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User Experience Dimensions for E-procurement: A Systematic Review

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ABSTRACT

The use of e-procurement is needed for business transactions, especially regarding procurement activities. However, system users always demand and expect to use the system without problems. Existing studies on e-procurement do not focus on user experience (UX). Only a few studies have identified dimensions for UX evaluation; however, they are for e-government online services and construction. Identifying the UX dimensions for e-procurement is important for measuring user experience to provide better services. Therefore, this study attempted to investigate and determine the dimensions of

user experience for e-procurement. The method for selecting articles was adopted from the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA). The study analysed the data using thematic analysis based on the Systems and software Quality Requirements and Evaluation (SQuaRE) standards, such as ISO 25022:2016 and ISO 25023:2016, as guidance. The findings showed that among the most used UX dimensions in the e-procurement literature were satisfaction, security, transparency, efficiency, and reliability. Other UX-related dimensions identified from the review were usability, compatibility, effectiveness, performance efficiency, functional suitability, attractiveness, explainability, fairness, and visibility. The study was conducted to identify the UX dimensions for e-procurement from literature studies by organising them using ISO 25022:2016 and ISO 25023:2016 standards. This study could serve as a guideline for designers, developers, and researchers to develop an e-procurement system by referring to the proposed UX dimensions to produce a positive user experience. Moreover, the findings are beneficial to practitioners on software quality attributes.

Keywords: User experience, UX, UX dimension, E-procurement, Systematic review.

INTRODUCTION

User experience (UX) is all forms of user engagement with the services and products of the organisation (Norman & Nielsen, 2020). UX relates to the users' feelings when interacting with the system, such as web applications. Moreover, it involves multiple study disciplines, including Human-Computer Interaction (HCI), product design and development, psychology, and physical state, resulting from past experiences, attitudes, abilities, and personality (Díaz-oreiro et al., 2019). Tullis and Albert (2013) agreed that UX consists of individual interactions with the system that involve feelings, opinions, and perceptions arising from the interaction. UX is also related to emotion, which is one of the human components that affect user experience (Wan Nooraishya & Nazlena, 2018) and convey human perspectives and responses to an event (Liliana et al., 2020).

As stated in the International Organisation for Standardisation's (ISO) standard 9241-210 clause 2.15 on human-centred design, UX

is defined as: "*a person's perception and responses resulting from the use and/or anticipated use of a product, system, or service*" (Morales et al., 2019). Nowadays, UX is increasingly becoming important as a parameter to achieve the success of a product, system, or service in many fields, including the government sector (Chen et al., 2021). Therefore, identifying the user experience of the government system is vital in strengthening the connections between providers and users or customers (Prakoso & Subriadi, 2018). For example, a government system may use an e-procurement system.

E-procurement is an integrated, web-based system that performs all the purchasing processes and is related to procurement activities such as sending and receiving information concerning quotations, tenders, contract awards, payment, and others (Aminah et al., 2018; Ibem et al., 2020). The e-procurement system is one of the government-to-customer (G2C) systems that can improve the quality of communication and business transactions. Nawi et al. (2017) stated that e-procurement could improve accountability and transparency in terms of government contracts. However, there are issues in e-procurement where a group of users would feel dissatisfied because they are using the system in a mandated environment by the government, thus leading to job dissatisfaction (Ramkumar et al., 2019).

Among the e-procurement implementation problems are difficulty to use due to complexity (Barahona et al., 2015; Brandon-Jones & Kauppi, 2018; Chen et al., 2021), lack of flexibility, high cost of Internet services (Aduwo et al., 2016; Ibem & Laryea, 2015), and time-consuming (Dmytryshyn et al., 2018; Kamau et al., 2016). Moreover, users are dissatisfied with systems that are less efficient, costly, and less user-friendly (Koggalage et al., 2022). Therefore, there is a need to investigate the dimensions of e-procurement that could enhance positive user experience. Identifying the dimensions of the e-procurement system is very important because system designers and developers can apply these dimensions to evaluate the system so that the users are satisfied using the system according to their needs (Ashok et al., 2014). Moreover, the findings can support future studies on UX dimensions for e-procurement and practitioners on suitable software quality attributes or dimensions (Almogahed & Omar, 2021).

Identification of UX dimensions can be used as the basis of model development related to procurement or other domains. Besides,

several studies on e-procurement did not focus on identifying the UX dimensions. For example, Alomar and de Visscher (2019) only investigated the acceptance determinants of companies' e-procurement systems. Meanwhile, Akenroye et al. (2020) focused on how the dynamic capabilities theory can improve user experience in public procurement. In contrast, Kumar and Ganguly (2020) emphasised identifying the non-financial e-procurement performance measures that influence the financial performance of firms through the use of e-procurement. These studies show that there is still a gap in determining UX dimensions, especially for e-procurement systems. Identifying the UX dimensions of a system, such as an e-procurement system, is important because it measures the user experience to have a better product or service (Paredes & Hernandez, 2017).

Identifying the UX dimensions of the e-procurement system is necessary to ensure that users are content while interacting with the system. Therefore, this paper aims to identify and discuss UX dimensions for the e-procurement system in the literature. The following content of this paper is organised as follows: literature review, research methodology, results and discussions (quantitative and qualitative analyses), and conclusion.

