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Patrick Ajibade (PhD)

University of KwaZulu-Natal, AjibadeP1@ukzn.ac.za

Stephen S.M. Mutula Prof.

University of KwaZulu-Natal, MutulaSM@ukzn.ac.za

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Bibliometric Analysis of Citation Trends and Publications on E-government in Southern African Countries: A Human-computer Interactions and IT Alignment Debate

Patrick Ajibade (PhD) & Prof. Stephen M. Mutula

Information Studies Programme
University of KwaZulu-Natal, South Africa
AjibadeP1@ukzn.ac.za; MutulaSM@ukzn.ac.za
ajibadep.sa@gmail.com
<http://orcid.org/0000-0002-8608-8378>

Abstract

Due to technology adoption, many countries are embracing e-government. This study presents the growth and pattern of research on e-government articles and conference proceedings internationally, by scholars in the Southern African countries. It presents research patterns, trends and current gaps in e-government, as well as the most prolific authors and the level of outputs' prominence. This paper uses bibliometric tools to present the analysis of articles on Web of Science, Scopus and Google Scholar databases. R computational programming for big data analysis was used to generate summarized metrics. The citation sample size was ($n = 33,689$), $\mu = 625$, and the outputs impact based on total link strength of citations were; $\min = 11.0$, $\max = 1,686.0$ and $\mu = 118.2$, showing the Southern African scholars outputs visibility and prominence on e-government research. The findings present the most prolific authors in the Southern African region and the prominence of their outputs on e-governance. The study, through the computational synthesis of the data, also reveals some of the missing links in e-governance research designs and implementation. Furthermore, the study indicates that the service-oriented design of e-government platforms are still lacking, and the integration of Information Technology (IT) alignment, which is necessary to successfully implement e-government is lacking. The use and integration of mobile technology to enhance citizen-centric and participatory public governance platform and e-government implementation is not sufficiently addressed. Therefore, there is need to measure the maturity level of e-government IT deployment, its user-interfaces, as well as the design of an e-government that is able to respond to often embryonic and heterogeneous needs of citizens.

Keywords: Bibliometric, E-government Development, E-government Implementation, E-participation, Information Technology Alignment, Southern African Countries

Introduction

In the 2018 United Nations e-government development index metric, none of the 57 African countries was in the top 65, showing lack of synergies between e-government research outputs, e-government initiatives, design, and implementation. Currently, South Africa is the leading African country in terms of e-government, but it is still ranked in the 68th place in the world, with E-government Development Index (EGDI) index of 0.6678, followed by Trinidad and Tobago in the 78th place with (0.6440), while Tunisia is third in Africa in the 80th place, with EGDI index of (0.6254). Rwanda was in the 6th place in African ranking but 120th in the world ranking on e-government development with EDGI index of (0.4590). Namibia was seventh in Africa but 121st

in world ranking, with an index of (0.4554), followed by Kenya 122nd (0.4541) index, Botswana 127th (0.4253), Zambia 133rd place (0.4111), Uganda 135th place (0.4055), Tanzania 139th (0.3929) and lastly, Zimbabwe 13th in Africa but 146th place in the world ranking of EDGI, with an index of (0.3692). These very low e-government development indexes suggested that there are persistent challenges manifesting in the implementation of e-government within the region. Many studies have failed to examine the participation of the public in the design and implementation of e-government (Alcaide-Munoz, Rodriquez-Bolivar, Cobo and Herrera-Viedma (2017). Perhaps the challenges are that many outputs might have become a conceptual artifact, for failing to look at the e-governance from the perspective of human-computer interactions.

Literature Review

Despite the huge amount of financial resources and human capital on e-government in the Southern African countries, the global indexes for e-government development still ranked these countries very low. This means that the effects of e-government projects and implements do not have a direct correlation with service deliveries and expected services the public requires from the government. Therefore, e-governance life cycles from conceptualization, design, implementation, and realities within these countries must be realigned. Using bibliometric analysis, this study presents the trends of e-government, e-participation and e-services within the Southern African Development Community (SADC). A bibliometric analysis in the field of Library and Information Science is a well-known methodology for presenting a snapshot and analyze knowledge production such as trends in e-government outputs. Alcaide-Munoz, Rodriquez-Bolivar, Cobo and Herrera-Viedma (2017) opined that bibliometric is useful to find patterns, trends and niche area within a field, subject areas as well as the focus of research. The purpose of this study was to analyze the development of scientific research and contributions of e-government in the SADC countries. The study, first of its kind to our knowledge, presents the use of bibliometric tools as a triangulation method to conduct a bibliometric analysis of e-governance in the SADC countries.

Because the bibliometric study is an important tool in the field of Library and Information Science (LIS) to evaluate the outputs trend of any given field of scientific endeavor, several studies have utilized bibliometric analysis to understand e-government (Dias, 2014; Muñoz, Bolívar, Cobo & Herrera-Viedma, 2016). The use of bibliometric analysis has been argued as one of the ways of overcoming the challenges often associated with searching a large volume of publications. As pointed out by Ram and Paul-Anbu, (2014). Bibliometric software is also used for sorting, storing, annotating and presenting research outputs. This paper presents agile methods of bibliographic classifications, clustering, and visualization based on the fractional counting methods (Perianes-Rodriguez, Waltman & van Eck, 2016).

Objectives of the Study

The study objectives were to;

1. determine the trend and pattern of e-government in the Southern African Countries,
2. examine the Prominence Percentile of the e-government outputs,
3. determine the most cited outputs and the prominence of their outputs,
4. summarize metric/indicators of most prolific outputs,

5. assess the relevance score of e-government research to examine the niche areas, and
6. determine publication sources of e-government outputs.

Methodology

The paper uses bibliometric analysis to conduct this study on e-government or participatory governance in Southern Africa on the Web of Science, Harzing Platform and Scopus databases. The justification for inclusion of all the three databases was to triangulate the findings in order to get robust and inclusive data. For instance, Scopus and Web of Science are subscription databases, while most resources found on Google Scholar are mostly indexed from the open access where it is probable that most scholars in the research setting often publish their articles. From the Web of Science, the following search phrases/ and combination of Boolean operators were employed and used. TS="E-government" OR TS="e-governance" OR TS="participatory government" OR TS="digital government" OR TS="Information Communication Technology" OR TS="E-democracy" OR TS="e-participation" AND CU= ("South Africa") AND CU=("Southern Africa") AND CU=("Kenya") AND CU=("Gambia") AND CU=("Namibia") AND CU=("Botswana") AND CU=("Uganda") AND CU=("Zimbabwe"). All the search strategies above from 1990 to 2018 were collected from the following Web of Science Collection Citation indexes. The indexes were Science Citation Index (SCI-EXPANDED), Social Sciences Citation Index (SSCI), Arts and Humanities Citation Index (A & HCI), Conference Proceeding Citation Index (CPCI-S), CPCI-SSH, ESCI Timespan=1990-2018.

