

Trends and Patterns in Workforce Agility Literature: A Scopus-based Bibliometric Analysis

Fajar Cahyo Utomo^{1*} and Tatag Herbayu Latukismo²

¹Universitas Krisnadwipayana, Jakarta, Indonesia. fajarcahyoutomo@unkris.ac.id,
ORCID: <https://orcid.org/0000-0003-3576-9226>

²Universitas Krisnadwipayana, Jakarta, Indonesia. tatag@unkris.ac.id,
ORCID: <https://orcid.org/0000-0002-5452-135X>

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Abstract

Workforce agility (WA) has been a critical topic to study. It is now the heart of creating an agile organization in an environment of turbulence and change. Despite the increasing recognition that the WA is essential for achieving competitiveness, the concept of agility remains unclear systematically. This paper presents a bibliometric and network analysis that provides new insights poorly understood or evaluated by other reviews. This analysis uses the Scopus database and Vos Viewer software. It starts by identifying more than 140 published studies from 1993 to 2020 and screening using a rigorous bibliometric analysis. Systematic mapping helps to describe the publication's evolution over time and identify current areas of study interest and potential directions for future research. In this research, five clusters provide a good roadmap for further investigation.

Keywords: Workforce Agility, Bibliometrics, Network Analysis.

1 Introduction

In this globalization era, everything is changing rapidly. That is why business entities must come to the "Age of Agility." It is a critical dimension at the moment, so significant research in publications on dealing with such an uncertain and unpredictable environment is the most dominant and popular notion of agility in recent times. Some findings show that more organizations must be agile rather than idle if they want to survive [1]. This concept can describe a new approach in corporate management that is necessary to be successful in a dynamically changing modern market [2].

At the organizational level, agility is an ability to adapt quickly to rapid changes in markets, technological tools, legal constraints, the environment, etc. [1]. Agility means reacting to strengths and threats in the best ways [3] and finding and determining opportunities with proper time management [4]. Agility is often equated with technological agility. Several studies have shown that workforce agility is the most basic form of agility. Technological agility is ultimately conditioned by the workers' agility to accept new technology and learn how to use it [5]. Therefore, an organization must maintain the agility of its workforce to achieve and sustain success [6]. It means that when individual employees are strong, there will be positive traits such as flexibility, endurance, and perseverance, and trigger employees' agility [7]. Although it is increasingly recognized that WA is very important for achieving competitiveness, the concept of workforce agility remains unclear systematically [8]. There are only a

few studies on the WA antecedents or facilitators. Most authors explore organizational characteristics only [9]. Workforce agility (WA) is derived from a behavioral perspective [10]. Sherehiy[3] redefined the behavior of agile people as proactive, adaptive, and resilient. Proactive behavior refers to expectations of problems associated with changes; launching engagement activities that help solve those problems. Adaptive behavior refers to the profession of flexibility. It is the ability to manage multiple roles while working in different teams. Tenacious behavior includes a positive attitude towards change, innovative ideas, and advanced technology; broad insight and acceptance of unforeseen circumstances; inconsistency in beliefs and approaches; and tough dealing with strange conditions and managing stress.

Goldman[11] wrote a series of factors contributing to organizational agility, including workforce agility. Like an agile organization, agile workers can adapt to sudden changes and take advantage of those changes [6]. This idea supports that workforce agility can provide successful work projects [12]. Besides, it is related to the division of power on tasks that offer the greatest potential to support the formation and creation of WA like by increasing the efficiency of training, mutation, multitasking, and collaboration [13]. Another finding states that an agile workforce mainly consists of individuals who have a positive attitude towards life, believe in self-development, are always eager to learn new things, have good problem-solving skills, and are creative and always ready to accept new challenges that come to their ways [14].

Recent studies found that the workforce is the main factor of agility rather than technical factors [5]. WA means how the employees of an organization adapt to changes in the work environment and generally includes two things, namely (1) the ability of the workforce to react to environmental changes in the most appropriate way in the optimal time and (2) to see that the challenges as an opportunity [15]. In carrying out their tasks, the workers need physical, structural, and cultural resources [16]. Empowering independence and autonomy in decision-making is crucial to creating a truly agile workforce [11, 15, 17]. Continuously developed skills in different fields and cooperatives can create an agile workforce [18].

To be an agile company, technology is not the only factor to cope with dynamic environments [2]. Hence, to remain survive, they must be psychologically empowered to adapt to the fast, stressful, and dynamic corporate environment [19]. Meanwhile, employees must always be proactive, resilient, and future-oriented [20]. Under these circumstances, potential researchers will think of starting the concept of agility in the workforce [21].

