after two rounds due to time constraints and practical research limitations. Subsequently, data analysis was done to draw conclusions.

C. Target Population

The expert Delphi panel was selected from procurers, bidders, and auditors involved in the public procurement of IS. Individuals from all three groups must be experts in their subject areas. Therefore, individuals who have done IS procurement projects in the public sector, for at least five years and having work experience with a minimum of five IS procurement projects, were considered the target population. However, auditors were removed from the research sample of the second Delphi round due to lack of expertise in the research area.

D. Sampling Size

The Delphi technique uses a panel of experts, which is not a random sample representing the target population (Keeney, Hasson and McKenna, 2010). In the first Delphi round, face-to-face interviews were conducted with five procurers, five bidders, and four auditors. Fourteen interviews were conducted altogether. In the second Delphi round, the questionnaire was electronically distributed among a panel of 48 experts with 24 procurers and 24 bidders.

3. Results

A. Results of the First Delphi Round/ Pre-survey

Except for two challenges, experts agreed that they had faced similar ones to those identified in

the literature survey. Further, thirty-six recommendations in total were generated through qualitative analysis of the interview data. These recommendations were used to prepare the questionnaire for the second Delphi round.

B. Results of the Second Delphi Round

Researchers received 43 responses after two email reminder rounds and several reminders through telephone to some participants. There were 21 responses from public sector employees and 22 responses from private sector employees. Data cleansing was performed to verify the accuracy of the data. The data cleansing process was done manually, and three responses had to be removed after detecting random answers given to the two redundant questions. After the data cleansing process, the data set was reduced to 40 responses, where 19 responses were from experts from procuring entities, and 21 were from experts from private sector bidding companies.

1) Level of Consensus: After inserting the data into SPSS, frequencies were run on the data set to determine the percentage of responses received under the Likert scale for each recommendation. This was done to identify the recommendations that have reached the 70% level of consensus after the second Delphi round. 26 out of the 36 recommendations achieved a 70% consensus in round 2. Five more recommendations achieved a consensus of more than 65%. Only five statements out of 36 failed to reach at least a 65% consensus. The recommendations that achieved at least a 70% level of consensus are listed in Table 1. The recommendations that failed to achieve at least a 70% level of consensus at the end of the second Delphi round are listed in Table 2.

2) Importance Ranking: The identified recommendations which achieved consensus had to be ranked according to their importance

to achieve one of the research objectives. The mean of each recommendation was calculated using SPSS to rank them from most important to least important. In the instances where two recommendations had the same mean, they were ranked according to the order of standard deviation as presented in Table 1.

3) Inter Group Comparison: Experts from the public sector procuring entities and experts from the private sector bidding companies participated in this survey. Therefore, it was beneficial to identify significant differences between the two groups when responding to and ranking each recommendation. Therefore, responses of each group were compared under the main categories General, TS, BEC, GR, PM, CAPB, and COP. The Mann-Whitney U test was used to identify significant differences between the way procurers and bidders responded to each recommendation. The significance level used in the Mann-Whitney U test was 0.05. If the test result was less than 0.05, it was decided that there was a significant difference between the two groups.

According to the results obtained in the Mann-Whitney U tests, there was no significant difference of opinion between the two groups in the General, TS, BEC, PM and COP categories. However, there was a significant difference between the way the two groups responded to a recommendation under Government Regulations; "Implementing an e-procurement system will facilitate both parties to use technology such as using email instead of sealed envelopes and e-payments instead of traditional payment methods". Mann-Whitney U test outcome of SPSS is as shown below. The mean rank of bidders is 26.4, while the mean rank of procurers is 13.97. Therefore, bidders rated this recommendation more favourably than procurers. ($p= 0.000$).