LITERATURE REVIEW

In the literature, user experience can be associated with the users' perception of a product, service, or process that can achieve their needs and expectations with ease of use and efficiency (Ibem et al., 2020). According to Sandler (2015), users who utilise products or services are always demanding and expect to use them conveniently. If their goals are not achieved, they become frustrated and find other alternatives. It is a positive experience that leads individuals to prefer one product, system, or service over another due to several factors (Ibem et al., 2020). For instance, users of e-procurement systems face several problems, such as lack of interoperability, privacy, lack of transparency, and information provenance during their business transactions (Alvarez-Rodríguez et al., 2014; Maleki et al., 2017).

Alternatively, other problems faced by users, such as difficulty to use due to complexity (Barahona et al., 2015; Brandon-Jones & Kauppi, 2018; Chen et al., 2021), occurrences of transaction errors, and detailed information filling, can cause unpleasant experiences

among e-procurement users (Kamau et al., 2016; Ramkumar et al., 2019). Moreover, several other issues have been identified, namely lack of flexibility, high cost of Internet services (Aduwo et al., 2016; Ibem & Laryea, 2015), low efficiency using the system such as time-consuming for some tasks (Dmytryshyn et al., 2018; Kamau et al., 2016), and high cost of e-procurement implementation (Abdullahi et al., 2019; Ramkumar et al., 2019). Chen et al. (2021) examined how procurement complexity and structure interacted to influence e-procurement adoption, with data collected from over 400 cities. They also found that a centralised structure would improve the chance of local governments adopting an e-procurement system to cope with the increasing procurement complexity.

Contrastingly, governments with a well-coordinated structure are less likely to use an e-procurement system. They can rely on the structure's intra-organisational collaboration and information sharing to handle complex procurements. From the information above, previous research has clearly explored the issues of adopting e-procurement. Furthermore, several studies have investigated user experience with e-procurement systems. These studies focused on the UX domain; however, their proposed dimensions were general and inappropriate for the e-procurement system. Hong and Shao (2020) studied the effect of buyer-supplier experience on e-procurement, yet the proposed dimensions were only for the performance of service projects. Meanwhile, Sukmasetya et al. (2018) only focused on e-Government online services, which were not for e-procurement and the description given was not specific in terms of a system. In the same vein, Prakoso and Subriadi (2018) used the dimensions from the User Experience Questionnaire (UEQ) instrument for their measurement, which was too general for e-procurement dimensions.

On the other hand, Ibem et al. (2020) investigated UX with e-procurement and provided UX dimensions that only focused on the construction domain. Nevertheless, these dimensions could be adapted to the current study to identify the appropriate UX dimensions for e-procurement systems. Many literature studies show the need to identify the UX dimensions of an e-procurement system to satisfy users with a better product or service (Paredes & Hernandez, 2017). It is also crucial to consider the users' point of view for identifying the UX dimensions (Sukmasetya et al., 2018). Moreover, UX studies focus more on a product than a system (Wan Nooraishya & Nazlena, 2018). Therefore, this study attempts to investigate and determine the

UX dimensions in e-procurement based on the Systems and software Quality Requirements and Evaluation (SQuaRE) standards. This study uses ISO 25022:2016 and ISO 25023:2016 as guidance to determine the dimensions with supported clear descriptions.

METHODOLOGY

The study adopted the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) for selecting the articles in the literature. PRISMA is a defined standard for conducting a systematic literature review, and the authors are directed by relevant information that enables them to evaluate the quality of a review (Shaffril et al., 2019). According to Sierra-Correa and Cantera Kintz (2015), the advantages of publication standards are authors can define the research questions clearly, identify the inclusion and exclusion criteria, and review scientific literature in a specified period from databases. This study adopted the PRISMA standard for literature review in relation to user experience and e-procurement. The following sub-sections give further details on the methodology used: resources, review process such as identification, screening, eligibility, and data abstraction and analysis.

Resources

The present study was conducted using three main databases, namely Scopus, Science Direct, and ACM Digital Library, which are considered robust databases. Accordingly, Younger (2010) suggested that searching through more databases is important to obtain the relevant articles for the study. Therefore, this study performed a searching strategy on three database sources.

Review Process for Selecting the Articles

The following sub-section will elaborate on the review process, namely identification, screening, eligibility, data abstraction, and analysis.

(i) Identification

The first stage was to identify keywords and then search for related terms. The study conducted search strings on Scopus, Science

Direct, and ACM Digital Library databases that ended on 20th May 2022 for the relevant keywords. The keywords "user experience" or "experience" and "e-procurement" were used. A total of 1,934 articles were successfully pulled from the three databases.

(ii) Screening

In this stage, after deleting duplicate articles, 1,931 articles were screened based on several inclusion and exclusion criteria. The first criterion was the literature type, which focused on journal articles (research articles) and conference proceedings as the primary sources of the study. Forms of publication, such as book series, books, and chapters in a book, were not included in this study. The screening process started with the researchers reviewing the articles' titles, abstracts, and keywords. Articles that did not provide the full text were removed in this review process. Only articles published in English were considered, and the timeline for the articles was from 2015–2022 (until 20th May 2022).

Most importantly, the selected articles must be related to user experience or UX and e-procurement. The researchers removed articles that were not associated with the keywords of the study. However, articles related to user experience and e-government or similar systems were selected if relevant. The screening criteria can be referred to in Table 1. Based on the exclusion criteria, a total of 1,505 articles were excluded. See Figure 2 for the flow diagram of the review process.

