The Critical Success Factors for Big Data Adoption in Government

Novan Zulkarnain

Computer Science Department, BINUS Graduate Program, Doctor of Computer Science
Information System Department, School of Information System
Bina Nusantara University, Jakarta, Indonesia 11480
novan@binus.ac.id

Meyliana*

Information System Department, School of Information System
Bina Nusantara University, Jakarta, Indonesia 11480
meyliana@binus.edu

Ahmad Nizar Hidayanto

Faculty of Computer Science
Universitas Indonesia, Depok, Indonesia 16424
nizar@cs.ui.ac.id

Harjanto Prabowo

Management Department, BINUS Business School Undergraduate Program
Information System Department, School of Information System
Bina Nusantara University, Jakarta, Indonesia 11480
harprabowo@binus.edu

ABSTRACT

Over the last ten year, governments all over the world have tried to take advantage of Big Data Technology to improve government services with citizens. Adoption of Big Data has increased in most countries, but at the same time, the rate of successful adoption and operation varies from country to country. ty. A systematic literature review (SLR) was conducted to identify the critical success factors (CSFs) for the Big Data adoption in Government. It includes the Critical Success Factor of Big Data Adoption in the government over the past 10 years. It presents general trends by examining 183 journals and several literatures that related to government operations, public services delivery, citizen participation, policy and decision making, and governance reform. We select 90 journal and find 11 classification factor that related to successions a Big Data Adoption in Government.

Keywords: Critical success factors; CSFs; Big Data; E- Government; systematic literature review; SLR.

1. INTRODUCTION

Amazingly, every day the world produces around 2.5 million bytes of data or 1 billion gigabytes [1]. These data include textual content (i.e., structured, semi-structured and unstructured), multimedia content (e.g., video, images, audio) on a variety of platforms (e.g.,

machine-to-machine communication, social media sites, networks). of sensors), cyber-physical systems and the Internet of Things [IoT]) [2]. The large amount of data can also come from other relevant areas, such as banking, education, military, medical research, public health, smart cities, security management, emergencies and disaster recovery [3]. The increase in data causes a problem about how to store and manage such heterogeneous datasets with moderate requirements in the hardware and software infrastructure [4]. Industry, education and Governments around the world have high aware and understood the importance of large amounts of data, commonly known as Big Data or Open Data [4]. Commonly, Industry use big data for customer sentiment analyst, behavior analytic, customer satisfaction, predictive support, and fraud detection [5]. In Education field, Big Data are use for analysis and extracting useful trends, education models, personalize learning, standardize the presentation of knowledge and using them to offer better and more enhanced education and curriculum [6]. And the Government use Big Data for improving government information and service to their citizen [7], addressing basic needs quickly, providing quality education and reduce unemployment rate [8]. It will create a better health, better teachers, better education and better decision making [9].

To realize and adoption a big data government must have a large funds. US Government, in early 2006 the state legislature appropriated $9.5 million to incentive Big Data for public sector [10]. In March 2012, the Obama Administration announced a USD 200 million investment to launch the Big Data Research and Development Plan in different government agencies [4]. Korea Government in 2013 decided to invest $500 million in the Big Data for Government 3.0 project over the next 5 years [11]. And also, the lesson in China Government has 731 million internet users according to government statistics in January 2017. Further, 695 million users use the internet through mobile devices. And has invest for $14.4 Trillion to share data on Internet of Thing (IoT) [12]. Base on that fact, it's clear that one of critical success factor is government budgeting. Many in developing countries have the same problem, the problem of costs and management. For funds to be used efficiently, funds must be properly managed. Good project management is the main key to the adoption of big data in government. You also need a top-down approach to managing and integrating big data [13].

Before Government Adopting Big data, they have to mature their infrastructure for supporting. One of recommendation choice for adopting Big Data is using Cloud Computing Infrastructure. Its benefits include: cost efficiency, unlimited storage, backup and recovery, automatic software integration, easy access to information, rapid deployment, a simpler scale of services and provision of new services [14]. Some paper also said the parallel computing is one of the fundamental infrastructures for the management of big data activities. It is capable of performing simultaneously the activity of the algorithm in a group of machines or supercomputers [15].

