E-Voting in Developing Countries

Current Landscape and Future Research Agenda

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Abstract. The rate of e-voting implementation in developing countries is too significant to ignore, yet the lack of theoretical common ground has resulted in dispersed ways of perceiving the technology. The objectives of this paper, therefore, are twofold: (1) providing a thematic landscape and defining the state of the current research on e-voting in developing countries, and (2) propounding courses for future research on e-voting which emphasize social, organizational and technological accounts of the technology. Following a systematic examination of sixty seven articles, this work found that the current studies have inclined towards technological centrism and that the question is no longer 'why' but 'how' to fit e-voting concepts and theoretical constructs into the various contexts of developing democracy. There is also evidence to suggest that system design studies have often been conducted without sufficient effort allocated for the strategic design of e-voting initiatives. This paper thus argues that future research on e-voting in developing countries should be focused on drawing the holistic image of reciprocal relationships between social and technical aspects of the technology. As a consequence, future studies must perceive e-voting not as a mere technological means but rather as a complex socio-technical agent that plays an important role in social and political reforms. They need to be more critical of the motives behind e-voting initiatives and conservative in following established development frameworks.

Keywords: E-voting in developing countries · Socio-technical aspects · Technological centrism

1 Introduction

The developing world has been reported to have significant interests in voting technology [1] and the rate of e-voting implementation has been faster therein than in developed countries [2]. In countries such as Nigeria, e-voting has been considered a necessity [3] and as the only solution for credible elections [4]. Nigeria has set its eyes on e-voting since 2011 [3, 5] and, undeterred by the problems found during its implementation [4, 6], seems determined to proceed with the technology. In Nigeria, the traditional voting system was believed to have allowed significant irregularities and a lower level of probity, accountability and transparency [6], and have overseen corruptions, oppressive acts and administrative failures [3, 4, 7]. Similar enthusiasm has

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been shown in India, where e-voting was assumed to be significantly more reliable than paper ballot [8]. In contrast, e-voting in Brazil is often seen from a different perspective, placing more concerns in the social aspects of its implementation. Although Brazil's e-voting election in 2000 was considered a success [9], issues of the lack of public trust and confidence in the system have been raised [10]. E-voting has failed to improve public involvement in politics and the delivery of public services despite the vast investments made to generate public trust in the system [11]. Critiques have also been raised over the government decision to employ the technology, given that millions of Brazilians still suffered from poverty and illiteracy [12]. The decision has been seen as market-driven and lacked adequacy in terms of information and communication technologies strategy [13].

Such a dispersed way of perceiving the technology might have been caused by a lack of theoretical common ground, departing from an insufficient literature review that focused specifically on e-voting in developing countries. This study aims to fill this gap by providing a landscape of current themes of research on the subject, underpinned by rigor and transparency. The result of this study is expected to endorse theoretical progress [14] and serves as a solid ground for academic communities [15], as well as to help practitioners developing a more grounded protocol [16] for e-voting initiatives in developing countries. This present study systematically examined sixty seven academic articles to answer the following questions: (1) what is the thematic landscape of the current research on e-voting in developing countries?; and (2) how should future research on e-voting in developing countries be conducted, taking into account the associated social, organizational, and technological aspects? This paper provides empirical evidence of the current state of the research and generates a summary of the existing research gaps, presented in the following structure. Firstly, Sect. 2 presents the arguments on the needs to view e-voting as an intricate interrelatedness of social, organizational, and technological actors. Subsequently how this present study was conducted and the definition of the classification methods employed are introduced in Sect. 3. Next, Sect. 4 identifies existing research gaps and discusses the findings. Note that, due to the limitation of space, the full list of articles included in the final dataset is only available in the appendix. Finally, recommendations for future e-voting inquiries are developed based on these gaps and presented in Sect. 5.

2 The Need for an Ecological View in E-Voting Research

Khan et al. [17] suggested that the success of computer-based systems implementations should be attributed to the simultaneous configuration of technical, organizational, and social aspects of the systems. The technical aspect concerns how technology and business processes transform inputs to outputs; while the organizational and social system emphasizes the needs for understanding people's attitudes, skills and values, as well as the relationships among them within an organizational structure [18]. This conception sees information technology not as a mere tool which is readily, un-problematically applicable in any given context for any specific purpose [19], but rather as a complex socio-technical agent whose correlative interactions with other social agents are significant in order to understand how the technology works.