Table 1

Screening Criteria

Criteria	Inclusion	Exclusion
Publication timeline	2015–2022 (May)	2014 and before
Document type	Article (research journal, conference proceeding) and review.	Chapters in book, book series, books etc.
Language	English	Non-English
Nature of the study	Focused on user experience and related to e-procurement	Not focused on user experience and e-procurement

(iii) Eligibility

There were 426 articles for the eligibility stage. At this stage, the titles, abstracts, and main contents of all the articles were examined carefully to ensure the inclusion criteria were fulfilled and achieved the research objectives. Consequently, 399 articles were excluded because they were unrelated to user experience and e-procurement. Finally, a total of 27 articles were selected for analysis, as shown in Figure 2.

(iv) Data Abstraction and Analysis

The study analysed 27 articles using qualitative data analysis software to identify the appropriate UX dimensions. See Figure 1 for metadata generated in the qualitative data analysis software. In this phase, the authors carefully analysed the extracted data to meet the research aims. Then, the data analysis was performed by identifying the UX dimensions of e-procurement based on standards such as ISO 25022:2016 and ISO 25023:2016. These ISO standards were used as guidance to extract the UX dimensions from the literature by referring to the descriptions or definitions in these two standards. Eventually, the results of the UX dimensions, namely effectiveness, efficiency, performance efficiency, compatibility, usability, reliability, security, satisfaction, functional suitability, and other dimensions, were extracted.

Figure 1

Metadata Generated in Qualitative Data Analysis Software

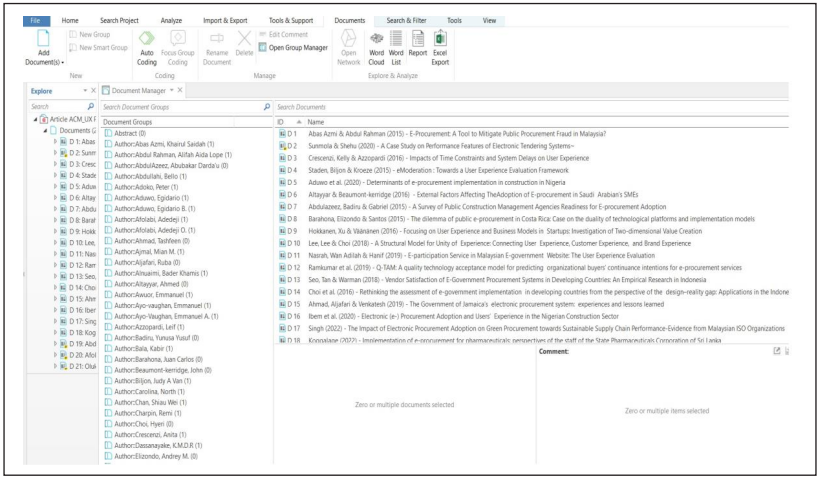
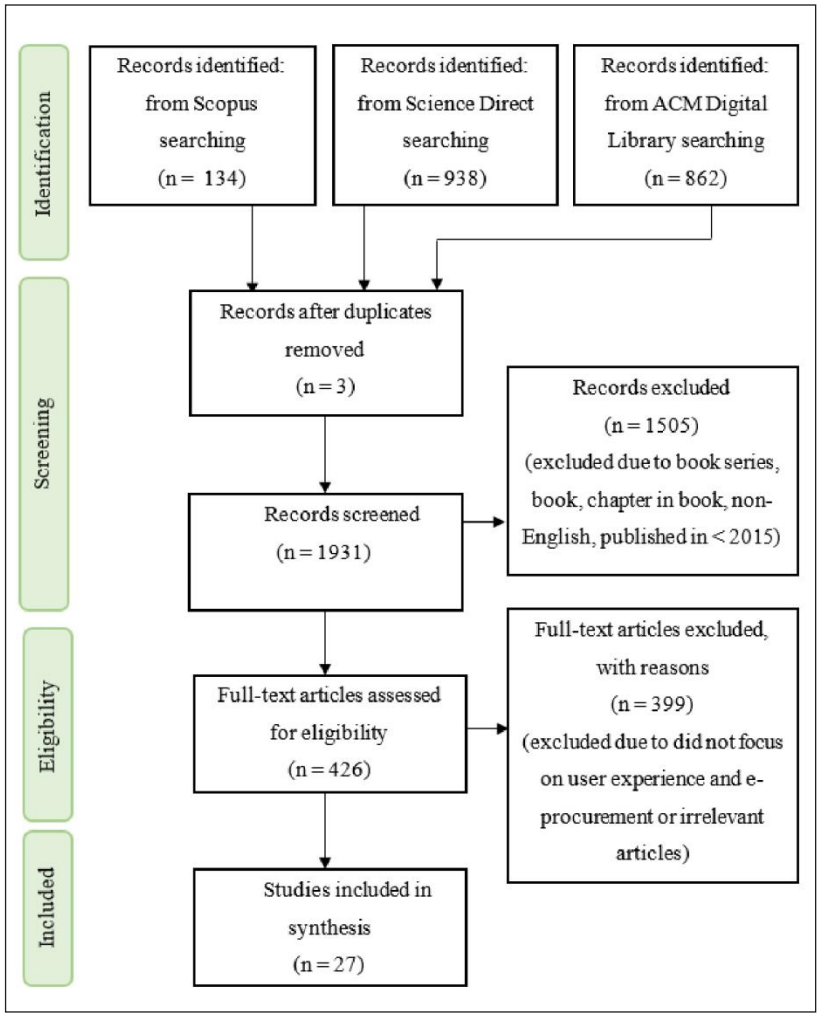


Figure 2

Flow Diagram of the Review Process



RESULTS AND DISCUSSIONS

Quantitative Analysis

The current study used the phrases "user experience" or "experience" and "e-procurement" in the three databases, which resulted in a minimal number of publications that were related to UX and e-procurement. Realising the low number of literature in the study, the selection of papers included proceedings to evaluate the trends and patterns. Besides, the objective of the study is to determine the UX dimensions related to e-procurement systems. Although this research focuses on user experience and e-procurement, journals containing relevant articles of the study varied. The final papers identified were 27 articles from several periodicals, namely Procedia Manufacturing, International Journal of Construction Education and Research, International Journal on Emerging Technologies, and others (Refer to Figure 4).