In order to build a sustainable Big Data infrastructure, Data integration is the key [16]. Governments should try to reconstruct large data control towers to integrate cumulative, structured or unstructured sets of departmental silos [13]. The basic requirements of the infrastructure level should be considered according to the types of governmental organizations, the use of data and the consumption of energy with environmental impact And It is preferable to use your own data centers with a private cloud structure as a basic security measure [17].

Furthermore, few researches are conducting in big data adoption in Government. And they have been success implementing it. Some research mention that adopting big data in government same as adopting it in industry or academia [18]. By this we use a Literature Review that have a relation between Big Data and Industry or Enterprise, Big Data and education, and last important focus on big data and government. Therefore, this research tries to define a question:" what are the critical success factors of the adoption of big data in the government?"

2. METHODOLOGY

This research conducted an exhaustive review of the literature of the study on research on the adoption of large data   on government. This process is divided into several parts, which are: determine the research sources, define the keyword model for a research process, initiate inclusion and exclusion criteria, extract data and analyze the result to answer a research question.

2.1 SEARCH PROCESS

The first process is defining the source of literature to find a suitable article/journal. The selected sources for systematic literature review are as follow:

- ACM Digital Library (dl.acm.org)
- Elsevier (www.sciencedirect.com)
- IEEEXplore Digital Library (ieeexplore.ieee.org)
- Igi Global (www.igi-global.com)
- Sage (www.sage.com)
- Springer (link.springer.com)
- Taylor & Francis (taylorandfrancisgroup.com/journals/)
- Wiley Online Library (onlinelibrary.wiley.com)

The pattern of keyword that is applied to find the research paper which related to answer the research question is formed using Boolean operator to filter the data, so we can define the priority to search the data based on the symbols which are used. The symbols and Boolean operators that we used in this paper, such as OR, AND. The combinations of the keywords are as follows:

- ((critical OR success OR factor) OR csf) AND ((big AND data AND adoption) OR BD) AND (((electronic AND government) OR e-gov) OR ((public AND sector) OR nonprofit))
- ((key OR success OR factor) OR csf) AND ((big AND data AND project) OR BD) AND (((electronic AND government) OR e-gov) OR ((public AND sector) OR nonprofit))
- (Success OR Adoption) AND (Big AND Data) AND (Government Or E-Government Or E-Gov)
- (Big AND Data) And (Adoption OR Success) And (Government Or E-Government Or E-Gov)

The inclusion criteria of searching mechanism consist of three processes of filter. The first is Studies Found process. All of the papers we found from source publication related to the specified keyword will keep as Studies Found. After that, the next step we are filtering the paper according to the title and abstract. If the title and abstract complimentary and match to define the research question, then this paper will keep as Candidate Studies. Then the last part to filter these papers is all of the candidate papers will be read thoroughly to answer the research question. If the papers are appropriate to answer the research question, those papers will be defined as Selected Studies.

Meanwhile to clarify the validity of literature, the exclusion criteria of searching is defined into some procedure, which are:

- The paper on the basis of their publication date between 2008 - 2018
- Structure of the paper complete, which means all identity (journal/conference, identity of author, etc.) is mentioned in the paper.
- Duplicate paper of the same study is excluded in SLR

2.2 DATA EXTRACTIONS

The study literature was examined 572 papers manually from all resource and criteria. From 572 examined papers, there are 183 papers which being to be candidate studies based on related title and abstract to the research question. After studied further, we search a case that relevant to the success adopting big data in government, and there are only 86 papers which can be used in this research.

Table 1. Publisher and Number of Selected Papers

Source	Found	Relevant	Selected
ACM	242	29	15
Elsevier	149	62	27
IEEEXplorer	107	58	28
IG Global	8	2	2
SAGE	5	5	1
Springer	23	9	4
Taylor & Francis	21	11	6
Wiley	16	7	3
Total	**572**	**183**	**86**

.

3. RESULT AND DISCUSSION

This research has intended to investigate the critical success factor of big data adoption for government. The usage of social media in higher institution has emerging a new opportunity and challenge both for basic functional usage or academic specific usage. Based on that, this study will identify the general component of electronic learning to define collaboration of social media and electronic learning [5].

