



AENSI Journals

Australian Journal of Basic and Applied Sciences

ISSN:1991-8178

Journal home page: www.ajbasweb.com



## E-Voting Indonesia: A Safety-Critical-Systems Model Towards Standard and Framework for Indonesia's Presidential Election

H. Manik

Faculty of Industrial Engineering, Universitas Islam Indonesia, Jalan Kaliurang K.M. 14,4 Yogyakarta, Indonesia.

### ARTICLE INFO

#### Article history:

Received 20 November 2013

Received in revised form 24

January 2014

Accepted 29 January 2014

Available online 5 April 2014

#### Keywords:

Safety-Critical-Systems Model

Standard Framework for Indonesia's

Presidential Election

### ABSTRACT

Despite the euphoria, the question remains if electronic voting is the ultimate answer to the problems lingering Indonesia's Presidential Election. There are issues of infrastructure unreadiness and people's reluctance to accept the technology on one hand. The are also issues of the lack of standard and framework, as well as policies and regulations, prior to its implementation on the other. Whether or not Indonesia could use the technology in their Presidential Election, the challenge is to firstly address these problems properly. This paper proposes a multi-disciplinary research scheme to answer the challenge. The results provide a platform for e-democracy in Indonesia through increases of people's participation in the government.

© 2014 AENSI Publisher All rights reserved.

**To Cite This Article:** H. Manik., E-Voting Indonesia: A Safety-Critical-Systems Model Towards Standard and Framework for Indonesia's Presidential Election. *Aust. J. Basic & Appl. Sci.*, 8(4): 301-308, 2014

## INTRODUCTION

Komisi Pemilihan Umum (KPU), Indonesia's election organizer, may be entitled as over-optimistic during 2010 with regard to implementing electronic voting (e-voting) in the country's 2014 Presidential Election (Aditya, 2010). The technology was expected to come up with answers to problems that occurred in the previous elections and was seen as the solution to cutting the costs, eliminating cheats and fixing vote-miscalculations. Two e-voting simulations were held in Jembrana and Pandegelang to prove the points. Both were considered a success, taking into accounts the participation-rate and vote-casting time, which was 47 seconds in average. However, the question remains whether e-voting is the answer to the problems lingering Indonesia's Presidential Election.

### 2. Related Work:

Some may argue that implementing e-voting in Indonesia would be as much of a success as those of e-banking, e-commerce and e-procurement. E-voting, however, is not like the other electronic transactions (K. Alexander, 2001), and this has to be made clear. E-voting has a different philosophy and applies different sets of rules. For instance, e-banking provides a certain level of tolerance for any errors that may come from frauds, system faults and disfunctionalities, or from exploits on known system's weaknesses. This is not the case with e-voting. Errors and non-accomplishments in vote casting, calculation and tabulation, however insignificant, may be used politically to cause losses of public confidence in the voting system and the result. This situation may lead to a public initiative for a re-election, which means increases in social and political costs. Continual losses of confidence may further affect public trust in the election organizer and in the running government, which at the end may cause social, political, economic and cultural unrests that would threaten the running of the country and endanger the life of its citizens. These are the reasons why e-voting is classified as a Safety Critical System (M. McGaley and J. P. Gibson, 2003).

### Issues with implementing e-voting in Indonesia:

The idea of applying voting technology in Indonesia is still debatable. Adam Schmidt of IFES (A. Schimdt, 2010), for instance, stressed on the importance of thorough assessment over e-voting applicability before jumping into conclusion that Indonesia is ready for the technology. He further stated that a failure to do so means the decision to use e-voting is ill-advised and premature. Similar notion was issued by Wardhani of Puskapol UI (T. Rachman, 2010) who suggested that Indonesia would need more proper preparations, in terms of supporting regulations, infrastructures and human resources, before deciding whether of not to use the technology.

