An Empirical Study of Sustainable E-Government Characteristics in Saudi Arabia

Sulaiman Aljarallah and Dr. Russell Lock
Computer Science Department, Loughborough University, Loughborough, UK
S.Aljarallah@lboro.ac.uk
R.Lock@lboro.ac.uk

1. Abstract

It is clear that sustainable e-government has become an important consideration for governments, and a political buzz-phrase encompassing e-government literature and sustainability. However, existing e-government literature on sustainability is sparse. A quantitative empirical study was conducted to survey the perceptions of Saudi Arabian citizens with regard to the characteristics of sustainable e-government. Survey data gathered from 442 respondents were analysed to investigate their understanding of the importance of each of these characteristics, allowing the identification of a set of key characteristics likely to influence citizens' utilization of sustainable e-government services. The study also investigated users' perceptions of three key barriers to the ability of policymakers to develop and adopt sustainable e-government systems. The most significant barrier was found to be low public awareness of the benefits of sustainable e-government, followed by the inability of governments to predict the needs of future generations of citizens, and their inability to meet current users' needs. This study also seeks to rank the characteristics of sustainable e-government according to citizens' perceptions of their priority. The ranking of sustainable e-government characteristics provides an authoritative measurement to guide efforts to develop e-government systems by identifying key characteristics in terms of their effects on the sustainability of e-government. The results indicate that the characteristics perceived to be the most significant were usability, security, performance, transparency and flexibility, whereas respondents were relatively unconcerned with the social, environmental and economic dimensions of the impact of the software used in e-government systems. Participants were found to differ by gender in the priority they assigned to the various characteristics. For example, females considered security to be the most important of the eleven characteristics assessed, while males considered usability to be the most vital characteristic. These results can be utilised in future as part of a framework for evaluating sustainable e-government. Furthermore, the characteristics identified here can be used as a means of providing valuable feedback for the planning and implementation of future sustainable e-government initiatives.

Keywords: e-government, sustainability, sustainable e-government, software, characteristics

2. Introduction

There is growing interest in sustainability and increasingly strong claims are made regarding sustainable development (Leyh et al., 2014). The most frequently cited definition of sustainability is that of the UN Commission on Economic Development in the Brundtland Report (Attah, 2010; Kates, 2010; Venters *et al.*, 2014) which states that sustainable development is *"development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs"* (Sheldrick, 2015, p.17). Similarly, there is no agreed definition of software sustainability (Venters et al., 2014; Mahmoud and Ahmad, 2013; Calero and Piattini, 2015), nor of e-government (Ibrahim et al., 2015). Unsurprisingly, Dzhusupova et al. (2011) report that there is no explicit definition of e-governance sustainability in the literature. The software industry often equates the term 'sustainability' with 'green-ability'; however, they are conceptually different: individual products and processes can be described as green, while sustainability refers to whole systems (Wang et al., 2015).

Given the existing variability in definition and scope of e-government sustainability (Dzhusupova et al., 2011; Estevez et al., 2013; Nurdin et al., 2016), it can be argued that the very notion of sustainable e-government is immature. Dzhusupova et al. (2011) state that the scoping of sustainability and e-governance is still in the early stages, while Larsson (2014) reports that sustainability has not been discussed before in relation to e-government research.

In 2005, the Kingdom of Saudi Arabia (KSA) initialised a programme of e-government services called 'Yesser', which interacts with over 170 organisations (Yesser, 2018; Alfayad and Abbott-Halpin, 2017) and whose aim is to deliver a national e-government programme (Alfayad and Abbott-Halpin, 2017). Alghazi et al. (2017) report that a national government strategy for 2030 has been launched by the KSA government for all government arms and public-sector bodies, aiming to improve performance. A digital transition plan has been launched in support of this 2030 Vision, with sustainable development a key consideration (MCIT, 2018).

It is clear that e-government systems will play an important role in the KSA's transformation, providing more transparency, efficiency and effectiveness. It will importantly involve the use of artificial intelligence and big data in risk management and in ensuring quick and accurate decision-making. Greater awareness of the benefits of ICT sustainability, including software sustainability, would enhance Yesser. However, setting sustainability as a high-level strategic goal in ICT development would not by itself ensure sustainable solutions and could prove problematic if practical guidance is not provided.