Technology has only a small effect in shaping human intention and choices, hence the impacts associated with e-voting initiatives, for instance, can be attributed to human agency shaped by social context [20]. It does not mean that technical solutions for e-voting systems can be ignored, rather the emphasis is on how social and organizational aspects should be seen just as decisive [21], if not more, to e-voting success.

It has been reported that the use of technology in elections might have failed to improve public participation due to socio-technical gaps. Al Shammari et al. [22] identified three dimensions of disparities lingering in e-voting implementations. First is the technological gap caused by incompatibility between systems components – both hardware and software. Next is the social gap occurring between social policies and human behavior which represents moral discrepancies among users, between users and social values, and between democratic culture and election protocols. E-voting indeed conveys different significance for different actors, and their use of the technology may depart from different agendas [23]. The last dimension is the socio-technical gap caused by disparities between social and computer policies. For e-voting systems therefore, the social world and the technology used therein cannot be seen as separate, rather, they co-constitute each other [24].

The causes of failures to implement electoral information technology are associated not only with the technological aspects of the systems, but also with the organizational context in which they are used [21, 25]. Although one of the main objectives of utilizing technology in elections is to improve democracy through increases in voter turnouts [26], in practice e-voting is seldom seen as a social utility. Adoptions are often driven simply by over-acknowledgement of technological possibilities and for the sake of bureaucratic convenience [27], as a result of unsatisfactory experiences from the use of traditional paper-based systems. In some cases, failures may originate from the scarcity of resources [28, 29] and the overreliance of governments on the private sector [27, 29] due to the lack of IT expertise.

The decision on whether or not a country should implement e-voting can never be detached from the political implications that precede and may follow. The question is what drives governments to initiate the adoption of a system that arguably is not better than the one it replaces? What motivates government to tolerate "social trade-offs" [23] to ensure public acceptance of the technology even though it may put democratic practices in the hands of near-monopolist private sectors [27]? E-voting, therefore, needs to be seen from a broader, ecological point-of-view that goes beyond the technology and includes social and organizational perspectives and interrelationships amongst them [22, 23].

3 Research Method

3.1 Literature Sampling

The approach for performing rigorous literature reviews [14–16, 30–32] was employed in this study. This present work examined a saturated set of literature which fell within the following criteria. Firstly, the main object of discussion of the reviewed papers was electronic voting or e-voting - a system, device, machine that records, stores, and

processes election data electronically – as illustrated by [33], among others. This present study agrees with the thematic characterization of e-participation wherein e-voting is defined as an instance of e-participation activities [34–36], and also with the view in which e-voting is considered an artefact of e-government [37]. Echoing [20], this paper took into account only sources associated specifically with e-voting, henceforth articles concerned with other closely related technologies, i.e. e-government, e-governance, e-polling, e-participation, e-democracy, e-inclusion, e-petition, e-politics, e-consultation, e-decision making, e-rule making, e-deliberation, e-campaign, and e-community were excluded even if they referred to e-voting as an instance. Secondly, this present study looked only at e-voting systems used in either presidential or parliamentary elections where they were considered safety-critical, thus those used for purposes otherwise, e.g. e-voting for entertainment [38], were not included. Thirdly, the context to which the research applies was of developing countries, or countries with a developing economy as indicated by the International Monetary Fund [39]. Finally, this study was interested only in papers published between January 2000 and January 2015 and discarded papers written in non-English language.