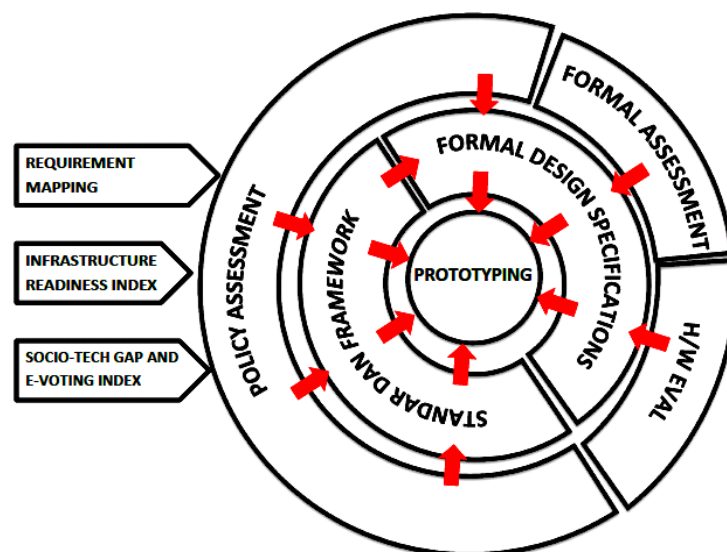
**Corresponding Author:** H. Manik, Faculty of Industrial Engineering, Universitas Islam Indonesia, Jalan Kaliurang K.M. 14,4 Yogyakarta, Indonesia.

An election is an effective and absolute decision making instrument and the result generates social and political bounds upon the voters. The elected candidate reserves all the authorities guaranteed by the voters to fulfill the promises they made during their campaign. A presidential election holds the same respect albeit with far greater magnitude. The election organizer is required to prepare legal apparatus in both technical and operational levels to design a proper election system, as well as to organize, monitor and evaluate the election transparently. The government also needs to firstly conduct a thorough study on whether e-voting is the answer to election problems in Indonesia, whether the people are ready to use the new technology, and whether the proposed system has been properly designed before deciding that the country would use the technology. At the end, whatever the decision is, these questions need to be fully addressed.

Flaws in e-voting systems mainly originate from its underlying technology, the internet. The internet is, by design, a highly vulnerable system. The holes through which attackers could penetrate and cause malfunctions to systems connected to the internet are there to exploit, and they are known to the world. Hence, should there be a secure internet voting system, *it would be the first secure networked application ever created in the history of computers* (Bruce Scheier, quoted from (R. Mercuri, 2002). A design methodology that fully relies on obscurity or lacks transparency, thus, should be avoided. A proposed e-voting system has to be publicly assessed and verified through formal assessments and formal design verifications, which unfortunately has not been the case in Indonesia. Despite the euphoria, there are very few papers about e-voting in Indonesia and none of them (E. R. Agustina and A. Kurniati, 2009; R. Azhari, 2005; H. Fahmi and D. Handoko, 2010; A. Rokhman, 2011) emphasizes on formal analysis, one of the most important components to developing a Safety Critical System.

#### **Security by Obscurity versus Security by Design:**

It is a common misunderstanding that in order to keep a system secure it has to be kept in tight secrecy. This approach is referred to as Security by Obscurity. It relies on an assumption of, whilst being understood as having theoretical and actual security vulnerabilities, how flaws in a system should be hidden as such that attackers would not find them. Assumption of such should not be expected to last long in the real world, however. Security by Obscurity never tempts to act as a sole solution to all security problems, rather as a part of an in-depth defense tactic during the development of a system. It may provide a temporary obstacle for attackers while a resolution to a known security issue is implemented. Therefore, applying Security by Obscurity to systems such as the internet, whose vulnerabilities are known to the world, and relying heavily on it is indeed a poor design.



