BIBLIOMETRIC ANALYSIS OF RESEARCH TREND ON AGILE IT GOVERNANCE

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Abstract: *This paper was prepared to analyze the scientific trends of research on Agile IT Governance through bibliometric studies in the Scopus and Google Scholar databases. From the search results using Publish or Perish in 2016 to 2021, samples were obtained consisting of 132 documents in the Scopus database and 962 documents in the Google Scholar database. The results of querying five years of data showed that scientific publications on Agile IT Governance had increased significantly since 2016. Based on the Scopus database, researchers from Germany contributed the most documents on Agile IT Governance. Still, the number of citations was dominated by the UK for research on this topic. Then, the visualization of research trends on Agile IT Governance also resulted in four clusters of co-occurrence from Scopus and Google Scholar, which lead into some topic areas mentioned in the result; 1) Agile IT Governance management in the world, 2) Agile IT Governance in relating to digital innovation and digital transformation, 3) Agile IT Governance in implementing technological and environmental innovations, and 4) Agile IT Governance in relating to its effect and benefit to society. The findings in this study will undoubtedly help related researchers recognize trends in Agile IT Governance research globally and recommend directions for further research in the future.*

Keywords: *Agile, IT Governance, Bibliometric Study, Research Trend, VOSviewer*

1. Introduction

In today's business world, there are many challenges in maintaining firm performance and providing the best service for its customers. There is a lot of competition from outside and similar industries. Companies must adapt to the new world to survive in their business and create business opportunities by enabling innovative technology for the new initiatives. Implementation in the highly regulated environment must be controlled by good IT Governance to remain at the standards that have been set (Shepard, 2018). Companies must immediately transform from conventional processes or services and gradually transform into digital

technology-based operations and services. The implementation of digital-based operations is expected to increase the effectiveness and efficiency of the company as well as create new service value for all stakeholders (customers, business partners, shareholders, and regulators). Many service companies have used information and communication technology (ICT). We call it Digital Technology in their production and delivery processes to achieve an effective and efficient way of tailoring customer satisfaction and experience (Beccalli, 2007). Digital transformation enables new businesses, socialites, and government reforms with agile frameworks that facilitate digital transformation such as incremental development, flexible terms, and customer engagement (Uludağ et al., 2021; Vejseli et al., 2020).

To remain competitive, companies must adapt their internal organization's collaboration and alignment between technology capabilities and business strategy. Building agile methods and new technologies makes it possible to quickly develop software features and deploy them to respond promptly to customer needs. Although the number of agile adopters in software organizations continues to grow, many challenges are faced during integrating agile practices across software projects. Many of today's challenges can be solved by organizations in applying agile philosophy and principles (Khalil & Khalil, 2016). The concept of a practical IT Governance framework has changed regarding the need for agility in organizations (Vejseli et al., 2018). While businesses are expected to grow and survive, resources must be adaptable and agile to experience change and innovative strategies. In addition, there is also the challenge of how the agile framework as a blueprint for an agile IT organization resolves the differences between the structures embedded in IT Governance and agility. IT Governance is dominated by top-down decision-making and focuses on traditional Business-IT alignment rather than IT convergence business (Horlach et al., 2018). Agility is defined as "the ability to respond operationally and strategically to changes in the external environment. The response must be fast and effective for the organization to be considered agile" (Fink & Neumann, 2007). Agility means the ability to respond efficiently and quickly in responding to changes within the internal organizational environment. In terms of information technology services, it can provide new services and solutions to support business processes innovatively (Abdelkebir et al., 2017).

Previous literature has highlighted the idea that firms with different IT Governance models perform better than their competitors (Weill, 2004). But as noted earlier, more and more IT functions are implementing cross-functional and agile IT teams. IT Governance helps meet the needs of internal business departments, and IT functions can be changed to react to new and unexpected demands made by external business customers (Wiedemann, 2018). IT Governance mechanisms are helpful for traditionally organized IT functions that need to be matched with lightweight IT Governance that provides the necessary guidance (Horlach et al., 2017). As Henderson and Venkatraman introduce the Strategic alignment model, IT governance aims to achieve strategic business/IT alignment (Henderson & Venkatraman, 1999). Researchers and practitioners have long advocated the need to integrate IT strategy and business strategy (Ein-Dor & Segev, 1978; Henderson et al., 1987). Thus, IT Governance may become a broadly studied area of research. With the track record of existential IT failures, IT Governance may become a key enabler to align technology with strategy, reduce risk, control costs, and deliver value to the company (Fox, 2020).