The researchers analysed 27 articles that were associated with user experience and e-procurement system or relevant articles. Figure 3 shows the publishing trend of the articles in which the researchers observed no publication concerning user experience and e-procurement in 2017. However, the number of publications increased from 2018 to 2019. This number is expected to rise yearly because of the increase in researchers' interest in UX, which has led to a vast number of scholarly publications in a relatively short period (Luther et al., 2020).

Figure 3

Number of Publications vs Years

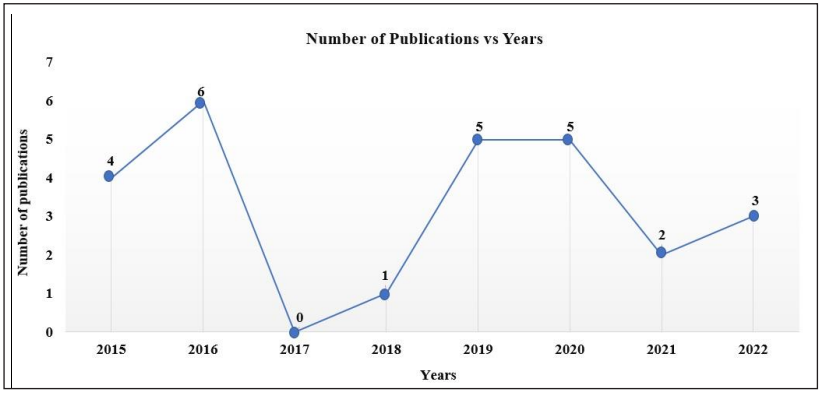


Figure 4

Authors, Journals or Proceedings, and Years

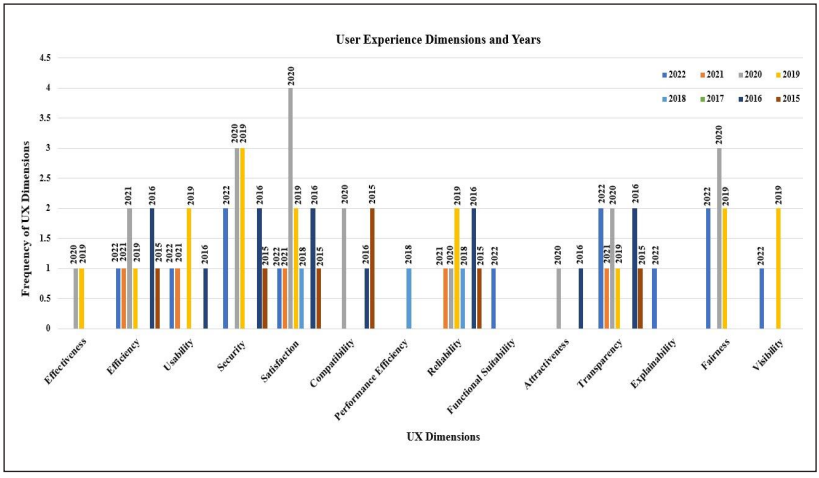
Authors	Journals or Proceedings	Years
Azmi and Rahman (2015)	The Electronic Journal of e-Government	2015
AbdulAzeez et al. (2015)	Jurnal Teknologi (Sciences & Engineering).	
Barahona et al. (2015)	Journal of Information Technology Teaching Cases.	
Imamoglu and Rehan (2015)	Proceedings of the International Conference on Engineering & MIS.	
Altayyar and Beaumont-Kerridge (2016)	Procedia - Social and Behavioral Sciences.	2016
Choi et al. (2016)	Telecommunications Policy.	
Crescenzi et al. (2016)	Proceedings of the 2016 ACM on Conference on Human Information Interaction and Retrieval.	
Hokkanen et al. (2016)	Proceedings of the 20th International Academic Mindtrek Conference.	
Rakotonirina and Raoelson (2016)	Proceedings of the 9th International Conference on Theory and Practice of Electronic Governance.	
Torvinen and Ulkuniemi (2016)	Industrial Marketing Management.	
Seo et al. (2018)	Information Technology for Development.	2018
Ahmad et al. (2019)	Internet Research.	2019
Abdullahi et al. (2019)	International Journal of Construction Management.	
Afolabi et al. (2019)	International Journal of Construction Management.	
Basri et al. (2019)	Proceedings of the 10th International Conference on E-Education, E-Business, E-Management and E-Learning.	
Ramkumar et al. (2019)	International Journal of Production Economics.	
Kosmol et al. (2019)	Journal of Purchasing and Supply Management.	
Wang et al. (2020)	Journal of Purchasing and Supply Management.	2020
Aduwo et al. (2020)	International Journal on Emerging Technologies.	
Ibem et al. (2020)	International Journal of Construction Education and Research.	
Sari et al. (2020)	Proceedings of the 6th International Conference on Industrial and Business Engineering.	
Sunmola and Shehu (2020)	Procedia Manufacturing.	
Alnuaimi et al. (2021)	Technological Forecasting & Social Change.	2021
Charpin et al. (2021)	International Journal of Production Economics.	
Koggalage et al. (2022)	International Journal of Procurement Management.	2022
Oluka et al. (2022)	Procedia Computer Science.	
Singh and Chan (2022)	Journal of Open Innovation: Technology, Market and Complexity.	