Visualization of bibliometric analysis is a vital tool to aid understanding of outputs scientometric research (Van Eck & Waltman, 2014). The fractional counting techniques or methods were adopted (Perianes-Rodriguez, Waltman, van Eck, 2016) and most of the results were presented based on the mapping and clustering of the data retrieved from the Web of Science (WoS), which was analyzed using VOS bibliometric applications (van Eck Waltman, Dekker and van den Berg, 2010). The text mining was consistent with the argument of Van Eck and Waltman (2011), which was predominantly used to mine the text within the abstract of each retrieved outputs on the Web of Science and other databases. The clustering techniques visualization was generated based on this model:

$$S_{ij} = \frac{2m_{ij}}{k_i k_j} \text{ where } a_{ij} = a_{ji},$$

Showing the normalization of the weights of the constructs strength of the network nodes edges i and j , $K_i(K_j)$ thus;

$$k_i = \sum_j a_{ij}, m = \frac{1}{2} \sum_i k_i \triangleright$$

S_{ij} denotes similarity of i and j nodes represents the total weight of nodes i (node j) and m denotes the total weight of the network based on the calculation of (Van Eck and Waltman, 2016).

$$\frac{2}{n(n-1)} \sum_{i < j} \|x_i - x_j\| = 1,$$

Base on the metric, the n represents the network node, and the xi represents the location of node i, and $\|x_i - x_j\|$ denotes the geometry of distances between the nodes i and j.

Results and Discussion

From the summarized data on e-government retrieved from the Google Scholar open platform, there were a sample ($n=4,878$) and 1161 duplicate data was removed and 4,861 data remained.

Authors' Outputs Prominence and Visibility within SADC

The visibility of outputs on e-government is a significant indication of the trend and focus of the scholars researching on e-governance. It shows the quantitative and descriptive analysis of output, as well as the most visible authors in terms of peer acceptance and citation. The top sixty outputs from a total outputs sample of publications ($n=4,825$), arranged and sorted by authors in alphabetical order, and based on their citation and volume of outputs, were presented in Table 1. However, the highest volume of outputs was by Mutula SM with (9) outputs, who co-authored additional four outputs. Findings revealed that Mutula and Mostert (2010) appeared to be the highest ranked outputs with an average cite per year, CPY of 11.88 on e-government in the Southern African region with a (CPY=11.88). The second highest ranked e-governance metrics was an article by Ngulube (2010) which had a prominence metric of CPY=9.82 with the output by Mutula and Van Brakel (2007) with CPY=9.55, which was the third highest ranked e-government output in the Southern African region. Furthermore, Mutula had published nine outputs on e-government as a single author with cumulative metrics of CPY=24.16 and four of such (Mutula 2003; 2005a, b; 2008) were ranked in the fourth place with a total cumulative metric of CPY = 17.81 as depicted in Table 1. Finally, Maumbe, Owei, and Alexander (2008) were ranked in fifth place with CPY=11. Bwalya articles on e-government in (2010; 2014, 2017a, b) were included in Table 1 despite its low metric such as CPY= 4.75 from four outputs. Nevertheless, the author had covered e-government in Namibia extensively and created useful models for e-government adoption. Srivastava and Teo (2006) had a CPY of 12.63, but their study used United Nation documentation which comprises of ($n = 113$) countries.

Table 1: Most Productive and Highly cited Scholars on E-government arranged in alphabetical order (ECC=total citations: CPY=Cite per Year: CPA=Cite per Author: AC=Author count: A=Age of the article

Authors	Title	Year	ECC	CPY	CPA	AC	A
N Ochara-Muganda, JP Van Belle	The link between the conceptualization of e-government and its perceived impacts: An exploratory empirical study in Kenya	2010	10	1.25	5	2	8
N Ochara-Muganda...	A proposed framework for E-Government knowledge infrastructures for Africa's transition economies	2010	13	1.63	7	2	8
A de Jager, V Van Reijswoud	E-Governance in the developing world in action: the case of DistrictNet in Uganda	2008	13	1.3	7	2	10

A Bailey, O Ngwenyama	Social ties, literacy, location and the perception of economic opportunity: Factors influencing telecentre success in a development context	2009	26	2.89	13	2	9
A Molla, PS Licker	Maturation stage of e-Commerce in developing countries: A survey of South African companies	2004	36	2.57	18	2	14
A Neupane, J Soar, K Vaidya...	Role of public e-procurement technology to reduce corruption in government procurement	2012	49	8.17	12	4	6
AV Anttiroiko	Electronic Government: Concepts, Methodologies, Tools, and Applications: Concepts, Methodologies, Tools, and Applications	2008	28	2.8	28	1	10
B Azad, S Faraj	E-Government institutionalizing practices of a land registration mapping system	2009	45	5	23	2	9
BE Asogwa	The state of e-government readiness in Africa: A comparative web assessment of selected African countries	2011	31	4.43	31	1	7
BJ Mostert, MA Ntetha	Availability and utilisation of information and communication technologies for service delivery: a South African case study	2011	10	1.43	5	2	7
BK Joseph	Designing Effervescent E-Government Solutions: Lessons from a Developing World Context	2018	0	0	0	1	1
BK Joseph	Determining Factors Influencing E-Government Development in the Developing World: A Case Study of Zambia	2017	2	2	2	1	1
BK Joseph	E-government Adoption Landscape Zambia: Context, Issues, and Challenges	2010	10	1.25	10	1	8
BK Joseph	Multi-Dimensional Nature of e-Government: Towards Adaptive e-Government Models	2017	1	1	1	1	1
BK Joseph	Pointers for designing context-aware e-government strategy in Zambia: Context, issues, and opportunities	2014	2	0.5	2	1	4
BK Joseph, O Mosweu	Integrating Document Workflow Management System in the Business Processes of a Public Institution	2017	0	0	0	2	1
BK Joseph, T Du Plessis	Consumers' Awareness of the Value of e-Government in Zambia: Empirical Evidence	2015	3	1	2	2	3
BM Maumbe, V Owei	Bringing m-government to South African citizens: policy framework, delivery challenges and opportunities.	2006	16	1.33	8	2	12
BM Maumbe, V Owei, H Alexander	Questioning the pace and pathway of e-government development in Africa: A case study of South Africa's Cape Gateway project	2008	110	11	37	3	10

