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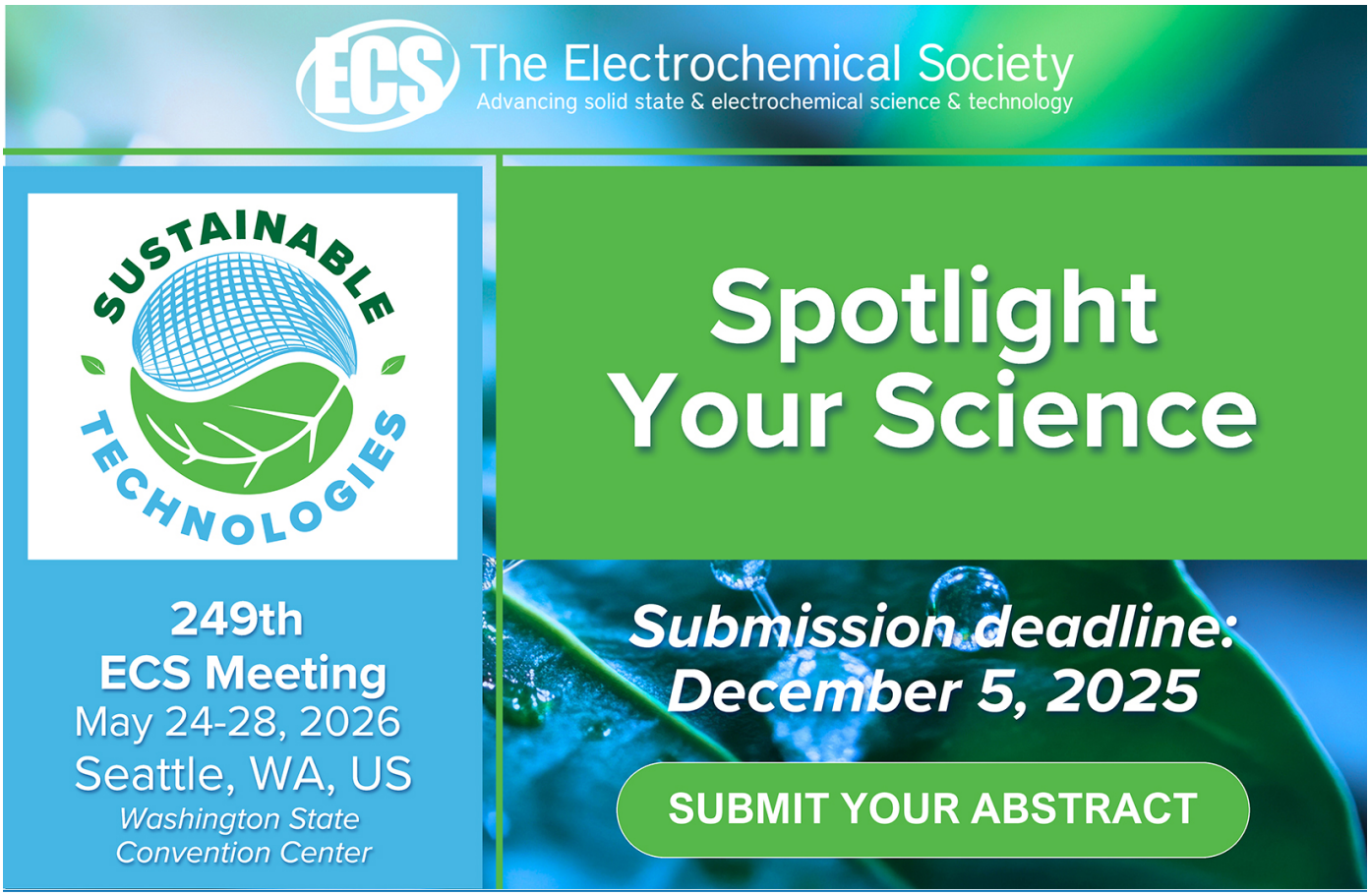
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Progress in the evolution of the use and management of data in Colombia