3. Literature review

3.1 Importance of sustainability within e-government

E-government is a way to improve national development (Khamis and van der Weide, 2017) and a fundamental element of sustainable development (Stoiciu and Popa, 2012), promoting integrated services, considering economic, social and environmental dimensions of sustainable development and supporting integration across these dimensions (Alcaide Muñoz and Rodríguez Bolívar, 2018). It is clear that the focus on digital preservation of e-government information is a significant contributor to sustainable development.

3.2 Characteristics of sustainable e-government

Calero and Piattini (2015) state that risk, security and safety are strongly related to sustainability. Moreover, Dečman (2003) affirms that without user trust, e-government systems can become unsustainable. Abu-Shanab and Al-Quraan (2015) studied the factors that influence e-government project continuity, asserting the importance of complying with national plans, goals and objectives for sustainable development. Their findings indicate that availability, participation and awareness are predictors of sustainability, whereas trust is not. Moreover, they affirm that citizens' participation makes a major contribution to e-government sustainability. Contrary to these findings, trust is generally considered an important candidate characteristic of sustainable e-government.

Stoll (2009) agrees that trust is an important factor in social sustainability and contends that usability is important in sustaining systems. Razavian et al. (2014) state that to be sustainable, government e-services must address the economic, social, environmental and technical dimensions. Koziolek (2011) argues that system sustainability cannot be achieved unless the system is cost-efficient, maintained and supports evolution over its lifecycle. Ashaye (2014) empirically studied e-government evaluation and implementation in developing countries, identifying sustainability and transparency as important criteria during implementation. A review of existing studies suggests that the characteristics of sustainable e-government are rarely highlighted explicitly during projects and that they first need to be identified.

3.3 Sustainable e-government in developing countries

Citizens' perceptions are important because they are major stakeholders in e-government (Almagwashi, 2014) and participate in one of the four relationships within e-government, Government-to-Citizens (Zaidi et al., 2014). However, Choi et al. (2014) warn of the complexity of studying stakeholder involvement.

There are several reasons for using Saudi Arabia as a case study for this research. Since it is a developing country (Saxena, 2018), Sæbø (2012) makes a connection between e-government and improved sustainability, asserting that introducing e-government in developing countries impacts sustainability in those countries. Furuholt and Wahid (2008) argue that in developing countries, e-government research tends to focus narrowly on the success or failure of system development, with little research into sustainability within e-government systems. Lessa et al. (2015) report that many e-government projects become unsustainable, indicating their failure to meet stakeholders' aspirations and needs. Moreover, a qualitative study by Mkude and Wimmer (2015) comparing e-

government design and implementation in developing and developed countries found that all respondents considered sustainability an important and significant factor which must be addressed appropriately. Helbig et al., (2015) identify two challenges to the sustainability of e-government initiatives in developing countries, namely the dependency on donations to fund initiatives and the difficulty of understanding citizens' needs. Dzhusupova et al. (2011) note that few studies have addressed the challenges which face developing countries and influence sustainable e-governance initiatives, in both identification and mitigation.

3.4 E-government success, failure and sustainability

Dečman (2003) states that sustainable development is a factor in e-government success. Nurdin et al. (2016) report that high failure rates of e-government projects in developing countries arise from a combination of organisational, financial, human and infrastructure challenges. According to Lessa et al. (2015), e-government systems in developing countries often fail because of poor understanding of the relevant success factors. Recent research has shown that in 2010, 21% of software development projects failed, while 63% of projects were rated as unsuccessful overall (Dalcher, 2014). In 2015, as many as 71% of projects were unsuccessful (Hastie and Wojewoda, 2015). In response to the lack of research into e-government sustainability in developing countries, the presented empirical study helps to identify sustainability characteristics and their importance from the perspective of citizen stakeholders.