Despite the importance of agility in IT Governance, there has been little effort to collect data on agile IT governance's scientific production worldwide. The bibliometric analysis provides an appropriate method for evaluating the contribution of a paper to knowledge

advancement (Chen & Ho, 2015; Yang et al., 2017). Bibliometric indicators, including research area, document source, publication output, document source, language source, country, institutional distribution, top authors, number of citations, and author keywords, have been frequently used to analyze trends (Dong et al., 2012). This study explores research trends in Agile IT Governance in the last five years (2016-2021) to help the researcher understand the Agile IT Governance global landscape.

A. Research Question
    This paper focuses on research trends on Agile IT Governance in the 2016-2021 interval with five research questions as follows:
 a.   What is the output profile of Agile IT Governance publications for 2016-2021?
 b.   How far is the distribution of Agile IT Governance publications across countries in the world?
 c.   Who are the top authors in researching Agile IT Governance in the world?
 d.   What is the publication pattern of Agile IT Governance for 2016-2021?
 e.   What are the results of the research theme cluster visual analysis on Agile IT Governance?

2. Research Method

    This study follows the reference of bibliometric studies (Dong et al., 2012; Kulakli & Osmanaj, 2020; Yang et al., 2017). The bibliometric review will benefit both the academic and the public community. It can help convert publication metadata into maps or visualizations, which are easier to manage to gain valuable insights. For example, visualizing keywords to identify research themes or clusters in a particular discipline, map author affiliations of a specific journal, determine the geographic scope of the journal, and map institutional collaboration and international collaboration as part of a framework to identify emerging technologies (Tanudjaja & Kow, 2017). The Scopus and Google Scholar database was used because it contains journals and conference proceedings deemed more relevant by the academic community. The research was started by conducting an online search on July 23-25th, 2021. The complete steps are illustrated in Figure 1, following the Five steps in conducting bibliometric analysis (Masitoh et al., 2021; Suprapto et al., 2021). The researcher conducted an online search by entering Agile +" IT Governance" in the title, keywords, and abstract from 2016 to 2021.

Figure 1. Five steps in conducting bibliometric analysis

    The initial search was carried out by searching for published papers in both the Scopus and Google scholar databases. In the Scopus database, only about 211 documents were obtained from 2011 – 2021, while on Google Scholar, the result is 5460 documents, as can be seen in the following summary figure 2. Based on Scopus and Google Scholar indexed data, we try to follow the trend from the keyword Agile + "IT Governance" and limit the analysis to 2016 – 2021 in both the Scopus and Google Scholar databases. The data is documented in the form of

(.ris) and (.csv). Furthermore, these records are processed in different bibliometric and network analysis programs: Microsoft Excel and VoSViewer. VoSViewer software was used to find out research trends on Agile IT Governance (van Eck & Waltman, 2016). An investigation was carried out to analyze research trends, including the characteristics of publication output, document sources, country distribution, output distribution in subject categories, top authors, top citations, and publication trends from 2016 to 2021. Keyword co-occurrence was carried out with VoSViewer. It uses an algorithm Visualization of Similarities (VoS) as an alternative to multidimensional scaling.
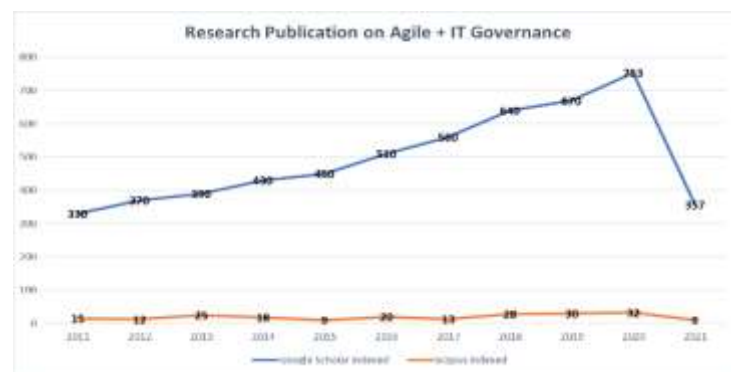