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Abstract. The current society seeks in technology the solution to reduce the time and effort required to carry out any transaction with another person or organization, more and more platforms and resources that allow the capture, transmission, storage and processing of information generated by the systems. The electronic government is responsible for regulating the management of communications, data and services that must be offered to citizens by public entities, with the aim of maintaining an agile and online interaction. This research makes a review of the literature on how the definition, use, and objectives of electronic government have been approached, focusing on the relationships that constitutes it and establishing an evolution of the concept in the last six years. Among the results it is necessary to build a consensus in its definition, additionally, the remains that are available for its implementation, the way of structuring, managing and evaluating it are mentioned.

1. Introduction

With the evolution of information and communications technology (ICT), the citizen plays a very important role when acquiring the information, since it must be reliable, fast and easy to access, that is why the so-called electronic government appears (e-government), where you can increase the speed, integrity, and efficiency of the processes of public entities, aligned with the information and reach of all citizens in decision making and thus be able to show themselves as door governments open [1,2]. The e-government uses ICT to be more efficient in providing information, increasing citizen participation and the services provided to improve them; this produces good internal and external government relations [3,4]. The electronic government needs to have a solid technological infrastructure so that citizen participation is imminent when entering the platforms that support the processes with the state to access the information [5].

The e-government consolidates a process that is based on four phases: presence, interaction, transaction, transformation, and democratic participation; these phases do not depend on each other to continue, they handle different conditions, which implies costs, knowledge, and use of ICT [6]. These phases are also called presence, dissemination, supervision, and participation [7] and in general, there are variations and additional proposals that ratify and complement them [8].

Having a site dedicated to offering services to the citizens of a country, generate a huge amount of data that must be used to make predictions and apply Big Data with machine learning to generate a user experience based on data behavior. In addition, producing sites with a high degree of concurrence requires a technological infrastructure with high computational capabilities, capable of supporting current demand and having the capacity to adapt to future needs [5,8].

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The definition of electronic government in different articles is different or has a particular scope by the author, which is why a literary analysis that focuses on a global definition is necessary. This research is intended to synthesize through a bibliographic review, regarding electronic government, the results were structured by types of government and show how the processes have improved citizens. These results serve as input to locate in the context of technology and information (TI) governance, the contribution that e-government generates and shows how it has been consolidated as a tool in the improvement of processes by state entities and how it allows improving the quality of life of the citizens.

2. Methodology

The research was carried out through a bibliographic review in electronic databases such Association for Computing Machinery digital library, IEEE Xplore digital library, Google Scholar and ScienceDirect, using scientific articles, conference proceedings, readings, and concept maps. The searches in the different databases resulted in 170 articles that mentioned e-government, 100 were discarded, as they did not propose a definition, use or structure that mentions the activities that must be followed to do e-government. Of the remaining 70, of these only 54 articles were selected if they met any of these themes of electronic government, definition, importance, phases, relationships, and evolution.

3. Results

The results are organized into two parts; the first is an exposition of the relationships that make up the e-government, its definition of each one is made and some research that addressed that topic is mentioned. The second part shows the evolution of e-government, based on the results of reviews made by researchers, which make a relationship for years showing how it is being addressed and what common elements they found in their reviews.

3.1. Types of e-government

To meet its objective, e-government defines four ways of relating to the people and entities of the state; Government-to-Citizen (G2C), Governments to Business (G2B), Governance to Employee (G2E) and also at the Governments to Government (G2G) level. Below is the definition for each of these types and how it is being applied.

3.1.1. Government-to-citizen. It offers administrative and information services to citizens through the use of ICTs in a ubiquitous manner. It is a very dynamic and flexible system because it saves citizens time, money, paperwork, queues in queues and that the continuous updating of the data by the government agencies that offer the G2C is also guaranteed [9].