There are various UX dimensions used in many research fields. Therefore, this study investigated and identified the UX dimensions of e-procurement based on the SQuaRE standards, such as ISO 25022:2016 and ISO 25023:2016, as guidance. ISO standards are widely used in the fields of HCI (Yusof et al., 2022), e.g., measuring public value UX on e-government website (Ashok et al., 2014), and e-procurement, such as developing a framework (Sugianto et al., 2019) and adoption of e-procurement system (Singh & Chan, 2022).

Based on the findings that were analysed as shown in Figure 5, satisfaction (n = 12), security (n = 11), transparency (n = 9), efficiency (n = 8), and reliability (n =8) were the most constantly used UX dimensions for e-procurement or related electronic government systems. The second most frequently used UX dimensions were fairness (n = 7), usability (n = 5), and compatibility (n = 5), followed by visibility (n =4), effectiveness (n = 2), attractiveness (n = 2), and performance efficiency (n = 1). Other UX dimensions that were underutilised in e-procurement were performance efficiency (n = 1), functional suitability (n = 1), and explainability (n = 1) as shown in Figure 5.

Figure 5

Frequency of UX Dimensions and Years



Meanwhile, Figure 6 illustrates the publications of previous studies based on authors and UX dimensions. There were 14 dimensions from 27 papers that were analysed and presented.

Figure 6

Publications Based on Authors and UX Dimensions

No	Authors	Effectiveness	Efficiency	Usability	Security	Satisfaction	Compatibility	Performance Efficiency	Reliability	Functional Suitability	Attractiveness	Transparency	Explainability	Fairness	Visibility
1	Koggalage et al. (2022)		√	√	√	√						√		√	√
2	Ohuka et al. (2022)				√							√	√	√	
3	Singh and Chan (2022)									√					
4	Alnuaimi et al. (2021)			√					√						
5	Charpin et al. (2021)		√			√						√			
6	Aduwo et al. (2020)				√	√	√								
7	Ibem et al. (2020)	√	√		√	√	√		√						
8	Sari et al. (2020)					√								√	
9	Sunmola and Shehu (2020)				√	√					√	√		√	
10	Wang et al. (2020)		√									√		√	
11	Ahmad et al. (2019)				√	√								√	
12	Abdullahi et al. (2019)				√							√		√	
13	Afolabi et al. (2019)			√	√				√						
14	Kosmol et al. (2019)								√						√
15	Basri et al. (2019)	√		√											
16	Ramkumar et al. (2019)		√			√									√
17	Seo et al. (2018)					√		√	√						
18	Altayyar and Beaumont-Kerridge (2016)		√		√				√						√
19	Choi et al. (2016)			√	√		√								
20	Crescenzi et al. (2016)					√									
21	Hokkanen et al. (2016)		√			√					√				
22	Rakotonirina and Raoelson (2016)								√			√			
23	Torvinen and Ulkuniemi (2016)											√			
24	Azmi and Rahman (2015)		√									√			
25	AbdulAzeez et al. (2015)						√		√						
26	Barahona et al. (2015)				√	√									
27	Imamoglu and Rehan (2015)						√								
	Totals	**2**	**8**	**5**	**11**	**12**	**5**	**1**	**8**	**1**	**2**	**9**	**1**	**7**	**4**

Based on Figure 6 above, 14 dimensions were discovered in the e-procurement literature from 2015 until 2022. Five UX dimensions were most widely used in the e-procurement literature, namely satisfaction, security, transparency, efficiency, and reliability.

Qualitative Analysis

This section discusses the research question highlighted in Section 1. The study identified the UX dimensions by referring to the list of characteristics and their definitions in the SQuaRE standards, i.e., ISO

25022: 2016 and ISO 25023:2016. These ISO characteristic definitions were used as the main references for UX dimension definitions as many studies in the past have applied inconsistent words to refer to the same dimensions and vice versa. The qualitative findings of UX dimensions and e-procurement are illustrated in Figure 7. The network diagram below lists the identified UX dimensions with the categorised criteria.

Satisfaction: Satisfaction is one of the most common UX dimensions identified in the e-procurement literature. Satisfaction can be defined as users' feelings regarding prior e-procurement use (Ramkumar et al., 2019). According to Seo et al.'s (2018) study about vendor satisfaction with e-procurement, the failure of performance in terms of information, function, and system can negatively influence vendors' satisfaction. Meanwhile, Sunmola and Shehu (2020) studied about E-Tendering and highlighted that privacy and security, transparency, and informativeness impacted user satisfaction when they completed tasks in the system and caused dissatisfaction when they had not fulfilled their tasks. On the other hand, Crescenzi et al. (2016) mentioned that users who completed their tasks earlier would be more satisfied with the system. Therefore, the satisfaction dimension is related to the system's ability to satisfy the users in terms of the information provided, function, and data security. This analysis shows that user satisfaction can be influenced by the quality of the systems or products utilised.

