

THE STATUS OF E-GOVERNMENT RESEARCH FROM A BIBLIOMETRIC ASPECT

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Abstract

The e-government as an ever-growing dimension of public administration gets more and more attention worldwide [10]. It is considered an essential tool nowadays to improve efficiency and cost-effectiveness while providing better services to citizens. The study aims to investigate the e-governance research advancements and trends from the past 10 years.

The empirical research is based on bibliometric data and defines the most active affiliations, top resource titles, the leading topic clusters, and research tracks from various angles. Data are collected restricted to the articles related to the “e-government” and “law or legislation” keywords between 2010 and 2019 November (a total of 513 articles). The data source is the Scopus citation database.

Findings show a fragmented picture of the research field, dominated by computer science and in alignment with this, by conference proceedings. Keyword co-occurrence analysis shows 14 different modules classified into a 3-dimension model based on research foci on the publications. These are managerial, political, and legal aspects. While based on density the leading keywords are interoperability, public administration, and social media. The latest trends show the emergence of natural language processing and smart city issues.

Our research emphasizes the trends of e-government research as a leading research field in public administration studies. It is important to note, however, that the topic is rather multidisciplinary. It is important to see the correlations between the academic basic research activities and countries' practical e-government implications.

Keywords: e-government; bibliometrics; e-government research

1. Introduction

The technology and communication system used in public administration and the functioning of the government tasks become more and more essential nowadays. It addresses the newest challenges of the information societies while serving the citizens with the highest standards of services achievable. The digital government requires new services, new methodological concepts, new technological advancements, and a new concept of leadership in public administration [3].

The UNESCO created a widely used and acknowledged definition of e-governance in 2011 as follows: „*The public sector’s use of information and communication technologies (ICTs) with the*

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aim of improving information and service delivery, encouraging citizen participation in the decision-making process, and making government more accountable, transparent, and effective.” [9] The e-government has three components in its concept, these are the follows [4]:

- more efficient government
- better services to citizens
- improved democratic processes.

There is a growing demand for e-governance primarily in the developed countries, such as the United States, Canada, Japan, and the European Union member states [10]. Within the EU, modern, technology-driven governance is considered as a condition to promote a knowledge-based society, while the government efficiency is an essential result in service improvement and cost-effective functioning. Due to its strategic nature, EU member states have adopted several strategies to implement and adapt the latest technologies into governmental procedures [10].

The electronic government – often referred to as e-government – is an ever-emerging field of research with different research tracks. The concept of e-government became a hot priority for every country as there are a growing demand and requirement from the side of citizens for an efficient, cost-effective, well-operating government structure. This demand drives growing pressures that the government sector should satisfy for a more engaged and satisfied private and business sector. The phenomenon itself is a complex one, referring to multiple links and connections occurring between authorities and citizens [6].

In recent years, there have been some attempts to synthesize the existing literature about e-government [1], [6], [8].

The article aims to provide an overview of the e-government research field between 2010 and 2019, particularly dealing with the questions of law and regulation. Besides identifying the key authors, institutions, and source titles, it is important to organize the leading topics and some of the current trends based on co-occurrence analysis. The research conducted gets its value from presenting the research field through the lens of public administration. It provides help for scholars researching e-government issues, and practitioners, pointing out the latest policy and research trends.

2. Electronic government as a research field

To provide a complex overview of the research field, it is important to identify the current research trends and a bigger picture of the research field. A general analysis was conducted based on keyword search, with the “e-government” keyword in the Scopus database³. The Scopus is one the biggest international and multidisciplinary citation databases, providing a wide range of sources internationally recognized. The keyword search shows a total of 14057 documents, with the starting year of 1979 (1 document). A significant increase started in 2000, reaching its peak in 2010 (1082 documents). Since then, a declining tendency can be found on a larger scale, reaching a total number of 883 documents in 2020. The leading countries from the perspective of the scholarly output are the United States (1753 documents), followed by China (1479 documents) and the United Kingdom (1143 documents). Other highly ranked countries in the research field are among the most developed ones too, including Germany, Australia, Italy, Greece, Spain, the Netherlands. However, after them, emerging states such as India can be observed as well. From a disciplinary