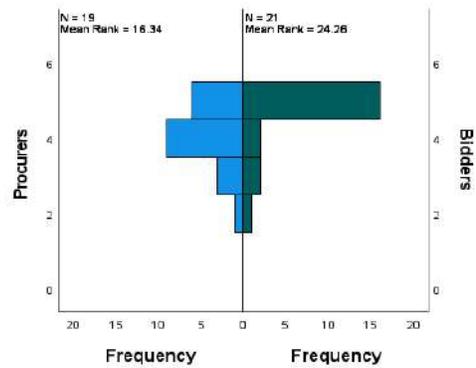


Figure 1. Mann-Whitney U Test outcome of SPSS
Source: IBM SPSS Statistics

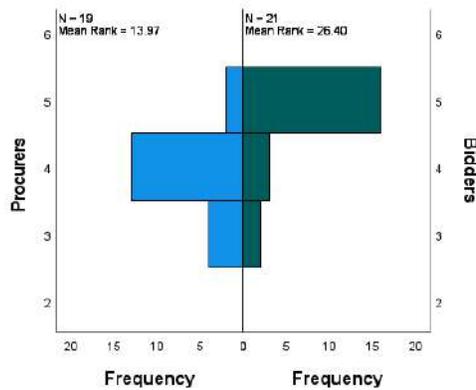


Figure 2. Mann-Whitney U Test outcome of SPSS
Source: IBM SPSS Statistics

Table 1: Recommendations that reached a 70% level of consensus ranked according to the importance

Rank	Recommendation	Category	Mean	Standard Deviation	Level of consensus
1	Procuring entity should complete a comprehensive feasibility study of the project, and necessary corrective measures should be implemented before the commencement of the tender process.	PM	4.65	0.533	97.5%
2	Large projects such as procurement and implementation of IS, should be well planned and carried out using a proven project management methodology from beginning to end.	PM	4.65	0.580	95%
3	Procurement of IS should be considered as projects with national interest, and necessary	General	4.58	0.636	92.5%

Rank	Recommendation	Category	Mean	Standard Deviation	Level of consensus
	legal regulations should be laid down to continue such projects regardless of changes in the governing political party.				
4	Due to the bureaucratic nature of the public sector, top management support and leadership is crucial for the successful implementation of IS projects.	PM	4.55	0.783	87.5%
5	The sustainability of the bidder should be addressed in the bid evaluation criteria.	BEC	4.50	0.816	90%
6	The two-stage bidding method is more suitable for procurement of complex IS, as the price bid is considered only upon completion of the technical evaluation.	BEC	4.43	0.747	90%
7	Potential users of a new system should be systematically guided to identify and present their requirements clearly and comprehensively.	COP	4.38	0.667	90%
8	In a straightforward IS procurement, publishing clear-cut functional and technical specifications at the beginning of the tender will ensure transparency and fair evaluation for all.	TS	4.38	0.774	87.5%
9	There should be at least two people with technical knowledge in a tender committee for the procurement of IS.	COP	4.38	0.952	77.5%
10	Strict regulations are mandatory in the public sector procurements to ensure transparency.	GR	4.35	0.802	85%
11	The Right to Information Act allows bidders to overcome ambiguities they have about the decisions taken during procurement.	CAPB	4.33	0.888	82.5%
12	Implementing an e-procurement system will facilitate both parties to use technology such as using email instead of sealed envelopes and e-payments instead of traditional payment methods.	GR	4.30	0.723	85%
13	If the provision is given to bidders to have a telephone conversation/email with a nominated person from the procuring entity to	CAPB	4.30	0.992	80%

Rank	Recommendation	Category	Mean	Standard Deviation	Level of consensus
	clarify unclear areas of a published tender, the appointed member of the procuring entity should maintain written records of any calls/emails received and points discussed				
14	In a complex IS procurement, doing a consultancy procurement upfront will aid the successful implementation of the rest of the project.	TS	4.23	0.8	87.5%
15	If bid evaluation of complex IS is done as a combination of quality and price (single-stage bidding), assign more weight to technical quality and less weight to price.	BEC	4.18	1.010	80%
16	If a tender committee member is given the provision to have a telephone conversation/email with a previously nominated person from the bidder to clarify unclear areas of a submitted bid, the said tender committee member should maintain written records of any telephone conversations/emails quoting discussed points and feedback received.	CAPB	4.18	1.130	75%
17	An IS procurement specialist knowledgeable in both IS and public procurement domains should be deployed to work with the internal procurement teams of public institutes.	COP	4.15	0.622	87.5%
18	Using well-known international standards and certifications of the industry to evaluate the service level of a bidder is useful.	BEC	4.13	0.723	85%
19	The procurement of complex IS should be addressed explicitly in the procurement guidelines to support the digital transformation of Sri Lanka.	General	4.13	0.911	75%
20	International standards requested in bid-evaluation criteria should be pre-approved to be used in the public sector IS procurements to prevent being biased towards a particular bidder.	BEC	4.10	0.778	85%
21	Apart from strong leadership, assigning an employee from the public sector entity, as the project champion to drive IS procurement	PM	4.08	1.071	75%