Based on ISO 25022:2016, the satisfaction characteristics comprise usefulness, trust, pleasure (user experience), and comfort (ergonomic) sub-characteristics (ISO 25022, 2016). Lee et al. (2018) mentioned that user satisfaction could be strengthened by the usefulness and good interface design of a system, service, or product. The study by Ramkumar et al. (2019) measured users' perceived usefulness and discovered that it significantly affected organisational buyers' satisfaction. In the work of Sari et al. (2020), the measurement of satisfaction comprised ease of use and usefulness. The study provided compelling evidence that users' scepticism about the ability of technology to work well could influence them on whether to use e-procurement or not. In the same vein, Charpin et al.'s (2021) study mentioned that usefulness, in terms of productivity, could improve procurement efficiency. Therefore, the satisfaction dimension used in the e-procurement literature is related to the system's ease of use and usefulness (criteria) that can influence user satisfaction.

Ahmad et al. (2019) discussed trust issues in e-procurement where the users were able to gain their trust and engage with the system processes if the system had the transparency element. Other than that, ease of use of the system can be associated with the satisfaction dimension, in which using the e-procurement system effortlessly (Ramkumar et al., 2019) influences users to use the system (Ibem et al., 2020). Meanwhile, the measurement of satisfaction in Koggalage et al.'s (2022) study, which was related to existing procurement processes and practices, highlighted that the majority of users were dissatisfied because the procurement process was still paper-based (manually). Therefore, the satisfaction dimension that comprises ease of use and trust (criteria) is identified in the e-procurement literature.

Security: Security is also among the most frequent UX dimensions identified in the e-procurement studies, and can be defined as the system's ability to protect user and stakeholder privacy, secure the data against unauthorised access, use, modification, or destruction in order to maintain the information's confidentiality (Choi et al., 2016). Based on ISO 25023:2016, the security characteristics comprise confidentiality, integrity, non-repudiation, accountability, and authenticity sub-characteristics. This dimension is the main factor for implementing e-procurement in organisations because it can be linked to the features of e-procurement technology (Aduwo et al., 2020). According to Altayyar and Beaumont-Kerridge (2016), online security is vital for all electronic business activities, such as payment, where the data must be protected from all sorts of scams. Meanwhile, Ahmad et al. (2019) mentioned that the accountability and transparency of the system could assist in procuring better quality products and services.

Besides, Ibem et al. (2020) revealed that the users use the system because the system processes are reliable and secure. On the other hand, the lack of trust among users to use the e-procurement system still exists due to the problems of understanding and being comfortable with the English language on the system interface (Altayyar & Beaumont-Kerridge, 2016). From the discussion above, it is apparent that the security dimension relates to technology, which consists of the confidentiality of data such as payment, company information, accountability, and transparency of the system. Moreover, privacy and security can be associated with user satisfaction once they have achieved their goals when interacting with the system (Sunmola &

Shehu, 2020). Therefore, it can be concluded that the key success factor for using an e-procurement system is security at all levels (Barahona et al., 2015).

In addition, Afolabi et al. (2019) investigated the level of security of e-procurement transactions, including system privacy. Their study revealed that system security influenced e-procurement acquisition. It showed that users use a system due to the existing security features. Oluka et al. (2022) indicated that data use and privacy were among the biggest challenges for users, such as suppliers in China and India. Koggalage et al.'s (2022) study was also concerned about secured data or information in the e-procurement system. Therefore, the bulk of the recent works in this direction is concerned with the privacy and confidentiality of e-procurement. In general, the security dimension comprises the criteria such as privacy, confidentiality, and accountability in the e-procurement literature.

Transparency: Transparency in terms of e-procurement is when the system is crystal clear, qualifying it for a contract with the government and eliminating external interferences (Azmi & Rahman, 2015). According to Torvinen and Ulkuniemi (2016), transparency relates to building trust and displaying openness between users, procurement planners, and suppliers for an extended period with regular meetings. Whereas, Rakotonirina and Raoelson (2016) described that the transparency of the procedure is to reduce the risk of corruption. Abdullahi et al. (2019) mentioned that a system needs to be improved in terms of system efficiency and transparency so that users continue to utilise it. In addition, Sunmola and Shehu (2020) described transparency as one of the dimensions that impact user satisfaction. Therefore, the transparency dimension is important for e-procurement process measurement. In support of this, Wang et al. (2020), Charpin et al. (2021), Oluka et al. (2022), and Koggalage et al. (2022) agreed on the need for increased transparency of the processes or procedures of e-procurement in order to increase the system usage.

Efficiency: The efficiency dimension is identified as the most used dimension in the e-procurement literature. The system's efficiency is measured by users' ability to maintain a high level of productivity while completing tasks in less time (van Staden et al., 2015). The efficiency dimension in terms of the e-procurement system refers to a lower cost of transaction and greater speed when the users are using the system

(Ibem et al., 2020). The work by Azmi and Rahman (2015) mentioned that a system is efficient if it can eliminate external interferences in the procurement processes. Altayyar and Beaumont-Kerridge (2016) revealed that buyers are dissatisfied with their suppliers' offered services that are slow or less efficient. However, there are still users who are willing to use the e-procurement system rather than manual systems. Therefore, the efficiency dimension used in e-procurement refers to completing the task in a short period, having lower costs, fast transactions, and no issues from external interferences.