2 Research Methodology

This research uses a bibliometric analysis technique following the research by Fahimnia[22]. This involves five stages; filtering, assembling, organizing, compiling, and presenting the results on the WA theme. The aim is to carry out a bibliometric analysis of all publications in SCOPUS related to the WA. The bibliometric analysis describes scientific communication quantitatively to create the structure of a research area and central themes and existing correlations like clusters and networks [23]. The literature search uses the Scopus database because it is multi-disciplinary and suitable for information systems researchers. It has also more stringent methodological criteria for database coverage [24].

Main Keywords and Search Results

In the filtering methodology, the article's search uses the keyword "workforce agility." There are about 140 relevant documents. It seems that the keyword is "Workforce Agility." The use of general words is to broaden the overall descriptions of the research topic and focus on high-quality journals. The

screening was carried out on November 30, 2020, by searching articles published from 1993 to 2020. 1996 was the first year the Scopus database published the topic of agility workforce as the basis for searching articles. Also, the search period provides an opportunity to highlight the evolution of the recent literature on the topic and allows for an overall analysis of WA research trends over time.

3 Descriptions of Agility Workforce

Related to the annual publication of articles on the WA (Figure 1), there is only little number of published journals on workforce agility since 1993. Therefore, there are great opportunities to find the latest journals. In terms of the development of the business and science worlds, the studies on the WA began to increase sharply in 2016 (14 articles), 2017 (13 articles), 2018 (12 articles), 2019 (15 articles), and 2020 (21 articles). The highest publication was in 2020. It will continue to increase along with the increasing importance of agility for organizations facing the global market and dynamic environmental changes. This phenomenon may be an indication of stronger academic interest in WA, which is manifesting itself in increasing the quality of the research.

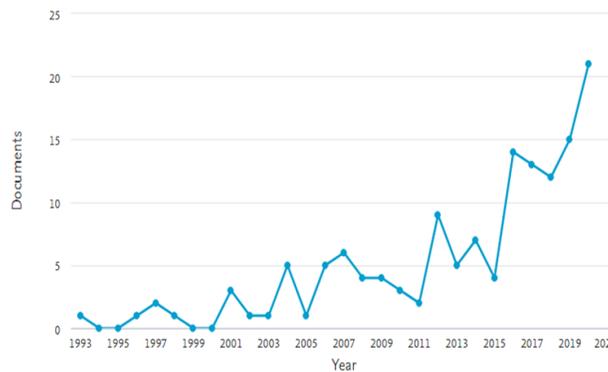


Figure 1: Development of Workforce Agility Documents 1993-2020

The search for articles using the Scopus database for 15 years (1993-2020) has found various documents with the keyword "workforce agility" with the highest citation. 140 documents are written in English; 77 documents are articles. There are 33 conference papers, 11 reviews, and 7 books presented in Table 1 and Figure 2.

Table 1: Summary of Document Types

Source	Scope	Article and Non Article	(%)
Time period	All Year		
Keyword	"Workforce Agility"		
Highest Citation			
Document Type	Article	77	55,097
	Conference paper	99	23,69
	Riview	11	7,99
	Book	7	5,0
	Book chapter	6	4,39
	Ceonference Review	2	1,49
	Editorial	2	1,49
	Erratum	1	0,79
	Short survey	1	0,79
Language	English	140	
Source: Scopus, 1993-2020 (30 November 2020)			

