CITC GLOBAL
Construction in the 21st Century

The Thirteenth International Conference on Construction in the 21st Century (CITC-13)

Arnhem, The Netherlands| May 8 – 11, 2023

Impact of the Covid-19 Pandemic on the adoption of E-Procurement in the South African Construction Industry

Abimbola Windapo[1], Kgomotso Sekgoele[2], Mochelo Lefoka[3]

[1,2,3] Department of Construction Economics and Management, University of Cape Town, 7701, Rondebosch Cape Town, South Africa
abimbola.windapo@uct.ac.za

Abstract

The uptake of e-procurement in the South African construction industry (SACI) has been generally slow. The onset of the Covid-19 pandemic presented an opportunity for this to change due to the new ways of working that had to be adopted. The paper examines the drivers of adopting e-procurement in the SACI post the Covid-19 pandemic towards understanding the advances made by the industry in the wake of the pandemic. A literature review of the drivers of e-procurement was undertaken to develop a framework to guide the study. The study used a quantitative research approach employing a cross-sectional research design survey of respondents working for companies listed on the Construction Industry Development Board (cidb) Register of Contractors in data collection. The study utilizes descriptive statistics in determining the critical drivers of adopting e-procurement on construction projects before and after the Covid-19 pandemic. Despite previous studies indicating that e-procurement rates increased post-Covid-19, the study found that the pandemic does not significantly influence the adoption of e-procurement on projects in the SACI. It was also found that the key drivers responsible for adopting e-procurement on construction projects are 'improved flexibility' and 'improved response time of the procurement process', and 'reduction of paperwork within the contracting or client company'. Based on the findings, the study recommends increased flexibility of the procurement process to allow for adopting electronic means of procurement towards improving the competitiveness of the SACI and its currency.

Keywords

Competition, Covid-19, Digital procurement, Procurement, South African Construction Industry

1. Introduction

The early stages of procurement were based on traditional procurement, which was paper-based. Procurement adopted electronic systems such as Enterprise Resource Planning (ERP) to support it (UN, 2006). Electronic procurement, or e-procurement or supplier exchange, is the procurement of goods, services, and works through information technologies - such as ERP and Electronic Data Interchange (EDI) - that rely on the internet (Farzin & Nezhad, 2010, p.1). E-procurement includes e-tendering, e-catalogue, and e-payment; e-MRO, web-based ERP, e-sourcing, e-reverse auctioning and e-informing to the list of EP tools (Tran, Nguyen & Nazir, 2016).

Generally, the uptake of e-procurement has been slow. The percentage adoption rate of e-procurement in the SACI has been documented as being as low as 11% (Ibem & Laryea, 2015) - far lower than in other developing countries. The onset of the Covid-19 pandemic presented an opportunity for this to change due to the new ways of working that had to be adopted. As a result of the Covid-19 pandemic, a nationwide lockdown was enforced in SA, which meant that many people were restricted to their homes and places of work- excluding those deemed essential - could not operate during lockdown level 5 (Disaster Management Act no.57 of 2002, as amended, 2020). Additionally, people who were infected, or were in contact with those who had been infected, had to self-isolate. Olatunji et al. (2021) noted that the remote working required during the post Covid-19 period provides an opportune environment to support e-procurement adoption.

There are limited studies focused on the drivers of the adoption of e-procurement in the SACI. It is not known whether the onset of the Covid-19 pandemic and its resultant restrictions and lockdowns in SA necessitating remote work and telework in different industries' work practices- including the construction industry would drive the increased adoption of e-procurement in the SACI. Therefore, this research examines the drivers for adopting e-procurement and e-collaboration within the SACI and whether Covid-19 served as a driver to increased adoption of e-procurement in the SACI. The research hypothesizes that Covid-19 significantly influenced the adoption of e-procurement in the SACI.

The following sections provide an overview of the adoption of e-procurement in the construction industry and the drivers of its adoption. The research approach and methods used in data collection and analysis are outlined, followed by the presentation of the results, conclusion, and recommendations.

2. Overview of the level of adoption, drivers to the adoption of e-procurement in the construction industry

2. 1 Adoption of e-procurement in the construction industry

E-procurement adoption in the Construction industry has historically lagged behind other industries, which has been attributed to the sector's conservative nature when adopting new technology (Laryea & Ibem, 2014). Industries like ICT have a 70% adoption rate; the Electronic sector of the Manufacturing industry has an adoption rate of 52% for e-procurement (Batenberg, 2007). In developed countries, rates of e-procurement adoption are as high as 61.7% in Singapore (Teo, Lin & Lai, 2009); 48% among SMEs on the South coast of Massachusetts, USA (Gunasekaran et al., 2009). In a developing country like Nigeria, the use of e-procurement among construction stakeholders was reported as being as high as 69.5 % (Ibem et al., 2021).