Efficiency is important for the procurement of goods and services for a company (Nanang et al., 2018) and business process (Hokkanen et al., 2016). Wang et al. (2020) stated that the measurement of time efficiency and a shorter procurement period offer more efficiency in terms of time. Moreover, suppliers should be given additional time to prepare the bidding documents (Wang et al., 2020). Charpin et al. (2021) also mentioned time efficiency, where the time for the procurement purchase cycle should be minimised and cost-efficient. In the same vein, Koggalage et al.'s (2022) study was concerned the average time buyers take to get goods after placing an order. Therefore, it shows that the efficiency dimension comprises the criteria such as time efficiency, cost-effectiveness, and task time. The dimensions' measurement relates to the time cycle, cost, and whether the users get the goods within a specific period.

Reliability: Availability is one of the reliability dimensions that is identified in the e-procurement literature based on ISO 25023 (2016), in which a system is operational and can be accessed by the users when required for use. Availability of the system is in terms of Internet connectivity (AbdulAzeez et al., 2015; Altayyar & Beaumont-Kerridge, 2016). Ibem et al. (2020) stated that authenticating documents and electronically submitting them is challenging because it is expensive. Similarly, Seo et al. (2018) mentioned that access to online transactions is associated with the availability of devices, which include computers, laptops, and Internet connections such as wireless networks. From these findings, the availability aspect of e-procurement relates to online transactions in which the users can access the facilities when required.

According to Afolabi et al. (2019), poor Internet access is a key impediment to the acquisition of e-procurement technologies in

numerous countries. Likewise, Kosmol et al.'s (2019) study also emphasised the availability of resources, such as the usage of the Internet in procurement. Organisational resources need to be ensured to be available for use, e.g., Internet access. On the other hand, Alnuaimi et al. (2021) mentioned data availability for procurement, such as access to fast-moving data. From the discussion above, it is apparent that an availability of quality Internet facilities is crucial for users to use the system. Therefore, the availability of the e-procurement system in terms of technology is important to be considered for better e-procurement implementation (Nawi et al., 2017).

Usability: Based on ISO 25023:2016, the usability characteristics consist of appropriate recognisability, learnability, operability, user error protection, user interface aesthetics, and accessibility. The usability dimension can be defined as the product or system that is usable and used by specific users with effectiveness, efficiency, and satisfaction to achieve the goals (van Staden et al., 2015; ISO, 2016b). Another study defined usability as the perceived ease of use and navigation in the e-procurement system. If the system is troublesome to use, users will be disappointed as it requires high effort (Sharabati et al., 2015). The appropriate recognisability of the system, such as when the system has updated information to the users that are appropriate for their needs, and user interface aesthetics of the system, such as layout design, font, and background, enable people to have a pleasurable and satisfying interaction (Basri et al., 2019; ISO, 2016b).

Meanwhile, the learnability dimension in e-procurement allows specific users to learn about the system and record their speed in performing a task and accomplishing specified goals by using a new interface (Kamau et al., 2016; ISO, 2016b). According to Alnuaimi et al. (2021), skills are important in order to use the e-procurement system, and the right skills are needed to accomplish the jobs successfully. From the short review above, key findings emerged, showing that the successful implementation of e-procurement requires competent human resources in terms of knowledge (Choi et al., 2016). The content of the system can be referred to as appropriate, comprehensive, and accurate information, including the easy navigation of information where the users interact with the system (van Staden et al., 2015). Therefore, the usability dimension in the e-procurement literature identified is related to the appropriate recognisability, user interface aesthetics, and learnability of the users to utilise the system.

Compatibility: Interoperability is related to two or more systems or products that successfully exchange information, such as technical aspects, policy, and managerial competencies for cross-organisational information sharing (Choi et al., 2016; ISO, 2016b). Aduwo et al. (2020) mentioned the interoperability dimension in terms of tools or applications of the e-procurement system. According to AbdulAzeez et al. (2015), there is inadequate infrastructure, such as computer systems, software, including intranet and extranet facilities, for information sharing in order to support e-procurement adoption. While Imamoglu and Rehan's (2015) study described that public procurement should consider interoperability with information and communications technology (ICT) usage in order to facilitate communication between suppliers (especially small and medium-sized enterprises (SMEs)) and government bodies. Therefore, users' technology usage and adoption could be related to the interoperability dimension.

In the work by Ibem et al. (2020), some of the users had unpleasant experiences due to the lack of flexibility and interoperability of e-procurement. By carefully examining the data, it was found that the compatibility dimension was related to availability and levels of interoperability in the organisation in the technical aspect, such as applications, computer system, and Internet facilities. These were the key factors that influenced user experience when using the e-procurement system (AbdulAzeez et al., 2015; Nawi et al., 2017). Therefore, interoperability is one criterion of the compatibility dimension identified in the e-procurement literature.

Effectiveness: Effectiveness is the level of successful task completion when users interact with the system (Kamau et al., 2016). The effectiveness dimension can also be defined as when the users can access the information and complete the task within a shorter time than the manual system (van Staden et al., 2015; ISO, 2016a). Procurement effectiveness is associated with achieving higher process efficiency, such as less staff and reduced cost and time. The issues that can be related to system effectiveness, such as the system requesting copious information about user personal details and the requirement of too much mandatory information, become difficult to complete filling at once and cause problems in the online return process (Kamau et al., 2016).

Other than that, Bienhaus and Haddud's (2018) findings revealed that communication tools and common user interfaces are critical to increasing the system's efficiency and effectiveness, whereby they could simplify tasks. Meanwhile, Ibem et al. (2020) investigated users' difficulty in transitioning from paper-based to using e-procurement systems. The results uncovered the lack of effective change and low level of system adoption by the users. Therefore, it shows that the effectiveness dimension is related to tasks that can be completed by users in less time. Users should be satisfied with the system's use if tasks are simplified and not difficult.