4. Methodology

Few studies have been conducted on sustainable e-government (Kumar & Best 2006; Larsson & Grönlund 2014). This study represents the first large-scale quantitative survey in the KSA on sustainability. Its objective is to identify and rank the characteristics of sustainable e-government in the KSA and barriers to its success. The characteristics and barriers explored were identified by reviewing the existing academic literature. However, this study breaks new ground by testing the relationship between these characteristics and sustainable e-government within a KSA context. This empirical investigation is exploratory and forms part of a larger ongoing PhD study aimed at the development of an e-government framework for sustainable development.

Wohlin et al. (2012) explain that an explorative survey is used to prepare for further detailed investigations, in order to ensure that vital issues are not overlooked. Accordingly, quantitative instruments were designed and non-probabilistic sampling was adopted in the data collection phase, because these are beneficial characteristics of exploratory research, particularly when seeking to understand a new situation (Cummings and Sibona, 2017). Multiple sampling strategies were used, in order to improve the quality and quantity of the responses.

The majority of the 88 items in the survey were of the closed type, to support more effective comparison of results. These were of two kinds: five-point Likert scale questions and ranking questions. Davino and Fabbris (2013, p.24) report that ranking individual items can provide an 'absolute measurement'. Ranking questions can however be challenging to respondents, since they require considerable effort in mapping, thinking, ordering and trading off their choices. Some open questions were also included, to explore respondents' opinions beyond the limits of fixed responses. However, the scope of this paper is limited to the analysis of a subset of the results.

The reliability and internal consistency of the survey were assured by two methods: experts were asked to assess its face validity and the Cronbach's alpha internal consistency test was applied. Alpha values ranged between .828 for the three items on barriers to adopting sustainable e-government systems and .874 for the nine items on sustainable e-government systems. These are well above the 0.7 cut off value below which Hair et al. (2010) suggest that consistency may be problematic. There were 442 responses in total, but no response rate could be calculated because the questionnaire was deployed online, using snowball, convenience and volunteer sampling.

5. Key findings

Analysis of the survey results was completed using SPSS. Table 1 ranks the results for the nine Likert scale questions on sustainable e-government systems. The results are shown as means in rank order for brevity.

Table 1: Sustainable e-government

Rank	Questions/hypotheses	Mean
1	A high level of software sustainability in e-government will encourage users to use it.	4.37
2	Using a sustainable e-government system will increase my trust in the system.	4.36
3	A sustainable e-government system will increase the security of my information.	4.32
4	A sustainable e-government system changes in a dynamic way to meet stakeholders' requirements.	4.31
5	Using a sustainable e-government system will maintain good performance.	4.29
6	System reliability increases the level of sustainability of the system.	4.26
7	Using a sustainable e-government system will reflect a good user experience.	4.20
8	Using a sustainable e-government system on PCs or smart devices will reduce energy consumption.	4.05
9	Using a sustainable e-government system on PCs or smart devices will reduce resource consumption.	4.01

Responses showed a positive relationship between the level of sustainability within an e-government system, especially its software, and its adoption. Trust and security were found to be respectively the second and third most important characteristics of sustainable e-government systems. This is consistent with Choi et al. (2014)., who found that security and privacy must be considered in order to achieve a sustainable e-government system.

An exploratory study by Condori-Fernandez and Lago (2017) identified satisfaction in terms of trust as a very important requirement for social sustainability in software-intensive systems. Similarly, Almarabeh and AbuAli (2010) state that trust is an important factor affecting the success of e-government systems. However, our results contradict those of another recent exploratory study, by Abu-Shanab and Al-Quraan (2015), who conclude that while the perception of trust is an initial factor attracting people to use a system, it does not contribute to the sustainability of e-government projects by making them more likely to continue to use it. They nevertheless argue that trust is a social belief which could evolve in future.

Lessa et al. (2015) report that many e-government systems become unsustainable because they fail to satisfy stakeholders' needs (explored in hypothesis 4; see Table 1). In view of the importance of meeting stakeholders' requirements, which can evolve over a system's lifespan, system flexibility is an important characteristic of sustainable e-government. The fifth most important characteristic of sustainable e-government, according to the current survey, is performance. Rodrigues et al. (2016) found that the adoption of e-government increased when the performance expectancy of e-government services was high.