Documents by type

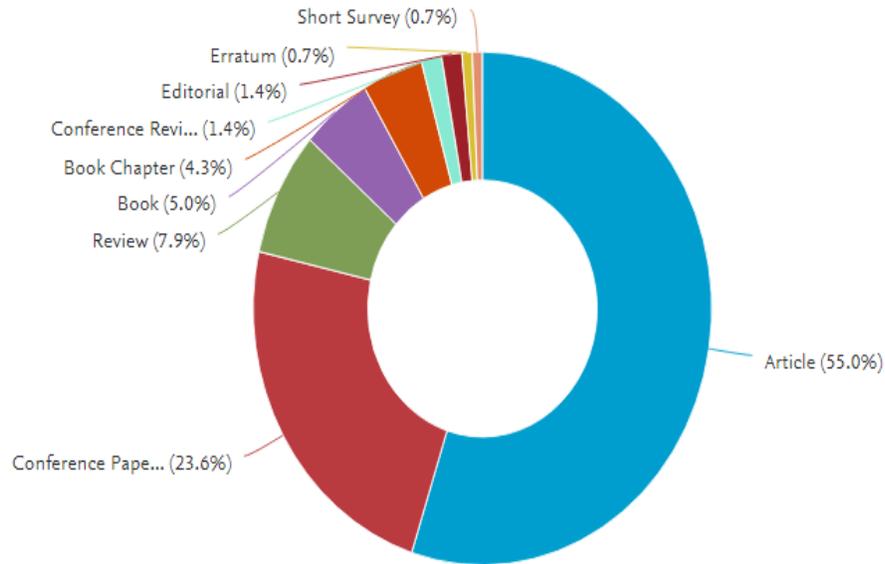


Figure 2: Types of Workforce Agility Documents

There is a list of authors who have published articles related to WA in the last 15 years. It is related to the contribution of articles from a journal perspective. The information will be very useful for the researchers who will research the WA. Figure 2 presents the sources and number of publications over 15 years. The sources are from IIE Transactions Institute of Industrial Engineer (IIE) with seven articles; Global Business and Organizational Excellence with four articles; International Journal of Production Research with three articles; Global Journal of Flexible Systems Management with two articles; and Human Resource Development Quarterly with two articles. Table 2 presents the complete result.

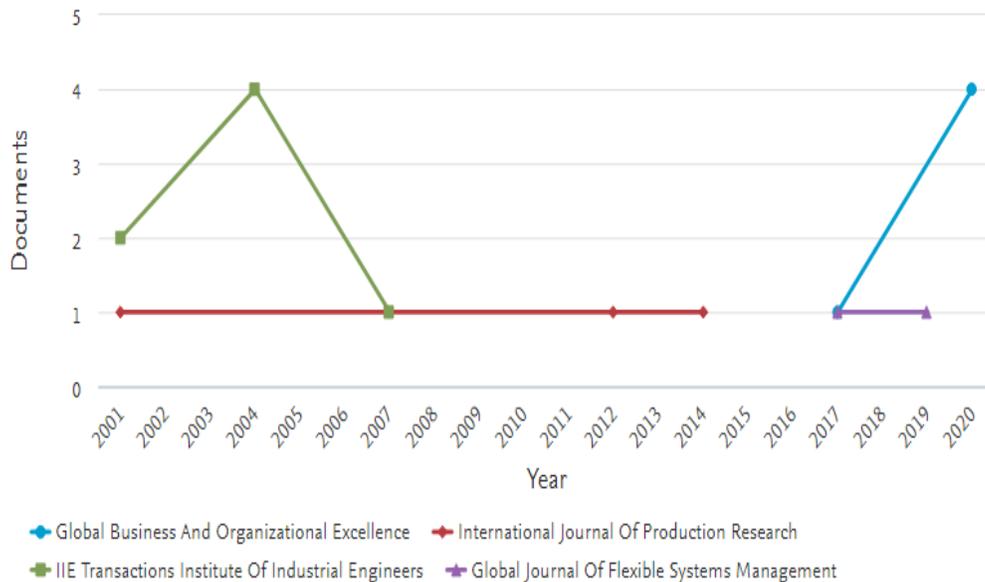


Figure 3: Article Publication Sources

Table 2: Top Ten Workforce Agility Article Publication Resources

Article Publication	Total Article
IIE Transactions Institute of Industrial Engineers	7
Global Business and Organizational Excellence	4
International Journal of Production Research	3
Global Journal of Flexible Systems Management	2
Human Resource Development Quarterly	2
International Journal of Agile Systems and Management	2
International Journal of Industrial Ergonomics	2
Research Journal of Applied Sciences Engineering and Technology	2
Advances in Science Technology and Engineering Systems	1
Sustainability Switzerland	1
Source: Scopus, 1993-2020 (30 November 2020)	

WA is necessary for the development of globalization and the work environment that changes quickly and is unpredictable. That is why there are many disciplines conducting studies on the WA. Lately, all organizations are demanded to strengthen their agility. It is where the workforce becomes the core of agility. This section shows the number of publications on different subjects in combination with the WA studying in the business areas of management and accounting (56 articles), Engineering (45), Computer Science (32), Social Sciences (30), Decision Sciences (18), Economics, Econometrics and Finance (15 articles), and other fields presented in Table 3 and Figure 4.