A 2014 study reported that only 11% of SA construction professionals had used e-procurement (Ibem & Laryea, 2015). This compares unfavourably with available records of both the developing and developed countries. However, it is worth highlighting that since the figures on SA were captured in 2014, there could have been an increase in subsequent years. This is illustrated by how Nigerian respondents who used e-procurement for 1-5 years formed the most significant percentage of overall users in the study by Afolabi et al. (2019).

2. 2 Covid-19 and its Effect on digital transformation in the Construction Industry

Previous studies (Kudyba, 2020; Bikse et al., 2021; Rehman, Shafiq & Afzal, 2021) show that the onset of the Covid-19 pandemic accelerated the adoption of digital transformation, which had been going on for years but at a slow pace. In some countries, the Covid-19 pandemic acted as a driver of the adoption of digital technology. Researchers found that Covid-19 acted as a driver for the adoption of digital tools and processes such as BIM, cloud-based collaboration and virtual project management in the United Arab Emirates Construction industry (Rehman, Shafiq & Afzal, 2021) and digital solutions in Latvia, which grew by 10% between May to July 2020 compared to the previous year (Bikse et al., 2021). In contrast, Ebekozien and Aigbavboa (2021) found that digital technologies in the Nigerian construction industry during the pandemic were not as successful as those in developed countries. Similarly, Bikse et al. (2021) established that Latvian SMEs struggled to adapt to the changing economic climate by modernizing their processes and integrating digital transformation at the pace required. However, the pandemic inspired Nigerian construction stakeholders to reconsider using digital technologies (Ebekozien & Aigbavboa, 2021).

There were no studies conducted on the effect of the Covid-19 pandemic on digital transformation or the adoption of its associated technology, such as e-procurement in South Africa. Thus, it is worth investigating the drivers of e-procurement before the pandemic to understand the situation and gather data on how it compares post the onset of the pandemic.

2. 3 Drivers to the adoption of e-procurement

The results of a literature review examining the drivers of e-procurement in the construction industry are presented in Table 1.

Table 1. Drivers to the adoption of E-procurement obtained from Literature Review

Drivers of the adoption of E-procurement	Driver Category	Authors						No. of times cited
		Rankin, Chen and Christian (2006)	Laryea and Ibem (2014)	Ibem and Laryea (2015)	Ibem and Laryea (2017)	Eadie, Perera and Heaney (2010)	Li et al. (2015)	
D1_Reduce process, transaction and administrative cost	Technology and process level	X		X		X		3
D2_Reduce cycle times for process and transaction	Technology and process level	X		X		X		3
D3_Improve response, accuracy and flexibility of the process	Technology and process level	X				X		2
D4_Ease of use of technology	Technology and process level			X			X	2
D5_Reduces paperwork	Technology and process level	X		X				2
D6_Increase trust, reliability of the process	Technology and process level			X				1
D7_Improve quality of the process	Technology and process level					X		1
D8_ External pressure from business partners	External						X	1
D9_Enhanced inventory management	Project level					X		1
D10_Wider access to suppliers	Project level	X						1

The drivers of the adoption of e-procurement shown in Table 1 are distributed into categories such as Technology and process, Project, External, Individual and Company levels as defined by Yevu and Yu (2019) and Li et al. (2015). Though other studies, such as Eadie, Perera and Heaney (2010) and Ibem and Laryea (2015), also defined categories to split the drivers. However, there was no explanation of what the different categories meant. For example, there was a General category (Eadie et al., 2010) which had some diverse drivers that could be split into better-defined categories.

Table 1 illustrates that the Technology and process level category has the most drivers. This category describes the benefits e-procurement brings to the process of procuring projects (Yevu & Yu, 2019). The top five cited drivers are: reducing process, transaction and administrative costs; reducing cycle times for process and transaction; improving response, accuracy and flexibility of process; ease of use of technology and reducing paperwork (Rankin, Chen & Christian, 2006; Ibem & Laryea, 2015; Eadie et al., 2010; Li et al., 2015) and they fall within this category.