E-voting cannot be treated with such an approach alone as there are too much political and social interests heaped upon it. It should always be assumed that the entire design of security system in such application is known to all attackers. Designers of e-voting system cannot use the same approach as with commercial software packages where reliance on Security by Obscurity may cause flaws being hidden to avoid degrading the reputation of the developers and the products. They have to utilize public observations and reviews to make sure that the public have confidence in the reliability of the proposed system. This approach is referred to as Security by Design, which means that the proposed e-voting system has to be designed from the ground up to be secure and that the public should be involved during the process. This is considerably advantageous as there would be more people looking into the system and examining the design and the code, which in turn would increase the chance that flaws can be found sooner.

The utilization of public observations and reviews has been supported by many researchers and election organizers in Europe and the U.K. The Council of Europe stated that sufficient debates should be conducted prior to implementing e-voting (S. Caarls, 2010). They argued that this stage of development could be used to collect further requirements from all stakeholders. Department for Communities and Local Government in the U.K. suggested similar approach should be used in the country and emphasized on the urgency of improving public awareness through transparency over the implementation plan (Implementing Electronic Voting in the UK, 2006). Public debates will nurture voters' confidence in the system and provide transparency over the decision-making process. This mechanism will reveal if potential voters would like to use e-voting, and if they see any advantages and disadvantages of the system. It also let the government and election organizer aware whether e-voting has successfully earned public trust and confidence.

Moreover, Hapsara (M. Hapsara, 2011) proposed three ways to imposing transparency in Indonesia's e-voting system through Security by Design. Firstly, the protocol of the proposed e-voting system has to be published. E-voting protocol is sets of regulations on how an election should be conducted, i.e. it determines how voters should vote, how votes should be transferred to ballots, how votes should be calculated and displayed, etc. Here imposing transparency means that the protocol has to be published to invite public observations and reviews. One way to avoid ambiguity and promote a more objective review is by presenting the protocol in formal definition. Secondly, the proposed e-voting system should be based on open-sourced and open architecture systems. This will ensure assessments can be done publicly and independently. Treating e-voting systems the same way as commercial software packages, on the other hand, will result in source code being hidden, architecture being kept secret, reviews and examinations being performed under the rug, and lacking in documentations. Lastly, the proposed e-voting system has to avoid over-complexity and any encryption function should be publicly known. The more complex a system is, the more difficult it is to review. Even if the designers decide to use complex algorithms, the functions should still be made available to the public for further reviews.

### **3. Proposed Model of Solution:**

This paper proposes a model that aims at addressing the issues discussed above. Firstly, Indonesia needs to have a firm understanding of the problems lingering the country's Presidential Election. This is important to map what e-voting systems have to offer as solutions to the real problems. Aspects to consider include evaluating the previous elections. Secondly, the country needs to know if they are ready with e-voting technology. Here, the proposed model addresses the issue by assessing infrastructure readiness, examining socio-technology gap, evaluating policies and regulations, as well as assessing the availability of standards and frameworks. Last but not least, the country needs to make sure that the proposed e-voting system is well-designed. The proposed model looks at whether the proposed e-voting system was designed using Security by Design approach, whether the protocol has been formally assessed and verified, and whether the hardware can support the protocol.

The proposed model categorizes the issues into nine fronts:

- 1.Requirement mapping (RM),
- 2.Infrastructure readiness indexing (IDX),
- 3.Socio-technology gap evaluation and e-voting readiness indexing (EDX),
- 4.Policy assessment (PA),
- 5.Standard and framework (SF),
- 6.Formal system assessment (FA),
- 7.Hardware evaluation (HW),
- 8.Formal design specification (FD), and
- 9.Prototyping (PT).

The objective of each front is given in Table.1 and the relationship between each front is described in Fig.1. Moreover, some methods that will be used to conduct research on these fronts are presented below. These include: Technology Acceptance Model, Theory of Planned Behavior, Multi-Criteria Decision Analysis, and Formal Method.