Table 3: Top Ten Document Summary by Subject Area

Subject	Total Article
Business, Management and Accounting	56
Engineering	75
Computer Science	32
Social Sciences	30
Decision Sciences	18
Economics, Econometrics and Finance	15
Mathematics	9
Medicine	9
Arts and Humanities	5
Chemical Engineering	5
Source: Scopus, 1993-2020 (30 November 2020)	

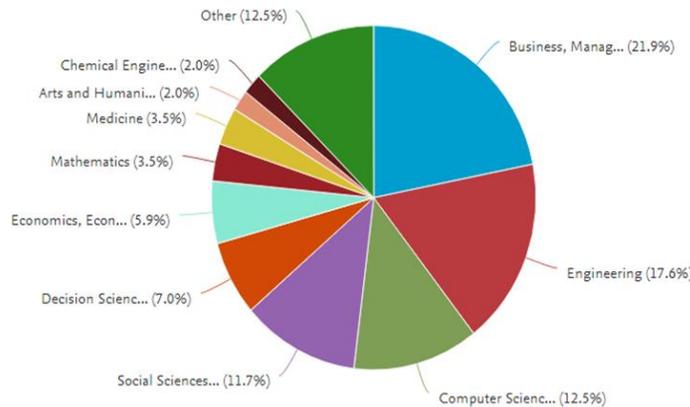


Figure 4: Agility Workforce Documents by Subject Area

Growth in research output is an indicator of progress for almost every country. The following is a list of the top countries which have contributed to the development of the research on WA in the last fifteen years. There is the United States with the most contributing nation (52 articles), considering agility was first expressed in 1991 by a committee at the Iacocca Institute Leigh University (PA). They tried to study the lack of international competitiveness of the US industry. The next is India with very significant progress for this research expansion (18 articles), the United Kingdom (8), Australia (5), Canada (5), Iran (5), China (4), Malaysia (4), Finland (3), Germany (3) and so on (Figure 5).

Table 4: Top Ten Documents by Country from Workforce Agility Research

Country	Total Article
United States	52
India	18
United Kingdom	8
Australia	5
Canada	5
Iran	5
China	4
Malaysia	4
Finland	3
Germany	3
Source: Scopus, 1993-2020 (30 November 2020)	

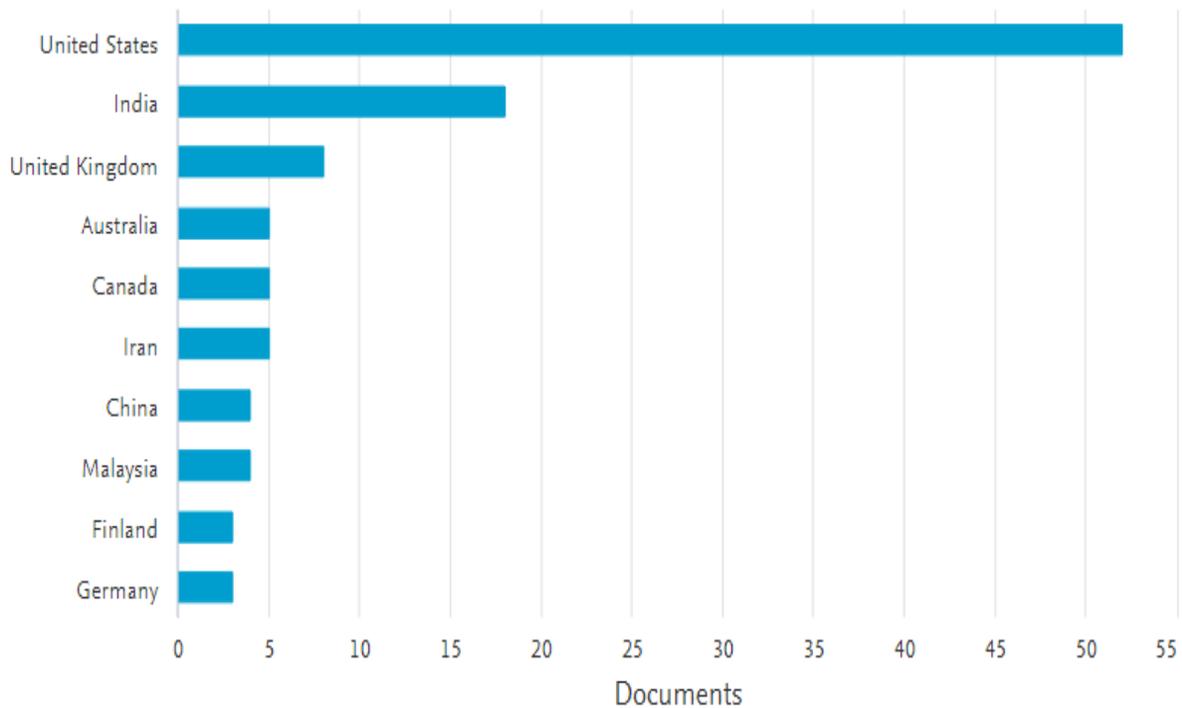


Figure 5: Documents by Country from Workforce Agility Research

The separation of articles by affiliation presents an interesting summary for the researchers and academics. This section provides a list of universities that have contributed to the research on WA. They are Northwestern University (7 articles), Amrita School of Business (3), Pandit Deendayal Petroleum University (3), Pennsylvania State University (2), Rochester Institute of Technology (2 articles), Loyola University of Chicago (2), Arizona State University (2), The University of Arizona (2), Western Illinois University (2), University of Hartford (2 articles), and others (see Table 5 and Figure 6).