Figure 2. Summary of Research Publication of Field Subject 2011 - 2021

3. Results and Discussion

3.1. Results

Publication Output and Document Sources

By using Publish or Perish (PoP) with keywords Agile + "IT Governance", the papers that meet the criteria and obtained for the past five years (2016 – 2021) in the Scopus database are 132 papers and on Google scholar 962 papers. Those associated with the term given including 4 document sources (journal, book, conference proceeding, and book series). The publications devoted to Agile IT Governance research throughout 2016 to 2021 are demonstrated in Figure 3 as extracted from Scopus database, while there's no clear category in Google Scholar database generated from PoP. Finally, we note the statistic given by Scopus database which the number of articles based on sources indicated the dominance of articles in the conference (75 documents) and journal (44 documents).

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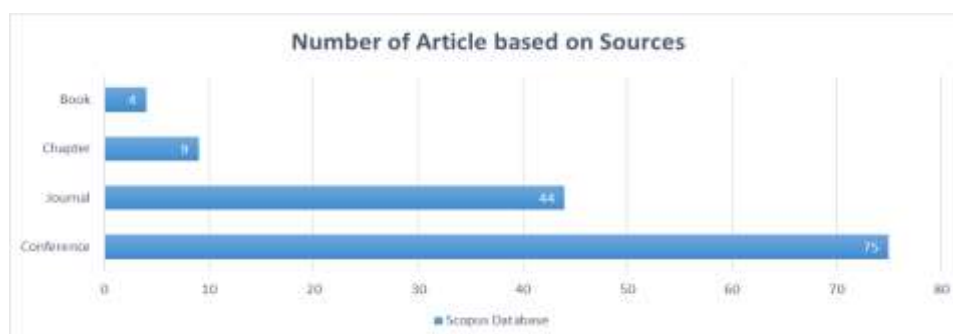

Figure 3. The number of articles of Agile IT Governance
based on source categories in Scopus Database

Publication Distribution of Countries

Based on the Scopus database, the number of documents across countries, Germany's dominance was evident with 20 papers from 2016 to 2021, followed by the US with 15 papers and UK with ten papers, respectively. Meanwhile, the most cited papers have come from the UK with 135 citations. Data is summarized by filtering of five documents minimum per country and one minimum connected link.
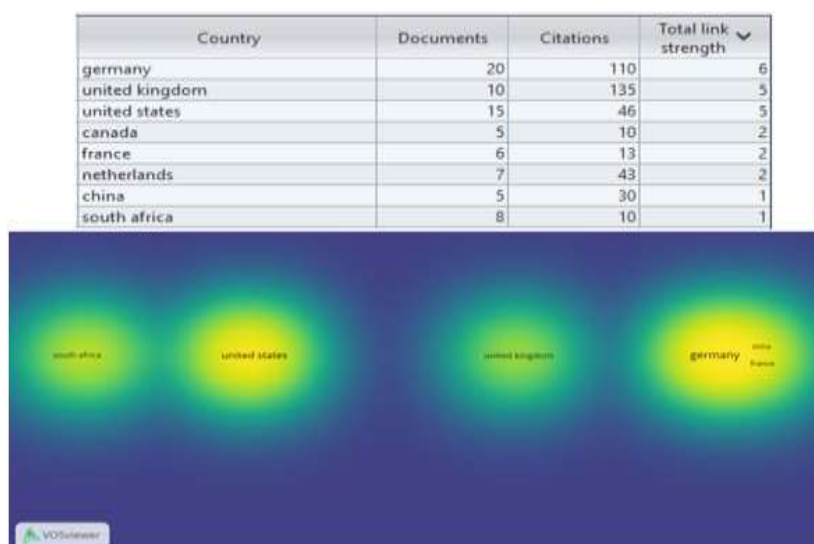
Country	Documents	Citations	Total link strength
germany	20	110	6
united kingdom	10	135	5
united states	15	46	5
canada	5	10	2
france	6	13	2
netherlands	7	43	2
china	5	30	1
south africa	8	10	1