#### **Technology Acceptance Model:**

Prior to implementing e-voting, it is necessary to assess people's acceptance of the technology. Indonesia had held three election simulations in Jembrana, Padegehang and Bantaeng. The proposed research model in this paper provides a framework to examine how the people in those regions perceived the technology.

Davis (F. Davis, 1989) proposed a method that gives better measures to describe variables related to people's acceptance of a new technology. Davis based his model on the theories of self-efficacy, cost-benefit, expectancy, innovation and channel disposition (A. Lederer, *et al.*, 2000). He (F. D. Davis, 1993) adopted the Theory of Reasoned-Action (TRA) proposed by Ajzen and Fishbein (I. Ajzen and M. Fishbein, 1980) to show

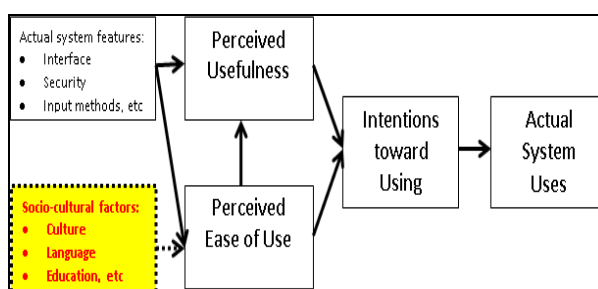
that *beliefs* would affect *attitudes* and cause *intentions* that drive *behaviors* of users of the technology. This method is called Technology Acceptance Model (TAM).

**Table 1:** Objective of each front.

| Front | Objective  | Outcome  |
|-------|--|--|
| RM    | Mapping of election requirements to what e-voting has to offer. This includes examining problems occurring during previous elections.        | - Requirement and system analysis.<br>Related front: PA  |
| IDX   | Assessing infrastructure readiness of the provinces.   | -Infrastructure readiness index and report.<br>Related front: PA   |
| EDX   | Assessing the gap between the people and e-voting technology. This includes people's readiness and their acceptance to the new technology.   | -Technology acceptance index and report.<br>-E-voting readiness index.<br>Related front: PA                        |
| PA    | Assessing the current policy and regulations, as well as generating recommendations for new ones.  | -Recommendations for new policy and regulations.<br>Related front: SF  |
| SF    | Developing the standard and framework required to implementing e-voting.   | -Standard and framework to implementing e-voting in Indonesia.<br>-E-voting readiness report.<br>Related front: PT |
| FA    | Assessing the currently used e-voting protocol to find existing flaws and weaknesses.  | -Formal analysis report of the current system.<br>Related front: FD  |
| HW    | Examining the hardware of the currently used e-voting system to find existing flaws and weakness, and if they can support the protocol.      | -Report of the current system.<br>Related front: PT  |
| FD    | Generating a new set of e-voting protocol and formal design specifications for the new protocol.   | -A new system design.<br>-Formal design specifications report of the new protocol.<br>Related front: PT            |
| PT    | Developing the prototype of the new e-voting system based on the formal design specifications and by refering to the standard and framework. | -Prototype.  |

TAM uses two determinants to determine *behavior*: perceived usefulness and perceived ease-of-use (F. Davis, 1989; F. D. Davis, 1993). Perceived usefulness is defined as the user's *beliefs* of how a technology would increase his performance. Perceived ease-of-use, on the other hand, refers to how the use of a technology is believed to be effortless.

TAM has been broadly used in various fields to evaluate the acceptance of technology. Lederer (A. Lederer, *et al.*, 2000) used the model to assess how office workers believe that the information quality of the World Wide Web can help them with their professional responsibilities. Meanwhile, Chiravuri and Nazareth (A. Chiravuri and D. Nazareth, 2001) and Al-Dwairi and Kamala (R. M. Al-Dwairi and M. A. Kamala, 2009) used TAM to assess e-commerce. Moreover, Money and Turner (W. Money and A. Turner, 2004) had also looked at TAM for knowledge management systems. In medicine, Su (S.-P. Su, *et al.*, 2012) utilized the model to look at how Taiwanese accept telecare systems.