This study performed searches over several publication databases, rather than concentrating only on a limited number of journals. The reason for this was to include articles available across disciplines, hence enriching the dataset [31]. The databases used in the sampling were: IEEEXplore, ScienceDirect, EbscoHost, ACM Digital Library, Springer Link, ProQuest, Emerald, Web of Science, SCOPUS, and Google Scholar. It is realized that the term "electronic voting" – despite being widely used since 1970s [40] – was not the only form, and that other phrases have been used to name or refer to the same instance. Moreover, this present study was interested in e-voting conducted at voting kiosks, through the internet and/or using mobile devices, and therefore it also searched for terms beyond "electronic voting" and "e-voting" (see Table 1). The sampling process was composed of episodes performed from March 2015 to September 2015 and was iterative in nature. This approach was preferred as it enabled the examination of the result of earlier set sampling, as well as provided chances to revisit the criteria and make necessary adjustments. Indeed, along the process several phrases which might have considerable similarities in their properties to e-voting, such as tele-voting [38, 41] and mobile referendum or m-referendum [42] had

Table 1. List of search terms

Search Terms					
Developing country	Internet voting	Online voting	Digital ballot	Virtual voting	e-voting
Developing countries	Internet election	Online election	Remote voting	Virtual election	e-election
Electronic voting	Internet ballot	Online ballot	Remote election	Virtual ballot	e-ballot
Electronic election	Mobile voting	Digital voting	Remote ballot	Voting machine	i-voting
Electronic ballot	Mobile ballot	Digital election	Voting device	Voting technology	m-voting

been identified. However, since they were used mainly for public polling and petition, they were taken out of the dataset. Furthermore, for the purpose of sampling, this present study adopted the selection algorithm proposed by [30] where the final dataset was the result of the following cyclic sampling-sequence: (1) After the first search, duplicates were identified and excluded from the sample; (2) Next, more papers that did not fit the criteria were left out after careful examination of the titles, abstracts and full texts; (3) Finally, to enhance the quality of the search, backward and forward citations checks were performed and the sequence was reiterated if new articles came up. This present work agrees with [30] that a literature review is never complete and that new articles will always appear, however, the sampling process was terminated when the data was exhausted, i.e. when there was no new result after the repeated search that fitted the criteria [15]. At the end, sixty-seven selected articles were included in the final dataset.

3.2 Research Themes Classification

Very few observers have contributed to the mapping of theoretical advancement in e-voting. Some of the most recent work offering a conceptual framework to perceive the trend of e-voting studies [22] have effectively categorized the current development and catered a clearly defined foundation for future inquiries. Despite their contributions, however, such studies have focused on technological aspects of e-voting and left little space for social, cultural and political variables. This study, therefore, looked further into the field of e-government and primarily adopted the themes classification of [17] for the following reasons. Firstly, their work emphasized framing e-government studies within socio-technical systems theory which enables the definition of the current state of research on e-voting aligned with social, organizational and technological aspects of e-voting implementations. Secondly, the context of their study was developing countries. Therefore, owing to this similarity, both studies are expected to enhance each other and set down a more resolute foundation for future work on e-government and e-voting in developing democracy.

The framework consists of four topic-clusters or themes: society-related, organization-related, technology-related, and combined issues. The society category encompasses issues from a society point-of-view where e-government initiatives are questioned over their effectiveness and impact on citizens, and how social behavior may, in return, determine government policies, strategies and practices. Topics of digital divide, e-readiness, public acceptance and attitude, trustworthiness, as well as socio-economic aspects were included in this class.

For e-voting, however, the mechanisms of public reviews and assessments needed to be further included for a design specification better resembling the reality [43] and the improvement of public awareness on e-voting implementation strategy [44]. Public debates, for example, foster public trust and confidence in the system, provide transparency over the decision-making process, and reveal if potential voters are willing to use the technology. This study further imposed that voters' education is an important factor to enhance people's intention to use the system [45], and hence also needs to be included. Next, the organization cluster includes topics related to organizational

arrangements, processes and performance, among others. Research that looks at public-sector innovation, public-sector performance assessments, institutional arrangements – e.g. organizational structures, managerial processes, bureaucracy – organization e-readiness, public sector reforms and open governments were classified into this group. Then, there is the technology class where discussions on e-government technologies and systems are grouped together. This category forms a circle around information security, information and telecommunications infrastructure, mobile government, e-government model, et cetera. Borrowing from Ngai and Wat's classification of e-commerce [46], this category was further expanded to include topics on network technology and infrastructure, algorithms, technological components, and system security. It also accommodates formal methods, such as model checking and theorem proving, to support un-biased assessment of voting protocols and to impose transparency during the process [22]. Finally, the combined category incorporates research which is a compound of social, organizational and/or technical issues; such as those on the effects of e-government system on public sector, the problems with digitization and access to cultural heritage, as well as the existing reality-design gaps in e-government systems. Table 2 presents the themes classification used in this review.