³ The keyword analysis is carried out based on the formula as follows: TITLE-ABS-KEY (e-government).

point of view, Computer Science dominates (9532 documents), followed by the Social Sciences (4541 documents) and the Business, Management and Accounting (2547 documents). Following disciplines are Engineering, Mathematics, and Decision Sciences that reveal the multidisciplinary nature of the research field both involving STEM (science, technology, and engineering and mathematics) researchers and social scientists. Concerning the most frequent document types, conference papers dominate (7251 documents), followed by journal articles (4605 documents) and book chapters (1288 documents). The conference papers are characteristic of dynamically developing research fields, mainly in computer sciences. The most active institutions are Brunel University London (the United Kingdom), Delft University of Technology (the Netherlands), and University at Albany (the United States).

After the general statistic overview on the existing literature, it is important to define the main research areas and questions related to the e-government research field. This can be done based on previous literature reviews. The e-government is identified as digital government, a concept that has already been presented in the introduction section [3]. In their article, they pointed out the most important scholars in the bibliometric and review analysis of the research field. They found that e-government gets its roots in computer science, political science, information science, and public administration. These disciplines, however, work with altered theoretical and methodological backgrounds, trying to address a different part of e-government. There is a discussion on the e-government as a sole, independent research field, where one group of scholars argues that e-government is not a sole field but an essential part of the public administration modernization [5], while others argue that e-government is a multidisciplinary but coherent field [2].

The most important themes of the e-government research have been identified including government transformation, citizen engagement, public service improvement, and digital democracy [7]. Besides these, they identified some of the issues worth investigating but still disputed such as how to measure and relate more accurately the e-government to the traditional public administration disciplinary research.

A framework has been established in which every e-government article can be classified based on their main research foci and perspectives, including managerial, political, or legal research projects [5]. It is interesting to classify their main keywords related to these three research perspectives summarized by Table 1.

Research perspective	Main issues
Managerial	Efficiency, effectiveness, economy Technology adaptation Cost-effectiveness Human Resource management
Political	Values of representativeness, accountability Information systems use for transparency. Citizen and community engagement
Legal	Values of equity, individual rights Privacy and access to information Human rights

Table 1: 3-dimension model of research perspectives in the field of e-government (source: own contribution based on [5])

3. Research goal and methodology

In the previous sections, the concept of e-government has established based on the findings of the international literature. From a specific perspective, the e-government can be seen as a multidisciplinary research field, having strong connections with the public administration. This will be later deeply analyzed by bibliometric tools, through a sample of articles consisting of 513 articles.

The identification of these articles is an essential point of the research. The articles were gathered by keyword analysis from the Scopus citation database, earlier already used to draw the general tendencies of the research field. The formula of keyword search is as follows:

TITLE-ABS-KEY ("e-government" AND law OR legislation) AND (LIMIT-TO (PUBYEAR, 2019) OR LIMIT-TO (PUBYEAR, 2018) OR LIMIT-TO (PUBYEAR, 2017) OR LIMIT-TO (PUBYEAR, 2016) OR LIMIT-TO (PUBYEAR, 2015) OR LIMIT-TO (PUBYEAR, 2014) OR LIMIT-TO (PUBYEAR, 2013) OR LIMIT-TO (PUBYEAR, 2012) OR LIMIT-TO (PUBYEAR, 2011) OR LIMIT-TO (PUBYEAR, 2010))

As it can be seen in the syntax, the keywords are “e-government” with an “and” parameter for law or legislation, defining mainly the public administration related papers. The time scope is restricted between 2011 and 2019. It is important to note here, that 2019 is the last fully administrated year of the database. Then, the set of the publications found was imported into the SciVal research intelligence platform for further analyses as a newly defined publication set.

Aspects of analysis	Publication set
Scholarly output	513
Number of researchers	1130
Field-weighted citation impact	0.83
Citation count	2591
Citations per publication	5.1

Table 2: Descriptive statistics of the publication set analyzed (source: own contribution based on SciVal)

Some of the main descriptive statistics can be seen in Table 2 about the publication set. The total number of publications is 513, involving a total of 1130 authors. The publications included received a total of 2591 citations, meaning an average of 5.1 citations per publication. The field-weighted citation impact shows that these publications are a bit under-cited compared to other similar publications in the discipline, having a value of 0.83.