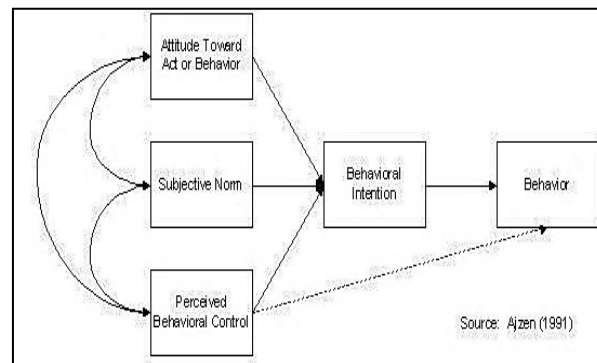
**Fig. 2:** Modified TAM.

Inclusion of social and cultural-related antecedents into the original TAM had been shown by Evers (V. Evers, 1997). He included user's cultural preferences to determine its relation with the design of user interfaces. In e-voting, Abu-Shanab, Knight and Refai (E. Abu-Shanab, *et al.*, 2010) used TAM to determine the factors defined the success of e-voting technology adoption in a public university in Jordan. It is realized that their work has not the same level of complexity and magnitude of a presidential election, however, they had successfully introduced *perceived propensity* and *perceived security* for evaluations of e-voting systems. Furthermore, a modified TAM proposed in this paper is presented in Fig.2.

### **Theory of Planned Behavior:**

Addressing the issue of the lack of standard and framework for implementing e-voting in Indonesia involves an in-depth study on election requirements, infrastructure readiness as well as people acceptance of the new technology. For this, a method that can capture and define psychological, social, cultural and technical factors that determine the nation's intention to use the e-voting is required. Icek Ajzen (I. Ajzen, 1985) introduced a method to see the relationship between intention and action, namely the Theory of Planned Behavior (TPB) (I. Ajzen, 1985; I. Ajzen, 1991). This paper proposes the use of TPB to formulate the standard and framework.

Ajzen (I. Ajzen and M. Fishbein, 1980) developed the method based on Theory of Reason Action (TRA) by introducing intention as the factor that could influence a person to behave consciously in a certain way. He defined intention as something that motivates people to perform the behavior and indicates how hard people are willing to try. The model of TPB is available in Fig. 3.



**Fig. 4:** The Theory of Planned Behavior.

Intention is said to be influencing behavior only if the actor has the power to decide whether or not he would like to perform the behavior. This attribute is called volitional control (I. Ajzen, 1991). However, intention is not the only influencing factor. TPB allows behavioral controls, such as: ability, skills, time, money and external supports, to influence the behavior.

The use of TPB to develop standard and framework has been performed by many researchers. Halac and Bulut (D. S. Halac and C. Bulut, 2012), for instance, used the method to develop a conceptual framework of entrepreneurship in Turkey. Moreover, Prieto, Phipps and Friedrich (L. C. Prieto, *et al.*, 2012) combined TPB with ACS (Access, Challenge, Support) model to generate a blueprint of Social Entrepreneur Development for african-american and hispanic students at universities in the U.S. In e-government, Nchise (A. Nchise, 2012) used TPB to look at the participation level of the people of Sub-Saharan Africa in e-democracy. Meanwhile, Alrashidi (A. Alrashidi, 2012) showed that there was a positive correlation between motivation and behavior of small-midium enterprise workers on the utilization of e-government services.

### **Multiple Criteria Decision Analysis:**

Making a strategic decision on whether e-voting should be used in Indonesia's Presidential Election is far from easy. Strategic decision making usually involves uncertainty, requires a large amount of resources, and has long-term consequences (G. Johnson, *et al.*, 2005). For these, a decision-making tool that can help depicting all alternatives and their consequences is required. The model presented here proposes Multiple Criteria Decision Analysis (MCDA) as the tool to help the government making the decision whether the country should utilize e-voting technology in its presidential election.