The most of authors expertise in" Big Data" was come from USA, China, Netherland, United Kingdom, Indonesia, Canada and India. For most Paper related to the topic's was from USA, China, United Kingdom, Netherland, India, and Canada. and Australia. Surprisingly, there no paper from Denmark, Germany, Iraq, Kuwait, Oman, Papua New Guinea, Portugal and Slovenia, even the author affiliate is coming from that country.

Table 2. Number and Country of The Authors

Country of the Author	Paper	%	Author	%
Australia	6	3	3	3
Austria	6	3	2	2
Brunei	3	2	2	2

Canada	11	6	4	5
China	23	12	12	14
Czech Republic	2	1	1	1
Denmark	1	1	0	0
Finland	4	2	1	1
France	4	2	2	2
Germany	1	1	0	0
India	10	5	5	6
Indonesia	11	6	2	2
Iraq	1	1	0	0
Italy	3	2	2	2
Japan	1	1	1	1
Kuwait	1	1	0	0
Macao	2	1	1	1
Malaysia	9	5	3	3
Marocco	5	3	2	2
Netherland	16	8	6	7
Oman	1	1	0	0
Papua New Guinea	1	1	0	0
Portugal	1	1	0	0
Republic of Korea	2	1	1	1
Slovenia	1	1	0	0
South Africa	4	2	2	2
South Korea	5	3	2	2
Sweden	1	1	1	1
Switzerland	1	1	1	1
UAE	1	1	1	1
United Kingdom	15	8	6	7
USA	43	22	23	27
Total	196	100	86	100

Table 3. Critical Success Factor's

Critical Success Factor	Source
Cost Effective / Efficient	[2], [4], [28], [27], [25], [36], [37], [38] [39], [20]
Management Supporting	[28], [40], [25], [13], [41], [39], [20]
Infrastructure	[6], [42], [43], [25], [27], [44]
Communication	[24], [45], [13], [25], [27], [44]
Skilled Team / Staff	[28], [27], [25], [46], [47], [48], [49], [20] [50]
Political Stability	[51], [32], [12], [10], [52], [53], [54], [55]
Social & Culture	[45], [56], [55], [57], [32], [58], [39], [4],[59], [35], [60], [61], [62], [63]
Citizen Involvement	[46], [11], [32], [54], [12], [53], [62], [64] [4], [65], [61], [21], [66], [67]
Organization Maturity	[21], [24], [53], [35], [4], [50], [48], [61]

Privacy & Security	[12], [54], [68], [39], [2], [69], [70], [38], [57], [64], [13]
Realistic Plan / Objective	[12], [28], [39], [51], [4], [36], [21], [5] [64], [71], [54]

Table 3 shows the critical success factor that has been found in 86 selected literature. We found 11 CSF, that have major issue which relevant on the topics.

3.1 Cost Effective / Efficient

Cost are high for adopting Big Data System [19]. This will be a major problem and a challenge for developing country. Cost are mostly use for infrastructure, technology, and consultant for helping government to integrate the big data system [12].

3.2 Management Supporting

Management support means that senior managers are willing to allocate resources and encourage the initial adoption of future changes [20]. Management in Government often changes. Top Management will make a decision for every project. It will difficult to adopting Big Data if the decisions are not aligning from previous management [21].

3.3 Infrastructure

The most critical issue for adopting Big Data in Government is infrastructure [16]. To have Big Data Infrastructure, government must integrate all the resources, especially datasets [22]. And also have a clear standardized for all department inside the organization [23].

3.4 Communication

The need for effective communication Effective communication is one of the key success factors for a Big Data project [24]. Active communication is very important to ensure that the information needed for the project is up to date, such as policies, procedures, and making decision [25]. Resistance to change are the issue that always be the challenge both internal and external, to handle this a good communication to gaining a trust will help the project [26].

3.5 Skilled Team / Staff

The need for effective communication Effective communication is one of the key success factors for a Big Data project [24]. Active communication is very important to ensure that the information needed for the project is up to date, such as policies, procedures, and making decision [25]. Resistance to change are the issue that always be the challenge both internal and external, to handle this a good communication to gaining a trust will help the project [26].

3.6 Political Stability

Another factor that must be consider for adopting Big Data in Government is a political stability [28]. The sustain of a Big Data project are different in democracy country and in dictatorial regime country [29]. As mention before change in government are often change. Therefore, all project must have top management that commit and can lead the project future success.