BM Maumbe, V Owei, W Taylor	Enabling M-Government in South Africa: An Emerging Direction for Africa	2007	4	0.36	1	3	11
BM Maumbe, WJ Taylor	E-value creation in a government web portal in South Africa	2007	8	0.73	4	2	11
BM Muraya	Factors Affecting Successful Adoption of E-Government in Kenya's Public Sector	2015	3	1	3	1	3
BT Mbatha, DN Ocholla, J Le Roux	Some implications of Information and Communication Technologies (ICTs) on public service work environments in South Africa	2011	16	2.29	5	3	7
BT Mbatha, DN Ocholla, JL Roux	Diffusion and adoption of ICTs in selected government departments in KwaZulu-Natal, South Africa	2011	16	2.29	5	3	7
CG Riley	The Changing Role of the Citizen in the e-Governance and e-Democracy Equation	2003	67	4.47	67	1	15
CG Wescott	e-Government and the applications of technology to government services	2007	17	1.55	17	1	11
CN Silva	Citizen E-Participation in Urban Governance: Crowdsourcing and Collaborative Creativity: Crowdsourcing and Collaborative Creativity	2013	18	3.6	18	1	5
P Ngulube	A lost opportunity to foster E-Democracy and service delivery: E-Government in Sub Saharan Africa	2010	5	0.63	5	1	8
P Ngulube	The nature and accessibility of e-government in sub-Saharan Africa	2007	108	9.82	108	1	11
SC Srivastava, T Teo	Determinants and impact of e-government and e-business development: A global perspective	2006	36	3	18	2	12
SC Srivastava, TSH Teo	E-government payoffs: Evidence from cross-country data	2007	110	10	55	2	11
SC Srivastava, TSH Teo	E-government, e-business, and national economic performance	2010	101	12.6 3	51	2	8
SC Srivastava, TSH Teo	The relationship between e-government and national competitiveness: The moderating influence of environmental factors	2008	56	5.6	28	2	10
SM Mutula	A model for building trust in e-government	2012	3	0.5	3	1	6
SM Mutula	Africa's web content: Current status	2002	24	1.5	24	1	16
SM Mutula	Bridging the digital divide through e-governance: A proposal for Africa's libraries and information centres	2005	51	3.92	51	1	13
SM Mutula	Comparison of sub-Saharan Africa's e-government status with developed and transitional nations	2008	45	4.5	45	1	10
SM Mutula	Cyber café industry in Africa	2003	59	3.93	59	1	15

SM Mutula	Digital Economies: SMEs and E-Readiness: SMEs and E-Readiness	2009	25	2.78	25	1	9
SM Mutula	E-government divide: Implications for sub-Saharan Africa	2013	7	1.4	7	1	5
SM Mutula	E-government implementation strategies and best practices: implications for sub-Saharan Africa	2012	4	0.67	4	1	6
SM Mutula	Peculiarities of the digital divide in sub-Saharan Africa	2005	71	5.46	71	1	13
SM Mutula, G Olasina	E-government strategies in Sub-Saharan Africa: Failures and successes	2014	7	1.75	4	2	4
SM Mutula, J Mostert	Challenges and opportunities of e-government in South Africa	2010	95	11.8 8	48	2	8
SM Mutula, P Van Brakel	ICT skills readiness for the emerging global digital economy among small businesses in developing countries: Case study of Botswana	2007	105	9.55	53	2	11
SM Mutula, J Wamukoya	E-government readiness in east and southern Africa	2008	5	0.5	3	2	10
V							
Weerakkody, Y Dwivedi, M Williams...	E-government implementation in Zambia: contributing factors	2007	64	5.82	16	4	11
W Munyoka, FM Manzira	E-Government Adoption in Developing Countries: The Case of South Africa	2013	4	0.8	2	2	5
W Munyoka, MF Manzira	From e-government to m-government-challenges faced by sub-Saharan Africa	2014	9	2.25	5	2	4
W Mwangi	The social relations of e-government diffusion in developing countries: the case of Rwanda	2006	34	2.83	34	1	12
W Visser, H Twinomurinzi	E-Government & Public Service Delivery: Enabling ICT to put "People First"—A Case Study from South Africa	2008	30	3	15	2	10

E-government Terms Co-occurrences

Co-occurrence trends are useful to visualize the synopsis of e-government focus. The visualized trends in (figure 1) revealed current trends of publications and gaps that still existed. For example, one of such missing links was the role of technological infrastructure for e-government, information governance and the nexus between information ethics and e-government. Furthermore, IT alignment and service-oriented e-government were barely visible in the trends. Nevertheless, it is imperative to note that the current digital divide in achieving functioning e-government might be a result of the lack of alignment of critical IT infrastructure to ensure responsive platforms.