MCDA was introduced by Keeney and Raiffa in 1976 (R. L. Keeney and H. Raiffa, 1976). The model was developed based on the decision theory, which was modified to integrate multi-attributed consequences. Dodgson (J. Dodgson, *et al.*, 2009) further defined MCDA as a method and techniques that aim at generating an order of available decision scenarios. MCDA sees big problems as sets of smaller and simpler problems, which enable uses of partial data and support partial decision making processes. The model will later integrate the these partial decisions to generate a complete and more comprehensive picture of the problems and solution scenarios. Belton and Stewart (S. Belton and T. S. Stewart, 2002) stated four properties that further explain the definition:

1. MCDA explicitly involves multiple-criteria,
2. MCDA helps the management to make decisions,
3. MCDA provides a model that categorizes solutions scenarios based on defined multiple-criteria,
4. MCDA offers an approach to generate strong arguments while making a rational decision.

Moreover, Mendoza and Martins (G. A. Mendoza and H. Martins, 2006) suggested the use of MCDA to solve complex problems for two reasons. Firstly, it supports the use of both quantitative and qualitative data, including opinions of experts. This is very useful in situations where quantitative data are incomplete, unreliable, or hard-to-understand; such as with the previous Indonesia's Presidential Elections. Secondly, it supports collaborations among experts and stakeholders in making a decision.

MCDA has been used in business, industrial and public sectors. Syaifulloh (A. F. Syaifulloh, 2013) had been using MCDA to help P.T. Pertamina, Indonesian state-owned oil company, to make a make-or-buy decision on whether it should build its own oil refineries to meet domestic needs. He defined five criteria for each solution scenario: 1)security of supply, 2)financial support, 3)controlability, 4)complexity, and 5)production quota. The result shows that MCDA can be used to help the authorities making a strategic decision at national level.

#### **Formal Method:**

System engineering for Safety Critical Systems, such as e-voting, requires a formal approach to ensure non-ambiguous design specification and to provide a way for full and thorough public assessments prior to the implementation. Formal method is techniques and tools, based on mathematical model and formal logic, that can be used to: 1)model and describe a complex system, 2)provide arguments on the design, and 3)support system implementation. Formal method translate non-mathematical description of a system into formal specification that models high-level behavior and properties of the system. The research model in this paper proposes the use of formal method to generate a proper e-voting design and to impose transparency during the process.

Formal method has been used extensively by e-voting researchers (K. Braunlich and R. Grimm, 2011; S. Campanelli, *et al.*, 2007; D. Cansell, *et al.*, 2007; D. Cansell, *et al.*, 2007; B. Meng, 2008; B. Meng, 2009; A. Villafiorita, *et al.*, 2009; K. Weldemariam, *et al.*, 2009). Braunlich and Grimm (K. Braunlich and R. Grimm, 2011) and Meng (B. Meng, 2009), for instance, used the method to verify e-voting protocols against receipt-freeness. Receipt-freeness is a property where an e-voting system will not produce a receipt after voters cast their vote. This property is used to ensure vote secrecy and prevent vote-buying. Liu and Tang (X. Liu and S. Tang, 2008), moreover, used formal method to assess privacy of GVS protocol and found that the property was hard to impose when voter authentication data coluded with vote-counting server.

Furthermore, formal method enables analysis of system behavior to find its flaws and weakness which are hard to identify withn the other design approaches. Early identification of flaws and weakness in a proposed e-voting system would improve its reliability and avoid increases in cost due to errors and non-accomplishments of voting transactions.

#### **Conclusion:**

Indonesia needs to conduct a thorough study before deciding to implement e-voting technology in its Presidential Election. This paper proposes a multi-disciplinary research model that is capable of identifying election problems, assessing the country's readiness to implement the new technology, and generating standard and framework for implementation. Moreover, the model promotes people participation in the government through public assessments during the design process. In the end, it would have a positive impact on Indonesian democracy.