The sixth most important characteristic was reliability, indicating a positive relationship with the level of sustainability within e-government systems. Usability was ranked seventh, indicating less importance compared to other studies, such as that of Venkatesh et al. (2012), who found usability to be a significant factor in determining citizens' intention to use services and be satisfied by them. Similarly, Condori-Fernandez and Lago (2017) identify usability as an important aspect of social sustainability in software engineering development. A review of other studies by Rodrigues et al. (2016) also found that usability was a key factor in effective e-government systems. Our results are consistent with the literature in finding that the use of sustainable e-government systems will reflect a better user experience.

The two characteristics which received the lowest scores concerned the environmental dimension of sustainability, specifically the beneficial effects of sustainable e-government on the consumption of energy and of resources. It is notable that relatively few respondents agreed strongly with either of these two items, compared with those ranked more highly. This could be interpreted as revealing a degree of uncertainty and lack of understanding of the environmental dimension and its characteristics, or of the whole concept of sustainable e-government. A relatively high proportion (around a fifth) of respondents gave neutral responses to these two items, showing that environmental issues are not clearly understood by KSA citizens. Venkatesh et al. (2012) affirm that computer resource requirements have an important effect on citizens' intention to use services and their satisfaction with them. The lack of concern with the consumption of both resources and energy in the present study places the environmental dimension as the least important in software sustainability in the KSA. More and deeper investigation is needed into green software issues, their intertwining with the sustainability of e-government and how members of society understand these concepts.

This area was explored further in a question exploring the difference between green-ability and sustainability. Unsurprisingly, around 40% of respondents expressed no opinion about similarities and differences between these concepts and a similar number had an incorrect understanding of the difference, despite definitions of the two concepts being provided alongside the question. While the overall results show that using sustainable e-government systems can reduce energy consumption on smart devices and PCs, this appears to be of little interest from the perspective of users in the KSA.

The Spearman's rank-order correlation coefficient (r_s) was calculated to determine the relationship between the importance of sustainability characteristics and the length of respondents' experience with e-government services (less than a year, 1-3 years, 4-6 years, over six years). The use of r_s was appropriate because the results were not normally distributed. We found a strong, positive correlation between experience of e-government use and seven of the nine characteristics explored in Table 1, all statistically significant according to their r_s and p-values, as seen in Table 2.

Table 2: Spearman's rank-order correlation results for experience in using e-government and sustainable e-government characteristics

Sustainable e-government characteristics	r_s	p
Trust	.152	.001
Performance	.119	.012
Resource consumption	.118	.013
Usability	.163	.001
Flexibility (Changing needs)	.111	.020
Sustainability increases adoption	.106	.026
Reliability	.175	.000

The results in Table 2 show that trust, usability and reliability were the most strongly correlated with e-government experience. Two characteristics, namely energy consumption and security, are absent from Table 2 because they were not significantly correlated with experience of e-government use.

Spearman's r_s was also calculated to determine the relationship between each sustainable e-government characteristic and the strength of respondents' knowledge of sustainability (none, poor, moderate, good, very good). There was a strong, positive and statistically significant correlation between sustainability knowledge and five characteristics, according to their r_s and p-values (Table 3).

Table 3: Spearman's rank-order correlation results for sustainability knowledge and sustainable e-government characteristics

Sustainable e-government characteristics	r_s	p
Trust	.171	.000
Performance	.138	.004
Resource consumption	.117	.014
Usability	.211	.000
Reliability	.129	.007

Table 3 shows that the characteristics most strongly correlated with e-government experience were trust, performance, usability and reliability. Overall, the results confirm the importance of awareness of the sustainability concept and its relation with e-government.