Figure 4. Number of documents based on Top 8 countries 2016 – 2021

Top Cited Author in Researching of Agile IT Governance

In terms of most productive authors, figure 5 indicates the top ten authors researching Agile IT Governance during 2016 – 2021 indexed by Scopus, which consists of Vejseli, Aquilar, Abijade, Amorim, Bouayad, Gregory, Horlach, Johnk, Mergel, and Poth. On average, the authors had two documents, and Vesjeli has four papers already till today. On the other hand, Figure 6 indicates the top ten authors researching Agile IT Governance during 2016 – 2021 indexed by Google Scholar, consisting of Haffke, Horlach, Schimer, Urbach, Benlian Johnk,

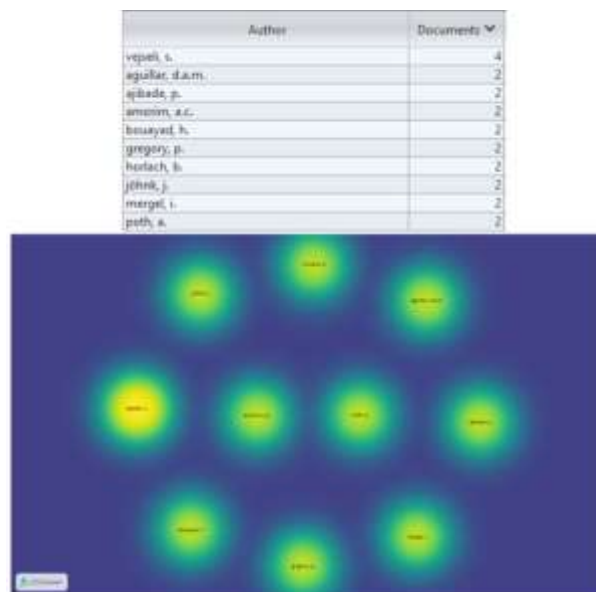Pulier, Lang, Schreiner, and Gerster. The top 4 authors had eight documents already, followed by the others.

Figure 5. Top 10 Authors in researching of Agile IT Governance
during 2016 – 2021 indexed by Scopus

Data collected using PoP also indicate the most cited authors as we can see in Table 1 Top 25 authors most cited from 2016 – 2021 in Scopus database and Table 2 Top 25 authors most cited from 2016 – 2021 in Google Scholar database. It's not the most author with documents has the most cited as probably because the interest of the topic from the other authors who cited the documents.
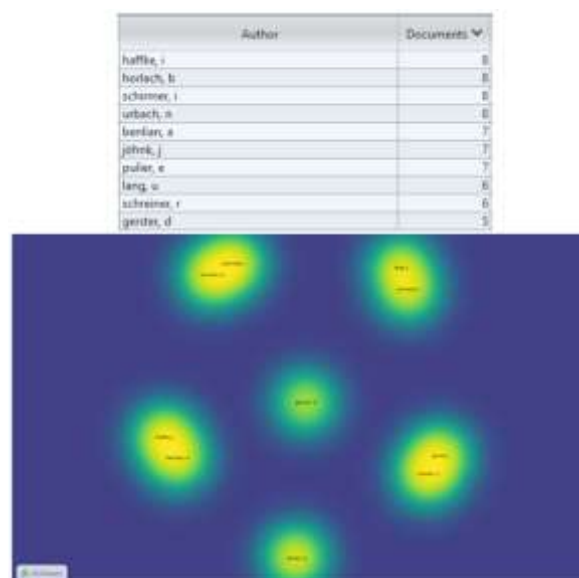

Figure 6. Top 10 Authors in researching of Agile IT Governance
during 2016 – 2021 indexed by Google Scholar

Publication Patterns: Source Titles (Journal or Publisher)

As indicates from table 1, we can see the most author and journals cited by authors indexed by Scopus, i.e., Moon M.J. (2020) in Public Administration Review-Journal, Bass J.M. (2016) and Gregory P., et al. (2016) from Information and Software Technology Journal. Meanwhile, from table 2, we can the most author and publishers cited indexed by Google Scholar, i.e., HJ Schmelzer et al. (2020) with Carl Hanser Verlag GmbH Co KG, TL Friedman, et al. (2017) with Picador USA, and G Vial, et al. (2019), K Dikert, et al. (2016), S Mittal, et al. (2018) respectively from Elsevier publisher.