#### **REFERENCES**

- Abu-Shanab, E., *et al.*, 2010. "E-Voting Systems: A tool for e-democracy," *Management Research and Practice*, 2: 264-274.
- Aditya, 2010. "Election Commission Optimistic E-Voting Usable in 2014," in *Antara News* ed. Jakarta: www.antaraneews.com,
- Agustina, E.R. and A. Kurniati, 2009. "Pemanfaatan Kriptografi dalam Mewujudkan Keamanan Informasi pada e-Voting di Indonesia," in *Seminar Nasional Informatika 2009*, Yogyakarta.
- Ajzen, I. and M. Fishbein, 1980. "Understanding Attitudes and Predicting Social Behavior". Englewood Cliffs, NJ: Prentice-Hall.
- Ajzen, I., "Title," unpublished.
- Ajzen, I., 1985. "From Intentions to Actions: A theory of planned behavior," in *Action-Control: From cognition to behavior*, J. Kuhl and J. Beckmann, Eds., ed. Heidelberg: Springer, 11-39.
- Ajzen, I., 1991. "The Theory of Planned Behavior," *Organizational Behavior and Human Decision Processes*, 50: 179-211.
- Al-Dwairi, R.M. and M.A. Kamala, 2009. "An Integrated Trust Model for Business-to-Consumer (B2C) E-Commerce: Integrating trust with the Technology Acceptance Model," presented at the *International Conference on CyberWorlds*.