Other Dimensions: Other UX dimensions that are used in the e-procurement literature are attractiveness, explainability, fairness, visibility, performance efficiency, and functional suitability. Attractiveness is related to attributes such as good, attractive, and convenient for the interactive systems (Müller et al., 2018). The attractiveness dimension is also associated with interesting designs that influence the users to use the system (Hasim et al., 2019; Sunmola & Shehu, 2020). Besides, user-interface features (menus and icons) are critical to a system's usefulness since they allow users to accomplish their duties efficiently (Brandon-Jones & Kauppi, 2018).

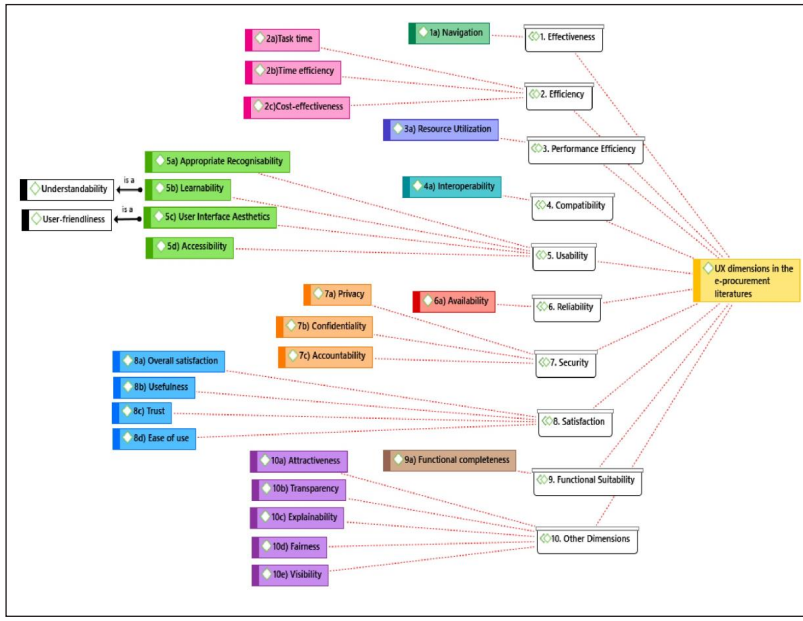
On the other hand, Oluka et al. (2022) mentioned explainability in terms of explainable user interfaces. At the same time, the fairness dimension in the e-procurement literature concerns the payment and shipping between buyers and suppliers (Sari et al., 2020), solicitation of procurement (Oluka et al., 2022), and public procurement implementation (Koggalage et al., 2022). In addition, visibility is related to the information provided in the system, for example, e-procurement services in terms of location and product inventory (Ramkumar et al., 2019). The performance efficiency dimension identified in the e-procurement studies is resource utilisation, which is the quantity of resources consumed by a system during its operation, such as Internet connection bandwidth (Seo et al., 2018). Moreover, functional suitability is related to procurement functions of specified tasks, e.g., e-ordering, e-sourcing, and e-tendering as measured in Singh and Chan's (2022) study.

From the short review above, it is clear that the dimensions, namely attractiveness, explainability, fairness, visibility, performance efficiency, and functional suitability, were identified in the

e-procurement literature. Figure 7 shows the network diagram of UX dimensions, including the criteria that were identified in the e-procurement studies. For example, one of UX dimensions in the e-procurement literature is usability, which comprises criteria such as appropriate recognisability, learnability (relates to understandability), user interface aesthetics (relates to user-friendliness), and accessibility.

Figure 7

Network Diagram of UX Dimensions Including Their Criteria



CONCLUSION

The study investigated the UX dimensions on e-procurement systems in the literature. Based on the findings of this study, a conclusion was made. All of the UX dimensions were discovered by analysing articles from three databases, namely Scopus, Science Direct, and ACM Digital Library, by considering the inclusion and exclusion criteria of the PRISMA procedure. The UX dimensions were identified based on the SQuaRE standards, i.e., ISO 25022:2016 and ISO 25023:2016, as a guidance with reference to the list of characteristics and their

definitions in order to categorise dimensions in the literature. According to the analysis findings, UX dimensions, such as satisfaction, security, transparency, efficiency, and reliability, are frequently discussed dimensions used in e-procurement studies. Other UX dimensions in the e-procurement literature that were identified include usability, compatibility, effectiveness, performance efficiency, functional suitability, attractiveness, explainability, fairness, and visibility.

In addition, the findings show that these UX dimensions are crucial dimensions to be measured for e-procurement systems or similar systems such as e-commerce. User satisfaction is the most important dimension considered in the literature because it affects user experience (Lee et al., 2018). Lastly, the findings of this study were limited to the UX dimensions that were identified based on ISO 25022:2016 and ISO 25023:2016 only. Other UX dimensions might exist in the e-procurement literature. This study could become a guideline to designers, developers, and other researchers to develop any relevant system or guidance of model development by considering all the dimensions highlighted in the findings. In addition, the literature review can support the results of future studies obtained by researchers related to the UX dimensions for e-procurement and government systems. Furthermore, the findings would be beneficial for practitioners on software quality attributes (Almogahed & Omar, 2021). Finally, the current researchers hope that this study could be extended to UX dimensions for e-procurement, whereby it is proven by empirical data.

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