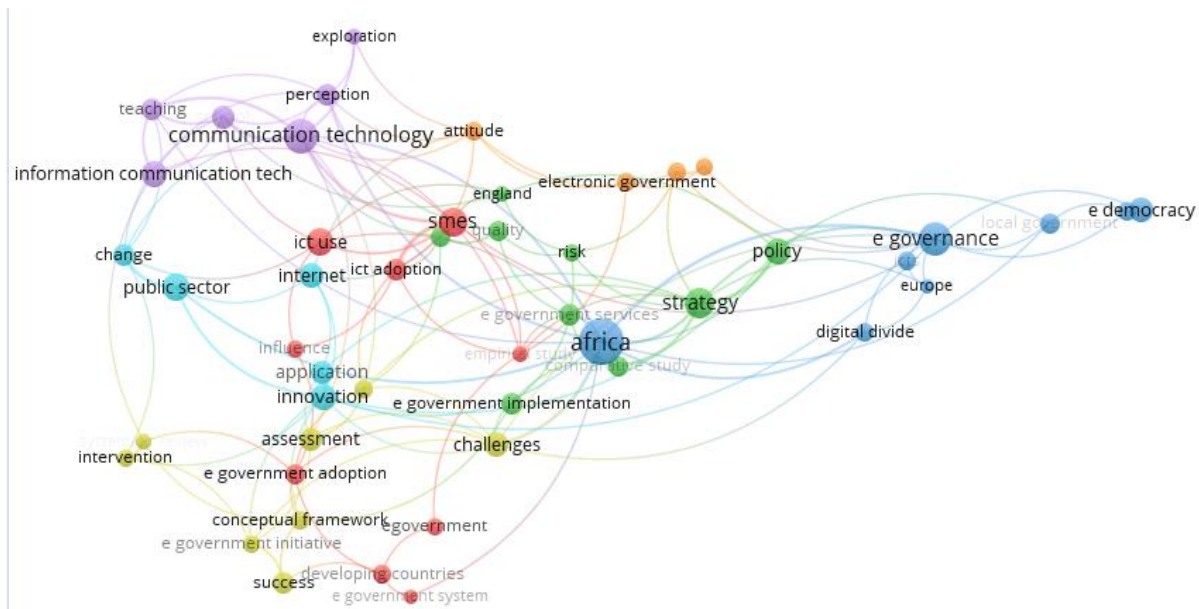


Figure 1: Co-occurrence based on the titles

The result visualization (in figure 2) was generated based on the relevance score for each e-government and key terms which had less than ten (10) occurrences were excluded and not presented in the co-occurrence visualization analysis. The text mining capability of the VOS was used to analyze the text in order to study the pattern and the link of each of the co-occurring terms. Terms that had higher relevance scores were central to the analysis in showing a higher level of significance. Cluster one (red) contained 41 terms, and for each term, relevance scores (see table 1), ranging from architecture, cloud computing, e-government initiative, application, implementation, e-government portal, e-government systems and e-service. Unfortunately, owing to the number of protests regarding service deliveries, and vandalism of public properties often experienced in South Africa, the e-services and e-government systems' real-time implementation might not have yielded intended purposes. Hence, e-government needs to move from mere theoretical and conceptualized argument to practical implementation. Furthermore, our synthesis revealed that alignment was isolated within the e-government clusters, as it was not connected to any of the e-government terms within these clusters. This meant that IT alignment has not been examined in terms of e-government initiative, designs and e-government systems implementation. Nevertheless, since the deployment of e-government relies on IT infrastructure and architecture, there may not be the successful implementation of e-government and e-services without robust integration of IT infrastructure and its alignment. Furthermore, although e-government and cloud computing have a direct link within the e-governance cluster, service-oriented architecture (SOA) was not linked with any of the e-government implementation, e-government application, and systems. Without the ability to design an e-government system that addresses different communities' heterogeneous nature, with often embryonic services demands and needs, e-government might remain a conceptual artifact.

The second cluster (in green) grouped citizen trust, Information Communication Technology (ICT), democracy as well as e-democracy, e-participation, e-voting and election, information management, internet use, and Facebook, local authority and online services (terms that co-

occurred) in the same cluster. This meant that information management in democratic systems, internet use, and social media, as well as e-accessibility, is crucial to achieving e-democracy or e-participation through digital platforms, and these terms must be conceptually linked in any e-government initiative, systems design and implementation, in order to ensure that the citizen accesses and participates in digital governance. The data synthesis also indicated that the citizen is disengaged in the public service delivery, which was isolated within the cluster. Hence, the failure of the public official and local authorities to carry the citizen along in the projects they intended to invest public funds possibly explains why there is a prevalence of citizen public protest for poor, and in some cases, lack of services delivery. Using the e-governance system to attract public opinion might avert the challenges of investing billions of rand on a public project that the citizens may destroy in a poor service delivery protest. Hence, allowing the people within a community to engage with the local government official about their scale of preference, and the most pressing needs within the communities would allow the government to prioritize public spending on what might directly benefit the people. At the same time, this process might encourage more e-participation and less protest that emanates from a lack of engagement and involvement of the people. However, the use of social media, Twitter and Facebook were all isolated and were not linked with any clusters in the figure below. Furthermore, our synthesis revealed that there seemed to be a lack of integration of the mobile platforms and social media with e-governance; thus creating a digital divide. From the visualization, e-governance and e-government initiative; information society, library, and ICT were all linked with the digital divide. This suggests the need to bridge the persistent challenge of the digital divide to achieve e-governance.

The third cluster (blue) consists of terms that co-occurred, but the result showed that citizen engagement, satisfaction, and digital technology were all isolated and not linked with any of the nine clusters (in figure 2). It appears that the Internet of Things, (IoT) has not been examined in the context of e-governance as this term was only linked to ICT and not linked with the remaining eight clusters (in figure 2). However, e-governance must be conceptualized from the service-oriented (modern) software design (SOD) and alignment context, for an effective and agile deployment due to the heterogeneous nature of intended communities and their e-service's needs. An agile platform in which IT alignment and SOD is taken into consideration from the design phases would be efficient to deliver agile e-platform for public and e-service systems. The fourth cluster (lemon) dealt with ICT and higher education and learning in general, while the fifth cluster (purple) dealt with ICT adoption and use in the industry, especially in the Small and Medium Enterprises (SMEs), which is outside the scope of this paper.