Table 2. Themes classification (adapted from [17])

Society	Organization	Technology	Combined
E-voting social outcomes; Culture issues and e-voting adoption; E-voting success factors; E-voting and political, economic and social development; E-voting socialization (education and campaign) Industry-enabled e-voting; Digital divide (access, awareness, infrastructure, cost); Service localization; Public infrastructure (internet); Demographics (gender, education); User satisfaction, socio-economic and socio-political context; Citizen's acceptance and attitude; E-skills; Citizens e-readiness; Public reviews and assessments	Leadership; Project management; IS competencies development; IT Change Management; E-voting and intellectual capital; Public servant training; Perception of public servants; Work performance assessment (CSFs, KPIs); Cross-agency collaboration, inter-organizational information integration; Institutional arrangements (structures, bureaucracy); Inter-organizational connectivity agreements (Service Level Agreements); Standardization; Organization e-readiness; Public sector reforms; Open government; IT law (regulations, legal infrastructures); Organizational performance framework; Inter-operability framework and standards; Certification and audit	Information security (data security, system security: secure transactions, VPN, internal/external attacks); Information security management; Service quality (information/system quality); Multi-platform approach; Technological components (DRE, EVM); Network technology and infrastructure (inter-platform connectivity and compatibility, security); Algorithm and protocols; Mobile voting; Voter's systems requirements; ICT infrastructure; E-voting risk management; E-voting models and prototypes; E-voting infrastructure; E-voting technology evaluation framework; E-voting standards and compliance; E-voting governance; Open systems model and safety-critical systems approach; Formal design analysis and specifications	E-voting assessment framework (strategic, technological, organizational, economic, operational, and service); E-voting technology adoption and diffusion (system characteristics, user characteristics, external variables); Effects of e-voting on public sector (public servant ethics and attitude, organizational changes and restructuring, organizational policies, other organizational, technological, managerial, political legal and human aspects); Effects of e-voting on society (alterations in political paradigm, culture and uses of democratic apparatus); E-society readiness (technological, social, organizational, political, cultural and legal aspects); Digitization and access to political traditions and cultural heritage; Reality-design gaps in e-voting systems

4 Findings and Discussion

4.1 Descriptive Overview of the Result

It is apparent from Fig. 1 that, even though interests in research on e-voting in developing countries did not start until late 2003, there has been a significant increase in the number of publications during the last fifteen years. The numbers of articles in 2013 and 2014 make up a total of 38.8 percent of the reviewed papers and have more than doubled the number of the previous years. Since some countries, such as India in 2009 [8, 47], had initiated and been considered successful in implementing e-voting [48]; it is interesting to further inquire if this might have excited e-voting initiatives in other developing countries and motivated researchers in the field. Nigerian e-voting, for instance, had a considerable effect upon research on e-voting in other African countries (see for example [49]). Interestingly, it was not until Nigeria planned to employ the technology in 2011 [3, 5] that there was a sudden, significant growth in the number of publications. This suggests that nation's agenda might have been another factor leading to more productive inquiries on the topic. Indeed, countries such as Lebanon and Thailand, who apparently had never exhibited strong interest in the technology, had only one publication each [50, 51]. Similarly, although e-voting in South Africa had drawn researchers' interest as early as Nigeria [52], it has been scarcely discussed since.