For further data analysis, we used the VOSViewer 1.6.16. version for Microsoft Windows System. The program is a bibliometric visualization and data analyzing software, where the research objects are the authors, publications, affiliations, citations, indexed keywords. Various bibliometric analyses can be conducted in the software based on a pre-defined and imported CSV file of the publication set.

Research topics were analyzed by the SciVal research intelligence online tool, importing the publication set. Two papers could not be imported into the SciVal, so a total of 513 publications were involved. The SciVal was used to identify the most active affiliations, resource titles, and topic clusters. These topic clusters draw the main research trends and tracks of the research field, which is extremely useful for scholars and practitioners who tend to connect to the international discussion

on the e-government. Three indicators are presented regarding the keywords: scholarly output, field-weighted citation impact, and prominence percentile. Here, it is important to make clear the meaning of these variables. Scholarly output refers to the number of publications published by the predefined set of authors. Field-weighted citation impact is the ratio of the total citations received by the denominator's output, and the total citations that would be expected based on the average of the subject field. It considers the differences in research behavior across disciplines such as the difference between heavily co-cited and lightly co-cited disciplines. The prominence percentile shows the current momentum of a topic by looking at very recent citations, views, and CiteScore values. CiteScore here refers to the yearly average number of citations to recent articles published in that journal. Leading keywords were visualized by VOSViewer based on the co-occurrence analysis of all keywords. All keywords contain both the author keywords and index keywords providing the whole collection of relating keywords found in the articles.

4. Results

Research findings are presented in three sections, first presenting the descriptive statistics of the publication set. Then, presenting the prominent topic clusters and topics leading the current research trends in the field. Thirdly, the leading research tracks are presented based on the keyword analysis, identifying their inter-connectivity and their time dimensions.

4.1. Sample characteristics

First, the leading institutions and leading source titles are presented.

Institution	Country/Region	SO	Authors	Citations per Publication	FWCI
University of Bologna	Italy	10	8	8.4	1.34
Delft University of Technology	Netherlands	9	14	16.8	1.67
Graz University of Technology	Austria	6	6	6.2	1.19
Universidad Autónoma de Madrid	Spain	5	9	4	0.76
Technical University of Munich	Germany	4	6	0.8	0.25
Tallinn University of Technology	Estonia	4	9	1.5	0.73
Brunel University London	United Kingdom	4	5	28.5	0.68
Harokopio University	Greece	4	7	2.3	0.5
Dublin City University	Ireland	4	7	4.3	0.5
National University of Ireland, Galway	Ireland	4	7	4.3	0.5
University of Agder	Norway	4	6	15	1.68

Table 3: List of the most active institutions (source: own contribution based on SciVal)

Table 3 summarizes the leading institutions. It is important to note that the research field is very fragmented, and institutions do not own it as the main research profile. This is strengthened by the scholarly output by institutions led by the University of Bologna with 10 publications, followed by the Delft University of Technology (9 publications) and Graz University of Technology (6 publications). The biggest group of researchers is found in Delft (14 authors), followed by Universidad Autónoma de Madrid and Tallinn University of Technology both with 9-9 authors. The highest number of citations per publication is reached by the Brunel University of London, being a leading university in the broad field of e-government (28.5 citations per publication), followed by

the Delft University of Technology (16.8 citations per publication). Surprisingly, the University of Agder in Norway scores the highest field-weighted citation impact with 1.68, closely followed by the Delft University of Technology (1.67).