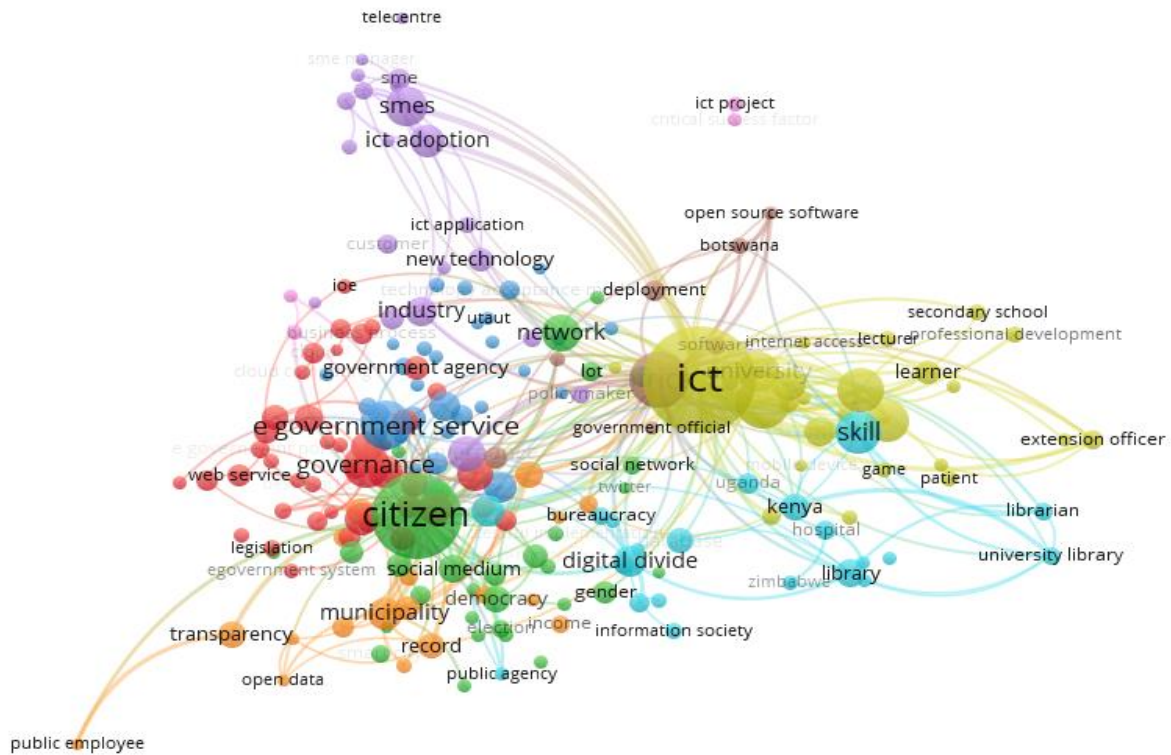


Figure 2: Co-occurrence based on the Abstract

The publication co-occurrences revealed some of the relevance scores of key e-government terms. Findings revealed that there were still gaps that must be addressed in the e-government research niche and the actual implementation of e-government in the SADC countries. For example, the emphasis on IT architecture in the e-government outputs was very limited, as IT architecture relevance score only amounted to 0.9623, while transformation government level of prominence or significance had a relevance score of 0.9597. Furthermore, the following are relevance scores of some of the critical key terms from the analysis; information service (0.9372), e-procurement (0.9099), e-government adoption (0.9064), ethic (0.8934), good governance (0.8769) and e-government application (0.8577). These findings indicated that e-government is predominantly focused on the policy, the conceptual design, and the integration of IT, and its alignment to the design and implementation of e-government has not been achieved. Besides, for e-government to be successful, human-computer interaction must also be aligned, as both are not mutually independent.

Table 2: Co-occurrence terms and their degree of relevance (RS=relevance score: t-occ=term occurrences)

terms	t-occ	RS	terms	t-occ	RS
e-voting	13	4.1405	ICT project	16	1.5315
e health	14	3.244	e government portal	23	1.5225
trustworthiness	14	2.7279	open source software	13	1.5071
hospital	26	2.5965	alignment	15	1.4969
election	21	2.5905	interoperability	39	1.4788

adoption process	22	2.4361	SOA	11	1.4628
public employee	10	2.3833	professional development	18	1.4287
citizen satisfaction	12	2.3663	maturity model	30	1.3983
e-accessibility	12	2.2596	performance expectancy	11	1.3966
e government website	32	2.1797	ICT tool	14	1.3617
public value	11	2.1679	user satisfaction	12	1.343
e government maturity model	13	2.1558	user satisfaction	12	1.343
user experience	13	2.0942	citizens trust	14	1.3235
medium enterprise	13	2.0537	ICT adoption	75	1.3228
healthcare professional	12	1.8501	telecentre	11	1.3221
medium-sized enterprise	11	1.8052	cloud computing	17	1.2768
service quality	24	1.7733	transparency	52	1.2571
digital preservation	11	1.73	ERP system	10	1.2199
information quality	21	1.7094	cloud	30	1.1447
open data	11	1.6897	compliance	17	1.1319
customer satisfaction	10	1.6832	government information	15	1.1167
web service	36	1.6321	technology adoption	16	1.087
usability	33	1.6235	information management	13	1.0497
democracy	52	1.6104	legislation	18	1.0459
blog	11	1.5649	e-government system	17	1.0449
ontology	44	1.5492	citizen engagement	16	1.0079

Citation Analysis

Citation analysis can be carried out using five different units of analysis in bibliometric analysis such as document, sources, authors, countries, and institution of affiliation. However, for this study, the authors used the documents since the study's main objective was to analyze the trend and trajectory of e-government outputs. The threshold was set at four citations per item; meaning articles with less than four citations were not analyzed and only 315 articles met this criterion. One of the findings revealed that the use of open-source platforms, tools, and technology have not been adequately promoted in e-government. For example, most of the focus of publications in e-governance or e-participation (with exception of Mutula and Kalaote, 2010b) had little coverage of open-source technologies in e-government. This lack of coverage was reflected in the thirty-three citations received by Mutula and Kalaote's (2010b) output on open-source software deployment in public office. One of the reasons some of these articles have not had a high volume of co-citation links may be due to the fact that some of the highly rated scholars in the field of Library and Information Science, and Information Studies publish in highly rated journals which often require paying up to forty US dollar (\$40) to download an article. Hence, most of the authors who might have found the work relevant would not have afforded the required amount to use the material. For example, our synthesis revealed that Ngoepe's (2015) publication on "deployment of open-source electronic content management software in national government in South Africa" was a typical example. However, in order to cite or use Ngoepe's publication (which was cited

nine times), an amount of thirty (\$30) US dollars was required. This trend of pay-per-use publications potentially weakens knowledge dissemination, when the role of knowledge management cannot be over-emphasized (Kang'ethe & Ajibade, 2016; Ajibade, 2016) in the conceptualization, design, and deployment of e-government projects. Therefore, promoting publication in open-source journals might be useful to address this challenge associated with limiting knowledge transfer in scholarly publications due to the cost of journals that require payments for use. The findings show that the majority of the citations had limited co-citation as depicted in figure 3, with the exception of those authors in the middle. However, Mutula (2005; 2008); Mutula and Mostert (2010a) were the few who had higher co-citation prominence within the central network visualization based on data retrieved from the Web of Science.

