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A Theoretical Extension of Technology Organization Environment (TOE) in E-Government: A Systematic Literature Review and Theory Evaluation

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Abstract

Currently, the universal influence of information technology is considered an essential tool in enhancing the performance of local governments in a country. There is a consensus that information technology significantly impacts good government. This effect will be realized when information technology is widely distributed and used in integrated e-government. Therefore, it is essential to understand the factors that determine the adoption of information technology. This article reviews the Technology Organization Environment (TOE) Framework theory for the adoption model in e-government, which is widely used in the information systems literature. The TOE framework identifies three contextual aspects: technology context, organization context, and environment context. We analyze and conduct an analysis of the TOE framework and studies that combine the TOE framework with other theories. This research examines the TOE framework and provides recommendations for future research opportunities.

Keywords: *TOE framework, e-government, information technology*

1. INTRODUCTION

The Technology, Organization, and Environment (TOE) Framework was developed by Tornatzky & Fleischer (L. G. Tornatzky & Fleischer, 1990), and is consistent with the Diffusion of Innovation Theory(Rogers, 1983). The TOE framework has proven useful for studying the adoption and assimilation of various information technology innovations.(Oliveira & Martins, 2010a). TOE is a valuable and adaptive framework for explaining adoption behaviour about three types of innovation: technological innovation includes hardware, software, and other tools an organization uses. Organizational characteristics refer to the internal structure, processes, and resources an organization has to support adopting new technology. Finally, the external environment includes factors such as competitiveness, government policies, and societal norms that can influence how and to what extent organizations adopt and use new technologies. According to the TOE framework, the successful implementation and adoption of technological innovations depend on the interaction between these three factors.

The TOE framework provides a holistic approach to understanding the factors influencing the adoption of new technologies. Is this also in e-government?. It is therefore essential to consider factors other than internal government factors, namely external environmental factors, when analyzing the impact of technology on e-government performance. The Technology-Organization-Environment (TOE) framework has been applied to e-government initiatives.(Suradi et al., 2024)To better understand the factors that influence the success of digital transformation efforts in the public sector. Most of the research based on the TOE-framework will only rely on internal input from decision-makers(Awa et al., 2017; Kuan & Chau, 2001; Oliveira & Martins, 2010b; Pham Quoc Thuan et al., 2022; Yeh et al., 2015)Respondents are sought to come from independent parties to avoid such ambiguity.

This paper aime aim of paper aimthis paper is to identify the adoption model of TOE in Indonesia's e-government and future opportunities regarding the expansion of TOE adoption in Indonesiae-government in Indonesia, and future opportunities regarding the expansion of TOE adoption in e-government. Furthermore, by implementing the TOE framework, the government can identify the key drivers and barriers to the successful implementation of e-government and develop strategies to address these factors. This will increase the efficiency and effectiveness of public service delivery, increase citizen involvement and participation, and ultimately contribute to a more transparent, accountable, and responsive government development program.

2. METHOD

The research method used is as proposed by Barbara Kitchenham(Kitchenham & Charters, 2007), which consists of three stages: planning, implementing, and reporting the review.

A. Search Strategy

The article search strategy was carried out through the central database, Scopus, and other databases such as Web of Science, IEEE Xplore, Springer Link, Emerald Insight, ACM Library, and Google Scholar. The keyword used is "TOE AND in AND e-government." The articles were then manually selected according to the needs of this study.

B. Research Method

This study uses a mechanism approach to identify, assess, and interpret all existing studies related to the research subject.(Kitchenham & Charters, 2007)The process, then adopted for this study, should consist of three phases: planning, implementation, and reporting, to build a roadmap to reduce the risk of bias (Kitchenham, 2004). Defining the problem with the condition boundary approach(Brewerton & Millward, 2001) With the stages as shown in the diagram below:

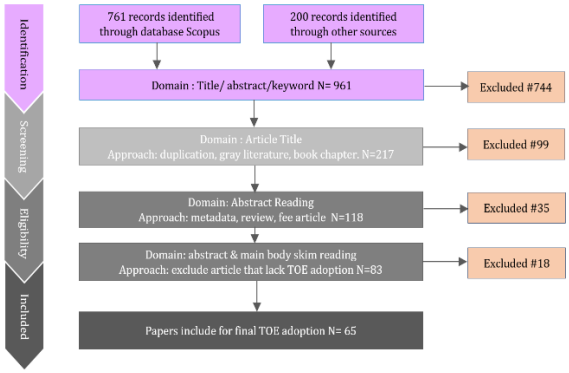

Figure 1. The flow diagram for searching the PRISMA adoption publication database (Page, McKenzie, et al., 2021)(Page, Moher, et al., 2021)(Diah et al., 2022).

3. RESULT AND DISCUSSION

3.1. A Theoretical Extension of Technology-Organization-Environment (TOE

The TOE model identifies three characteristics influencing adopting, implementing, and using technological innovations.(A. L. G. Tornatzky et al., 1990),(Faridha & Angel Christy Praveena, 2021). The three aspects of the TOE model assessment are based on the following:

a. Technology Context: describes existing and new technologies that are relevant to the organization, with the use of technology that will determine the organization's ability to serve and innovate with its technology(Collins et al., 1988b)(Maldonado et al., 2021).
b. Organizational context: refers to the characteristics and resources of the company(Collins et al., 1988a)The descriptive steps related to the organization in this study are associated with e-government towards good government.
c. Environmental Context: related to the organizational environment in this study is that the government, in carrying out its policies, will intersect with external factors that might affect the government process, such as regulations, pressure from citizens, community organizations, and strict competitors to stimulate innovation adoption(Edwin Mansfield, 1968).

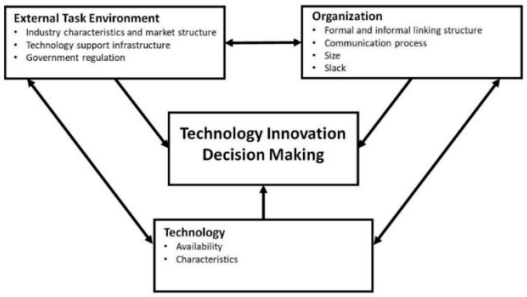

Figure 1. TOE Framework.

Factors influencing the adoption of Technology-Organization-Environment (TOE) have been adopted in various aspects. For example, SMEs carried out research on social commerce in Saudi Arabia, with the results of SMEs being categorized as 58.0% service sector, 25.4% manufacturing sector, and 16.6% retail/wholesale sector.(Abed, 2020)In the same period, China has carried out research on the success factors of AI adoption in the telecommunications industry by integrating technology, organization, and environment (TOE) frameworks and the theory of diffusion of innovation (DOI).(Chen et al., 2021)The same thing was also done in the case of Indian architectural firms. (Ahuja et al., 2020)Adoption of smart farms in Korea(Yoon et al., 2020)Smart real estate in Australia(Ullah et al., 2021)nd telework in Japan(Hosoda, 2021)and disaster management in England(AlHinai, 2020).

3.2. Technology-Organization-Environment in government.

The TOE framework has evolved since its original development. Identify how technological, organizational, and environmental factors interact and influence each other in e-government. The Indonesian government wishes to implement e-procurement by Presidential Regulation Number 16 of 2018 concerning government procurement of goods/services using TOE conducted by S. Ardya et al.(Susantya et al., 2022). In the same

year, a study was conducted on the attitude of SME owners or managers on the adoption of e-wallets(Wiradinata et al., 2022)(Gunawan et al., 2020). The combination of TOE with TAM, DOI, and guanxi theory, for e-wallet adoption in Indonesia has also been carried out(Gunawan et al., 2020).

The development of e-government involves concrete steps to increase the effectiveness of implementation, overcome obstacles, and take advantage of existing opportunities, including adopting e-government at the village government level.(Sihotang et al., 2023). Technology adoption in MSMEs in Indonesia was carried out by Ema et.al, regarding compatibility factors, ICT experience, and customer pressure.(Tria Wahyuningtihas et al., 2021).

Table 1. Research mapping using the TOE model and collaboration with other models.