Scopus Source	Publications	Citations	Authors	Citations per Publication
ACM International Conference Proceeding Series	45	120	95	2.7
Proceedings of the European Conference on e-Government, ECEG	35	28	75	0.8
Lecture Notes in Computer Science	31	147	65	4.7
Communications in Computer and Information Science	8	3	23	0.4
Proceedings of the Annual Hawaii International Conference on System Sciences	7	85	13	12.1
Lecture Notes of the Institute for Computer Sciences, Social-Informatics and Telecommunications Engi	7	10	15	1.4
Transforming Government: People, Process and Policy	6	52	9	8.7
Government Information Quarterly	5	407	6	81.4
Electronic Government	5	21	13	4.2
Applied Mechanics and Materials	5	1	12	0.2
International Conference on Management and Service Science, MASS 2011	5	5	7	1

Table 4: List of the top resource titles (source: own contribution based on SciVal)

Table 4 indicates the leading resource titles gathering the most legal and public administration-oriented e-government publications. The list is led by conference proceedings, namely the ACM International Conference Proceeding Series (45 publications), Proceedings of the European Conference on e-Government, ECEG (35 publications), and Lecture Notes in Computer Science (31 publications). Some journals are observed as well, gathering somewhat a smaller number of publications, but having a much higher field-weighted citation impact and in the case of Government Information Quarterly, a much higher number of citations received as well. These journals are the Transforming Government: People, Process, Policy, and Government Information Quarterly. SciVal-based analyses show 24.9 percent of publications have been published in Q1 top-quartile journals, while more than half of the publications in the top 50% (Q1 or Q2) journals. It shows the high relevance of these papers.

4.2. Prominent topics

The identification of the prominent topic clusters and topics sheds light on the main trends in the research field. It contributes to the understanding of the main elements of e-government research.

Rank	Topic Cluster	SO	FWCI	PP	Topic	SO	FWCI	PP
1	Research; Technology; Industry	199	0.73	79.384	Open Government; E-Participation; E-Governance	141	0.71	99.462
2	Industry; Information Systems; Research	24	1.91	85.542	Electronic Government; Information Dissemination; Interoperability	13	0.97	73.131
3	Cryptography; Authentication; Data Privacy	19	1.06	97.256	Electronic Government; Semantic Web Services; Interoperability	10	0.36	33.191
4	Archives; Library; Collections	12	0.55	19.076	Web Accessibility; Visually Impaired; Electronic Government	9	2.12	93.261
5	Design; Human Computer Interaction; Websites	11	1.85	42.102	Electronic Signatures; Identity Management; Non-Repudiation	9	0.82	67.258
6	Knowledge Management; Industry; Research	9	1.14	58.835	Legal Documents; Case Law; Deontic	8	0.96	84.556
7	Artificial Intelligence; Algorithms; Semantics	9	1.33	54.083	E-Procurement; Tendering; Government Procurement	6	0.09	78.234
8	Industry; Research; Marketing	8	1.58	98.394	Information Security; Protocol Compliance; Breach	5	0.68	98.799
9	Software Engineering; Models; Software Design	8	1.07	91.901	Smart Cities; Municipal Administration; Internet of Things	5	2.56	99.846
10	Party; Election; Voter	8	0.38	86.479	Top Management Support; Cloud Computing; Software-As-A-Service	5	5.5	95.609

Table 5: List of prominent topic clusters and topics (source: own contribution based on SciVal)

Table 5 includes the leading topic clusters and topics within the scope of the publication set. The classification is based on the three dimensions including the managerial, political, and legal perspectives [5]. The dominating topic cluster based on scholarly output is the “Research; Technology; Industry” (199 publications), while based on the field-weighted citation impact the “Industry; Information Systems; Research” stands out (1.91). The prominence percentile shows the highest value for the “Industry; Research; Marketing” (98.394). Among the more specific topics, the “Open Government; E-Participation; E-Governance” dominates based on the scholarly output (141 publications), while the “Top Management Support; Cloud Computing; Software-As-A-Service” topic has the highest field-weighted citation impact (5.5) and prominence percentile (99.846).

Classifying the topic clusters into the 3-dimensional model, the dominance of managerial topic clusters is observed. The first two topic clusters based on scholarly output belong to the managerial cluster. Besides this, on the top 10 list, 6 topic clusters can be classified to the managerial, 2 to the political, and 2 to the legal clusters. When turning to the more specific, smaller topics, the most active topic can be found in the political cluster, while the second in the legal cluster. 5 of the top 10 topics are devoted to legal issues, 3 for the political, and 2 for the managerial issues.

dimension of managerial, political, and legal aspects; however, the biggest, red cluster is a mix of the three containing some of the managerial aspects (e.g. transformation), political (e.g. trust), and legal (e.g. privacy and security). All the other modules can be categorized into three dimensions.