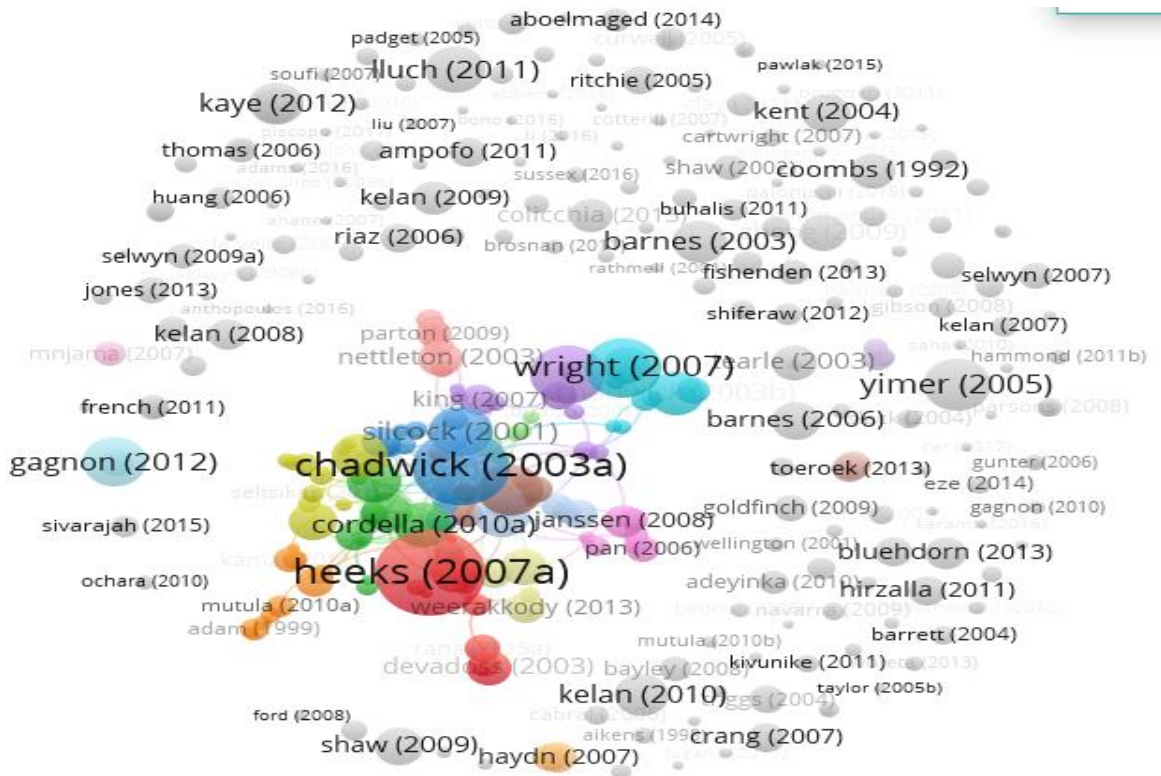


Figure 3: Citation Network. The color showed the trend of citation pattern relationship within the clusters while the sparsely distributed nodes suggested those closely cited authors in other study but not directly linked.

Co-citation Analysis

The co-citation analysis was conducted to see the trend within the cited reference $n = 33,689$, only 34 outputs had at least minimum of 20 citations references, and 60 had a minimum of 15 citations. When the minimum co-citation of cited references threshold was readjusted and restricted to outputs that have less than 10 cited references, the result showed that only 126 met the threshold. However, since raising the minimum threshold to 10 cited reference in a co-citation might exclude a large proportion of the data and favored old publication and apparent biases toward recent publications, the threshold was lowered to five citations of a cited reference, and 486 cited references were found in this threshold. The result in figure 4 was presented based on the total link strength of the co-citation with other cited references, and 486 cited references with the highest

total link were selected. Each color represented the co-citation trends and the figure showed that e-governance is highly relevant and applicable to several domains of studies such as Library and Information Science (LIS), Computer Science, Public Administration, Management and Social Sciences. There were seven clusters and the green clusters represented co-citation network in LIS, Information Systems; the orange cluster represented the public administration, electronic journal, government information systems; and the blue and red clusters represented the co-citation in the journal of technology, information management, and research design and methods.

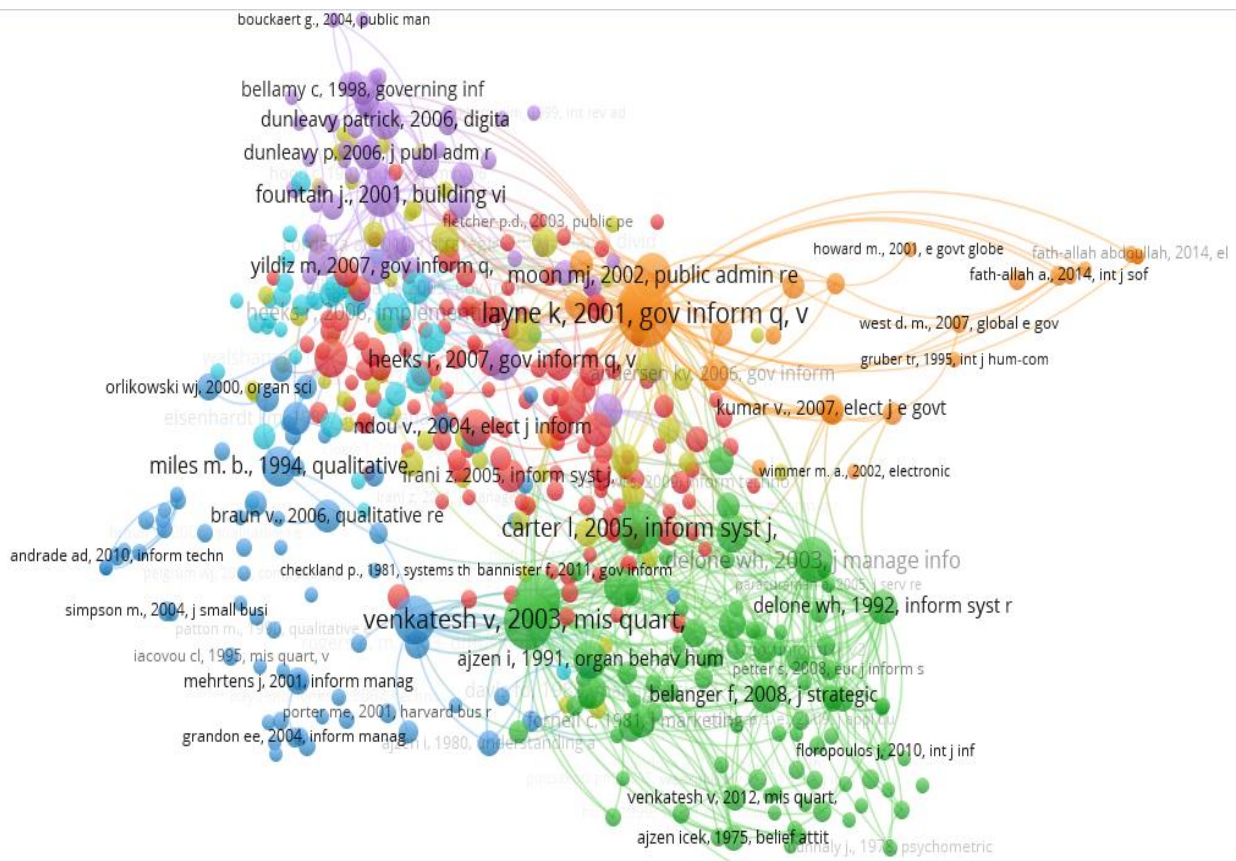


Figure 4: Co-citation pattern and journal sources. The color in the cluster indicated research outputs authorship and journal where it appears

Co-authorship by Countries

The figure below showed co-authorship by 65 countries categorized within 16 clusters (color-coded) with a total of 194 links, and a total link strength of 485. Most of the productive outputs in the entire Southern African Development Countries (SADC) specifically, emerge from South Africa, and the trend is presented in the bibliographic coupling (figure 5). Outputs of England on e-government were deliberately included to compare with South Africa outputs on e-government.