5.1 Barriers

The study investigated three main barriers to the adoption of sustainable e-government, identified from the literature, namely lack of awareness, inability to predict the needs of future generations and inability to meet current users' needs. The first barrier is related to policymakers' mission to improve public awareness of the benefits of using sustainable e-services, including e-government. Dzhusupova et al. (2011) found that there had been little research into the challenges, including low awareness, facing developing countries in their efforts to undertake sustainable e-governance initiatives. Abu-Shanab and Al-Quraan (2015) report a significant positive

relationship between citizens' awareness of e-government projects and sustainability. Related research indicates that in order to ensure that software engineering is sustainable, it is essential to raise awareness among business analysts and developers of the benefits of sustainability in the software industry (Penzenstadler, 2014).

The second and third barriers arise from the pivotal importance of meeting users' present and future needs when developing sustainable e-government systems. Al-Khouri (2013) argues that existing practice in the e-government field reflects the difficulties of ensuring that such complex systems meet current needs. Considering the Brundtland definition of sustainable development cited in the introduction to this paper, sustainable e-government systems must be designed to meet the next generation's needs. However, it is unclear how they can be expected to do so if their development does not satisfy current needs and take account of their dynamic nature. These considerations highlight a number of issues which are critical to the sustainability of e-government systems, namely predicting future needs, identifying the effects of existing e-government systems in the short and long term and mitigating the negative influence of e-government services on the sustainability dimension.

Calculation of mean scores on survey items related to the above barriers reveals little difference among them in their perceived importance. Respondents considered lack of awareness to be marginally the most important, with a mean score of 4.1, followed by the government's inability to predict future generations' needs (4.0) and its inability to meet current users' needs (3.9). While failing to distinguish clearly among them in terms of importance, the results are consistent with findings in the literature that these are three key barriers to sustainable e-government.

5.2 Ranking

Respondents were asked to evaluate the characteristics of sustainable e-government discussed in Section 3.2 according to their priority. The proposed list was based on reviewing the literature on software sustainability and e-government. Overall mean values were calculated and a non-parametric Friedman test was conducted, allowing the characteristics to be ranked by total mean scores as shown in Figure 1.
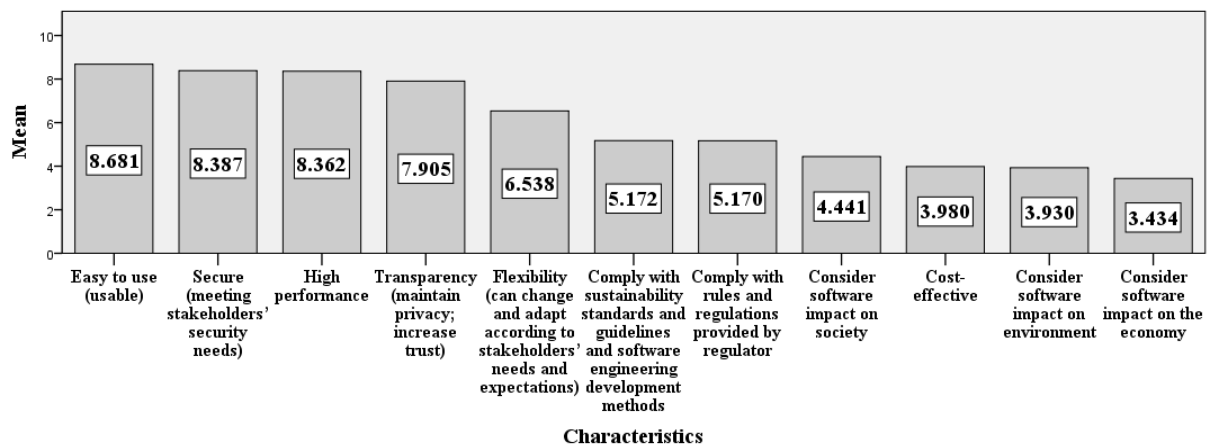

Figure 1: Total mean scores for sustainable e-government characteristics

Figure 1 shows that participants considered usability more important than users' security, contradicting the results reported earlier. The contradiction can be justified as the previous question asked respondents how important a specific characteristic is for sustainable e-government, whereas in this question, respondents rank a characteristics against one another. Other highly significant characteristics were performance, transparency and flexibility, while sustainability standards and compliance with software engineering guidelines during the development of e-government systems were more important for respondents than compliance with conditions established by regulators, which indicates users' awareness of sustainable e-government. It is notable that respondents were not greatly concerned with the impact of sustainable e-government software on social, environmental and economic factors but that they were somewhat more concerned about its social impact.