Two examples that apply to the G2C are public employment agencies, a platform that offers to facilitate the publication and application of jobs for both employers and citizens or also for the online registration of exams for higher education and subsequent consultation and validation of results [10], this can be taken as an example of an efficient, effective and transparent modernized public administration [11,12].

In Europe, G2C offers the following electronic services: taxes, job search, social security benefits, use of personal documents such as licenses and passports, car registration, building permits, police declarations, public libraries, certificates (birth and marriage), tuition for higher education, removals, and health-related services [13]. Also, G2C can be used in rural areas and in agriculture sectors, with the expansion of internet service coverage through the establishment of internet cafes to help contribute to the daily activities of the population [14].

G2C, provides solutions to better evaluate and monitor the planning and implementation of applications that lead to the satisfaction of citizens, to offer specific services to the public of type of transactions in order to present solutions to the needs of a client through development, implementation, training, marketing and maintenance of applications that improve your quality of life [15-17].

3.1.2. Governments to business. It is oriented to offer the aforementioned services, but to companies through the internet. The benefits offered are practically the same as those obtained by citizens, but that being at a business scale also improves transparency processes, decreased administrative costs, speed in public management [9]. G2B is focused on global marketing, sometimes prioritizing e-commerce for the implementation of initiatives that provide other types of online interactions, allowing companies and businesses to optimize their services in a more reliable way for citizens and generate better quality in the trade [18]. For the G2B productive sector, it develops processes of production, exchange, marketing, financing, consumption of goods and services, to meet the needs of all its actors and produce higher revenues [19].

In Europe there are 8 electronic services offered by G2B: Social contributions to employees, corporate taxes, and notifications of value-added taxes, registration of new companies, data shipments to statistical centers, customs declarations, environmental permits and public contracts [13]. There is a methodology called goal-oriented modeling, which allows covering problems related to the software requirements of a company; by obtaining, improving and analyzing objectives as well as the responsibilities that these objectives imply; to be able to manage and evaluate tasks corresponding to software and applications for G2B [20] that allow, among other things, the digitalization of financial transactions [21].

3.1.3. Governance to employee. This relationship is intended to improve the professional part of employees who belong to the field of public administration; promoting the training of public officials for a better disposition of human resources, to generate new capabilities. It is applied through online conferences for workers, online training and work-related information [9,22]. G2E, acts in the field of electronic human resources, in large part of the private sector, electronic human resources management systems tend to be reorganized with the administration of electronic human resources which allows scientists to analyze data from both the private sector as public to improve human resources management [23]. Additionally, at the educational level, it allows early detection of students with particular behaviors that suggest a predisposition to acquire some negative vice for their mental and physical health [24].

G2E is usually included as part of G2B since in the literature they initially refer to G2C, G2B, and G2G; This is why in the past there was no talk about the development of G2E services, generating important activities to eliminate bureaucratic functions from day to day and also dealing directly with employees [25].

Among the challenges that G2E must overcome for its implementation are: the lack of technical knowledge of employees in ICT, little command of the English language in countries where this language is not spoken, inadequate infrastructure in workplaces, under financing for software and resistance to the implementation of re-engineering and restructuring processes; needing to carry out actions regarding technological, cultural and organizational aspects that must be carefully considered and managed to overcome these challenges [26,27].

3.1.4. Governments to government. It is used in the improvement of internal processes for the administration of public management, giving importance to tasks such as budgets, planning, management of resources and works [9]. In order for G2G to be implemented efficiently, success factors must be taken into account such as: political leadership, commission status for the e-government department, ICT infrastructure, alternation of methods and practices by periods, employee capabilities in the area of technology, legislation, use of modern communication, interoperability and finally providing digitalization to the population that does not have access to them G2C [28-30].