Table 1. Top 25 Authors Most Cited from 2016 – 2021 in Scopus Database

Authors	Journal	Cited
Moon M.J. (2020)	Public Administration Review	78
Bass J.M. (2016)	Information and Software Technology	56
Gregory P., et al. (2016)	Information and Software Technology	51
Janssen M., et al. (2020)	International Journal of Information Management	31
Wang C., et al. (2018)	Government Information Quarterly	26
Jöhnk J., et al. (2017)	Proceedings of the 25th European Conference on IS, ECIS 2017	26
Hofmann P., et al. (2020)	Electronic Markets	17
Ansell C., et al. (2021)	Public Management Review	11
Alaerts L., et al. (2019)	Resources, Conservation and Recycling	11
Mergel I., et al. (2021)	Public Administration Review	9
Mergel I. (2019)	Government Information Quarterly	9
Gober P. (2018)	Building Resilience for Uncertain Water Futures	9
Gregory P., et al. (2016)	Information and Software Technology	9
Calefato F., et al. (2019)	IEEE Software	8
Wiedemann A. (2018)	Proceedings of the Annual Hawaii International Conference on System Sciences	8
Lah O. (2017)	Sustainability (Switzerland)	8
Poth A., et al. (2020)	Lecture Notes in Business Information Processing	6
Frølich N., et al. (2019)	Public Policy and Administration	6
Kirchmer M., et al. (2019)	Lecture Notes in Business Information Processing	6
Fernandes G., et al. (2018)	Procedia Computer Science	6
DeLone W., et al. (2017)	CIOs and the Digital Transformation: A New Leadership Role	6
Millett L.I., et al. (2017)	Foundational Cybersecurity Research: Improving Science, Engineering, and Institutions	6
Ozkan N. (2016)	Proceedings - Asia-Pacific Software Engineering Conference, APSEC	6
Vejseli S., et al. (2018)	26th European Conference on Information Systems: Beyond Digitization - Facets of Socio-Technical Change, ECIS 2018	5
Horlach B., et al. (2018)	MKWI 2018 - Multikonferenz Wirtschaftsinformatik	5

Table 2. Top 25 Authors Most Cited from 2016 – 2021 in Google Scholar Database

Authors	Publisher	Cites
HJ Schmelzer, et al. (2020)	Carl Hanser Verlag GmbH Co KG	988
G Vial, et al. (2019)	Elsevier	802
TL Friedman, et al. (2017)	Picador USA	637
K Dikert, et al. (2016)	Elsevier	571
JT Marchewka, et al. (2016)	books.google.com	521
C Legner, et al. (2017)	Springer	416
S Mittal, et al. (2018)	Elsevier	350
B Bogsnes, et al. (2016)	books.google.com	346
MT Tinnefeld, et al. (2019)	degruyter.com	231
RG Cooper, et al. (2016)	Taylor & Francis	210
S Ritchie, et al. (2017)	Google Patents	161
F Martinez, et al. (2019)	Google Patents	155
M Alqudah, et al. (2016)	researchgate.net	145
I Haffke, et al. (2016)	researchgate.net	134
D Leffingwell (2018)	Addison-Wesley Professional	134
B Horlach, et al. (2016)	researchgate.net	133
KY Akdil, et al. (2018)	Springer	130
S Denning (2016)	emerald.com	128
W Li, et al. (2016)	journals.sagepub.com	121
A Moran (2016)	Springer	121
PP Tallon, et al. (2019)	Elsevier	118
CC Snow, et al. (2016)	journals.sagepub.com	113
B Womack (2016)	books.google.com	112
M Queiroz, et al. (2018)	Elsevier	111
F Martinez, et al. (2016)	Google Patents	110