Finally, the study identified gender differences in the responses. According to the results of a Mann-Whitney U test, males ranked usability and flexibility higher than females did to a statistically significant degree: $U = 13702$, $p = .002$ and $U = 12955$, $p = .000$ respectively. Conversely, females ranked software impact on society and cost-effectiveness statistically significantly higher than males: $U = 13918$, $p = .004$ and $U = 13544$, $p = .001$

respectively. The mean rankings of these characteristics also differed by gender in that the first priority for males was usability, whereas for females it was security.

6. Conclusion

This paper reports an in-depth exploration of sustainability from the perspective of e-government service users in the KSA. In doing so it highlights key differences between priorities reported in the literature on green-ability, in terms of both resource and energy usage, and those identified within the KSA. The research also investigated the importance of key barriers identified in the literature with regard to sustainability in the KSA, confirming their importance. Finally, it indicates interesting variances in the perceived importance of characteristics based on gender, which could be explored more fully in a follow-up study.

7. References

Abu-Shanab, E. and Al-Quraan, H. (2015), "Factors Influencing Electronic Government Social Sustainability", *International Journal of Information Communication Technologies and Human Development*, Vol. 7 No. 2, pp. 42–56.

Al-Khouri, A.M. (2013), "e-Government in Arab Countries: A 6-Staged Roadmap to Develop the Public Sector", *Journal of Management and Strategy*, Vol. 4 No. 1, pp. 80–107.

Alcaide Muñoz, L. and Rodríguez Bolívar, M.P. (2018), "Experiences of E-Government Development Implementation in Developing Countries: Challenges and Solutions", *International E-Government Development*, 1st ed., Springer, Cham, pp. 3–18.

Alfayad, M. and Abbott-Halpin, E. (2017), "Understanding the Current Situation of E-Government in Saudi Arabia: A Model for Implementation and Sustainability", in Borges, J.V. and Rouco, J.C.D. (Eds.), *Proceedings of the European Conference on E-Government ECEG*, Academic Conferences Ltd, Lisbon, pp. 306–314.

Alghazi, A., Li, M., Shen, J. and Fosso, S. (2017), "Aligning Business Strategy with IT Strategy from Business Model to Enterprise in Saudi Arabia Public Sector", *21st Pacific Asia Conference on Information System (PACIS 2017)*, AIS Electronic Library, Australia, pp. 1–8.

Almagwashi, H.A.A. (2014), *A Framework for Preserving Privacy in E-Government*, Cardiff University.

Almarabeh, T. and AbuAli, A. (2010), "A general framework for e-government: definition maturity challenges, opportunities, and success", *European Journal of Scientific Research*, Vol. 39 No. 1, pp. 29–42.

Ashaye, O.O.R. (2014), *Evaluating the Implementation of E-Government in Developing Countries: The Case of Nigeria*, PQDT - UK & Ireland, Brunel University.

Attah, N. V. (2010), *Environmental Sustainability and Sustainable Growth: A Global Outlook*, University of Pennsylvania.

Calero, C. and Piattini, M. (2015), *Green in Software Engineering*, 1st ed., Springer, Cham.

Choi, H., Park, M.J., Rho, J.J. and Zo, H. (2014), "Rethinking the assessment of e-government implementation in developing countries from the perspective of the design–reality gap: Applications in the Indonesian e-procurement system", *Telecommunications Policy*, Elsevier, Vol. 40 No. 7, pp. 644–660.

Condori-Fernandez, N. and Lago, P. (2018), "Characterizing the contribution of quality requirements to software sustainability", *Journal of Systems and Software*, Vol. 137, pp. 289–305.

Cummings, J. and Sibona, C. (2017), "Crowdsourcing Surveys: Alternative Approaches to Survey Collection", *Journal of Information Systems Applied Research*, Vol. 10 No. 1, pp. 44–54.