Some governments can have statutes that have the task of implementing e-government covering G2C, G2E, and G2G; these programs include technological standards for public administration and projects for transparency in public administration [31,32]. Additionally, there is a classification for this type of front-office and back-office relationship, G2C, and G2B services are classified as front-office while G2E and G2C as back-office [25,33].

Technological advances benefit e-government, with the integration of cloud computing in government services in terms of G2C, G2B and G2G allows benefits to traditional infrastructure such as greater information hosting, to be able to share information in a way easier and more accessible and promote standards for resources offered by governments [34]. On the other hand, the Block chain is part of the fourth industrial revolution of technologies because they create very secure and concise information in different sectors of the digital government including the G2C, G2B and G2G, such sectors include: health, commerce, stock exchanges, insurance, higher education, supply chains, asset management and banks [35].

The state must focus on providing each public service with a government website to improve electronic democracy [36] and thus generate more confidence in citizens. To achieve this, it is recommended to use technologies in general that focus on an ecosystem model that studies the changes that occur over a period of time so that design plans and evaluation of related programs that seek to consolidate can be taken into account a close connection with citizens for the use of smart devices and their integration into their daily work [37,38].

3.2. E-government evolution

In 2014 and 2015, there was a tendency to include technological, organizational and environmental factors [39], the parties involved are defined as are the government, employees, and researchers. Also, little research was manifested specifically in terms of efficiency in implementation; the information found about the evaluation of success or failure in implementation was limited [40].

In 2016, a classification of services is presented introducing the concept of service offered by universities through digital tools and technologies. Such tools include, for example, student exam records, conference announcements and salary payments for employees [41]. In this same year, an e-government dimension is proposed, in: usability, innovation, performance, web design, advantages of online services, availability of services, speed of processing, online integrity, emotional attraction, customer service, complaints, channels alternates , privacy, security, reliability, deadlines, quality of information and information on tasks [42], stating that e-government has evolved and has matured into a discipline [43,44]. In [45], four main categories that align e-government with organizations are established: strategic-organizational, technical, economic and political.

In 2017, studies emerged as one focused on the factors that influence the trust of citizens towards e-government, these are: technological factors (quality of system and information service), factors of government agencies (reputation and previous experience), individual factors (trust, internet experience, education) [46]. Another study states that e-government is not fully implemented finding a limitation in its progress based on digital gaps [47], this coincides with [48], so it suggests the need to design government strategies and policies on science technology and innovation, in turn, these strategies coincide with the critical factors of the success of e-government, established by [49].

For 2018, it was found that there are missing characteristics of the e-government to be defined, because it does not establish a service quality model and that everyone has a tendency to focus a lot on the needs of citizens and not of employees, in addition to they do not define the quality of service [50]. At the university level, it has been implemented through mobile applications that allow administrative transactions [51]. For this year too, the success factors in the implementation of e-government are sought based on challenges, opportunities, gaps and obstacles [52,53].

In 2019, a literary analysis was conducted organized by existing research on the public value of e-government to investigate its current status and what value e-government is supposed to generate. There is also a tendency to classify the articles found in six dimensions regrouped in the improvement three main dimensions: Public services, administration (efficiency, open government, ethics, and professionalism) and the social aspect (social welfare, trust, and confidentiality in government) [54].

3.3. E-government technology

Many are the frameworks that are used for the implementation of electronic government software. It is important that these operates in an efficient and smooth way. For example, the success of implementing

G2G not only makes its users to enjoy it, but also helps the national progress [15]. The goal-oriented modeling (GORE) applied in a G2B software can establish for this type of e-gov criteria and quality measurement, due to a correct implementation requirement that assess the applications of this G2B environment that can be set [36]. The use of blockchains in electronic government software increases the privacy and security of users at the time of making transactions with the government, since this technology's speed, robust and flexible data structures that allow anonymity in its nodes and in addition its implementation facilitates to the administrators a better versioning of an application [35]. However in order that implemented technologies can be used properly, it is necessary to fix some human topics such as the lack of political initiatives and the continuity of e-gov programs, it is essential to train professionals, teachers and leaders in the education sector in order to acquire sufficient knowledge to be able on understanding all the issues that involve computational science with electronic government and the use of ICTs [34].