The categories with the second most drivers of e-procurement, as seen in Table 1, are the Company level and Project level categories. The Company level category also referred to as the Organizational category (Li et al., 2015), refers to drivers that inspire management to take up e-procurement (Yevu & Yu, 2019), and examples include gaining a competitive advantage' and compatibility of technology to the company goals, among others. The Project level category refers to the benefits that can be enjoyed (at the project level) when e-procurement is used (Yevu & Yu, 2019). Examples include archiving convenience and enhanced inventory management (Eadie et al., 2010). The description of the Project level drivers matches that given for the Technology and process level drivers, and the drivers identified in both categories appear to be benefits.

The categories with the third most drivers are External level and Individual level – each category had two drivers. The External category refers to drivers influenced by external bodies or organizations involved in promoting e-procurement (Yevu & Yu, 2019). Examples include external pressure from business partners and the availability of policies promoting e-procurement (Ibem & Laryea, 2015; Li et al., 2015). The Individual category refers to drivers

which describe how people are motivated to promote the adoption of e-procurement (Yevu & Yu, 2019), and examples include staff which is adaptable and keen to use technology and available staff expertise in technology systems (Ibem & Laryea, 2015; Li et al., 2015).

It can be deduced from the literature that the top drivers to the adoption of e-procurement as identified in the literature are: reduction of transaction, process and administrative cost; reduce cycle times for procurement processes and transactions; improve response, accuracy and flexibility of process; ease of use of the technology and reduced paperwork. However, the drivers do not include Covid-19, which is the focus of this research.

3. Research Methodology

The research adopts a quantitative approach because the research objective is based on the positivist philosophy. The study population consists of active construction organizations in South Africa listed in Grades 7 to 9 on the Construction Industry Development Board (cidb) Register of Contractors (RoC); this is because these companies are the ones with the most significant turnover and available capital and are thus the most likely to be able to afford e-procurement software. Table 2 shows the minimum turnover, minimum available capital and population numbers across Grades 7 to 9 on the cidb RoC.

Table 2. Details of active construction companies with cidb grade of between 7-9

Company grade level	Annual turnover	Available Capital	No. of active companies
7	R20 000 000	R4 000 000	1197
8	R65 000 000	R13 000 000	561
9	R200 000 000	R40 000 000	227
Total population			1985

Source: cidb (2022)

The research used the random sampling technique in selecting 322 active companies from the cidb RoC determined using the formula for calculating the sample size in Saunders, Lewis and Thornhill (2009). The research employed an online questionnaire survey in data collection because it offers convenient access to the respondents and is suitably aligned with the quantitative research approach and positivist philosophy adopted in the study. Seventy-five responses were received at the end of the survey period representing a response rate of 23.3% which is in line with the response received for the questionnaire in construction research of 20% - 30% (Akintoye & Fitzgerald, 2000).

The questionnaire sought to find out the profession, years of experience, highest education level and company location of the respondents, and the level of use of e-procurement before and after the onset of Covid-19 which required 'yes' and 'no' responses- as well as another two on whether Covid-19 caused an uptake in the use of e-procurement, and the drivers of e-procurement. Respondents expressed their perceptions about the influence of the identified drivers from the literature on adopting e-procurement using a 5-point Likert scale ranging from 1 (no influence) to 5 (strong influence).

Two methods of data analysis – descriptive and inferential statistics were used in analyzing the data collected. Types of descriptive statistics used were percentages and frequencies. The drivers were after that rated using the Mean Item Score (MIS) method of descriptive analysis (see Equation 1).

$$MIS = \frac{5M_5 + 4M_4 + 3M_3 + 2M_2 + 1M_1}{5 \times \left(M_5 + M_4 + M_3 + M_2 + M_1\right)} \quad (1)$$

Where M_5, M4, M_3, M_2 and M_1 are frequencies of the rating responses given to each driver.

The Cronbach's Alpha test was used to determine the level of reliability. The Cronbach Alpha test determines the level of internal consistency among individual responses to questions. A value of 0.7 or above indicates high reliability (Saunders, Lewis & Thornhill, 2009). Table 3 shows the Cronbach Alpha values for those scales and the number of items making up that scale. All Cronbach alpha values are above 0.7 and therefore indicate high reliability.