7 modules are devoted to the political aspects, including the orange, dark green, purple, blue, yellow, light rose and light-yellow modules. The orange cluster deals with the question of smart government and public administration from a regulation perspective. The dark green module consists of the words “blockchain”, “consultation” and “citizen participation”, while the purple consists of the “e-democracy” and “information society”. The blue module deals with the general concepts of “digital government”, “digital transformation” and “good governance”, while the yellow with the more specific “civil society” and “participation”. While the light-rose cluster consists of the keywords “transparency” and “public sector information”, the light-yellow consists of the “accountability”.

5 modules can be classified as legal perspectives, including the light-green, light-blue, brown, pink, and light-purple modules. In these modules, the keywords focused on the legal and privacy issues, such as in the light-green module (e.g. data protection), in the brown module (e.g. legislation, big data), and the light-purple module (e.g. personal information, accessibility). The light-blue module (e.g. law, artificial intelligence) and the pink module (e.g. social media, information sharing, police) deal with more specific questions related to technological advancements very much present in every-day use.

Following this categorization, only 1 module is centered around the managerial aspects. This is the turquoise module with the keywords, for example, “automation”, “e-services” and “information technology”.

Turning to the keywords of 2020 and 2021, although they are not included originally in the database due to their incompleteness, some interesting finding can be drawn. The latest leading words are network security, security of data, interoperability, and crime. Besides these, several market leading emerging technologies are presented including artificial intelligence and cloud computing. The keywords can be seen in Figure 2.

