

BIBLIOMETRIC ANALYSIS OF DIGITAL ACCOUNTING USING R BIBLIOSHINY

Irman Firmansyah^{1*}

Wildan Dwi Dermawan²

^{1,2}Faculty of Economics Universitas Siliwangi

*Correspondence: irmanfirmansyah@unsil.ac.id

Abstract

Digital technology significantly affects business processes, one of which is the accounting aspect that supports providing fast and accurate financial reports. The use of digital technology in accounting is often called digital accounting. This has prompted researchers to examine the impact of digital technology on accounting. Therefore, many publications have been detected examining this issue but have not mapped it well. This study aims to map research on digital accounting. This research was conducted on the dimensions.ai database from 2013 to mid-2022. Using the keyword "digital accounting", 1,397 documents were obtained consisting of journal articles, book chapters, monographs, preprints, and proceedings. The R biblioshiny software found that the most relevant journals were Contributions to Management Science, IOP Conference Series Materials Science and Engineering, and Plos One. Meanwhile, the one with the biggest impact is Plos One. In addition, the most relevant authors are Muravskiy and Shao. But the ones who had the biggest impact were Agrell, Karlsson, and Troshani. The distribution of words is dominated by 'digital transformation', 'accounting information', 'digital technologies', and 'digital accounting'. Topics that have emerged in recent years are digital transformation, accounting information, digital accounting, blockchain technology, and accounting systems. Even blockchain technology is still emerging in 2022. These findings illustrate the importance of using digital technology in accounting, thus triggering researchers to continue to develop ideas and other significant findings related to digital accounting.

Keywords: Accounting; Digital; Digital Accounting; R Biblioshiny.

JEL Classification: M41, M49

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INTRODUCTION

Internet and digital technology are growing rapidly, especially in the era of Industrial Revolution 4.0. This development is both a challenge and an opportunity for the business world. Digital technology has a positive impact on business because it provides convenience in financial management, especially in the use of a financial

reporting application to produce quality information. According to Romney and Steinbart (2018), the characteristics of quality financial reports are meeting the elements of being relevant, reliable, complete, timely, understandable, verifiable, and accessible. For this reason, digital technology is designed to make it easier to present financial reports so that they fulfill the elements of quality financial reports and can be used by users (Spilnyk et al., 2020).

Some of the company's financial information seen based on the types of information systems include *transaction processing systems* (TPS), *office automation systems* (OAS), *knowledge work systems* (KWS), *management information systems* (MIS), *decision support systems* (DSS), *expert systems*, *group decision support systems* (GDSS), *computer support collaborative work systems* (CSCW) and *executive support systems* (ESS). These types of information systems are components of digital technology in the company. It's just that of the several types of information systems that exist, the *decision support system* is a system that is widely used by companies. The use of decision support systems helps companies make the right decisions to generate added value for an organization (Megawaty & Ulfa, 2021).

DSS also supports company financial management activities, especially accounting activities known as *digital accounting*. The term *digital accounting* is an information technology system regarding management in *cloud-based* data storage and processing the recording of business transactions to produce company financial reports (Güney, 2014). The application of *digital accounting* aims to make it cost-efficient, improve the financial reporting process, minimize the risk of errors, and reduce or even eliminate the use of paper for making financial reports because the resulting financial reports are stored in digital form (Lipaj et al., 2013).

Many relevant literature studies have attempted to assess perceptions of successful *Enterprise Resource Planning* (ERP) implementation and performance (Velcu, 2007; Kallunki et al., 2011; Ellnaby et al., 2012). This shows the importance of implementing digital accounting in a business. This situation invites the interest of researchers to examine more deeply about digital accounting, both in the realm of implementation and in the academic realm. Therefore, research on *digital accounting* has become a new field for researchers. This topic is also quite new because empirical studies have not shown development over a long period. This is in line with the times related to the development of information technology.

Research by Kruskopf et al. (2020) explains that the skill factor of mastering *digital accounting* greatly supports one's career in supporting success as an accountant or auditor. Meanwhile, research by Bonson et al. (2006) explains the importance of digitizing information in Europe to provide accurate and transparent information. This is related to the size of the company, especially in the financial business. In addition, the application of technology to accounting helps accountants and auditors in the process of making wise decisions by processing *big data* into relevant information for stakeholders (Arnaboldi et al., 2017; Medennikov, 2021). As well as many other recent studies (Krokhicheva et al., 2021; Chanthinok et al., 2021; Esposito et al., 2021). This shows that there is a fairly good development in the publication of research articles on *digital accounting*.

The significant development of articles on *digital accounting* recently shows that the topic of *digital accounting* in the accounting world is a very important topic and relevant to current conditions. Knudsen's research (2020) found that the topic of *digital accounting* will increasingly interest researchers and will develop in the future. So it is

necessary to know its development to explain the development of accounting science which is currently very dynamic. Usually by mapping the research results, certain patterns will be formed that explain the current situation. Therefore, it is necessary to research mapping the publication of articles on *digital accounting* using bibliometric analysis to map research in the field of technology-based financial accounting for academics and practitioners as reference material and a foothold in studying a field of science. This research specifically aims to find out the developments of article publications, publication sources, authors, the most used keywords, and the most relevant topics.