3.7 Social and Culture

The moderating role of organizational culture has been considered a key influence factor in studies focused on the adoption of innovative information systems [30]. Culture are related to the human behavior, the more viable the organizational culture, the greater the willingness of

the staff to adopt the technology of big data. [31].

3.8 Citizen Involvement

User or citizen involvement also consider as a factor for adopting big data [28]. Citizens are the centric of all government services and need to be care [32]. Without citizen involvement and participation, government cannot know what information that have to discovered [22].

3.9 Organization Maturity

one of the indicators of readiness of Big Data Adoption is a maturity of organization [21]. Maturity comes from the past experience of the government, with that they can have deep understanding about how to adopt big data [33].

3.10 Privacy and Security

one of the indicators of readiness of Big Data Adoption is   a maturity of organization [21]. Maturity comes from the past experience of the government, with that they can have deep understanding about how to adopt big data [33].

3.11 Realistic Plan and Objective

The success of adopting big data depend on the realistic   of plan and objective [28]. Learning from existing cases, saying that many of the big data have failed is the lack of preparation in planning [52]. Sometimes, government forces use technology that is not ready, do not plan according to existing conditions. Good planning will have an impact on the good performance of the project and, above all, on cost efficiency [12].

4. IMPLICATION AND CONCLUSION

This literatures on big data identified 11 factors related to the success of the adopting big data on government. There are cost effective / efficient, management supporting, infrastructure, communication, skilled team / staff, political stability, social and culture, citizen involvement, organization maturity, privacy and security, and realistic plan / objective. To classify these factors, a literature review was use. we selected 86 paper bases on the topic that related to big data adoption in government. this study took several cases in various countries, as seen in table 3, with several authors who were experts in the field of big data.

5. LIMITATION AND FUTURE RESEARCH

In the future work, research should be conducted to investigate how much that factors have an impact to the success of big data adoption in government. This paper has a limitation on the number of databases. It has restricted access from reputable journal so few of them not include in this paper. Besides that, we will add some of new search engine to find more journals and include with only journal from top publisher. The publication year should be in the last 20 years. For future research, 11 factors that have been found will be tested statistically. Then an information system model will be designed to monitor these factors for helping succession of big data adoption in government.

REFERENCES

[1]   C. Dobre and F. Xhafa, "Intelligent services for big data science," Future Generation Computer Systems, vol. 37, pp. 267–281, 2014.

[2]   U. Sivarajah, M. M. Kamal, Z. Irani, and V. Weerakkody, "Critical analysis of Big Data challenges and analytical methods," Journal of Business Research, vol. 70, pp. 263–286, 2017. [Online]. Available: http://dx.doi.org/10.1016/j.jbusres.2016.08.001

[3]   Z. Yan, "Big Data and Government Governance," 2018 International Conference on Information Management and Processing (ICIMP), pp. 111–114, 2018.

[4]   M. Chen, S. Mao, and Y. Liu, "Big Data: A Survey," Mobile Networks and Applications, vol. 19, no. 2, pp. 171–209, apr 2014. [Online]. Available: http://link.springer.com/10.1007/s11036-013-0489-0

[5]   D. W. Bates, A. Heitmueller, M. Kakad, and S. Saria, "Why policymakers should care about big data in healthcare," Health Policy and Technology, vol. 7, no. 2, pp. 211–216, 2018. [Online]. Available: https://doi.org/10.1016/j.hlpt.2018.04.006

[6]   E. Al Nuaimi, H. Al Neyadi, N. Mohamed, and J. Al-Jaroodi, "Applications of big data to smart cities," Journal of Internet Services and Applications, vol. 6, no. 1, pp. 1–15, 2015. [Online]. Available: http://dx.doi.org/10.1186/s13174-015-0041-5

[7]   Y.-C. Chen and T.-C. Hsieh, "Big Data for Digital Government," International Journal of Public Administration in the Digital Age, vol. 1, no. 1, pp. 1–14, 2014. [Online]. Available: http://services. igi-global.com/resolvedoi/resolve.aspx?doi=10.4018/ijpada.2014010101

[8]   N. Z. B. Zainal, H. Hussin, and M. N. M. Nazri, "Big data initiatives by governments - Issues and challenges: A review," Proceedings - 6th In- ternational Conference on Information and Communication Technology for the Muslim World, ICT4M 2016, pp. 304–309, 2017.