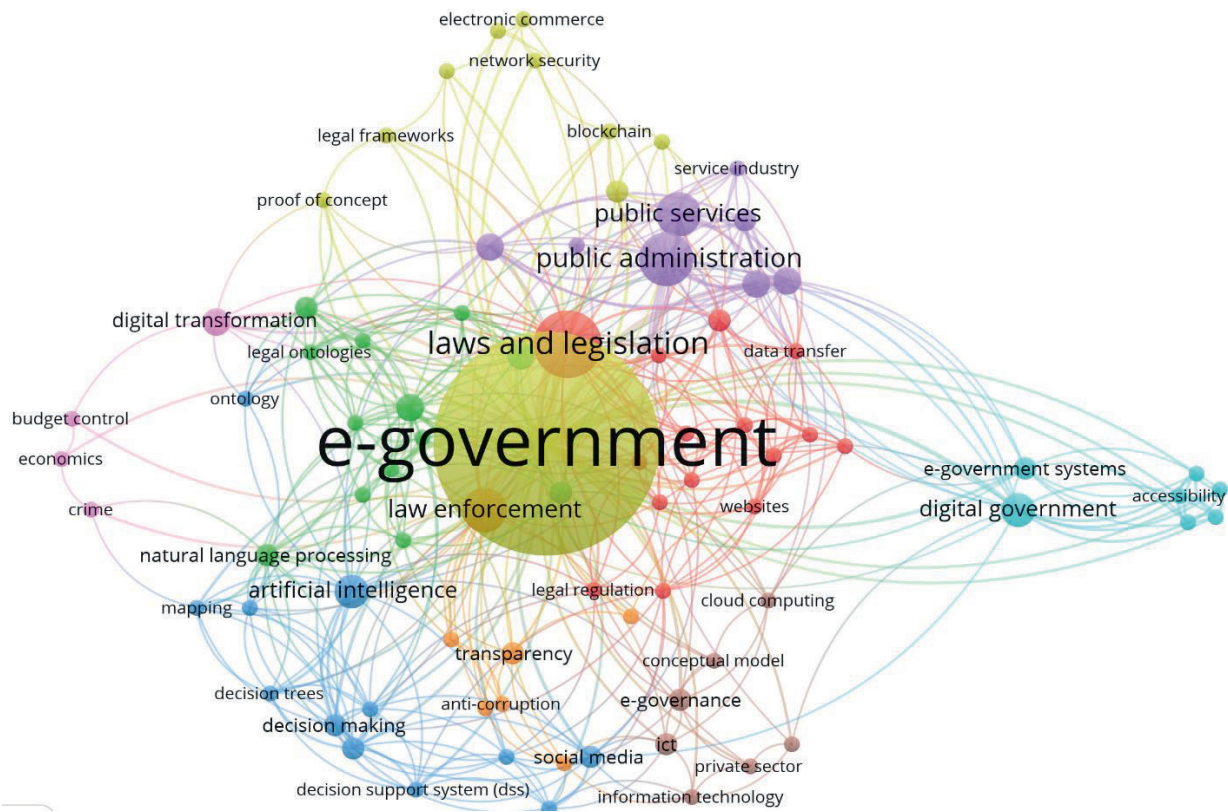


Figure 2: Co-occurrence map with keywords of the publication year 2020 (source: own contribution by VOSViewer)