Table 3. The Cronbach Alpha reliability results for different scales

Scale	Cronbach's Alpha	Cronbach's Alpha based on standardized items	Number of items
Covid-19 influence on e-procurement adoption	0.864	0.881	2
EP drivers before Covid-19 onset	0.942	0.942	8
EP drivers after Covid-19 onset	0.953	0.953	8

In order to ensure construct validity, the questionnaire questions were formulated from a framework of drivers of e-procurement adoption developed from an extensive literature review. Ethics clearance has to be sought in accordance with the Ethics requirements for the Engineering and Built Environment faculty at the University of Cape Town. A pre-screening questionnaire was completed, establishing that full ethics clearance was needed for this study as it involved human participants. After submitting the required documents, ethics approval was granted for the research.

4. Data Presentation, Analysis and Discussion

4. 1 Background details of the respondents and the companies represented

The study sought to know the background details of the respondents and companies represented. The data collected shows that the highest percentage (49.33%) of respondents identified themselves as Contractors; the majority of respondents (31.88%) have more than 20 years of experience; and most respondents (34.78%) are holders of a diploma. Also, the highest number of respondents (34.78%) work for companies that are in the Gauteng province of South Africa, and the majority of the companies (44.93%) have an annual turnover of less than R20 million ($1.1 million).

4.2 Adoption of e-procurement before and after the onset of Covid-19

The study sought to know the level of use of e-procurement before and after the onset of Covid-19, and the data collected in this regard is presented in Table 4.

Table 4. E-procurement use before and after Covid-19.

Options	Yes	No	Total Response
E-procurement use before the onset of Covid-19	45.10% 23	54.90% 28	51
E-procurement use after the onset of Covid-19	60.78% 31	39.22% 20	51

The findings presented in Table 4 indicate that 45.10% of the respondents used e-procurement before the onset of Covid-19, and that figure rose to 60.78% after the onset of Covid-19.

4.3 Perceived Impact of Covid-19 on the adoption of e-procurement

The data shows that most respondents (42.86%) viewed that Covid-19 caused an increase in the adoption of e-procurement, with a lesser number (34.69%) viewing that it had no influence, in other words, the adoption of e-procurement stayed the same. In comparison, 22.45% of the respondents viewed that Covid-19 affected the adoption of e-procurement negatively.

4.4 Drivers impacting the adoption of e-procurement pre and post onset of Covid-19

The study sought the respondents' opinions on the drivers impacting the adoption of e-procurement pre and post onset of Covid-19. The data collected in this regard is rated on a scale of 1 to 5, where 1 = No Influence and 5 = Very High Influence and analyzed using the Mean Item Score presented in Tables 5 and 6, respectively.

The findings indicate in Table 5 that respondents perceived from a ranking perspective that the top four drivers influencing the adoption of e-procurement before the onset of Covid-19 are ‘improved flexibility’ and ‘improved response time’ of the procurement process, ‘Reduction in cycle times for processes and transaction’ and ‘reduction of paperwork within the contracting or client company’.

Table 5. Drivers of e-procurement adoption before the onset of Covid-19

E-procurement drivers before the onset of Covid-19	Influence of Driver					Total Response	Total Score	MIS Score	Rank
	Very Low	Low	Average	High	Very High				
Improved flexibility of the procurement process	8	6	10	5	4	33	90	0.545	1
Improved response time of the procurement process	10	5	11	5	3	34	88	0.518	2
Reduction in cycle times for processes and transaction	10	6	10	2	5	33	85	0.515	3
Reduction of paperwork within the contracting or client company	9	7	9	3	4	32	82	0.513	4
Improved accuracy of the procurement process	10	5	11	5	2	33	83	0.503	5
Availability of policies promoting e-procurement	10	6	10	4	3	33	83	0.503	5
Reduction in process, transaction and administrative cost	9	10	6	6	2	33	81	0.491	7
Ease of use of e-procurement technology	12	8	8	3	2	33	74	0.448	8

Table 6. Drivers of e-procurement adoption after the onset of Covid-19

E-procurement drivers after the onset of Covid-19	Influence of Driver					Total Response	Total Score	MIS Score	Rank
	Very Low	Low	Average	High	Very High				
Improved response time of the procurement process	9	5	3	5	5	27	79	0.585	1
Improved flexibility of the procurement process	7	6	4	4	6	27	77	0.570	2
Reduction of paperwork within the contracting or client company	9	4	5	0	9	27	77	0.570	2
Improved accuracy of the procurement process	10	6	3	2	5	26	70	0.538	4
Availability of policies promoting e-procurement	9	5	4	6	3	27	70	0.519	5
Reduction in cycle times for processes and transaction	10	5	4	5	3	27	67	0.496	6
Ease of use of e-procurement technology	12	3	3	5	4	27	67	0.496	7
Reduction in process, transaction and administrative cost	9	7	4	4	3	27	66	0.489	8

Table 6 indicates that from a ranking perspective, the respondents perceived that the drivers of e-procurement adoption after the onset of Covid 19 are ‘improved response time’, and ‘improved flexibility of the procurement process’,

‘reduction of paperwork within the contracting or client company’ and ‘improved accuracy of the procurement process.’