Author	Title	Tahun	Metode
E. Tria Wahyuningtihas(Tria Wahyuningtihas et al., 2021)	Driving Factors for MSMEs in Indonesia to Adopt Information Technology in Culinary.	2021	TOE, ICT
H. Gunawan (Gunawan et al., 2020)	A model of the e-wallet adoption in small and medium enterprises (SME) in indonesia	2020	TOE, DOI, TAM
Hong Chen , Ling Li & Yong Chen(Chen et al., 2021)	Explore success factors that impact artificial intelligence adoption in the telecom industry in China	2021	TOE, DOI
Tiago Oliveira and Maria Fraga Martins(Oliveira & Martins, 2010a)	Information technology adoption models at the Firm Level: Review of literature	2010	TOE, DOI
Fahim Ullah, Samad M.E. Sepasgozar, Muhammad Jamaluddin Thaheem, Fadi Al-Turjman(Ullah et al., 2021)	Barriers to the digitalization and innovation of Australian Smart Real Estate: A managerial perspective on the technology non-adoption	2021	TOE, DDT
Hart O. Awa, Ukoha Ojiabo and Longlife E. Orokor(Awa et al., 2017)	Integrated technology-organization-environment (T-O-E) taxonomies for technology adoption	2017	TOE, TTF, UTAUT
Tiago Oliveira, Maria F. Martins(Oliveira & Martins, 2010b)	Understanding e-Business Adoption Across Industries in European Countries	2010	TOE, IS
Chi-Hung Yeh, Gwo-Guang Lee, Jung-Chi(Yeh et al., 2015)	Using a technology-organization-environment framework to investigate the factors influencing e-business information technology capabilities	2015	TOE, ICT
Pham Quoc Thuan, Nguyen Vinh Khuong, Nguyen Duong Cam Anh, Nguyen Thi Xuan Hanh, (Pham Quoc Thuan et al., 2022)	The Determinants of the Usage of Accounting Information Systems toward Operational Efficiency in Industrial Revolution 4.0: Evidence from an Emerging Economy	2022	TOE, DOI, RBV
Jerry Li(Li, 2020)	Roles of Individual Perception in Technology Adoption at the Organization Level: Behavioral Model versus TOE Framework	2020	TOE, TAM, TPB, UTAUT, DOI
Cinnie Liu(Liu, 2019)	TOE Framework and DOI Theory	2019	TOE, DOI
Ibrahim Osman Adam, Muftawu Dzang Alhassan(Adam & Dzang Alhassan, 2022)	The mediating role of ICT regulation on the effects of ICT access and ICT use on e-participation: Evidence from structural equation modelling and necessary condition analysis	2021	TOE, ICT
Khairini Azlin Khairuddin, Afdallyna F. Harun (Khairuddin & Harun, 2018)	Cloud Computing Adoption in Government Agencies	2018	TOE, DOI
Mohamed Gamal Aboelmaged(Aboelmaged, 2014)	Predicting e-readiness at firm-level: An analysis of technological, organizational, and environmental (TOE) effects on e-maintenance readiness in manufacturing firms	2014	TOE, TRI
Tamin Masran, Azaze Azizi Abdul Adis(Tamin & Adis, 2022)	The Impact of TOE Framework on E-Commerce Advantage Among Small and Medium Enterprises (SME's) Digital Channels in Malaysia	2022	TOE, DOI

The table above shows that the TOE Framework has been developed by experiencing expanded collaboration with other models, such as combining the TOE model with other models. For example, There can be two, three, four, or more combining with ICT, TAM, DOI, TPB, DDT, TTF, UTAUT, RBV, TRI, or other possible models.