Dalcher, D. (2014), "Rethinking Success in Software Projects: Looking Beyond the Failure Factors", *Software Project Management in a Changing World*, 1st ed., Springer, Berlin, pp. 27–49.

Davino, C. and Fabbris, L. (2013), *Survey Data Collection and Integration*, 1st ed., Springer, Berlin, available at:https://doi.org/10.1007/978-3-642-21308-3.

Dečman, M. (2003), "Trust in e-Government: Digital Signatures without Time Stamping?", *Electronic Government*, 1st ed., Springer, Berlin, pp. 256–259.

Dzhusupova, Z., Janowski, T., Ojo, A. and Estevez, E. (2011), "Sustaining electronic governance programs in developing countries", *European Conference on E-Government ECEG*, Ljubljana, pp. 203–212.

Estevez, E., Janowski, T. and Dzhusupova, Z. (2013), "Electronic Governance for Sustainable Development – How EGOV Solutions Contribute to SD Goals?", *14th Annual International Conference on Digital Government Research - Dg.o '13*, ACM Press, New York, pp. 92–101.

Furuholt, B. and Wahid, F. (2008), "E-Government Challenges and the Role of Political Leadership in Indonesia", *41st Annual Hawaii International Conference on System Sciences*, IEEE, Waikoloa, pp. 411–421.

Hair, J., Wolfinbarger, M., Ortinau, D. and Bush, R. (2010), *Essentials of Marketing Research*, 2nd ed., McGraw-Hill/Irwin, New York.

Hastie, S. and Wojewoda, S. (2015), "Standish Group 2015 Chaos Report", available at: https://www.infoq.com/articles/standish-chaos-2015 (accessed 26 September 2016).

Helbig, N., Dawes, S., Dzhusupova, Z., Klievink, B. and Mkude, C.G. (2015), "Stakeholder Engagement in Policy Development: Observations and Lessons from International Experience", *Policy Practice and Digital Science*, 10th ed., Springer, Cham, pp. 177–204.

Ibrahim, M., Al-Nasrawi, S., El-Zaart, A. and Adams, C. (2015), "Challenges facing e-government and smart sustainable city: An arab region perspective", in Adams, C. (Ed.), *15th European Conference on eGovernment ECEG*, ACPIL, Portsmouth, pp. 396–402.

Kates, R.W. (2010), *Readings in Sustainability Science and Technology*, No. 213, Cambridge, MA.

Khamis, M.M. and van der Weide, T.P. (2017), "Conceptual Diagram Development for Sustainable e‑Government Implementation", *Electronic Journal of E-Government*, Vol. 15 No. 1, pp. 33–43.

Koziolek, H. (2011), "Sustainability evaluation of software architectures", *Proceedings of the Joint ACM SIGSOFT Conference -- QoSA and ACM SIGSOFT Symposium -- ISARCS on Quality of Software Architectures -- QoSA and Architecting Critical Systems -- ISARCS - QoSA-ISARCS '11*, ACM Press, New York, p. 3.

Kumar, R. and Best, M.L. (2006), "Impact and Sustainability of E-Government Services in Developing Countries", *The Information Society*, Vol. 22 No. 1, pp. 1–12.

Larsson, H. (2014), *Sustainable eGovernance*, Örebro University.

Larsson, H. and Grönlund, Å. (2014), "Future-oriented eGovernance: The sustainability concept in eGov research, and ways forward", *Government Information Quarterly*, Vol. 31 No. 1, pp. 137–149.

Lessa, L., Anteneh, S., Klischewski, R. and Belachew, M. (2015), "Towards a conceptual framework for pledging sustainable e-Government success", *AFRICON 2015*, IEEE, Ethiopia, pp. 1–5.

Leyh, C., Rossetto, M. and Demez, M. (2014), "Sustainability management and its software support in selected Italian enterprises", *Computers in Industry*, Vol. 65 No. 3, pp. 386–392.

Mahmoud, S.S. and Ahmad, I. (2013), "A green model for sustainable software engineering", *International Journal of Software Engineering and Its Applications*, Vol. 7 No. 4, pp. 55–74.