4. Conclusions

The electronic government allows transparency and security to be delivered to the government by presenting updated information, uses of public resources and equal access to government services. Efficient use of e-government by the government increases the confidence and security of citizens (G2C) when using an electronic tool on the web to carry out procedures or use services.

As for companies and public employees, the approach of governments towards these, is somewhat reduced because it generally goes mainly towards citizens, but nevertheless companies are those that drive economic development and are always in constant contact with different government agencies and that is why if G2B and G2E are correctly attributed, strategies can be used to reduce the gaps and barriers that involve citizens.

Thanks to current technologies (internet, internet of things, big data) that are available to everyone, they can be better used in electronic government, but it is necessary that citizens (G2C), public and private employees (G2B/G2E) and government officers (G2G) are trained in the subject to achieve a collective benefit in the field of electronic government.

References

[1] A Santamaría Philco, D Macías Mendoza, D Ceballos Zambrano, W Zamora, P Quiroz Palma 2018 Modelo de los factores de confianza que influyen en los gobiernos electrónicos *International Journal of Information Systems and Software Engineering for Big Companies* **5(2)** 19

[2] F Galindo, F J García Marco, P Lasala Calleja 2009 *Electronic Government* (Zaragoza: Prensas Universitarias de Zaragoza)

[3] R Jijena Leiva 2016 Gobierno electrónico, transformación tecnológica del gobierno y derecho *Foro Jurídico* **15** 199

[4] D F Católico Segura, S Y Suárez Barreto, J P Velandia Espitia 2016 El gobierno electrónico en las administraciones tributarias de América Latina *Revista Logos Ciencia & Tecnología* **7(2)** 50

[5] L Naili, M Lei 2019 Research and application of big data in e-government *IOP Conf. Series: Materials Science and Engineering* **563(052086)** 1

[6] R U De Armas, A De Armas 2011 *Gobierno electrónico: Fases, dimensiones y algunas consideraciones a tener en cuenta para su implementación* (Cuba: Contribuciones a las Ciencias Sociales-Universidad de la Habana)

[7] J García García 2014 Gobierno abierto: Transparencia, participación y colaboración en las administraciones públicas *Innovar* **24(54)** 75

[8] F Bannister, R Connolly 2015 The great theory hunt: Does e-government really have a problem *Government Information Quarterly* **32(1)** 1

[9] A Naser, G Concha 2011 *El gobierno electrónico en la gestión pública* (Santiago de Chile: Naciones Unidas CEPAL)

[10] S C Riascos, G Martínez Giordano, O J Solano 2008 El gobierno electrónico como estrategia de participación ciudadana en la administración pública en Suramérica casos Colombia y Uruguay *Libre Empresa* **5(1)** 143