LITERATURE REVIEW

Digital technology in the era of *smart society* is the most important thing in supporting life activities. Digital technology is the process of delivering information through digital devices (Tilson et al., 2010). Digital technology is used in various sectors including economics and business. The existence of digital technology changes the company's business processes. Business processes change along with technological changes. Changes in business processes can be seen from the increase in transactions using digital technology, one of which is online payment system transactions (Feld et al., 2021). In addition, the emergence of *artificial intelligence* (AI), *blockchain*, *the Internet of Things* (IoT), and robotics is predicted to have a broad impact on the economic and business sectors (Chen et al., 2012; Lansiti et al., 2014; Ng et. al., 2013). Well-designed digital technology can add benefits to the company. The benefits of digital technology for the Company are increasing and reducing product/service costs, improving control structures, and increasing accuracy in decision-making. By using digital technology, companies can maximize more efficient business processes to create added value for consumers (Pagani et al., 2017).

Decision-making is closely related to accounting. The definition of accounting is the language of business that performs the activities of recording, reporting, and interpreting data about the business. The results of the accounting process are used by managers, employees, customers, governments, auditors, and investors for decision-making (Warren et al., 2016). Along with the times in the era of the industrial revolution 4.0, the scope of accounting activities is not carried out manually but is facilitated by digital technology. The application of digital technology provides benefits for the Company's business activities, especially in terms of recording and monitoring business transactions more easily. A very important benefit for accounting due to the application of digital technology is to increase flexibility, quality reliability, and timeliness so that the resulting financial statements are of high quality (Nawawi, 2016).

The application of digital technology in accounting or what is often referred to as digital accounting is a term used for the application of digital technology as a tool that helps accountants in preparing financial reports. In addition, the existence of digital technology encourages the role of accountants to become business analysts in company activities (Dan-Richard, 2020; Granlund et al., 2002; Scapens et al., 2003). The application of digital technology makes companies have to make continuous improvements in terms of integrated business processes to produce the right decision-making for the Company (Colmenares, 2009). Research shows the results that digital technology can improve the decision-making process (Raj et al., 2020; Granlund et al., 2002; Spathis, 2006; Kanellou et al., 2007). Another benefit that is the application of

digital technology is to produce more accurate financial reports (Velcu, 2007).

The main benefit of *digital accounting* in companies is to provide accurate and fast financial reports. Research by Brazel et al. (2008) found that the application of digital technology can reduce the slowness of financial reporting to achieve the effectiveness and efficiency of submitting financial reports. Not only increasing coordination within the company, the application of digital technology can also increase and improve performance, especially from an information perspective. They explained that the application of digital technology increases information availability, integration of business procedures and functions, and information quality (Nguyen, 2021; Olhager et al., 2003). Improved data quality to be processed and processed properly, flexibility and integrated data in accounting applications also provide benefits after the implementation of digital technology in the company (Sutton, 2006). Therefore, digital accounting has become inseparable from business. The availability of fast and accurate information is the reason that financial reports must be provided using digital technology.

RESEARCH METHODS

This research uses the bibliometric method to map research on *digital accounting*. This method will provide an overview of the mapping of authors, sources, impact, words that appear frequently, topics, and others. Usually, bibliometric research provides a map construction through visualization accompanied by a representation of the map. The biggest concern of this research is mainly the construction of the map with different mapping techniques. Although bibliometric research has received less attention, many researchers have begun to focus on bibliometric representations in the form of graphs (Chen, 2003; Firmansyah et al., 2021) even though they rely on software to build graphical representations. The research used R Studio software to facilitate mapping through simple visualization. Although there are quite a lot of articles collected, this software can present simple output, making it easier for researchers to analyze.

The publication articles were obtained from the dimensions.ai database. This database makes it easy for researchers to access quite a lot of publications at a fast time and low cost. So that the publications obtained were 1,397 documents consisting of journal articles 1,228 documents, Book Chapters as many as 116 documents, Monographs as many as 2 documents, Preprints as many as 13 documents, and Proceedings as many as 38 documents. The keyword used is 'digital accounting' in the publication period 2013 to 2022.

RESULTS AND DISCUSSION

Research Results

Table 1. presents data from 10 years from 2013 - 2022.

Table 1. Number of Articles and Average Citations		
Year	Total	Average Citations per
		Article
2013	45	9.822

Year	Total	Average Citations per
		Article
2014	63	20.000
2015	59	14.797
2016	69	19.058
2017	91	12.154
2018	147	10.068
2019	219	8.795
2020	282	2.752
2021	316	0.560
2022	106	0.113
Total	1.397	9.812

Based on the article data collected, the data is presented based on the year of publication, the number of articles published, and the average number of citations per article that discuss the theme of *digital accounting*. Table 1 shows that the most article publications related to the theme of digital accounting were published in 2021 with a total publication of 316 documents. Then, based on the average total citations of each article, the highest occurred in articles published in 2014 with an average of 20.00 citations. Usually, articles that are widely referenced indicate that the article has good quality, both the quality of the substance and the quality of the journal that publishes it (Ebrahim et al., 2013).

1. Most Relevant Sources

Figure 1 explains the number of research documents published by each journal based on their relevance to the digital accounting theme. The data shows that the list of the top journals that publish the most on the digital accounting theme is shown in the blue bar chart. The darker the blue color indicates the greater quantity and relevance to the research theme, the number of documents published by all the top 20 journals ranges from 6 to more than 27 documents.