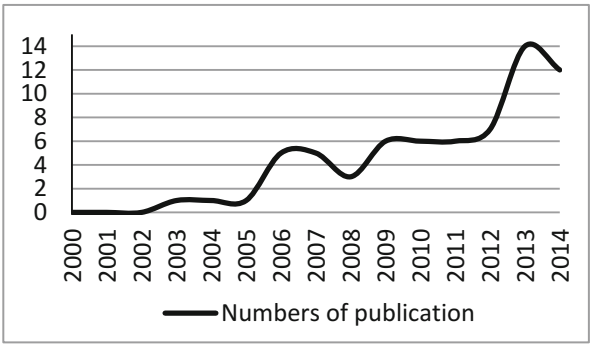

Fig. 1. Numbers of publications by year

Next, in order to understand the state of research on e-voting in developing countries, the articles under review were categorized according to the context in which the research was applied and were not associated with the country of the authors' origin or where their affiliation resided (see Table 3). This approach was favorable for two reasons: (1) the result can be used to depict the global interests in e-voting in a particular country, and (2) it enriched and improved the accuracy of the dataset. For example, the articles on e-voting in Nigeria were associated not only with Nigerian institutions but also with Malaysian [4, 7] and British [53] universities, among others. On the other hand, research on Brazilian e-voting was more society-centric and was, to a large extent, driven by only two prominent groups, namely Filho [11–13], and Avgerou [10, 54, 55].

Table 3. Distribution of articles by subject country

Country	n	%	Country	n	%	Country	n	%	Country	n	%
Nigeria	19	27.54	Iran	3	4.35	Tanzania	2	2.90	Mauritius	1	1.45
Brazil	7	10.14	Jordan	3	4.35	UAE	2	2.90	Mexico	1	1.45
Indonesia	5	7.25	S. Africa	3	4.35	Ghana	2	2.90	Thailand	1	1.45
Argentine	4	5.80	Colombia	2	2.90	Ecuador	1	1.45	Turkey	1	1.45
India	3	4.35	Pakistan	2	2.90	Lebanon	1	1.45	Uganda	1	1.45
									Others	5	7.25

This study further inquire on whether e-voting initiatives in developing countries have been preceded by a firm research foundation or otherwise. Indonesia, for instance, despite having only recently experienced several e-voting simulations at village and district level elections [56–58], contributed to 23.8 percent of the number of publications on e-voting in Asia. India, on the other hand, whose full e-voting elections had been referred to by many [9, 59, 60], was subject to fewer publications. Indeed several developing countries had conducted e-voting, such as Philippines in 2010 and 2013 respectively [61], and yet scientific articles that put significant effort into discussing them could hardly be found.

4.2 The Thematic Landscape of the Current Research

This study found that forty six percent of the reviewed articles saw e-voting from technological perspectives, where Nigeria topped the list with fourteen technology-related papers (see Table 4). That body of work mostly involved the development of e-voting models and prototypes, security analysis of the current systems [62] and assessment of mobile voting [63]. Topics looking into technology standards and compliance, governance, evaluation frameworks, and service quality have not been discussed anywhere during the last fifteen years. Understandably, emphasizing the provision of cutting-edge voting technology would likely speed up the

Table 4. Distribution of articles (Theme vs Country)

Theme	Country																				
	Nigeria	Brazil	Indonesia	Argentine	India	Iran	Jordan	S. Africa	Colombia	Pakistan	Tanzania	UAE	Ghana	Ecuador	Lebanon	Mauritius	Mexico	Thailand	Turkey	Uganda	Others
Society	1	3	1	0	0	0	2	2	1	0	1	0	0	1	0	0	0	0	0	1	0
Organization	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Technology	14	1	1	0	3	1	1	0	0	1	0	0	2	0	1	1	0	1	0	0	4
Combined	4	3	3	4	0	2	0	1	1	1	1	2	0	0	0	0	1	0	1	0	1

technological advancement of e-voting, which might have been considered as a major factor to further improve its adoptability. This emphasis is endorsed in the society theme which saw public acceptance of e-voting as the major issue to address, making up 76.9% of the number of articles in this class. As much as this topic would encourage better understanding of system requirements from voters' points of view, it might have overlooked e-voting social outcomes and its relationship with political and economic development. Topics on the digital divide [64], the socio-economic context of e-voting [11, 65, 66] and culture-related issues [52] have been scarcely discussed. The absence of society discussion suggests that current studies are technology-centric, reinforced by the lack of interest shown towards solely organization-related topics. The literature appears to show a growing focus on technology as the only solution for credible elections and for eliminating election irregularities, and that there exists no disparities between social/organizational agents and e-voting. That might have led to deficiencies of theoretical and conceptual advancement in the institutionalization of e-voting initiatives, which may, ironically, further jeopardize its implementation in developing countries. On a positive note, however, there have been attempts to combine organization with other themes, e.g. a look at security issues from organizational perspective [67], which contributed to thirty four percent of the total number of papers. Researchers have seen interrelationships among themes and acknowledged the complex nature of the context of e-voting implementations. The papers on combined issues discussed mainly topics of e-voting assessment framework, technology adoption and diffusion, and e-society readiness. Issues of how voting technology may affect public servants' ethics and attitude, how to narrow the reality-design gaps, as well as how e-voting impacts organizational changes and policies therefore still need attention.