[9]   D. J. Power, "Using Big Data' for analytics and decision support, "Journal of Decision Systems, vol. 23, no. 2, pp. 222–228, 2014.

[10] H. Jarman, "Incentivizing health information exchange: collaborative governance, market failure, and the public interest," Proceedings of the 15th Annual International Conference on Digital Government Research, pp. 227–235, 2014.

[11] C. N. Jun and C. J. Chung, "Big data analysis of local government 3.0: Focusing on Gyeongsangbuk-do in Korea," Technological Forecasting and Social Change, vol. 110, pp. 3–12, 2016. [Online]. Available: http://dx.doi.org/10.1016/j.techfore.2015.11.007

[12] M. Parasol, "The impact of China's 2016 Cyber Security Law on foreign technology firms, and on China's big data and Smart City dreams," Computer Law and Security Review, vol. 34, no. 1, pp. 175–179, 2018. [Online]. Available: https://doi.org/10.1016/j.clsr.2017.05.022

[13] G.-H. Kim, S. Trimi, and J.-H. Chung, "Big-data applications in the government sector," Communications of the ACM, vol. 57, no. 3, pp. 78–85, 2014.

[14] M. Al-Ruithe and E. Benkhelifa, "Analysis and Classification of Barriers and Critical Success Factors for Implementing a Cloud Data Governance Strategy," Procedia Computer Science, vol. 113, pp. 223–232, 2017. [Online]. Available: http://dx.doi.org/10.1016/j.procs.2017.08.352

[15] V. S. Reinhardt, "a Statistical Model for Flicker Noise," Le Journal de Physique Colloques, vol. 42, no. C8, pp. C8–211–C8–216, 1981. [Online]. Available: http://www.edpsciences.org/10.1051/jphyscol: 1981825

[16] P. B. Goes, "Editors Comments: Big Data and IS Research," MIS Quarterly, vol. 38, no. 3, pp. iii–viii, 2014.

[17] P. P. Khine, "Big data in government organizations: A review Big Data in Government Organizations: A Review," Big Data Analysis (ICBDA), 2017 IEEE 2nd International Conference, no. March 2017.

[18] H. H. Huang and H. Liu, "Big data machine learning and graph analytics: Current state and future challenges," Proceedings - 2014 IEEE International Conference on Big Data, IEEE Big Data 2014, pp. 16–17, 2015.

[19] A. Chakravarthi, "The Etymology of Big Data on Government Pro- cesses," Information Communication and Embedded Systems (ICICES), 2017 International Conference, no. Icices, 2017.

[20] S. Sun, C. G. Cegielski, L. Jia, and D. J. Hall, "Understanding the Factors Affecting the Organizational Adoption of Big Data," Journal of Computer Information Systems, vol. 58, no. 3, pp. 193–203, 2018.

[21] B. Klievink, B. J. Romijn, S. Cunningham, and H. de Bruijn, "Big data in the public sector: Uncertainties and readiness," Information Systems Frontiers, vol. 19, no. 2, pp. 267–283, 2017. [Online]. Available: http://dx.doi.org/10.1007/s10796-016-9686-2

[22] A. K. Bhadani and D. Jothimani, "Big Data: Challenges, Opportunities and Realities," Effective Big Data Manangement and Opportunities for Implementation, pp. 1–24, 2016. [Online]. Available: https: //arxiv.org/ftp/arxiv/papers/1705/1705.04928.pdf

[23] V. N. Gudivada, R. Baeza-Yates, Y. Labs, and V. V. Raghavan, "GUEST EDITORS' INTRODUCTION Big Data: Promises and Problems," Computer (2015), p. 21, 2015. [Online]. Available: http://www.cs.rug.nl/ ~ roe/courses/isc/BigDataPromises.pdf

[24] J. S. Saltz and I. Shamshurin, "Big data team process methodologies: A literature review and the identification of key factors for a project's success," Proceedings - 2016 IEEE International Conference on Big Data, Big Data 2016, pp. 2872–2879, 2016.