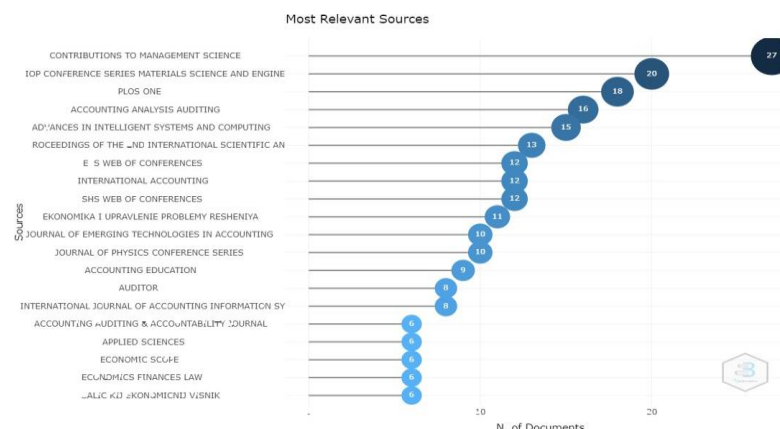


Figure 1.
Most Relevant Sources
 (Source: R-Studio, 2022)

Of the 20 journals detected to be most relevant to the theme of *digital accounting*, the journal at the top is Contributions to Management Science which published 27 articles and is shown in the longest diagram and dark circles. This number is quite different from the second place, namely the IOP conference series Material Science and Engineering which published 20 articles. This is because the journal is very relevant and productive in publishing articles with the themes discussed. While in the lowest order with a total publication of 6 articles, there are 4 journals marked with a short blue color with bright circles, namely Accounting Auditing & Accountability Journal, Applied Science, Economic Scope, Economics Finance Law, and Calikij Economicnij Visnik.

2. Source Impact

The role of journals is not only seen based on the quantity produced and its relevance. However, this research is also conducted based on the impact of each journal that publishes articles with the theme of digital accounting by calculating the journal's h-Index. R depicts it in a blue-colored bar chart. The longer and darker the blue color on the diagram, the greater the impact generated by the journal.

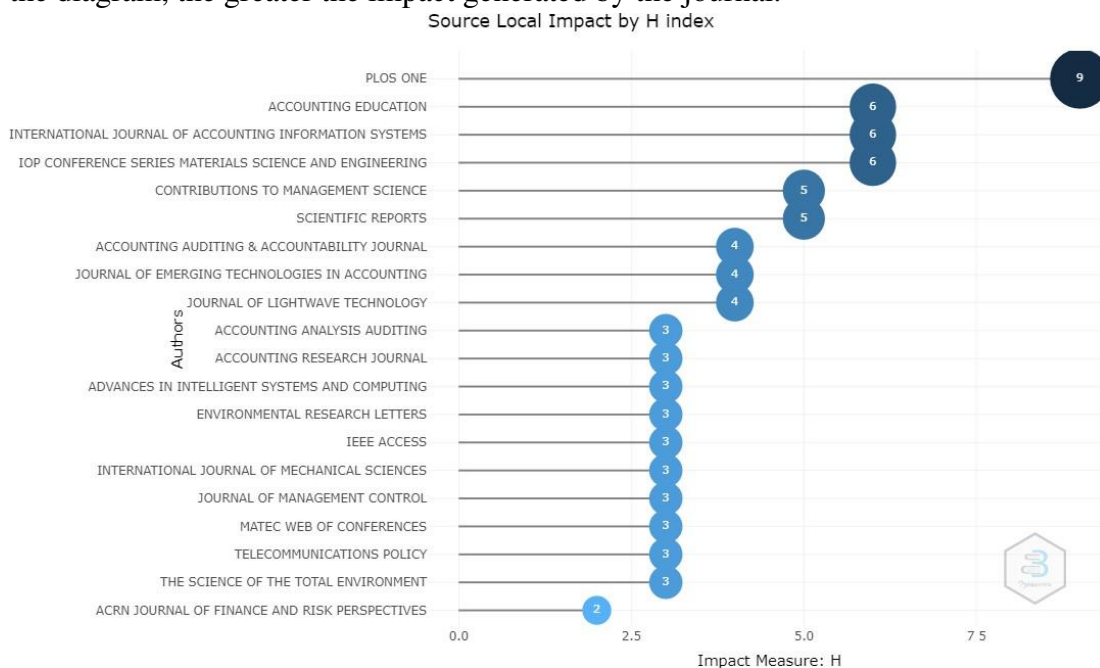


Figure 2.
Source Impact
(Source: R-Studio, 2022)

From Figure 2, that Plos One occupies the top position with an h-index of 9. In the second order there are three publishers, namely Accounting Education, International Journal of Accounting Information System, IOP Conference Series Material Science and Engineering with an h_index value of 6. The lowest h_index score of 2 is found in the ACRN Journal of Finance and Risk Perspectives.