Rank	Recommendation	Category	Mean	Standard Deviation	Level of consensus
	projects will ensure the successful implementation of them.				
22	Letting bidders architect solutions to match the procuring entity's functional requirements will aid the procuring entity to identify the best solution for their requirements.	TS	4.05	0.876	70%
23	Public institutes with dedicated IT teams stand a better chance in successfully procuring and implementing complex IS projects.	COP	3.98	1.025	70%
24	If the procuring entity is expected to publish detailed functional and technical specifications at the commencement of the tender, they should be allowed to communicate with potential bidders upfront to get an idea about existing technologies.	TS	3.88	1.159	72.5%
25	The IS procurement specialists should be made liable for the successful implementation of the projects they are involved in.	COP	3.83	0.903	72.5%
26	In a complex IS procurement, the technical knowledge gap between bidder and procuring entity will be less, if the latter only publishes functional requirements and lets bidders architect solutions to match those requirements.	TS	3.80	0.966	70%

Table 2: Recommendations that did not reach a 70% consensus after the second Delphi round

	Recommendation	Level of consensus
1	Implementing an e-procurement system will facilitate international bidders to participate in a tender.	67.5%
2	In a complex IS procurement, publishing clear-cut functional and technical specifications at the commencement of the tender will limit bidders' opportunity to present the best solution available in the market.	67.5%
3	Procuring entities should justify the requirement of asking for each international standard.	67.5%
4	It will be useful if a bidder can have a telephone conversation/email with a previously nominated person from the procuring entity to clarify unclear areas of a published tender.	67.5%

	Recommendation	Level of consensus
5	Implementing an e-procurement system will ensure that government regulations are adhered to throughout the procurement process.	65%
6	It will be useful and timesaving if a tender committee member can have a telephone conversation/email with a previously nominated person from the bidder to clarify unclear areas of a submitted bid.	60%
7	It will be useful if a single entity in the government with IS procurement specialists can overlook all government IS procurement projects with national interest.	55%
8	The guidance provided by the existing public procurement guidelines is not sufficient for the procurement of information systems due to the intangible and volatile nature of IS	45%
9	Public procurement guidelines should be used as a guide only, and the procuring entity should not be restricted by the law if they can justify their decisions.	40%
10	The quality of the bidder is not a significant factor if the procured item is a "product", as manufacturers thoroughly test the products before releasing them to the market.	20%

Furthermore, there was a significant difference between how the two groups responded to a recommendation under Collaboration among procurers and bidders; "The Right to Information Act allows bidders to overcome ambiguities they have about the decisions taken during the procurement". Mann-Whitney U test outcome of SPSS is as shown below. The mean rank of bidders is 24.26, while the mean rank of procurers is 16.34. Therefore, bidders rated this recommendation more favourably than procurers. ($p= 0.031$).

4. Discussion

The main finding of this study is the 26 recommendations that were generated using the Delphi method. It is suggested to incorporate these recommendations into the existing public procurement procedure of IS. It was observed that the panel of experts gave more prominence to the recommendations related to project management, than to other recommendations under the main categories such as tender

specifications and bid-evaluation criteria. The importance of proper project management was highlighted by the participants of the face-to-face interviews while mentioning that many IS procurement activities in the public sector fail due to poor project management. However, ten out of the thirty-six recommendations did not achieve consensus at the end of the second Delphi round.

The recommendation, "The quality of the bidder is not a significant factor if the procured item is a "product", as manufacturers thoroughly test the products before releasing them to the market." reached the least level of consensus at 20%. Hence, quality of the bidder is considered an essential factor by both procurers and bidders regardless of the quality of the product. This could be due to the importance of the bidder's service level during the after-sales period. Further, the recommendation, "Procuring entity should not be restricted by the law if they can justify their decisions" reached only a 40% level of consensus. Therefore, most procurers and

bidders preferred clear guidance provided by the procurement guidelines to conduct the procurement process. Procurers may prefer clear guidelines so that they have clear directions to make decisions. It also gives them the ability to support their decisions hassle-free if such decisions are queried later. Bidders may prefer clear guidelines to prevent procurers from manipulating the procedure and granting undue advantage to a particular bidder.