[25] M. Guntur, B. Purwandari, T. Raharjo, I. Solichah, and L. Kumaralalita, "Critical Success Factors for Information Systems Development: A Case Study in e-Government," in Proceedings of the 2Nd International Conference on Business and Information Management, ser. ICBIM '18. New York, NY, USA:ACM,2018, pp.29–33.[Online]. Available: http://doi.acm.org/10.1145/3278252.3278288

[33] M. Janssen, H. van der Voort, and A. Wahyudi, "Factors influencing big data decision-making quality". Journal of Business Research, vol. 70, pp. 338–345, 2017. [Online]. Available: http://dx.doi.org/10. 1016/j.jbusres.2016.08.007

[34] G. Lee and Y. H. Kwak, "An Open Government Maturity Model for social media-based public engagement," Government Information Quarterly, vol. 29, no. 4, pp. 492–503, 2012. [Online]. Available: http://dx.doi.org/10.1016/j.giq.2012.06.001

[35] J. Akoka, I. Comyn-Wattiau, and N. Laoufi, "Research on Big Data A systematic mapping study," Computer Standards and Interfaces, vol. 54, pp. 105–115, 2017. [Online]. Available: http://dx.doi.org/10.1016/j.csi.2017.01.004

[36] F. Malomo and V. Sena, "Data Intelligence for Local Government? Assessing the Benefits and Barriers to Use of Big Data in the Public Sector," Policy and Internet, vol. 9, no. 1, pp. 7–27, 2017.

[37] N. Mehta and A. Pandit, "Concurrence of big data analytics and healthcare: A systematic review," International Journal of Medical Informatics, vol. 114, no. January, pp. 57–65, 2018. [Online]. Available: https://doi.org/10.1016/j.ijmedinf.2018.03.013

[38] A. Oussous, F. Z. Benjelloun, A. Ait Lahcen, and S. Belfkih, "Big Data technologies: A survey," Journal of King Saud University - Computer and Information Sciences, vol. 30, no. 4, pp. 431–448, 2017. [Online]. Available: https://doi.org/10.1016/j.jksuci.2017.06.001

[39] D. H. Shin, "Demystifying big data: Anatomy of big data developmental process," Telecommunications Policy, vol. 40, no. 9, pp. 837–854, 2016. [Online]. Available: http://dx.doi.org/10.1016/j.telpol.2015.03.007

[40] Y. Gong and M. Janssen, "Enterprise Architectures for Supporting the Adoption of Big Data," Proceedings of the 18th Annual International Conference on Digital Government Research - dg.o '17, pp. 505–510, 2017. [Online]. Available: http://dl.acm.org/citation.cfm?doid=3085228. 3085275

[41] G. J. Miller, "Comparative Analysis of Big Data and BI Projects," 2018 Federated Conference on

Computer Science and Information Systems (FedCSIS), vol. 15, pp. 701–705, 2018. [Online]. Available: https://fedcsis.org/proceedings/2018/drp/125.html

[42] Alexandros Labrinidis and H. V. Jagadish, "Challenges and Opportuni- ties with Big Data," Proceedings of the VLDB Endowment, pp. 1–15, 2012.

[43] J. Chen, Y. Chen, X. Du, C. Li, J. Lu, S. Zhao, and X. Zhou, "Big data challenge: A data management perspective," Frontiers of Computer Science, vol. 7, no. 2, pp. 157–164, 2013.

[44] N. Al-Qirim, A. Tarhini, and K. Rouibah, "Determinants of Big Data Adoption and Success," Proceedings of the International Conference on Algorithms, Computing and Systems - ICACS 17, pp. 88–92, 2017. [Online]. Available: http://dl.acm.org/citation.cfm?doid=3127942.

[26] S. Joshi, S. Saxena, T. Godbole, and Shreya, "Developing Smart Cities: An Integrated Framework," Procedia Computer Science, vol. 93, no. September, pp. 902–909, 2016. [Online]. Available: http://dx.doi.org/10.1016/j.procs.2016.07.258

[27] A. Y. Gheni, Y. Y. Jusoh, M. A. Jabar, and N. M. Ali, "The Critical Success Factors (CSFs) for IT Projects," Journal of Theoretical Biology (2009), vol. 9, no. 3, pp. 13–17, 2015.