3. Source Growth

Source Growth

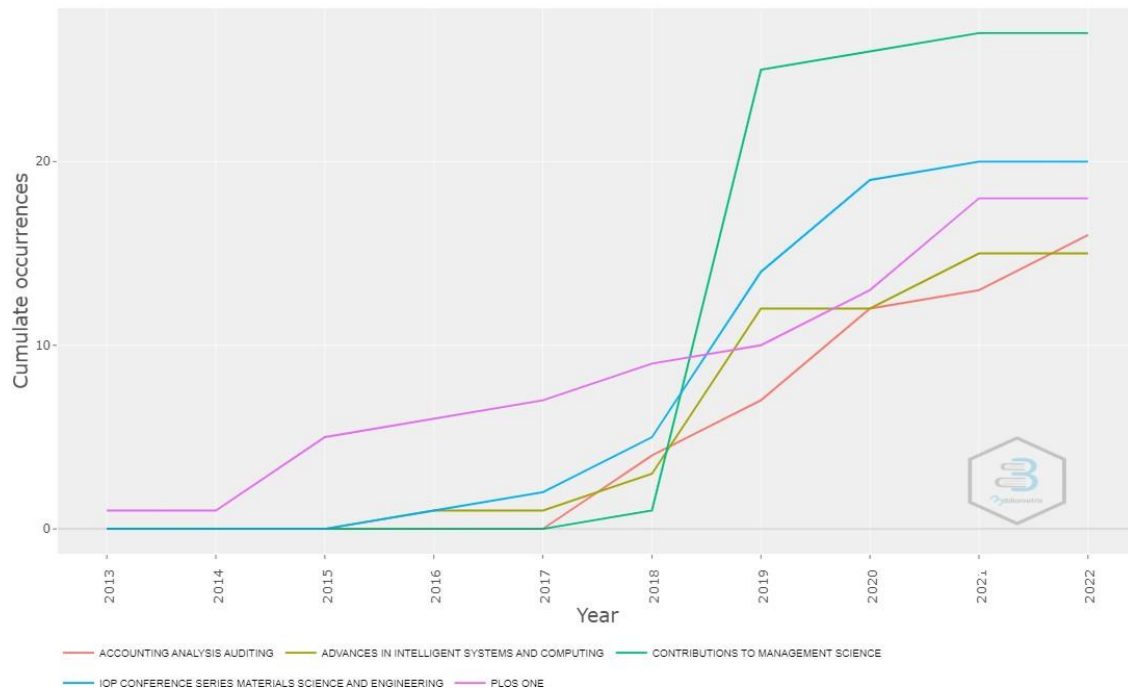
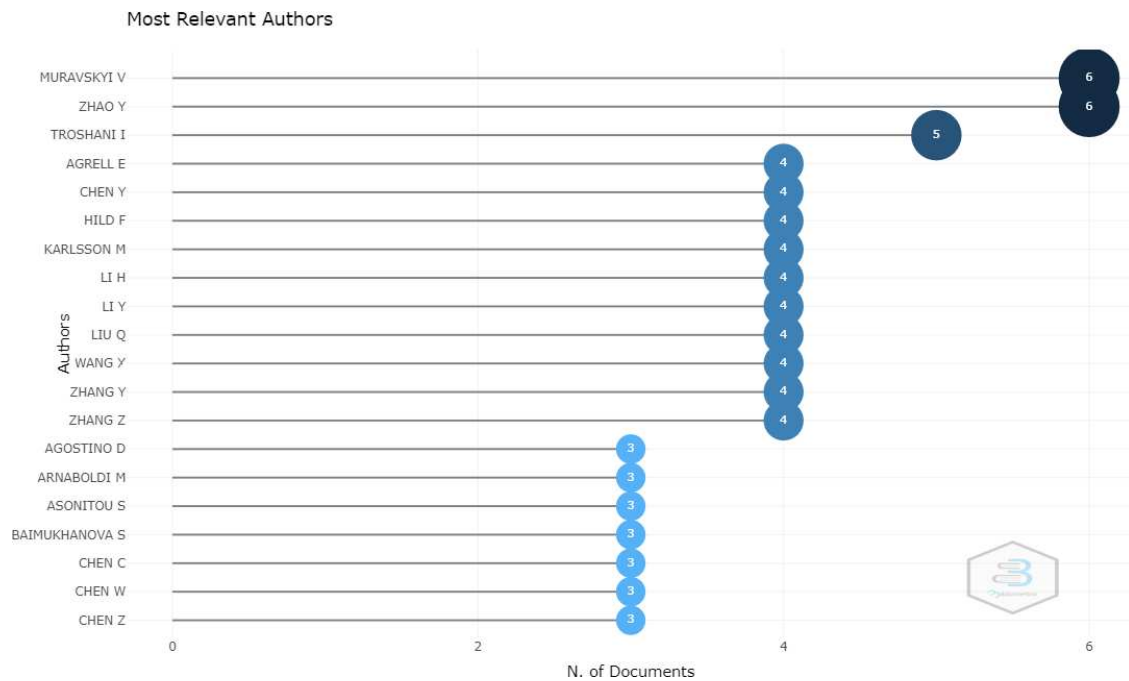


Figure 3.
Source Growth
 (Source: R-Studio, 2022)

This study also found the development of journals that are the source of research on the theme of digital accounting. Figure 3 shows the cumulative occurrence development of each journal from 2013 to 2022. The curve illustrates that research with the theme of digital accounting tends to increase in its publication. A significant increase occurred from 2019 to early 2022, especially in Contributions to Management Science and IOP Conference Series Material Science and Engineering. While Plos One began to see its development in 2015.

4. Most Relevant Author

Authors who have published their articles can also be sorted based on their relevance to the digital accounting theme based on the number of articles. Of the 20 most productive authors, the number of articles of each author ranges from 3 to 6 documents. Based on Figure 4, the longer the diagram with dark blue circles, the more relevant the author is. The results show that the authors with the most articles are Muravskyi and Zhao who have 6 articles. While Troshani has 5 articles. The other 17 authors have 3 and 4 articles respectively.