MCIT. (2018), "National transformation: Enhancing government integration. MCIT initiatives for more efficient outputs", available at: http://www.mcit.gov.sa/Ar/MediaCenter/Pages/News/News-08121437_138.aspx (accessed 18 February 2018).

Mkude, C.G. and Wimmer, M.A. (2015), "E-government Systems Design and Implementation in Developed and Developing Countries", *Electronic Government*, Springer, Cham, pp. 44–58.

Nurdin, N., Stockdale, R. and Scheepers, H. (2016), "Influence of Organizational Factors in the Sustainability of E-Government", *Trends, Prospects, and Challenges in Asian E-Governance*, 1st ed., IGI Global, pp. 281–323.

Penzenstadler, B. (2014), "Infusing Green: Requirements Engineering for Green In and Through Software Systems", in Penzenstadler, B., Mahaux, M. and Salinesi, C. (Eds.), *Third International Workshop on Requirements Engineering for Sustainable Systems*, CEUR-WS, Karlskrona, pp. 44–53.

Razavian, M., Procaccianti, G. and Tamburri, D.A. (2014), "Four-Dimensional Sustainable E-Services", in Gmez, J.M. and Sonnenschein, M. (Eds.), *28th EnviroInfo 2014 Conference*, BIS-Verlag, Oldenburg, pp. 221–228.

Rodrigues, G., Sarabdeen, J. and Balasubramanian, S. (2016), "Factors that Influence Consumer Adoption of E-government Services in the UAE: A UTAUT Model Perspective", *Journal of Internet Commerce*, Vol. 15 No. 1, pp. 18–39.

Sæbø, Ø. (2012), "E-government in Tanzania: Current Status and Future Challenges", *Electronic Government. EGOV 2012. Lecture Notes in Computer Science*, Springer, Berlin, pp. 198–209.

Saxena, S. (2018), "National open data frames across Japan, The Netherlands and Saudi Arabia: role of culture", edited by Cox, D. and Saritas, O.*Foresight*, Vol. 20 No. 1, pp. 123–134.

Sheldrick, L. (2015), *Designing Ubiquitous Sustainability into Product Design Processes*, Loughborough University.

Stoiciu, A. and Popa, A. (2012), "E-government – a gateway to the future", *Revista de Stiinte Politice*, No. 35, pp. 372–381.

Stoll, P. (2009), *Exploring Sustainable Industrial Software System Development within the Software Architecture Environment*, Malardalen University.

Venkatesh, V., Chan, F.K.Y. and Thong, J.Y.L. (2012), "Designing e-government services: Key service attributes and citizens' preference structures", *Journal of Operations Management*, Vol. 30 No. 1–2, pp. 116–133.

Venters, C., Jay, C., Lau, L.M.S., Griffiths, M.K., Holmes, V., Ward, R.R., Austin, J., et al. (2014), "Software sustainability: The modern tower of babel", in Penzenstadler, B., Mahaux, M. and Salinesi, C. (Eds.), *Third International Workshop on Requirements Engineering for Sustainable Systems*, CEUR-WS, Karlskrona, pp. 7–12.

Wang, S.H.-M., Williams, P., Shi, J. and Yang, H. (2015), "From Green to Sustainability - Trends in the Assessment Methods of Green Buildings", *Frontiers of Engineering Management*, Vol. 2 No. 2, pp. 114–121.

Wohlin, C., Runeson, P., Höst, M., Ohlsson, M.C., Regnell, B. and Wesslén, A. (2012), *Experimentation in Software Engineering*, 1st ed., Springer, Berlin.

Yesser. (2018), "Overview", available at: https://www.yesser.gov.sa/EN/programdefinition/pages/overview.aspx (accessed 10 February 2018).

Zaidi, S.F.H., Siva, S. and Marir, F. (2014), "Development and Validation of a Framework for Assessing the Performance and Trust in e-Government Services", *International Journal of Applied Information Systems*, Vol. 7 No. 4, pp. 28–37.