Visualization of Research Trends on Agile IT Governance based on VoSViewer Software

Co-occurrence analysis can reveal the research topic statistically. Co-occurrence analysis is simply counting paired data in the collection unit. These methods are helpful for researchers to study an overview of the Agile IT Governance domain. Analyze a map based on text data that created a term co-occurrence map, and terms are extracted from the title and abstract fields with binary counting. Only the presence of keywords in a document matters, filtering the minimum number of occurrences of keywords to 10. Among the 132 papers related to Agile IT Governance research in the Scopus database from 2016-2021, we found 3993 keywords and 68 terms that meet the threshold. After the relevance score is calculated based on the default choice to choose 60%, the most relevant keywords are 41. Figure 7 shows the overall picture of research on Agile IT Governance in the Scopus database.
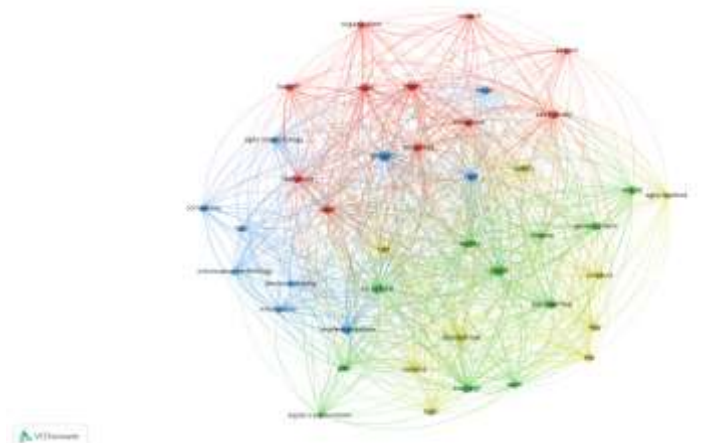

Figure 7. The Co-Occurrence Network Visualization

mapped based on text data of Abstract and Title field from Scopus database.

Meanwhile, among the 962 papers related to Agile IT Governance research in the Google Scholar database from 2016-2021, we found 6793 keywords and 151 keywords meet the threshold. After the relevance score is calculated, the default choice to select the 60% most relevant keywords is 91. Figure 8 shows the overall picture of research on Agile IT Governance in the Google Scholar database. From the Scopus database shown in Figure 7, researchers worldwide produced three primary clusters indicated with red, green, and blue and one secondary cluster (yellow). The first cluster (red color) is grouped by keywords such as case study, literature, adoption, business, team, value, organization, benefit, and culture, leading to the topic of Agile IT Governance business management in the world

The second cluster (green) is grouped by keywords such as digital transformation, agility, need, concept, government, perspective, and the gap leading to the topic of Agile IT Governance related to digital innovation and transformation. The third cluster (blue) is grouped by keywords such as project, information technology, implementation, decision making, and an agile methodology leading to Agile IT Governance's technological and environmental innovations. Finally, the last cluster (yellow) is grouped by keywords such as product, way, risk, service, application, quality, which indicated Agile IT Governance relating to its effect and benefit to society.
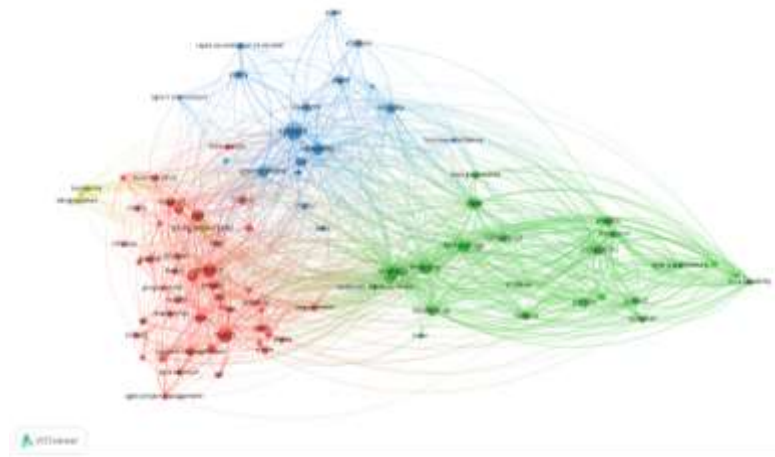

Figure 8. The Co-Occurrence Network Visualization
mapped based on text data of Abstract and Title field from Google Scholar database.