Although technology-related research has had a positive trend, it showed an average growth-rate of only 0.3 publications per year. It seems that despite displaying sudden increases in some places, there were scattered swift declines and plateaux in publications (see Fig. 2), which might have come from a lack of research continuity on

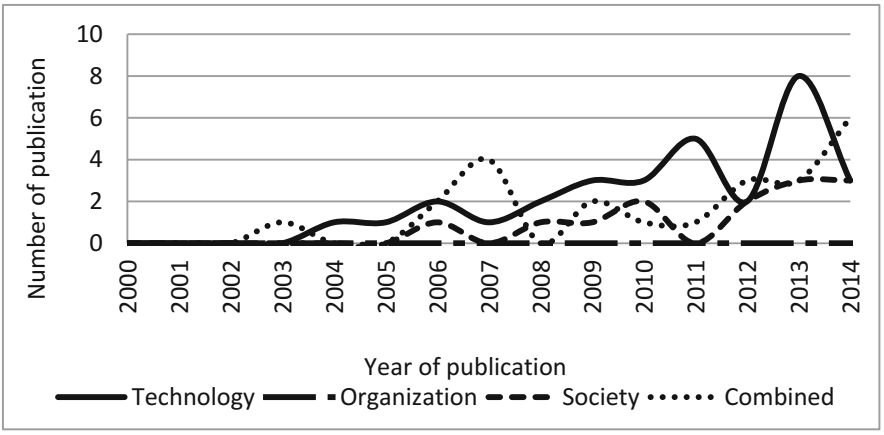

Fig. 2. Trend of themes

countries such as Lebanon and Thailand (see Table 4). The same situation also occurred in society-related themes (for example, Uganda and Ecuador) and combined studies (for example, Mexico and Turkey). With regard to technology-related theme, only Nigeria has demonstrated continuity since 2006 when the first end-to-end e-election model was proposed [68]. The trend continued with half of the publications afterwards addressing the prospect [63, 69] and promoting some models [5, 70] of mobile voting systems.

Other technology-related topics, such as service quality, multi-platform approaches, technology components, network technology and infrastructure, as well as formal design analysis and specifications have not drawn any interest. Articles of non-technological nature were first published in 2012 [71] and the later period has seen combined issues emerging in the field. Research on Nigerian e-voting, therefore, seems to have shifted towards more holistic inquiries such as on technology adoption [1, 4] and on critical factors of e-voting implementations [53] during recent years. The characteristics shown by Brazil, on the other hand, were considerably different. It is apparent that since its first full utilization of e-voting in 2000, Brazil has found researchers mostly interested in issues related to finding answers to electoral fraud problems [72], assessing the risks that come with implementing the system [13], and examining its social impacts [10, 11, 55, 65]. There are topics, nevertheless, that have never been visited, e.g. voter education, readiness of national industries, effects of e-voting on public sectors, reality-design gaps, and those under technology and organization-related themes, which require more attention in the future.