[11] J L Franco Ríos, C A Cruz Meléndez 2018 Gobierno electrónico, calidad y eficiencia en la relación G2C en el estado de Oaxaca, 2011-2015 *Encrucijada Revista Electrónica del Centro de Estudios en Administración Pública* **30** 25
[12] R Pérez Zúñiga, O Camacho Castillo, E Mena Hernández, G Arroyo Cervantes 2015 Análisis general del gobierno electrónico en México *PAAKAT: Revista de Tecnología y Sociedad* **5(9)** 1
[13] D Yannacopoulos, P Manolitzas, A Spyridakos 2010 E-Government: A comparative study of the G2C online services progress using multi-criteria analysis *International Journal of Decision Support System Technology* **2(4)** 1
[14] N Yadav, V B. Singh 2012 E-governance: Past, present and future in India *International Journal of Computer Applications* **53(7)** 36
[15] S Prem Kumar, J Keziya rani, C Umashankar, V Venkata Ramana 2010 E-governance applications for citizens - issues and framework *International Journal on Computer Science and Engineering* **2(7)** 2362
[16] S Sophiarani, C Ibohal Singh 2013 Use of G2C information services under the e-Governance initiatives in NE India: A pilot survey *Annals of Library and Information Studies* **60(2)** 107
[17] L L Salehu Anteneh, R Klischewski, M Belachew 2015 towards a conceptual framework for pledging sustainable e-government success: The case of G2G in Ethiopia *AFRICON 2015* (Addis Ababa: IEEE)
[18] R C Joseph 2009 *Government-to-business (G2b) perspectives in e-government* (Harrisburg: Pennsylvania State University Harrisburg)
[19] Secretaría Nacional de la Administración Pública 2015 *Plan Nacional de Gobierno Electrónico 2014-2017* (Ecuador: Subsecretaría de Gobierno Electrónico)
[20] R Andrian, B Hendradjaya, W D Sunindyo 2016 *Software assessment model using metrics products for e-government in the G2B model* (Bandung: Cuarta Conferencia Internacional sobre Tecnología de la Información y la Comunicación)
[21] P Martínez Coral 2018 Seguro mató a confianza: Desafíos para la adopción del gobierno digital en Colombia *Inclusión & Desarrollo* **5(1)** 63
[22] S Bhattacharya, and J Goswami (Ghosh) 2011 *Study of e-governance: The attractive way to reach the citizens* (Kalyani: 2nd National Conference-Computing, Communication and Sensor Network)
[23] A Baležentis, G Paražinskaitė 2012 The benchmarking of the government to employee (g2e) technology development: Theoretical aspects of the model construction *Social Technologies* **2(1)** 53
[24] C Strang, I Goldstein 2012 Design and implementation of a public school government-to-employee system *6th International Conference on Theory and Practice of Electronic Governance* (New Delhi: Association for Computing Machinery)
[25] V Ranga Rao 2011 Collaborative government to employee (G2E): Issues and challenges to e-government *Journal of E-Governance* **34(4)** 214
[26] M Ramana Reddy 2019 Challenges for e-governance in andhra pradesh – a holistic view *International Journal of Research and Analytical Reviews* **6(1)** 735
[27] O Ahmed Ibrahim, N Hidayati Zakaria 2014 Towards a model of e-government services adoption among employees in developing countries *Journal of Information Systems Research and Innovation* **8** 66
[28] M Irfanullah Arfeen, J Iqbal, and M Jamil Mushtaq 2017 Model for e-government implementation in Pakistan *10th International Conference on Theory and Practice of Electronic Governance* (New Delhi: Association for Computing Machinery)
[29] R Klischewski, and E Askar 2010 Success factors of developing G2G services: The case of Egypt *4th International Conference on Theory and Practice of Electronic Governance* (Beijing: Association for Computing Machinery)
[30] S Al-Shuaili, M Ali, A Amril Jaharadak, M Al-Shekly 2019 An investigate on the critical factors that can affect the implementation of e-government in Oman *15th International Colloquium on Signal Processing & its Applications, CSPA* (Penang: IEEE)
[31] T Lau, M Aboulhoson, C Lin, D J Atkin 2008 Adoption of e-government in three Latin American countries: Argentina, Brazil and Mexico *Telecommunications Policy* **32(2)** 88
[32] T Obi, N Iwasaki 2015 *A Decade of World e-Government Rankings* (Tokyo: IOS Press BV)
[33] S Azelmad, A NfissI, S Mohamed 2018 eGovernment whole-of-government approach for good governance: initiatives from morocco *African Journal of Governance and Development* **7(2)** 24
[34] M Ahmad, Z A Hasibuan 2012 Government services integration based on cloud technology *14th International Conference on Information Integration and Web-based Applications & Services* (Bali: Association for Computing Machinery)