5. Top Author's Productivity

Figure 4.
Most Relevant Author
 (Source: R-Studio, 2022)

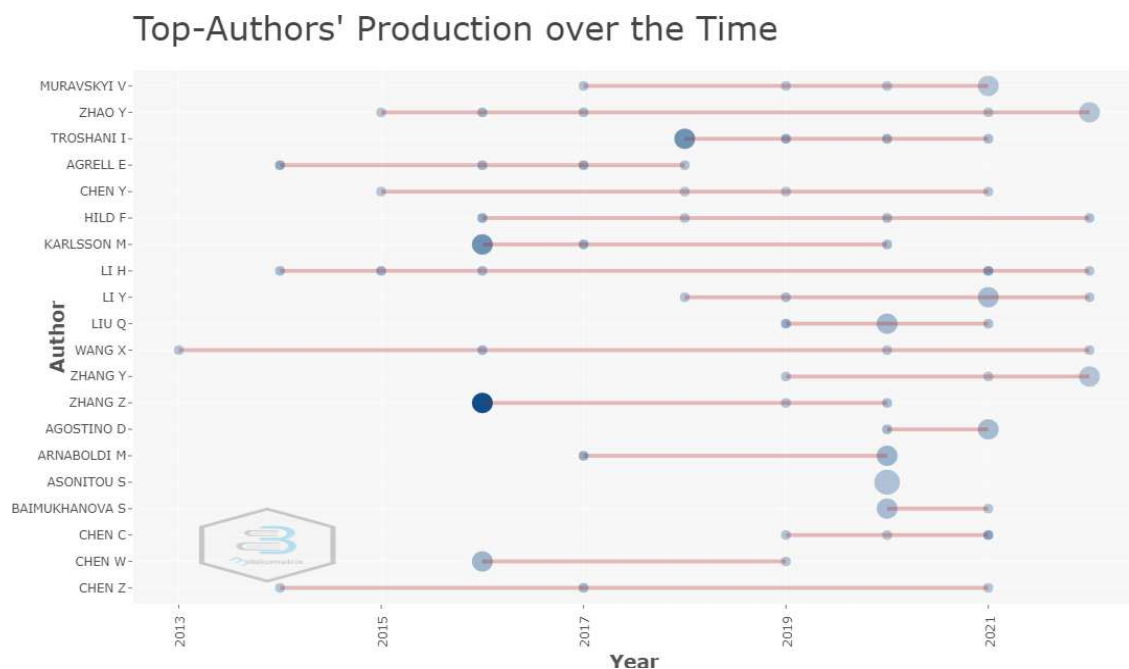


Figure 5.
Top Author's Productivity
 (Source: R-Studio, 2022)

In addition, author productivity can also be seen from their publications each year. Figure 5 shows the productivity of authors based on the distribution of publications from year to year. The productivity is shown by the red line from the beginning of the author publishing their research until the last year the author is recorded publishing their research. The circle within the red line shows the number of articles published according to the applicable year.

It was found that Muravskiy, who wrote 6 articles, spread across 2017 with 1 article, 2019 with 1 article, 2020 with 1 article, and 2021 with 3 articles. Meanwhile, Zhao, who has 6 articles, was detected starting in 2015 with 1 article, 2016 with 1 article, 2017 with 1 article, 2021 with 1 article, and 2022 with 2 articles. The author who has been detected researching digital accounting for the longest time is Wang X, who has appeared since 2013. But his productivity is less consistent. It was recorded that he wrote again in 2016, then in 2020 and 2022.

6. Author Impact

Authors who have published articles related to *digital accounting* can also be sorted based on their impact. The impact can be seen using the h_Index score which has been visualized using a line graph and blue circles in Figure 6. The longer the line with dark blue circles, the greater the impact the author has. The results show that 20 authors have the largest h_index score related to digital accounting. The authors with the greatest impact are Agrell, Karlsson, and Troshani with an h_index score of 4. Then 7 authors with an h_index score of 3, and 10 other authors have an h_index score of 2.

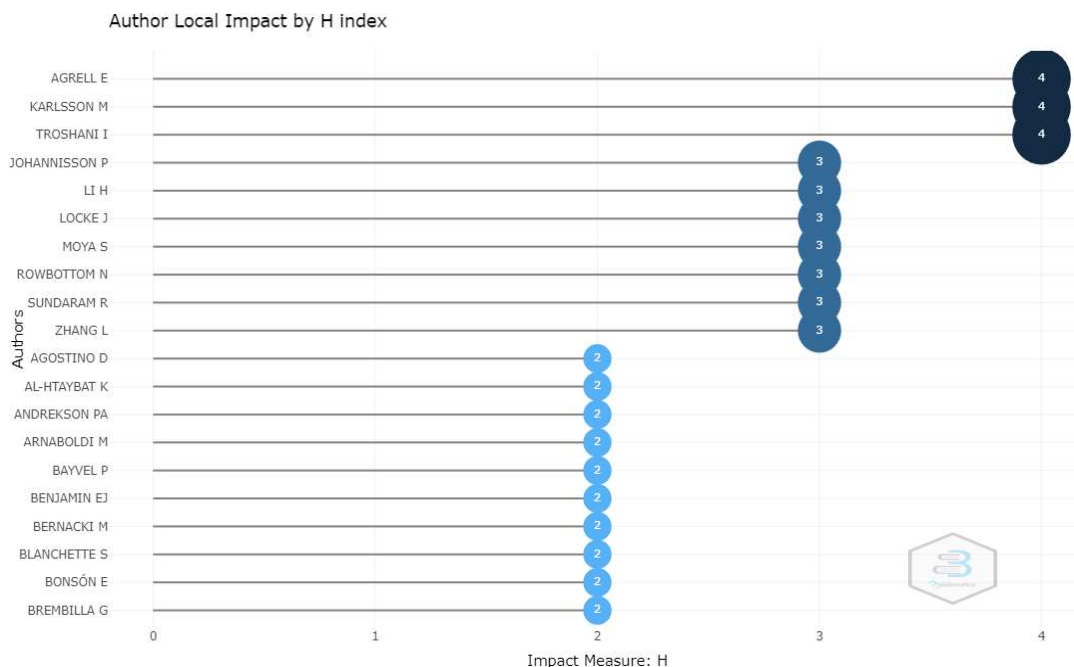
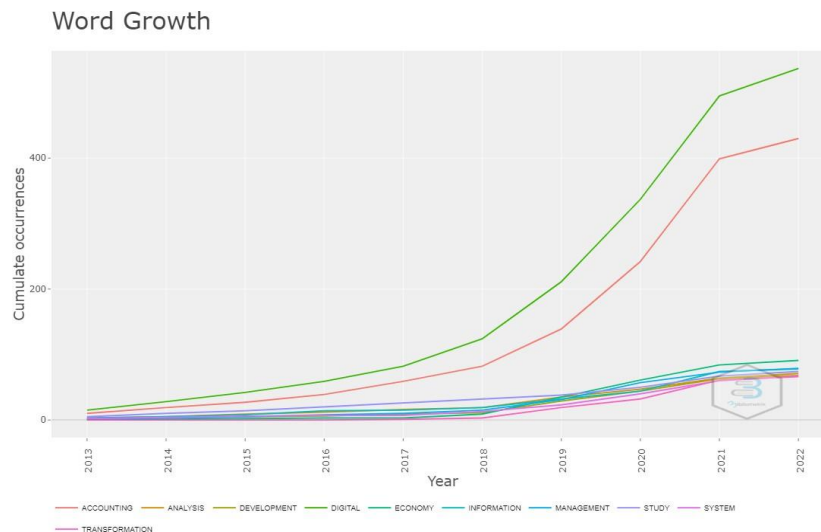