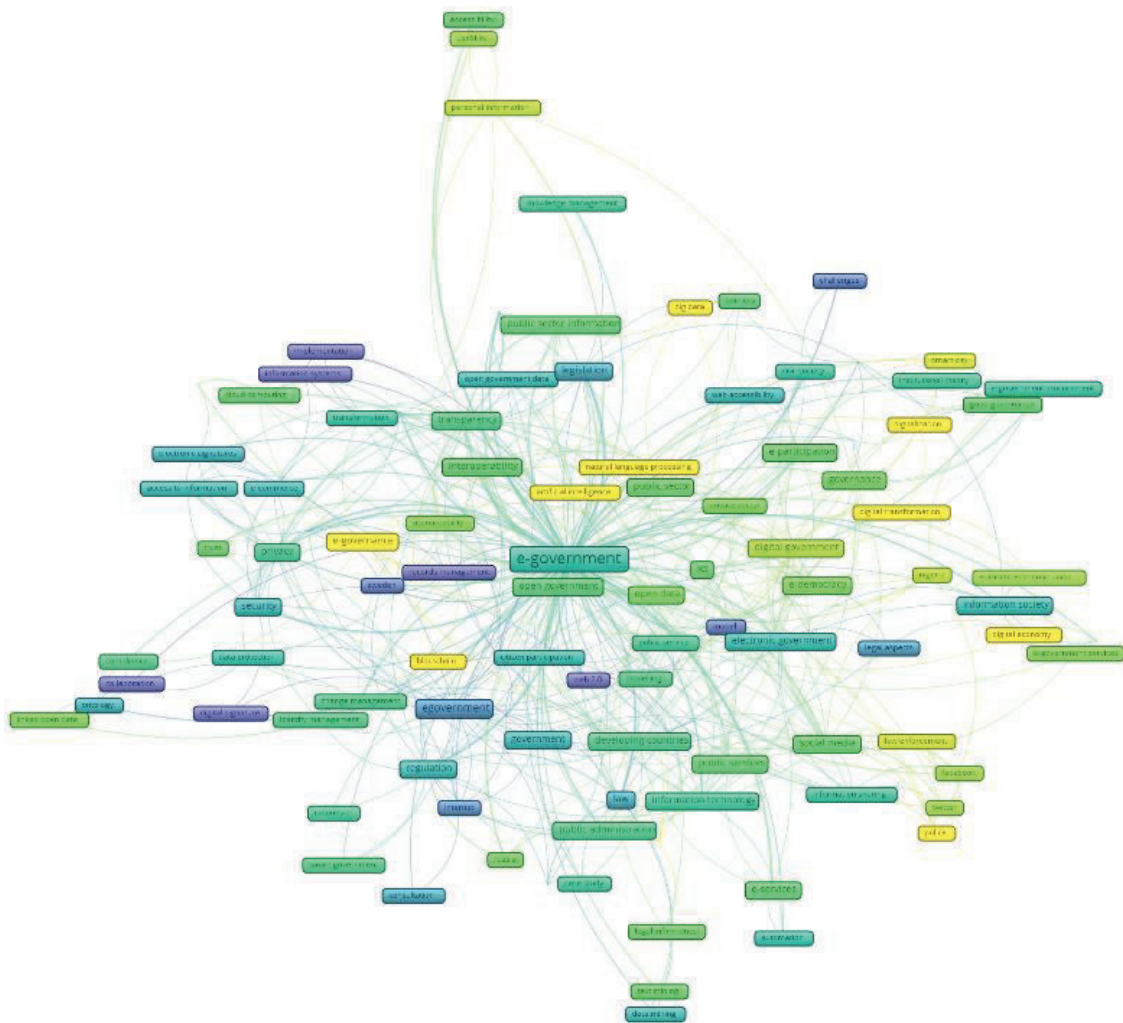


Figure 3: Overlay frame map (source: own contribution by VOSViewer)

After the thematic classification of the keywords, it is worth analyzing them from a chronological aspect. Figure 2 contains the same keywords as Figure 1 but from an overlaying perspective. It is interesting to identify the time horizon of these keywords, and how the new joint research tracks come up with new questions and issues. The analysis is conducted between 2012 and 2018.

Some of the first keywords are for example “records management”, “web 2.0.”, “implementation”, “digital signature”, and “information systems”. Then, a newer generation of keywords contains the words “legal aspects”, “challenges”, “e-government” and “consultation”. They are followed by the words “information sharing”, “automation”, and “civil society” (first appearing around 2015). Then, the concepts of “change management” and “identity management” have been included (first appearing around 2016). In 2017, new research tracks included the “social media”, “e-services”, “legal informatics” and “text mining”. The latest joining keywords are “natural language processing”, “artificial intelligence”, “big data”, “smart city” and “blockchain”.

Studying the chronological order, it is important to note that the research field has its roots in the 1990s, but it is nevertheless interesting to see the new-comer research tracks in parallel with the technological advancements.