The Google Scholar database showed in figure 8 that researchers on the world produced three primary clusters indicated with red, green, and blue and one secondary cluster (yellow). The first cluster (red color) is grouped by keywords such as team, project management, agile approach, agile project management, requirement, role, control, information, work, scrum, which lead to implementing technological and environmental innovations of Agile IT Governance. The second cluster (green) is grouped by keywords such as strategy, industry, technology, compliance, data, analytic, product, integration, culture, and core capability, leading to Agile IT Governance concerning digital innovation and digital transformation. The third cluster (blue) is grouped by keywords such as system, capability, risk, policy, security, cloud, platform, which indicated Agile IT Governance business management relating to its

effect and benefit to society. Finally, the last cluster (yellow) is grouped by keywords such as taxonomy, design option, leading to academic and science of Agile IT Governance.
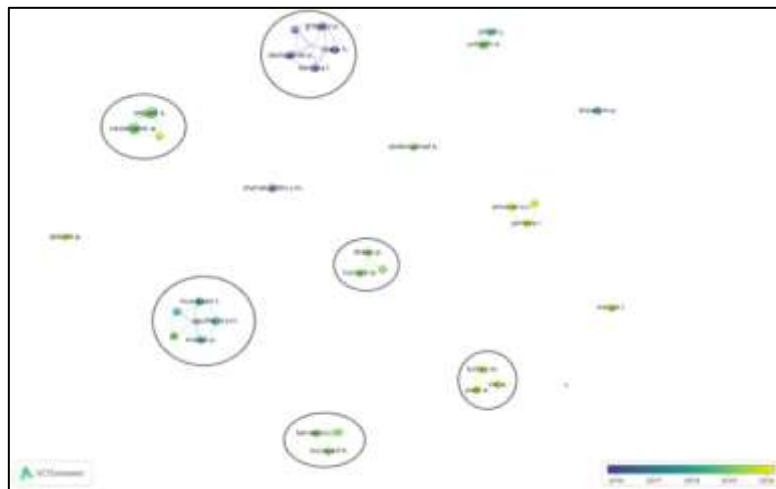

Figure 9. Co-Authorship Network Overlay Visualization from Scopus database

Co-authorship analysis is used to find relationships between various studies based on research documents produced by researchers. A co-authorship network is a tool for uncovering the direction of collaboration and identifying researchers and institutions leading research. Analysis of co-authorship networks can help overcome, make a substantial contribution to academic development. Figure 9 showed the top researcher and its cluster in researching Agile IT Governance. There were six dominant groups of authorships like Vejseli and Rossman, Drews and Horlach, Bouayad and Benabbou, while Aguilar is the most influenced in the cluster and Gregory, which indicated by a bigger circle.
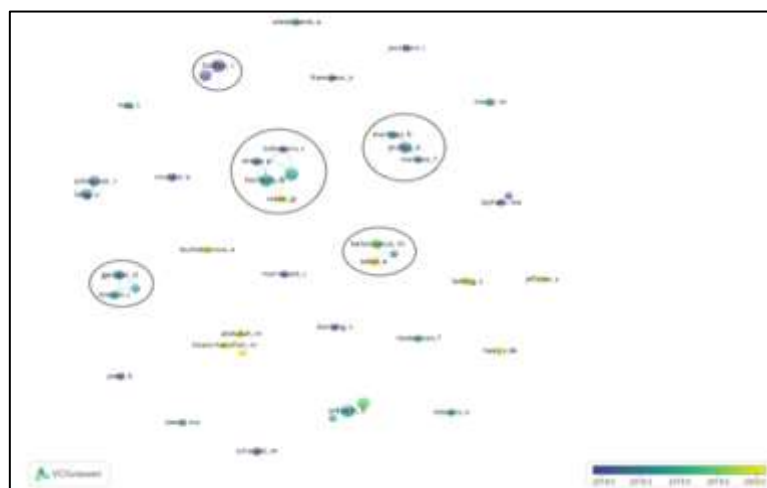