Figure 6.

Author Impact

(Source: R-Studio, 2022)



9. Trend Topics

Figure 8.
Word Growth
(Source: R-Studio, 2022)

Another important part of this research is the topic trend, where Figure 9 displays the development of topics from year to year. Therefore, it can be seen what topics have been used for a long time and what topics have been used recently. The occurrence of the topic is also adjusted to the frequency of the quantity of the word appearing in the *digital accounting* theme research. The larger the blue circle indicates the more the word is used and the more towards the right indicates the more recently the word is used. The length of the line indicates the length of time the topic was used in the research.

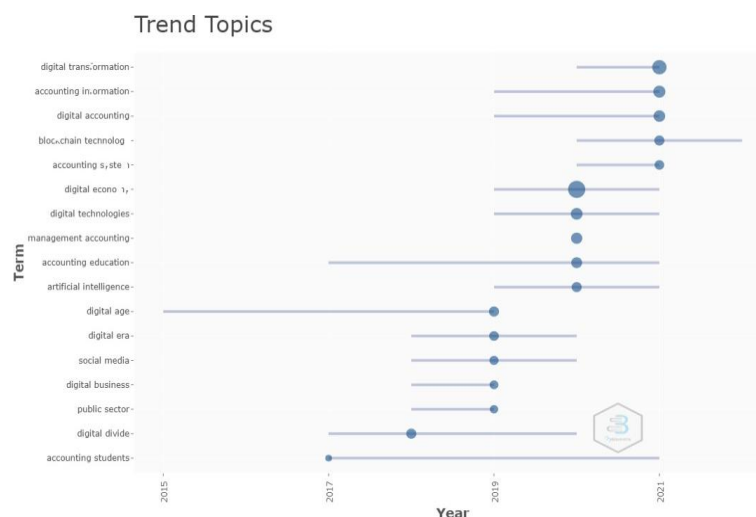


Figure 9.
Trend Topics
(Source: R-Studio, 2022)

Based on Figure 9, the emergence of the topic of the digital age was detected in 2015 and continued to be used until its peak in 2019. Meanwhile, the most recent and widely found topics in 2021 are *digital transformation*, *accounting information*, *digital accounting*, *blockchain technology*, and *accounting systems*. The topic of *blockchain technology* was still found until early 2022. Meanwhile, *accounting students'* topics that appeared in 2017 continued to be used until 2021.

10. Co-occurrence network

Next is the *Co-occurrence network* which displays words in the form of colored spheres by considering the relationship between one word and another. Clusters of the same color indicate that the words are interconnected while the size of the spheres indicates the size of the relationship between words. Based on Figure 10, the words *digital* and *accounting* are the words that have the most relationships with other words.

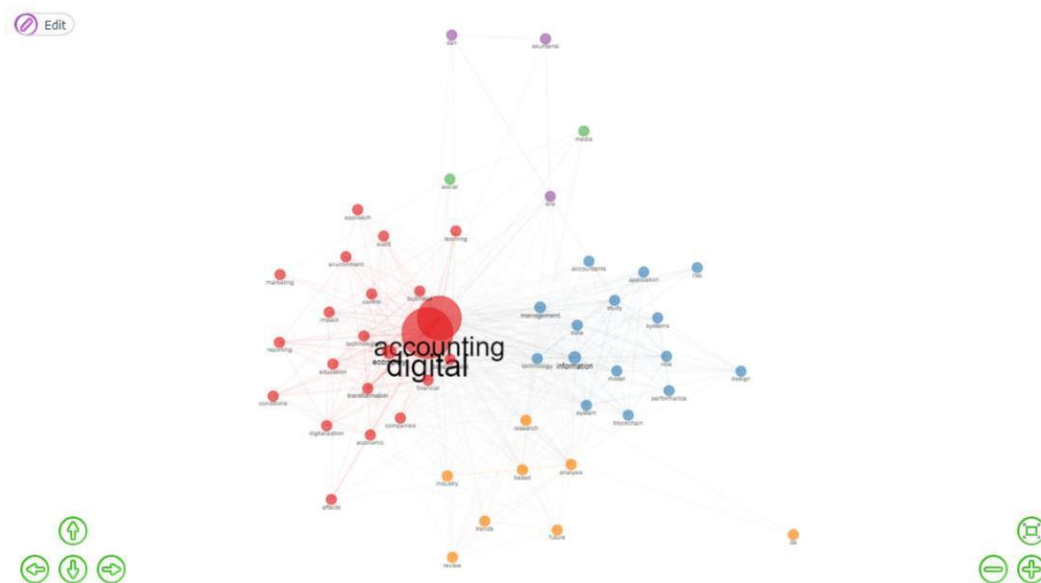


Figure 10.
Co-occurrence network
(Source: R-Studio, 2022)