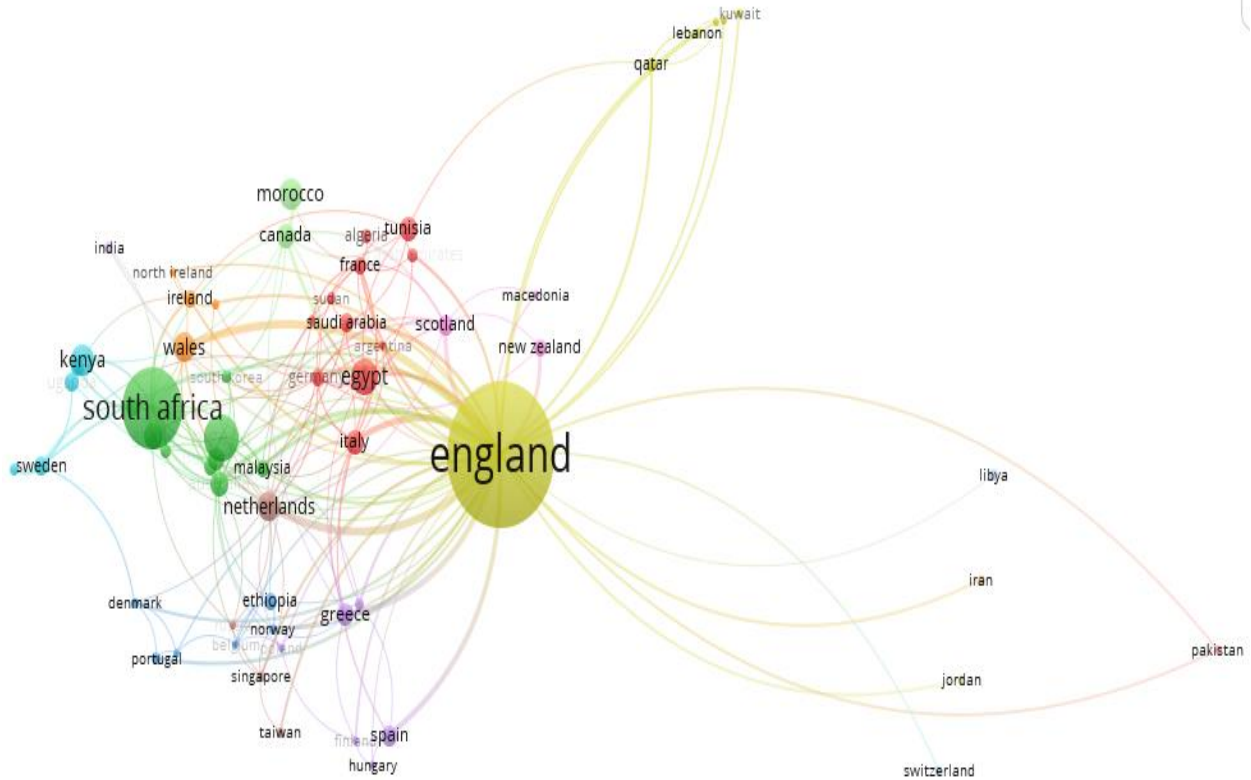


Figure 5: Bibliographic Coupling of co-authorship by Countries. The color showed trends by countries and suggested countries of related network and the prominence and visibility of the outputs is represented by the sizes of the network nodes.

Bibliographic Coupling

Bibliographic coupling is useful to display the overlap of references in research outputs by showing the strengths of an output base on the number of citation two outputs might have in common (Van Eck & Waltman, 2014: 3). The use of the bibliographic coupling is important to determine the link between two or more items that both use or cite the same document. However, co-citation link shows the link between two items which are used or cited by the same document, we used the document as the unit of analysis, we limited the citation threshold to three, and 365 articles met this criterion. The color indicated outputs published within a certain year period in the network, but the outputs indicated lack of co-citation, except those in the middle that consisted of 46 authors when the cluster was zoomed out.

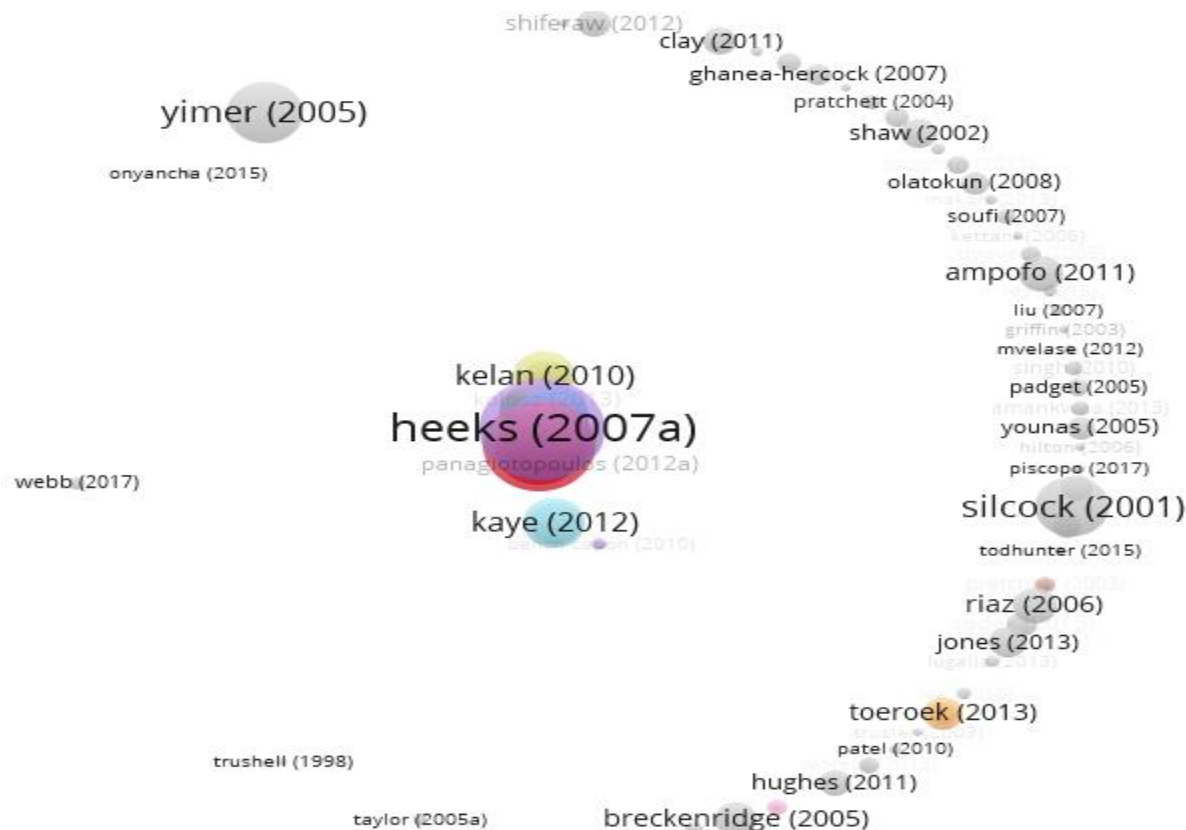


Figure 6: Bibliographic Coupling based on Authors

In a bibliometric analysis, bibliographic coupling base on this analysis show relation between two nodes, and in this case, institutions (Table 3), but this analysis shows the strength of the relationship in their outputs, based on the prominence of the outputs. The visualization of the analysis (Table 3) was presented in figure 6. The topmost productive institutions presented in Table 4)