[28] J. Fortune and D. White, "Framing of project critical success factors by a systems model," International Journal of Project Management, vol. 24, no. 1, pp. 53–65, 2006.

[29] S. Basu, "Egovernment and developing countries: an overview," International Review of Law, Computers & Technology, vol. 18, no. 1, pp. 109–132, 2004. [Online]. Available: http://www.tandfonline.com/ doi/abs/10.1080/13600860410001674779

[30] R. Dubey, A. Gunasekaran, S. J. Childe, T. Papadopoulos, Z. Luo, S. F. Wamba, and D. Roubaud, "Can big data and predictive analytics improve social and environmental sustainability?" Technological Forecasting and Social Change, no. June, pp. 0–1, 2017. [Online]. Available: http://dx.doi.org/10.1016/j.techfore.2017.06.020

[31] M. H. Alkharusi and A. H. Al-Badi, "IT personnel perspective of the slow adoption of cloud computing in public sector: Case study in Oman," 2016 3rd MEC International Conference on Big Data and Smart City, ICBDSC 2016, pp. 179–186, 2016.

[32] J. C. Bertot, P. T. Jaeger, and J. M. Grimes, "Using ICTs to create a culture of transparency: E-government and social media as openness and anti-corruption tools for societies," Government Information Quarterly, vol. 27, no. 3, pp. 264–271, 2010. [Online]. Available: http://dx.doi.org/10.1016/j.giq.2010.03.001

[45] E. Olshannikova, T. Olsson, J. Huhtamaki, and H. Karkkainen, "Cen- ceptualizing Big Social Data," Journal of Big Data, vol. 4, no. 1, 2017.

[46] E. W. Welch, M. K. Feeney, and C. H. Park, "Determinants of data sharing in U.S. city governments," Government Information Quarterly, vol. 33, no. 3, pp. 393–403, 2016. [Online]. Available: http://dx.doi.org/10.1016/j.giq.2016.07.002

[47] Y. Zhan, K. H. Tan, Y. Li, and Y. K. Tse, "Unlocking the power of big data in new product development," Annals of Operations Research, vol. 270, no. 1-2, pp. 577–595, 2018.

[48] W. A. Gu¨nther, M. H. Rezazade Mehrizi, M. Huysman, and F. Feldberg, "Debating big data: A literature review on realizing value from big data," Journal of Strategic Information Systems, vol. 26, no. 3, pp. 191–209, 2017.

[49] F. Matsebula and E. Mnkandla, "Information Systems Innovation Adop- tion in Higher Education: Big Data and Analytics," Advances in Computing and Communication Engineering (ICACCE), pp. 326–329, 2016.

[50] S. Eybers and M. Hattingh, "Critical success factor categories for big data: A preliminary analysis of the current academic landscape," 2017 IST-Africa Week Conference (IST-Africa), no. June, pp. 1–11, 2017. [Online]. Available: http://ieeexplore.ieee.org/document/8102327/

[51] M. J. Moon, "The Evolution of E-Government among Municipalities: Rhetoric or Reality?" Public

administration review, vol. 62, no. January, p. 2005, 2002.

[52] H. Kudo, "Bridging Big Data and Policy Making," Proceedings of the 11th International Conference on Theory and Practice of Electronic Governance - ICEGOV '18, pp. 609–615, 2018. [Online]. Available: http://dl.acm.org/citation.cfm?doid=3209415.3209479

[53] R. Tassabehji, R. Hackney, and A. Popovic̆, "Emergent digital era governance: Enacting the role of the 'institutional entrepreneur' in transformational change," Government Information Quarterly, vol. 33, no. 2, pp. 223–236, 2016.

[54] L. van Zoonen, "Privacy concerns in smart cities," Government Information Quarterly, vol. 33, no. 3, pp. 472–480, 2016. [Online].

Available: http://dx.doi.org/10.1016/j.giq.2016.06.004

[55] D. Boyd and K. Crawford, "Critical Questions for Big Data," Informa- tion, Communication & Society, vol. 15, no. 5, pp. 662–679, 2012.