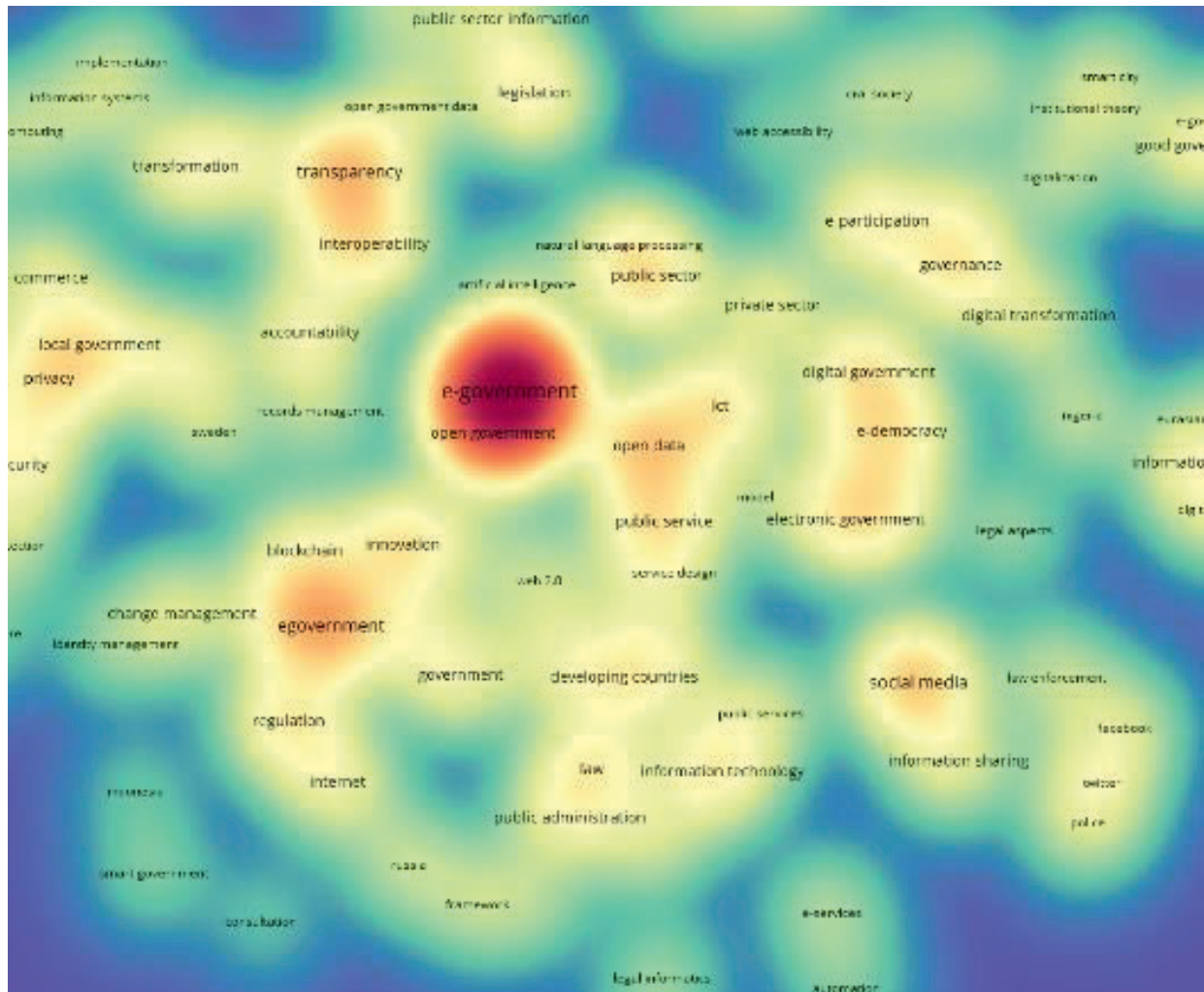


Figure 4: Density heatmap (source: own contribution by VOSViewer)

Figure 3 shows the density map of the same keywords, analyzed previously in Figure 1 and Figure 2. This heatmap helps to identify the key research clusters, being the most actively researched. The “e-government” and “open government” concepts have the strongest density, meaning the highest number of linked keywords. These two keywords are in the core, gathered around some of the actively studied research clusters.

6 bigger clusters can be identified on the heatmap. The most closely connected to the core concepts is the module containing the keywords “open data”, “public service”, and “service design”. Another strongly interrelated cluster consists of the keywords “blockchain”, “innovation”, “regulation”. Other research core points can be found related to the “social media” and “information sharing”, “e-democracy” and “digital government”, “transparency” and “interoperability”, “local government” and “privacy”, and “public sector” and “natural language processing”.

5. Discussion and conclusion

The e-government as a concept of modernization in public administration is essential for many countries, primarily including the developed states. Its main driver is the growing demand from the side of the citizens, which causes pressures on the government to provide better services, more efficiently and cost-effectively. This can be reached by the support of technology and

communication systems. These technological advancements create development opportunities but require new methodological background and a differently organized leadership. The research field has its roots in computer science, social sciences, and business management studies, being a multidisciplinary field gathering scholars with various research profiles. Extended literature exists attempting to cover the existing literature on e-government research publications.

This present study aimed at providing an overview of the e-government research field from a public administration aspect, characterized and specialized to the implementation of new policy regulations. Research findings demonstrated a fragmented picture of the most active institutions, and a primary computer science dominated publication pattern led by conference proceedings. Topic clusters, topics, and research tracks have been analyzed based on a 3-dimension model focusing on the research foci of the publications. This includes the managerial, political, and legal aspects. The wide collection of topic clusters has a strong managerial focus, while more specific research topics are devoted to legal issues. This can be explained by the more general focus of managerial sciences, while the legal and political issues are characterized by more well-defined issues. This means on the other hand, that the managerial perspective plays a role in gathering a large number of publications as an umbrella aspect. Keyword co-occurrence analyses shed light on the importance of political perspective involving most of the modules with different specific issues. The overlay analysis framed and chronologically ordered the research tracks between 2012 and 2018. In this analysis, we could see the new-comer issues of smart city, blockchain, artificial intelligence, and natural language processing which are some of the biggest breakthroughs of recent years in technology. Finally, research core points were identified as well.

The research limitations are found in its specific nature, concentrating on the public administration related e-government publications, while its strength is found here as well. It provides scholars and practitioners various research tracks and gives hints on the best-fit literature.

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