Table 3: Bibliographic Coupling base on Citations and Total Link Strength. Colors indicate clusters that are related base on the yearly output ranges

Outputs by Institutions	Documents	Citations	Total Link Strength
University Pretoria	33	105	828
University South Africa	23	9	707
University Botswana	15	203	452
University Cape Town	25	3	402
North-west University	15	2	387
Cape Peninsula University Technology	6	822	374
University KwaZulu Natal	17	42	345
University South Africa	15	3	250
University of Western Cape	5	13	244
Durban University Technology	8	97	238
University Nairobi	10	81	237
University Free State	5	15	210

University of Rwanda	5	8	173
Vaal University of Technology	5	130	163
University Mauritius	6	263	142
German University Cairo	7	4	123
University Fort Hare	10	177	108
University of Zululand	6	21	102
Nelson Mandela University	7	29	81
Rhodes University	5	92	65

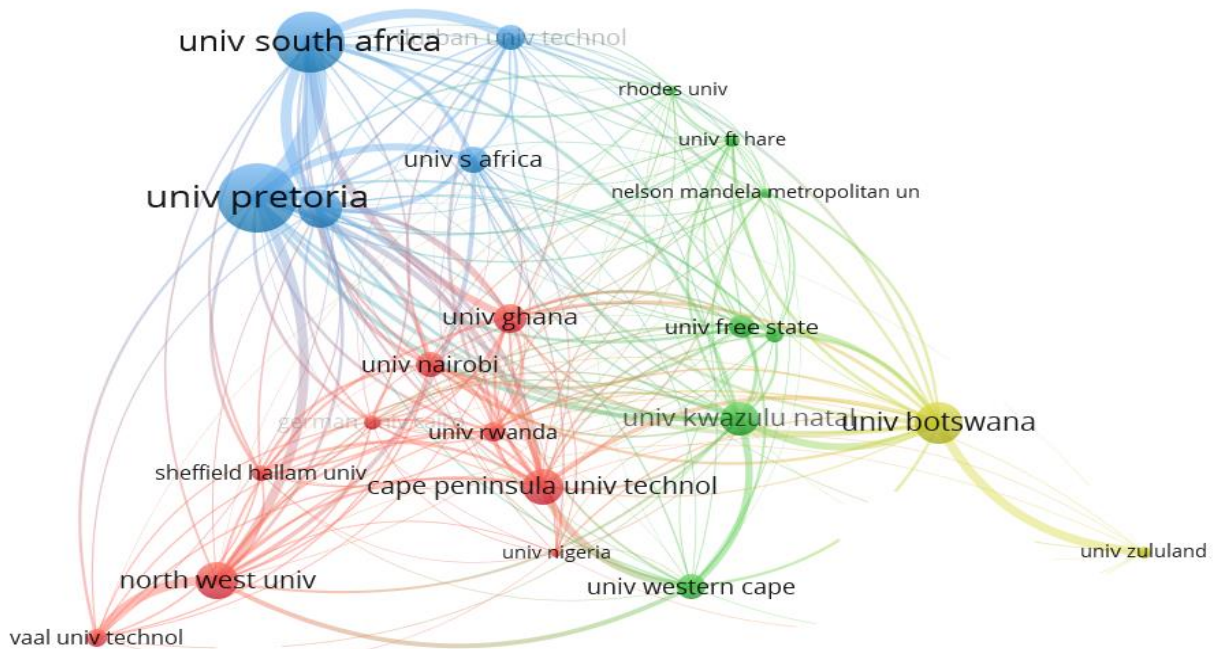


Figure 7: Bibliographic Coupling base on Total Link Strength. Clusters colors indicated the total link strength of each institution outputs prominence and visibility

The implication of the Study

The study presented some implication for e-government development in the African context, which is still plagued by a huge divide between the citizens and public administration in our government architecture. As most citizens are experiencing frustration and are disconnected from their elected public official, some engage in public dissent and violent protest. For example, although South Africa is ranked the most developed in the African continent in terms of e-government development with an EDGI index of 0.6678, there is still persistent poor service delivery due to lack of participation in e-government. Although there is a considerable growth of publications in e-government in Southern African countries, there is still a lack of consistent upward growth in the output trends. It appears that other Southern African countries' e-government outputs' visibility is very weak, and the level of prominence is significantly low. The findings also indicated that most of the e-government articles might be published in paid or subscription-based journals that limit their use by most scholars in SADC, consequently limiting the impact of using the knowledge in the output to effect changes to e-government design and implication. Most of the

e-government publications are published outside the continent which and some in subscription-based journals, which might have reduced their visibility in the region.

Conclusion and Recommendation

The global e-government index revealed a huge gap between e-governance initiative and the anticipated standard that is needed to be reached in order to achieve agile e-participation. As the findings showed, most Southern African countries' e-government development is very low with South Africa ranked 68th with an index metric of 0.6678 out of 193 countries, Rwanda 120th in the world, but 6th in Africa with EGDI index of 0.4590 and second-ranked in the SADC. The third-ranked country in SADC was Namibia, but 121st in the world with an index metric of 0.4554, followed by Botswana ranked 127th in the world with 0.4253 EGDI indexes, and Zambia which was ranked 133rd in world EGDI ranking with index of 0.4111, and the fifth-ranked country in the SADC was Uganda in the 135th place with an index of 0.4055. Therefore, since e-government required integration and alignment of Information Technology through human-computer interaction, these low indexes suggested that e-government platforms and IT alignment has not been achieved in the Southern African countries to facilitate agile e-government services. The findings also indicated that this lack of IT and e-government alignment might be one of the reasons citizens felt isolated and thus, resulted in service delivery protests especially in South Africa due to lack of e-participation. The bibliometric data also indicated that South African institutions were the most productive in terms of outputs in the area of e-government. The study found that the use of cloud service and open-source IT application have not been used to enhance e-participation and e-services delivery. Current studies have not explored the connection between IT infrastructure and e-government alignment, as well as used customized software design methodology (such as service-oriented design) in e-government, which is highly recommended. This study concludes that, in as much as the citizens and communities needs are often embryonic and heterogeneous; this must be considered in e-government systems initiative and design. The study also recommends that Information Systems and Information Studies scholars must be consulted in future e-government project designs and rollout, as most of these scholars can help e-government system designers to improve e-government platforms. The authors also recommend that stakeholders' utilization of service-oriented design approach in e-government design development should be considered might aid the agile deployment of e-services in the Southern African countries.

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