11. Thematic Evolution

The development of themes in articles related to *digital accounting* continues to evolve. This can be seen in the changes in themes used based on the *thematic evolution* diagram presented in Figure 11. Although the theme of this research is digital accounting, this data shows several sub-themes that are quite widely used. The left part shows several themes that have been widely used from 2013 to 2018. There are three most frequently used themes, namely *digital image*, *digital business*, and *digital economy*. The middle section shows some of the most used themes from 2019 to 2020. Some of the themes that

appear in this period are evolutions of the themes used previously and have a connection in the discussion, such as the theme of *artificial intelligence* which appears because of the revolution of the *digital business theme*.

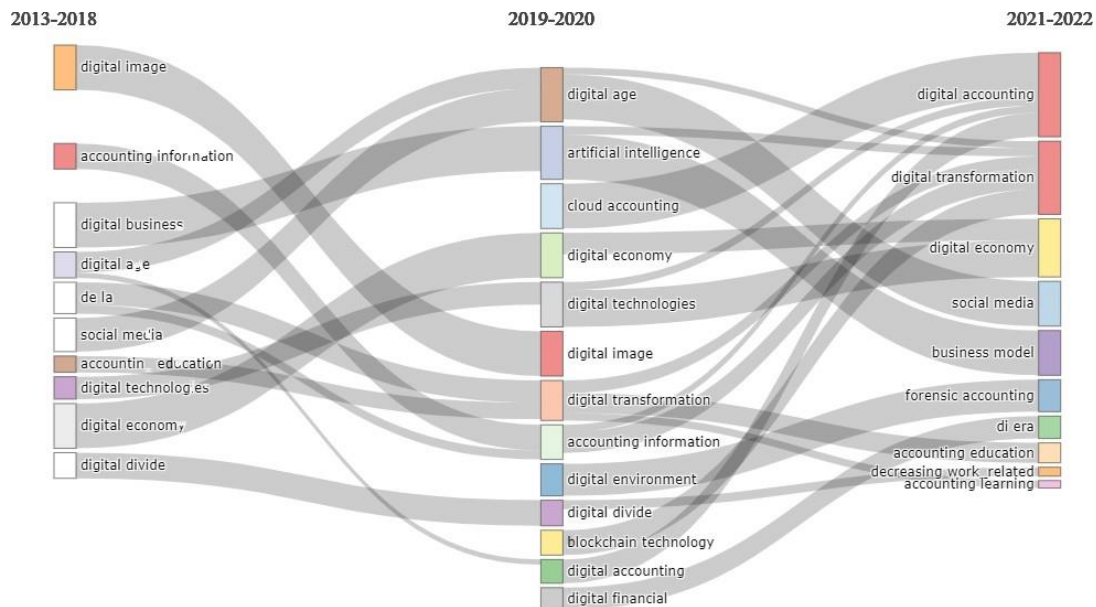


Figure 11.
Thematic Evolution
(Source: R-Studio, 2022)

The right part shows the new widely used themes from 2021 to 2022. Many themes appear in this period but the most common is digital accounting which evolved from several themes in the previous period such as *cloud counting*, *digital technologies*, *accounting information*, and *digital accounting*. The other themes can be seen in Figure 11.

Discussion

Digital accounting is the use of technology in accounting that aims to simplify work, especially in presenting financial information to parties in need.

Nowadays, the times demand disruption in anything, especially in the business aspect. Therefore, the use of technology is not an option but an obligation (Syntelli, 2020) that must be carried out by business entities. In this era of the Industrial Revolution 4.0, the information received by management must be fast and accurate, especially vital information. One of them is information about financial statements. The financial information must be accurate and have good credibility because it is used as material for decision-making (Avakmovic et al., 2016).

Researchers around the world welcome this opportunity to conduct research related to accounting digitalization. The dimensions.ai database as a place for research information shows that articles related to *digital accounting* continue to grow. Even until the beginning of 2022 shows a considerable amount. So it is estimated that articles on

digital accounting will continue to increase until the end of 2022 and the following years.

From the data collected over the past ten years, namely 1,397 articles on the dimensions.ai database, 2021 is the year with the most publications of *digital accounting* articles. However, the citation of the article has not been shown by articles published recently so articles that have been published for a long time are the most cited.

This study found that the publisher most relevant to articles on *digital accounting* is Contributions to Management Science with 27 publications. Contributions to Management Science is a book series in the form of monographs containing high-quality research reports. This publisher is published by Springer, which is one of the publishers that actively publishes research results in the field of management and business. Another relevant publisher is IOP Conference Series Material Science and Engineering which publishes 20 documents. The publications produced here are in the form of proceedings published by IPO Science, which is the largest proceedings publisher in the world. Publications in the form of journals are in the third position, namely Plos One, which publishes 18 articles.