5 Recommendations

Society-related studies of e-voting in developing countries have put a greater emphasize on looking at citizens' acceptance of and their attitude towards the technology. Researchers have been trying to identify the applicability of e-voting concepts and theoretical constructs within the various contexts of developing democracies. These investigations can be understood as an attempt to answer challenges arising during several instances of e-voting implementation in, most notably, Latin America where election technology is seen as a social agent that interacts and reciprocally modifies political, economic, and other social agents. Concerns over the decision making process and public trust have been brought into attention by highlighting the correlations between e-voting and the citizens, for instance. There was a supposition that election technology contributes to changes in social, economic and political structures, whether positively or negatively, which need to be properly addressed to ensure smooth transitions as the consequence of e-voting adoption initiatives. Encouragement should be given to specific studies on how healthy domestic industries would have enabled developing countries' self-provision of e-voting infrastructures to eliminate their technological and political dependencies on foreign power and preserve their control over democracy. E-voting, hence, must not be seen as a mere technological means but a complex socio-technical agent that contributes to social and political reforms. In

addition, there also needs to be more inquiries highlighting public education to improve voters' e-skills and invite substantial feedback for e-voting arrangements more suited to voters' demographic characteristics.

Such supposition, that technologies play important roles in developing countries, was even more apparent in technology-related studies. The shortcomings experienced during previous democratic practices might have resulted in technological determinism shown by countries such as Nigeria and India. Research in this theme has focused on equipping democracy with technological advancement, but it exhibited a significant void in coping with issues associated with the increasing technological intricacies. While topics of mobile voting and information security were popular among researchers, there was an absence of studies on e-voting technology standards, compliance and governance, for instance, which may later cause setbacks to the progress of e-voting development. Moreover, technological centrism should be limited to allow a state of parity among the themes. Indeed organization-related issues have been largely neglected during the last fifteen years, which may result in government having difficulties defining the relevance of posing technological advantages against the expected implementation model – an instance of design-reality gaps. Future inquiries on e-voting in developing countries, therefore, are expected to look further into the complex nature of e-voting implementations and their impacts within public sector organizations. They need to closely examine the motives behind e-voting initiatives, clearly define system ownership, and distinctly specify all institutional arrangements necessary. There are also issues of public sector reforms and public servant training that need addressing in order to make sure that there will not be any discontinuity issues found further down the road. Nevertheless, research on some countries such as Nigeria has started to shift towards a more holistic approach addressing the topics under combined issues.

Failures to sustainably run e-voting projects in most developing countries mainly come down to the lack of political commitment and the lower level of resources available. Such states of affairs will likely induce changes in the countries' political and strategic agendas, creating a condition unsuitable for large and long-term investments in ICT development. E-voting researchers may further find it difficult to keep their interests in the field as their research will at the end have little practical impact. This is apparent in the reviewed studies, shown by a very small number of articles early on which were then followed by an absence of publication for a considerably long period of time. The government of developing countries and the academic world, for these reasons, need to work towards a common goal and incorporate a holistic view while perceiving e-voting development in order to benefit from the technology. Furthermore, another form of discontinuity is where studies on particular themes by a particular research group were ceased in the interest of pursuing knowledge categorized under different themes. This is not by any means a bad practice, however, it meant the earlier studies were left incomplete and hence might only contribute to providing partial representation of the overall picture. Comprehensiveness, on the other hand, will likely add to a more thorough assessment necessary for authorities to make decisions on whether or not to initiate e-voting projects.

6 Conclusion

The contribution of this present study is twofold. Firstly, it provides the thematic landscape and defines the state of the current research on e-voting in developing countries. The study systematically examined sixty-seven articles and found that the current literature was in favor of the technology-related theme. There are signs of technological centrism in the literature and there is a growing belief that technology is the only solution for credible elections and for eliminating election irregularities. The current studies seemed to focus on how to practically put the technology into effect by fitting e-voting concepts and theoretical constructs into the various contexts of developing democracy. They tended to solve problems associated with the technology, which were not necessarily election problems, while paying little attention to the issues of increasing technological intricacies and navigating away from socio-cultural, organizational and political aspects of e-voting implementations. There is also evidence to suggest that the current research was vested at socio-technical system design without sufficient effort allocated for strategic design of e-voting initiatives, which might result in poor decision on whether or not a developing country should use e-voting technology. Secondly, this present study propounds courses for future research on e-voting in developing countries. Despite the strong inclination towards the technology-related theme identified in the current studies, for instance, topics on e-voting standards and compliance, election technology evaluation frameworks and service quality still require more attention. This technological advancement should further be rooted in theoretical fluency in social aspects of e-voting. E-voting must be seen as a complex socio-technical agent that plays an important role in social and political reforms and future research on the subject should be focused on drawing the holistic image of reciprocal relationships between social and technical aspects of the technology. Future studies on e-voting in developing countries should also consider the complex nature of its implementations and its impacts within public sector organizations. They need to constantly question the motives behind e-voting initiatives and look further into other organizational issues such as public sector reforms and institutional arrangements. Further inquiries on system ownership, following investigations on problems lingering in traditional voting, are also encouraged.