[56] J. Sheng, J. Amankwah-Amoah, and X. Wang, "A multidisciplinary perspective of big data in management research," International Journal of Production Economics, vol. 191, no. June, pp. 97–112, 2017. [Online]. Available: http://dx.doi.org/10.1016/j.ijpe.2017.06.006

[57] R. C. LaBrie, G. H. Steinke, X. Li, and J. A. Cazier, "Big data analytics sentiment: US-China reaction to data collection by business and government". Technological Forecasting and Social Change, vol. 130, no. June 2016, pp. 45–55, 2018. [Online]. Available: http://dx.doi.org/10.1016/j.techfore.2017.06.029

[58] A. Gandomi and M. Haider, "Beyond the hype: Big data concepts, methods, and analytics," International Journal of Information Management, vol. 35, no. 2, pp. 137–144, 2015. [Online]. Available: http://dx.doi.org/10.1016/j.ijinfomgt.2014.10.007

[59] X. Sixin and Y. Yayuan, "A New Governance Architecture for Govern- ment Information Resources based on Big Data Ecological Environment in China," Proceedings - 2017 IEEE International Symposium on Mul- timedia, pp. 524–530, 2019.

[60] K. Hardy and A. Maurushat, "Opening up government data for Big Data analysis and public benefit," Computer Law and Security Review, vol. 33, no. 1, pp. 30–37, 2017. [Online]. Available: http://dx.doi.org/10.1016/j.clsr.2016.11.003

[61] M. Poel, E. T. Meyer, and R. Schroeder, "Big Data for Policymaking: Great Expectations, but with Limited Progress?" Policy and Internet, vol. 10, no. 3, pp. 347–367, 2018.

[62] M. Anshari and S. A. Lim, "E-Government with Big Data Enabled through Smartphone for Public Services: Possibilities and Challenges," International Journal of Public Administration, vol. 40, no. 13, pp. 1143–1158, 2017. [Online]. Available: http://dx.doi.org/10.1080/ 01900692.2016.1242619

[63] J. Frizzo-Barker, P. A. Chow-White, M. Mozafari, and D. Ha, "An empirical study of the rise of big data in business scholarship," International Journal of Information Management, vol. 36, no. 3, pp. 403–413, 2016. [Online]. Available: http://dx.doi.org/10.1016/j. ijinfomgt.2016.01.006

[64] K. Galloway, "Big Data: A case study of disruption and government power," Alternative Law Journal, vol. 42, no. 2, pp. 89–95, 2017.

[65] S. Qanbari, N. Rekabsaz, and S. Dustdar, "Open Government Data as a Service (GoDaaS): Big Data Platform for Mobile App Developers," Future Internet of Things and Cloud (FiCloud), 2015 3rd International Conference, pp. 398–403, 2015.

[66] S. Nativi, P. Mazzetti, M. Santoro, F. Papeschi, M. Craglia, and O. Ochiai, "Big Data challenges in building the Global Earth Observation System of Systems". Environmental Modelling and Software, vol. 68, pp. 1–26, 2015. [Online]. Available: http://dx.doi.org/10.1016/j.envsoft.2015.01.017

[67] H. Lee, H. Choi, J. Lee, J. Min, and H. Lee, "Impact of IT Investment on Firm Performance Based on Technology IT Architecture," Procedia Computer Science, vol. 91, no. Itqm, pp. 652–661,

2016.

[68] M. Janssen and J. van den Hoven, "Big and Open Linked Data (BOLD) in government: A challenge to transparency and privacy?" Government Information Quarterly, vol. 32, no.4, pp. 363–368, 2015. [Online]. Available: http://dx.doi.org/10.1016/j.giq.2015.11.007

[69] H. K. Patil and R. Seshadri, "Big data security and privacy issues in healthcare," Proceedings - 2014 IEEE International Congress on Big Data, Big Data Congress 2014, pp. 762–765, 2014.

[70] K. David Strang and Z. Sun, "Meta-analysis of big data security and privacy: Scholarly literature gaps," Proceedings - 2016 IEEE International Conference on Big Data, Big Data 2016, pp. 4035–4037, 2016.

[71] J. Shi, X. Ai, and Z. Cao, "Can big data improve public policy analysis?" Proceedings of the 18th Annual International Conference on Digital Government Research - dg.o '17, pp. 552–561, 2017. [Online].Available:http://dl.acm.org/citation.cfm?doid=3085228.308531