Of the many publishers who publish articles on *digital accounting*, the one with the greatest impact is Plos One with an h_index score of 9, quite far compared to other publishers. From the results of the researcher's search, it is known that Plos One is a journal that has a high reputation, namely a journal indexed by Scopus quartile 1 (Q1) with an h_index score on Scimago of 332. Although Plos One's productivity is below Contributions to Management Science and IOP Conference Series Material Science and Engineering, researchers tend to choose Plos One as a reference material for other research. This is because sources from scientific journals are more credible than other sources. After all, they have gone through a rigorous review process (Library, 2020). So that researchers around the world use reputable journals as the main reference compared to book series and proceedings. Several other sources, namely Accounting Education, International Journal of Accounting Information Systems, and IOP Conference Series Material Science and Engineering are in second place. All three are reputable and Scopus-indexed sources, but unfortunately, the International Journal of Accounting Information Systems has been discontinued in 2021.

Over the past ten years, each source that publishes articles about *digital accounting* has continued to increase. The fastest growing source is *Contributions to Management Science*, especially in 2019, which increased significantly. Several other sources such as *Accounting Analysis Auditing*, *Advance in Intelligent Systems and Computing*, *IOP Conference Series Material Science and Engineering*, and *Plos One* also experienced an increase. This shows that the five publication sources are quite consistent in contributing to *digital accounting* research. Usually, the contribution made by journals to the development of science is through scientific publications on certain themes whose contents can be utilized by academics, researchers, and industry practitioners. In this case, these sources care about the importance of organizing financial information using technology because it can be quickly processed and informed to stakeholders.

Of the many researchers who are most relevant to studying *digital accounting*, there are two most relevant researchers, namely Muravskiy and Shao. Both have 6 articles related to digital accounting that have been published. However, the number of published articles does not necessarily indicate that the researcher has a major impact on the research. Both of them are not researchers who enter the ranks of researchers who have a big impact on this theme. Instead, Agrell, Karlsson, and Troshani are the

researchers who have the greatest impact on this research. Nonetheless, Troshani is an author who has quite a lot of articles.

In addition to sources and authors, this study also found the distribution of words that most often appear in articles related to *digital accounting*. The distribution of words is dominated by the words digital transformation, accounting information, digital technologies, digital accounting, and other words. This shows that the frequent appearance of these words in digital accounting research indicates an affirmation of the importance of using digital technology in current financial reporting because this will improve the quality of financial reports (Mene et al., 2018).

Based on the development of topic trends related to *digital accounting*, this research found that the derivative topics are diverse and evolve from year to year. For example, the topic of accounting students has appeared since 2017 and continues to appear until 2021. However, of the many sub-topics that have developed, the topics that have emerged in recent years are *digital transformation*, *accounting information*, *digital accounting*, *blockchain technology*, and *accounting systems*. Even blockchain technology is a topic that has appeared until early 2022. Therefore, the discussion of *blockchain* on *accounting digitalization* can be used as a topic that is quite important to be researched and implemented at this time. Even based on Figure 9, it can be seen that the line still exists until 2022. It is predicted that this topic will continue to be discussed and will be an important issue in digital accounting research in the following years. This is in line with what Aguiar and Gouveia (2020) stated that research related to digital transformation in accounting shows the importance of development at the technical skills level, especially in digital technology innovations such as blockchain. Therefore, this study provides direction regarding the opportunity for researchers to continue to develop their ideas related to digital accounting research associated with the use of blockchain. However, several other topics are still widely used at the end of this year so it is still very worth discussing, including *digital transformation*, *accounting information*, *digital accounting*, and *accounting systems*.

In the end, this research can illustrate the importance of using technology in accounting so that it becomes a new study material for researchers today. The development of technology in this aspect of information systems is material for the development of science in the business world where researchers and academics will contribute in the form of research results related to *digital accounting*.

CONCLUSIONS, LIMITATIONS AND SUGGESTIONS

This research was conducted on the dimensions.ai database and obtained as many as 1,397 documents with the theme of *digital accounting* from 2013 to 2022. Based on the data collected, it is known that the development of article publications is growing every year, only a decline occurred in 2022. This is because this research is limited to March 2022. This study found that the most relevant source to the theme of digital accounting is Contributions to Management Science. The source is a Book Series owned by Springer Publishers which contains research results in the form of monographs. However, the source that has the greatest impact is Plos One. This publisher is one of the best journals in the world indexed by Scopus Q1 with an h_index score on Scimago of 332. This makes Plos One a reference for other articles.

The most relevant and productive authors on the theme of *digital accounting* are Muravskyi and Shao. Both have published 6 articles. However, their publications have

not shown a big impact on research on this theme. Instead, those with the greatest impact are Agrell, Karlsson, and Troshani.

Regarding topic development, the topic of *blockchain technology* still appears in 2022. This is in line with Aguiar and Gouveia's (2020) research that the use of blockchain is important to develop as a form of accounting technology innovation. So this research suspects that the topic that has the opportunity to continue to be developed is *blockchain technology* considering the relationship between digital accounting and blockchain is very close. However, several other topics that have been discussed a lot in recent years and can continue to be developed are *digital transformation*, *accounting information*, *digital accounting*, *blockchain technology*, and *accounting systems* so this research provides implications for other researchers regarding reference updates and research mapping, especially regarding digital accounting. The development of research on digital accounting is closely related to the times when technology is needed to support management decisions. So it emphasizes to researchers to conduct *digital accounting* research always associated with the times.

LIMITATIONS

This research has limitations, especially the period which is limited to the last 10 years, while many other *databases* can be studied and extend the research period. In the end, the data obtained will be more numerous so that the research mapping becomes more comprehensive.

SUGGESTIONS

The author recommends other researchers conduct *digital accounting* research always associated with the times.

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