- Alexander, K., 2001. "Ten Things I Want People to Know about Voting Technology," presented at the The Democracy Online Project's National Task Force, Washington D.C.
- Alrashidi, A., 2012. "User Acceptance and Motivation of E-Governance Services based on Employees Levels of Experience in the UAE SME," *American Journal of Economics*, 2: 132-135.
- Azhari, R., 2005. "e-Voting," ed. Depok: Fasilkom UI,
- Belton, S. and T.S. Stewart, 2002. "Multiple Criteria Decision Analysis - An integrated approach." Massachusetts: Kluwer Academic Publishers.
- Braunlich, K. and R. Grimm, 2011. "Formalization of Receipt-Freeness in the Context of Electronic Voting," presented at the Sixth International Conference on Availability, Reliability and Security.
- Caarls, S., 2010. "E-Voting Handbook: Key steps in the implementation of e-enabled elections. Strasbourg:" Council of European Publishing. "Implementing Electronic Voting in the UK, 2006." Department for Communities and Local Government, London.
- Campanelli, S., *et al.*, 2007. "Mobile Implementation and Formal Verification of an E-Voting System,"
- Cansell, D., *et al.*, 2007. "Formal Verification of Tamper-Evident Storage for E-Voting,"
- Cansell, D., *et al.*, 2007. "Refinement: A constructive approach to formal software design for a secure e-voting interface," *Electronic Notes in Theoretical Computer Science*, 183: 39-55.
- Chiravuri, A. and D. Nazareth, 2001. "Consumer Trust in Electronic Commerce: An alternative framework using technology acceptance," presented at the Seventh Americas Conference on Information Systems, U.S.
- Davis, F., 1989. "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology," *MIS Quarterly*, 13: 319-340.
- Davis, F.D., 1993. "User Acceptance of Information Technology: System characteristics, user perceptions and behavioral impacts," *International Journal of Man-Machine Studies*, 38: 475-487.
- Dodgson, J., *et al.*, 2009. "Multi-Criteria Analysis: a manual," National Economic Research Associates, London.
- Evers, V., 1997. "Human-Computer Interface: Designing for culture," Doctoral, Faculty of Mathematics, Informatics, Physics and Astronomi, University of Amsterdam, Amsterdam.
- Fahmi, H. and D. Handoko, 2010. "Kajian Teknis tentang Pemungutan Suara secara Elektronik (Electronic Voting)," Badan Pengkajian dan Penerapan Teknologi, Jakarta 11 May 2010.
- Halac, D.S. and C. Bulut, 2012. "Entrepreneurial Education at Universities: A conceptual framework," *Journal of Entrepreneurship and Development*, 7: 11-23.
- Hapsara, M., 2011. "Imposing Transparency in Indonesia's E-Voting System through Security by Design," in E-Indonesia Initiative, Bandung, Indonesia.
- Johnson, G., *et al.*, 2005. "Exploring Corporate Strategy: Text and cases", 7th ed. London: Prentice Hall.
- Keeney, R.L. and H. Raiffa, 1976. "Decisions with Multiple Objectives: Preferences and value tradeoffs". New York: John Wiley.
- Lederer, A., *et al.*, 2000. "The Technology Acceptance Model and the World Wide Web," *Decision Support Systems*, 29: 269-282.
- Liu, X. and S. Tang, 2008. "Formal Privacy Analysis of an Electronic Voting Scheme," presented at the 2008 International Conference on Computational Intelligence and Security.
- McGaley, M. and J.P. Gibson, 2003. "Electronic Voting: A Safety Critical System,"
- Mendoza, G.A. and H. Martins, 2006. "Multi-criteria Decision Analysis in Natural Resource Management: a critical review of methods and new modelling paradigms," *Forest Ecology and Management*, 230: 1-22.
- Meng, B., 2008. "Formal Analysis of Key Properties in the Internet Voting Protocol using Applied Pi Calculus," *Information Technology Journal*, 1-8.
- Meng, B., 2009. "A Formal Logic Framework for Receipt-Freeness in Internet Voting Protocol," *Journal of Computers*, 4: 184-192.
- Mercuri, R., 2002. "A Better Ballot Box?," .
- Money, W. and A. Turner, 2004. "Application of The Technology Acceptance Model to A Knowledge Management System," in The 37th Hawaii International Conference of System Sciences, Hawaii.
- Nchise, A., 2012. "An Empirical Analysis of the Theory of Planned Behavior - A review of its application on E-Democracy adoption using the Partial Least Squares Algorithm," *eJournal of Democracy*, 4: 171-182.
- Prieto, L.C., *et al.*, 2012. "Social Entrepreneur Development: An integration of critical pedagogy, the theory of planned behavior and the ACS model," *Academy of Entrepreneurship Journal*, 18.
- Rachman, T., 2010. "Indonesia belum siap gelar E-Voting," in *Republika*, ed. Jakarta.
- Rokhman, A., 2011. "Prospek dan Tantangan Penerapan e-Voting di Indonesia," presented at the Seminar Nasional Peran Negara dan Masyarakat dalam Pembangunan Demokrasi dan Masyarakat Madani di Indonesia, Jakarta.
- Schimdts, A., 2010. "E-Voting a Boon, if Managed Properly," in *The Jakarta Globe*, ed. Jakarta: www.thejakartaglobe.com.

Su, S.P., *et al.*, 2012. "Applying the Technology Acceptance Model to Explore Intention to Use Telecare System in Taiwan," presented at the The 13th ACIS International Conference on Software Engineering, Artificial Intelligence, Networking and Parallel/Distributed Computing.

Syaifulloh, A.F., 2013. "The Analysis of Make or Buy Decision in The Oil Procurement Activities in PT Pertamina (Persero)," Master Degree, Faculty of Economics and Business, Universitas Gadjah Mada, Yogyakarta.

Villafiorita, A., *et al.*, 2009. "Development, Formal Verification, and Evaluation of an E-Voting System with VVPAT," IEEE Transactions on Information Forensics and Security, 4: 651-661.

Weldemariam, K., *et al.*, 2009. "Formal Analysis of Attacks for E-Voting System,"