Figure 10. Co-Authorship Network Overlay Visualization from Google Scholar database

Meanwhile, figure 10 showed the top researcher and its cluster in researching Agile IT Governance. There were five dominant groups of authorships Haffke, Gerster and Dremer, Sahid and Belaissoui, Pulier, and Martines. Horlach is the most influenced in the cluster, which is indicated by a bigger circle. From these figures of network overlay visualization, we can also

discover the author from the year of their existence to identify the paper related within 2016 to 2021.

3.2. Discussion

Nowadays, every change requires speed and agility that should be supported by governance in the context of implementing IT infrastructure and its application systems. The strategic alignment model was introduced by Henderson and Venkatraman (1999) a long time ago. The goal of IT Governance is to achieve strategic business/IT alignment. Researchers and practitioners have long advocated the need to integrate IT strategy and business strategy (Ein-Dor & Segev, 1978; Henderson et al., 1987). IT Governance may become a widely studied area of research. Based on Scopus database, we found few papers from 2005 to 2006, from the source of The Agile Enterprise, IBM System Journal, as well as AGILE and IEEE Conference. Previous literature already has interested in the topic with a different term as mentioned here. In the fast-paced global economy, an organization must be flexible and agile to fulfill the shifting needs of operating in an on-demand environment. Aligning IT systems using service-oriented architecture (SOA) to support end-to-end enterprise integration and virtualized IT services is critical (Bieberstein et al., 2005). A fundamental principle of "services" is that the customer will be the judge of the value. It is essential to deliver the value, internally and externally, as formalized services which are the customer-driven governance mechanism of an Agile Enterprise (Uram & Stephenson, 2005). Most large IT organizations need the best software results that provide ever-changing business needs and processes for delivering predictable, trainable, and auditable software. Organizations with agile software teams often receive timely and cost-effective solutions of adequate quality (Baker, 2006).

From the top three author with the most document from Scopus database, we found Vejseli put intention on IT Governance and agile strategies in banking industry (Vejseli et al., 2019, 2018), while Aguillar and Abijade put it on business-IT alignment in SME (Aguillar et al., 2017; Ajibade & Mutula, 2020). Meanwhile from the top three author with the most document from Google scholar database, we found Haffke, Horlach, and Schirmer were put intention in business-IT alignment, it's implication, and the term of Bimodal IT organization (Haffke et al., 2017; Horlach et al., 2016). The phenomenon is different if we analyze the data based on the top five most cited author, we find topics in the fields of development, implementation, governance, (Dikert et al., 2016) and interestingly related to the Covid-19 pandemic (Janssen & van der Voort, 2020; Moon, 2020).

Research planning and evaluation is an essential activity for researchers today. Using references quoted from articles with at least 100 references can be seen as an excellent standard for finding taxonomies of research fields, can be compared the accuracy of topic level taxonomies based on grouping documents using direct citations, bibliographic coupling, and co-citation. Research efforts should focus on value differences between taxonomic subjects that are stable and incorporate historical records, with areas of research that can change rapidly. Analysis of the innovation of research articles, researchers, institutions, and countries must be more accurate if one uses more accurate methods to detect topics. Direct citations produce a correct taxonomy, and it is recommended that this taxonomy be a suitable basis for decision-making.

4. Conclusion

Agility in this section focuses on software development. As can be read that several times software development terms are mentioned. Hence, agility should be discussed as part of a business strategy, instead of software development context. Agility has all the principles explained and can be followed by professionals trying to prepare the tool. Teams may achieve superior performance and add value to the organization by ensuring its transformation. Agility is challenging, but stories from various industries show that organizations have overcome initial hurdles and continue to plan for their progress, putting up the value to their organization and the benefits to the team. Through research on the topics and analysis of the works listed in the previous session, it is possible to identify which institutions are more active and can be used as references when the subject to be researched is related to agile methodology. In addition, it is possible to identify which works are most cited on the subject and, consequently, those works can be used to base new studies and research on the issues.

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