3.4. Technology-Organization-Environment in government.

Several studies have been carried out by combining the TOE theory with other theories presented in the following table Several studies have been carried out by related scholars and experts by combining TOE theory and TAM expansion theory, DOI, DDT, TTF, UTAUT, ICT, IS, RBV, TPB, TRI presented in the following table:

Table 1. Distribution of primary studies based on the model that was used

Primary Studies	TOE	TAM	DOI	DDT	TTF	UTAUT	ICT	IS	RBV	TPB	TRI
E. Tria et.al. (Tria Wahyuningtihas et al., 2021)	X						X				
H. Gunawan et.al. (Gunawan et al., 2020)	X	X	X								
Hong Chen, et.al(Chen et al., 2021)	X		X								
Tiago Oliveira et.al. (Oliveira & Martins, 2010a)	X		X								
Fahim Ullah, et.al. (Ullah et al., 2021)	X			X							
Hart O. Awa, et.al. (Awa et al., 2017)	X				X	X					
Tiago Oliveira et.al. (Oliveira & Martins, 2010b)	X							X			
Chi-Hung Yeh, et.al.(Yeh et al., 2015)	X						X				
Pham Quoc Thuan, et.al. (Pham Quoc Thuan et al., 2022)	X		X						X		
Jerry Li (Li, 2020)	X	X	X			X				X	
Cinnie Liu (Liu, 2019)	X		X								
Ibrahim Osman Adam, et.al. (Adam & Dzang Alhassan, 2022)	X						X				
Khairini Azlin Khairuddin, et.al. (Khairuddin & Harun, 2018)	X		X								
Mohamed Gamal Aboelmaged. (Aboelmaged, 2014)	X										X
Tamin Masran, et.al. (Tamin & Adis, 2022)	X		X								

The table shows that the TOE has collaborated with other models, with the DOI model dominating. However, the combined percentage of each model can be seen in the graph below.

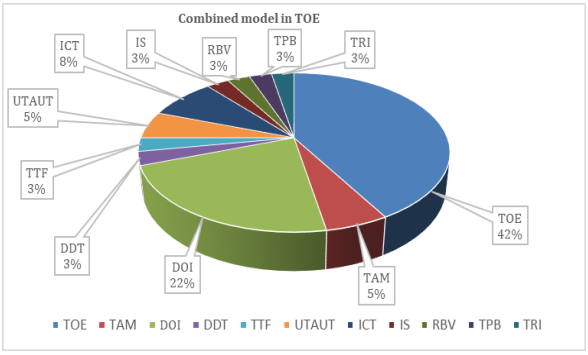

Figure 2. visual representation of the model using the combined TOE

Factors that influence the adoption and application of new technologies in e-government from user perceptions can adopt the extended theory of TOE and collaborate with the theories of TAM, DOI, DDT, TTF, UTAUT, ICT, IS, RBV, TPB, TRI, and can be developed with another theory. There are several reasons underlying the need for e-government in Indonesia, from user perceptions, the following are some of them:

1. Improving the Efficiency and Effectiveness of Public Services: Digital technology allows the service process to be faster, more accurate, and more easily accessible to the public, making it more efficient and effective. With the adoption of e-government, bureaucracy can be minimized, and services can be improved as a whole.
2. Increase Transparency and Accountability: This can minimize corruption, collusion, and nepotism and be transparent and easily accessible to the public. With an e-government system, the government can increase accountability in managing public resources and strengthen the relationship between government and society.
3. Increase Citizen Participation: Through e-government platforms, citizens can provide input, provide feedback, and participate in public decision-making processes. This can strengthen the relationship between government and society and create more inclusive governance.
4. Accelerating Economic Development: With the adoption of e-government, business and investment can be carried out more easily, regulatory compliance can be increased, and bureaucracy can be reduced, thus encouraging economic growth and creating a conducive climate for companies and entrepreneurs.
5. Improving Accessibility of Public Services: E-government can overcome geographic and time barriers in accessing public services through online platforms..

4. CONCLUSION

In developing the TOE framework, it is essential to have a more comprehensive understanding of how technology, organizations, and the environment interact in a development context. TOE can be combined with other theories such as TAM, DOI, DDT, TTF, UTAUT, ICT, IS, RBV, TPB, TRI, and other relevant theories.

The TOE framework needs to involve a wide variety of stakeholders, including governments that make and regulate policies, managers, technologists, and other interested parties. By involving different perspectives, future research opportunities with TOE are still very broad, especially for collaboration with the adoption of other theories and from different perspective factors.

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