The data presented in Tables 5 and 6 show a similarity in the respondents' perception of the key drivers influencing the adoption of e-procurement on construction projects. The respondents were of the view that 'improved flexibility' and 'improved response time of the procurement process' are the two top drivers of the adoption of e-procurement before and after Covid-19, and ‘reduction of paperwork within the contracting or client company’, the only difference being in their ranking.

5. Discussion and findings

It emerged from the study that e-procurement adoption saw an increase from pre-Covid-19 figures. While 45.1% of the respondents stated that they used e-procurement before the onset of Covid-19, 60.7% used it after the onset of Covid-19. The last reported e-procurement adoption rate for the SA construction industry stood at 11%, based on data collected in 2004 (Ibem & Laryea, 2015), indicating an increase in its uptake. A similar study recently reported EP adoption in Nigeria at 69.5% (Ibem et al., 2021); thus, at 60.7%, SA is now comparable with other African countries.

Before the onset of Covid-19, respondents perceived from a ranking perspective that the drivers of e-procurement adoption after the onset of Covid 19 are ‘improved flexibility’ and ‘improved response time’ of the procurement process, ‘Reduction in cycle times for processes and transaction’ and ‘reduction of paperwork within the contracting or client company’. After Covid-19, the respondents perceived from a ranking perspective that the key drivers of e-procurement are ‘improved response time’, and ‘improved flexibility of the procurement process’, ‘reduction of paperwork within the contracting or client company’ and ‘improved accuracy of the procurement process.’ There was no ranking conducted in previous research, but it does make sense that the adoption of a technology that leads to a reduction in paperwork (Rankin et al., 2006; Ibem & Laryea, 2015) and one that improves the response and flexibility of the procurement process (Rankin et al., 2006; Eadie et al., 2010) both technology and process level drivers, would be perceived by the respondents as critical drivers of the adoption of e-procurement notwithstanding the onset of Covid-19. This result was unexpected since ‘Reduction in process, transaction and administration cost’ was noted as a top driver in previous studies by Ibem and Laryea (2017).

Based on these findings, Covid-19 was found not to significantly influence the adoption of e-procurement, meaning it did not cause the e-procurement adoption rate to improve because the perceived key drivers did not change significantly between the period before and after Covid-19. Since there is an increased percentage uptake in both e-procurement adoption post-Covid-19, as shown in Table 5, regardless of Covid-19 itself being a cause- this points to other drivers being more influential, thus resulting in this increased adoption rate.

6. Conclusions and recommendations

This research examined the drivers to adopting e-procurement in the South African construction industry (SACI) before and after the onset of the Covid-19 pandemic. It emerged from the study that there was an increase in the use of e-procurement before and after the onset of Covid-19. The findings also showed no significant difference in the key drivers influencing the adoption of e-procurement before and after the onset of Covid-19; the only difference seen was in the ranking of the drivers. The results indicate that e-procurement adoption grew past the onset of Covid-19 and appears not to influence its adoption significantly. Based on these findings, the study concludes that the adoption of e-procurement on construction projects will grow with the need of clients to make the procurement process more flexible, timeous and reduction in the paperwork used, and recommends increased flexibility of the procurement process to allow for the adoption of electronic means of procurement towards improving the competitiveness of the SACI and its currency.

This study would have been better suited as a longitudinal study where the respondents would have been questioned at different points in time: before and after the onset of Covid-19. Also, respondents may be affected by recall bias (participants' remembrance of exposure to a phenomenon differs based on their outcome status, and vice-versa); the researchers may find it difficult to measure cause and effect, and the timing of the study may not be representative of the phenomenon.

7. Acknowledgement

This work is supported by NRF (Grant Number SRUG2204254737). However, the authors' opinions and conclusions are not necessarily attributable to the NRF.

References

Afolabi, A., Ibem, E., Aduwo, E., Tunji-Olayeni, P. and Oluwunmi, O., 2019. Critical success factors (CSFs) for e-Procurement adoption in the Nigerian construction industry. *Buildings*, *9*(2), p.47.