There were recommendations stating that administering a communication method between tender committee members and bidders would be useful. Considering the responses, it was eminent that both procurers and bidders had ambiguity when communicating with each other regarding a published tender or a submitted bid. This might be due to the possibility of using such a provision to gain undue advantage by either party. Based on the agreement levels of 60% and 67.5%, we can consider that such provisions will be helpful for both parties during the procurement process and that the ambiguity of whether it will be used against them was preventing them from agreeing to those statements unanimously. This idea was further established because the consensus was achieved on the statements which mentioned that records should be kept by an appointed person for such communication.

The statement, "Single entity in the government with IS procurement specialists can overlook all government IS procurement projects with national interest" has reached only an agreement level of 55%, and there is no significant difference in the way procurers and bidders have responded to this statement. Therefore, it can be said that both procurers and bidders believe that the appropriate method to handle public procurement of IS is through the government entity that has the requirement. This may be because both procurers and bidders have experienced that the correct requirement can be gathered only through the actual entity that has

the requirement, rather than through an outside party.

Further, inter-group comparison between procurers and bidders implied that both groups did not have major disagreements about the way they responded to the recommendations except for two. Therefore, it could be concluded that both these groups saw the same issues as challenges in the public procurement of IS and may agree on the same recommendations if the procurement procedure is changed to make it more favourable for IS procurement.

The first recommendation with a disagreement is under the main category "Government Regulations", "Implementing an e-procurement system will facilitate both parties to use technology such as email instead of sealed envelopes and e-payments instead of traditional payment methods." It is noteworthy that bidders rated this recommendation more favourably than procurers. This depicts that bidders were ready to adopt an e-procurement system and considered it a better way to handle procurement procedures than the traditional method. Meanwhile, procurers may need encouragement and awareness-building to adapt to an e-procurement system.

The second recommendation which procurers and bidders rated in a significantly different manner is "The Right to Information Act allows bidders to overcome ambiguities they have about the decisions taken during procurement." under the main category "Collaboration among procurers and bidders". It was prominent that bidders rated this recommendation favourably than procurers. Therefore, it could be concluded that while bidders see it as an opportunity to clear ambiguities, procurers may see it as another cumbersome procedure to follow.

The group "auditors" had to be excluded from the second Delphi round as the researcher identified that they lacked specialized knowledge in auditing the procurement of IS during the face-to-face interviews. They were unable to answer the questions which were

focused on the procurement of IS. Therefore, it is recommended to provide auditors with specialized training to audit the public sector IS procurements. Doing so may prevent any irregularities during the procurement process and will effectively utilize public funds.

5. Conclusion

The recommendations presented in Table 1 has a high level of efficacy as they were generated by a panel of experts in the subject area. Hence, incorporating these recommendations into the existing public procurement procedure will make it more suitable for the procurement of IS. Furthermore, it was concluded that auditors require specialized training to audit public procurement of IS which will enable them to prevent irregularities and secure public funds. Furthermore, it will be useful to implement a method for procurers and bidders to communicate promptly to clarify unclear areas of a published tender or a submitted bid.

Providing e-procurement awareness sessions for procurers will increase their enthusiasm and encourage them to adopt e-procurement systems. As recommendations under project management were highly rated by both procurers and bidders, it is imperative to give more attention to the project management aspect of the public procurement of IS. It was also concluded that both procurers and bidders saw the same issues as challenges in public procurement of IS and may agree on the same recommendations if the procurement procedure is changed to make it more suitable for procurement of IS.

Due to the time constraints, the first Modified-Delphi round was conducted with a fraction of the Delphi panel. Future researchers can adopt the Classical Delphi Method using an open-ended questionnaire in the first round, distributed among the entire panel of experts. This method would generate more recommendations and provide better insight into the research question.

Further, the Delphi survey was conducted for only two rounds in this study due to time constraints and to prevent participant fatigue. Conducting one more round would allow more recommendations reach consensus and would allow experts to observe the responses of the rest, re-evaluate and compare their answers. It would also give the researcher an opportunity to analyse the stability of responses and understand how the expert panel worked towards consensus.

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