[35] R M Zein, and H Twinomurinzi 2019 Towards blockchain technology to support digital government *8th International Conference on Electronic Government and the Information Systems Perspective* (Linz: Springer)
[36] S Lee-Geillera, and T Lee 2019 Using government websites to enhance democratic e-governance: A conceptual model for evaluation *Government Information Quarterly* **36(2)** 208
[37] S S Dawes, L Vidiasova, O Parkhimovich 2016 Planning and designing open government data programs: An ecosystem approach *Government Information Quarterly* **33(1)** 15
[38] R C Joseph 2013 A structured analysis of e-government studies: Trends and opportunities *Government Information Quarterly* **30(4)** 435
[39] H Zhang, X Xu, J. Xiao 2014 Diffusion of e-government: A literature review and directions for future directions *Government Information Quarterly* **31(4)** 631
[40] M Haider, M U Khan, S Farooq 2015 e-Government an empirical analysis of current literature *International Conference on Information and Communication Technologies-ICICT* (Karachi: IEEE)
[41] A Pasini, P Pesado 2016 Quality model for e-government processes at the university level: A literature review *9th International Conference on Theory and Practice of Electronic Governance* (Montevideo: Association for Computing Machinery)
[42] F Sá, Á Rocha, M Pérez Cota 2016 From the quality of traditional services to the quality of local e-government online services: A literature review *Government Information Quarterly* **33(1)**149
[43] M Yusuf, C Adams, K Dingley 2016 A Review of e-government research as a mature discipline: Trends, themes, philosophies, methodologies, and methods *EJEG: The Electronic Journal of e-Government* **14(1)** 18
[44] B Cestnik, A Kern 2016 Cross-context linking concepts discovery in e-government literature (EGOV) *International Conference on Electronic Government, Guimarães* (Guimarães: Springer)
[45] F M Al-Balushi, M Bahari, A A Rahman 2016 Defining e-government integration and its objective: A systematic literature review *3rd International Conference on Computer and Information Sciences - ICCOINS* (Kuala: IEEE)
[46] L Alzahrani, W Al Karaghouli, V Weerakkody 2017 Analysing the critical factors influencing trust in e-government adoption from citizens' perspective: A systematic review and a conceptual framework *International Business Review* **26(1)**164
[47] B W Wirtz, J C Weyerer 2017 e-Government implementation: Theoretical aspects and empirical evidence *Public Organization Review* **17(1)** 101
[48] J M Sánchez Torres, I Miles 2017 The role of future-oriented technology analysis in e-government: A systematic review *European Journal of Futures Research* **5(1)** 1
[49] R Meiyanti, M Misbah, D Napitupulu, R Kunthi, T I Nastiti, D I Sensuse, Y G Sucahyo 2017 Systematic review of critical success factors of e-government: Definition and realization *International Conference on Sustainable Information Engineering and Technology-SIET* (Malang: IEEE)
[50] M I Arias, A C Gastaud Maçada 2018 Digital government for e-government service quality: A literature review *11th International Conference on Theory and Practice of Electronic Governance* (Galway: Association for Computing Machinery)
[51] I P M Astawa, K C Dewi 2018 e-Government facilities analysis for public services in higher education *Journal of Physics: Conference Series* **953(012061)** 1
[52] R Meiyanti, B Utomo, D I Sensuse, R Wahyuni 2018 e-Government challenges in developing countries: A literature review *6th International Conference on Cyber and IT Service Management-CITSM* (Parapat: IEEE)
[53] L T Mabinane, E I Edoun 2018 Global e-government trends and developments: who is performing well or poorly? a review of the literature *International Conference on Internet and e-Business-ICIEB* (Singapore: Association for Computing Machinery)
[54] J D Twizeyimana, and A Andersson 2019 The public value of e-government – A literature review *Government Information Quarterly* **36(2)** 167