Akintoye, A. & Fitzgerald, E. (2000) A survey of current cost estimating practices in the UK. *Construction management and economics*. [Online] 18 (2), 161–172.

Batenburg, R., 2007. E-procurement adoption by European firms: A quantitative analysis. *Journal of Purchasing and supply management*, *13*(3), pp.182-192.

Bikse, V., Lusena-Ezera, I., Rivza, P. and Rivza, B., 2021. The Development of Digital Transformation and Relevant Competencies for Employees in the Context of the Impact of the COVID-19 Pandemic in Latvia. *Sustainability*, *13*(16), p.9233.

Disaster Management Act no.57 of 2002, as amended, 2020. Available: https://www.gov.za/sites/default/files/gcis_document/202004/43199rg11078-gon446.pdf [2022, April 01].

Eadie, R., Perera, S. and Heaney, G., 2010. A cross-discipline comparison of rankings for e-procurement drivers and barriers within UK construction organizations. *Journal of Information Technology in Construction*, pp.217-233.

Ebekozien, A. and Aigbavboa, C., 2021. COVID-19 recovery for the Nigerian construction sites: The role of the fourth industrial revolution technologies. *Sustainable Cities and Society*, *69*, p.102803.

Farzin, S. and Nezhad, H.T., 2010. E-procurement the golden key to optimizing the supply chain system. *International Journal of Economics and Management Engineering*, *4*(6), pp.837-843.

Gunasekaran, A., McGaughey, R.E., Ngai, E.W. and Rai, B.K., 2009. E-Procurement adoption in the Southcoast SMEs. *International Journal of Production Economics*, *122*(1), pp.161-175.

Ibem, E.O. and Laryea, S., 2015. E-Procurement use in the South African constructionindustry. *Journal of Information Technology in Construction*, *20,* pp.364-384.

Ibem, E.O. and Laryea, S., 2017. E-tendering in the South African construction industry. *International Journal of Construction Management*, *17*(4), pp.310-328.

Ibem, E.O., Aduwo, E.B., Afolabi, A.O., Oluwunmi, A.O., Tunji-Olayeni, P.F., Ayo-Vaughan, E.A. and Uwakonye, U.O., 2021. Electronic (e-) procurement adoption and users' experience in the Nigerian construction sector. *International Journal of Construction Education and Research*, *17*(3), pp.258-276.

Kudyba, S. (2020) COVID-19 and the Acceleration of Digital Transformation and the Future of Work. Information systems management. [Online] 37 (4), 284–287.

Laryea, S. and Ibem, E.O., 2014. Barriers and prospects of e-procurement in the South African construction industry.

Li, X., Pillutla, S., Zhou, H. and Yao, D.Q., 2015. Drivers of adoption and continued use of e-procurement systems: Empirical evidence from China. *J of organizational computing and electronic commerce*, *25*(3), pp.262-288.

Olatunji, S.O., Adeniyi, O. and Jegede, B.E., 2021. Perspectives on the benefits of e-procurement tothe Nigerian construction industry. *Journal of Contemporary Research in the Built Environment (JOCREBE)*, p.34.

Rankin, J.H., Chen, Y. and Christian, A.J., 2006. E-procurement in the Atlantic Canadian AEC industry. *Journal of Information Technology in Construction (ITcon)*, *11*(6), pp.75-87.

Rehman, M.S.U., Shafiq, M.T. and Afzal, M., 2021. Impact of COVID-19 on project performance in the UAE construction industry. *Journal of Engineering, Design and Technology*.

Saunders, M., Lewis, P. and Thornhill, A., 2009. *Research methods for business students*. Pearson education.

Teo, T.S., Lin, S. and Lai, K.H., 2009. Adopters and non-adopters of e-procurement in Singapore: An empirical study. *Omega*, *37*(5), pp.972-987.

Tran, Q.D., Nguyen, T.Q.T. and Nazir, S., 2016. Initial adoption vs institutionalization of e-procurement in construction firms: The role of government in developing countries. In *Web design and development: Concepts, methodologies, tools, and applications* (pp. 1417-1437). IGI Global.

United Nations. 2006. UN procurement practitioner's handbook. New York: United Nations.World Bank (nd) E-procurement reference guide. Available: https://bit.ly/3mxsaa1 [17 January 2022].

Yevu, S.K., Yu, A.T.W. and Darko, A., 2021. Barriers to electronic procurement adoption in the construction industry: a systematic review and interrelationships. *International Journal ofConstruction Management*, pp.1-1