Finally, the authors realize that a number of limitations of the approach used in this study needs to be taken into consideration. First, this paper includes only literature written in English. This might have allowed a relevant portion of e-voting inquiries at national and local level, which are published in national language other than English, to be excluded from the final dataset. Second, the search process has focused on academic publishing outlets and, thus, might have ignored other types of literature, such as government reports, which may be decisively relevant to directing future e-voting research. The authors welcome all comments, critiques, and recommendations.

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Appendix: List of Articles Included in the Final Dataset

Papers discussing more than one country of interest are listed under each country, respectively.

Country of interest	Title
Nigeria	Ayo, C., Daramola, J., Grabriel, O. & Sofoluwe, A. An End-to-End e-Election System based on Multimodal Identification and Authentication. In: 6th International Conference on E-Government, 2006 Cape Town, South Africa Ekong, U. & Ayo, C. 2007. The Prospects of M-Voting Implementation in Nigeria. 3GSM & Mobile Computing: An emerging growth engine for national development, 172-179 Ayo, C., Adebiyi, A. & Fatudimu, I. 2008. E-Democracy: A requirement for a successful e-voting and e-government implementation in Nigeria. International Journal of Natural and Applied Sciences, 4, 310-318 Ayo, C., Adebiyi, A. & Sofoluwe, A. 2009. E-Voting Implementation in Nigeria: the success factors. In: Curbing Political Violence in Nigeria: The role of security profession. Nigeria: Institute of Security, Mukagamu and Brothers Ent. Ayo, C. & Azeta, A. A Framework for Voice-Enabled m-Voting System: Nigeria a case study. In: 9th European Conference on E-Government, 2009 London, UK Ekong, U. & Ekong, V. 2010. M-Voting: A panacea for enhanced e-participation. Asian Journal of Information Technology, 9, 111-116 Olaniyi, O., Adewumi, D., Oluwatosin, E., Bashorun, M. & Arulogun, O. 2011. Framework for Multilingual Mobile E-Voting Service Infrastructure for Democratic Governance. African Journal of Computing & ICT, 4, 23-32 Faniran, S. & Olaniyan, K. Strengthening Democratic Practice in Nigeria: A case for e-voting. In: 5th International Conference on Theory and Practice of Electronic Governance, 2011 Tallin, Estonia. 337-340 Adeyinka, T. & Olasina, G. 2012. Voter's Perception of the Adequacy and Suitability of e-Voting in the Nigeria Polity. In: Handbook of Research on E-Government in Emerging Economies: Adoption, e-participation, and legal frameworks. IGI Global Kuye, C., Coker, J., Ogundeinde, I. & Coker, C. 2013. Design and Analysis of Electronic Voting System in Nigeria. International Archive of Applied Sciences and Technology, 4, 15-20 Ishaq, S., Osman, W., Shittu, A. & Jimoh, R. 2013. Adoption of E-Voting System in Nigeria: A conceptual framework. International Journal of Applied Information Systems, 5, 8-14 Musa, M. & Aliyu, F. 2013. Design of Electronic Voting Systems for Reducing Election Process. International Journal of Recent Technology and Engineering, 2, 183-186 Olaniyi, O., Arulogun, O. & Omidiora, E. 2013. Design of Secure Electronic Voting System using Multifactor Authentication and Cryptographic Hash Function. International Journal of Computer and Information Technology, 2, 1122-1130 Adeshina, S. Towards Improved Adoption of e-Voting - Analysis of the case of Nigeria. 8th International Conference on Theory and Practice of Electronic Governance, 2014 Portugal Brooks, L. & Mohammed, A. eVoting in Nigeria: The case of the Independent National Electoral Commission. EGOSE '14, 2014 St. Petersburg, Russian Federation. 127-136

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