Table 5: Top Ten Documents Based on Affiliation from Workforce Agility Research

Affiliation	Total Article
Northwestern University	7
Amrita School of Business	3
Pandit Deendayal Petroleum University	3
Pennsylvania State University	2
Rochester Institute of Technology	2
Loyola University of Chicago	2
Arizona State University	2
The University of Arizona	2
Western Illinois University	2
University of Hartford	2
Source: Scopus, 1993-2020 (30 November 2020)	

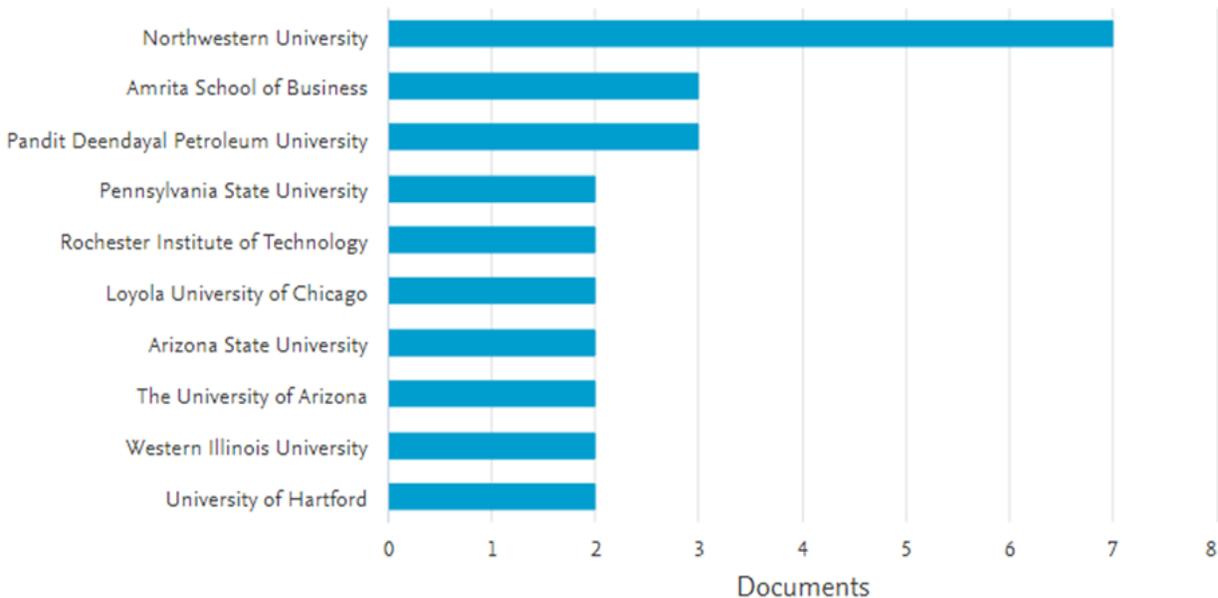


Figure 6: Documents Based on Affiliation of Workforce Agility Research

This section identifies the most prolific authors for the WA research based on the first ten authors who produce the most publications. Table 7 and Figure 8 present the authors and their papers and the associated high index in the top ten rankings. Table 7 shows that the authors with the highest scores are Hopp, W.J. (6 articles), Van Oyen, M.P. (4), Alavi, S. (3), Muduli, A. (3), (Suresh, M. (3 articles), Adeboye, T. (3), Asari, M. (2), Cai, Z. (2), Irvani, S.M.R. (2), and Ivanov, I.I. (2).

Table 6: Top Ten Workforce Agility Authors

Author	Affiliation
Hopp, W.J.	6
Van Oyen, M.P.	4
Alavi, S.	3
Muduli, A.	3
Suresh, M.	3
Adeboye, T.	2
Asari, M.	2
Cai, Z.	2
Iravani, S.M.R.	2
Ivanov, I.I.,	2
Source: Scopus, 1993-2020 (30 November 2020)	

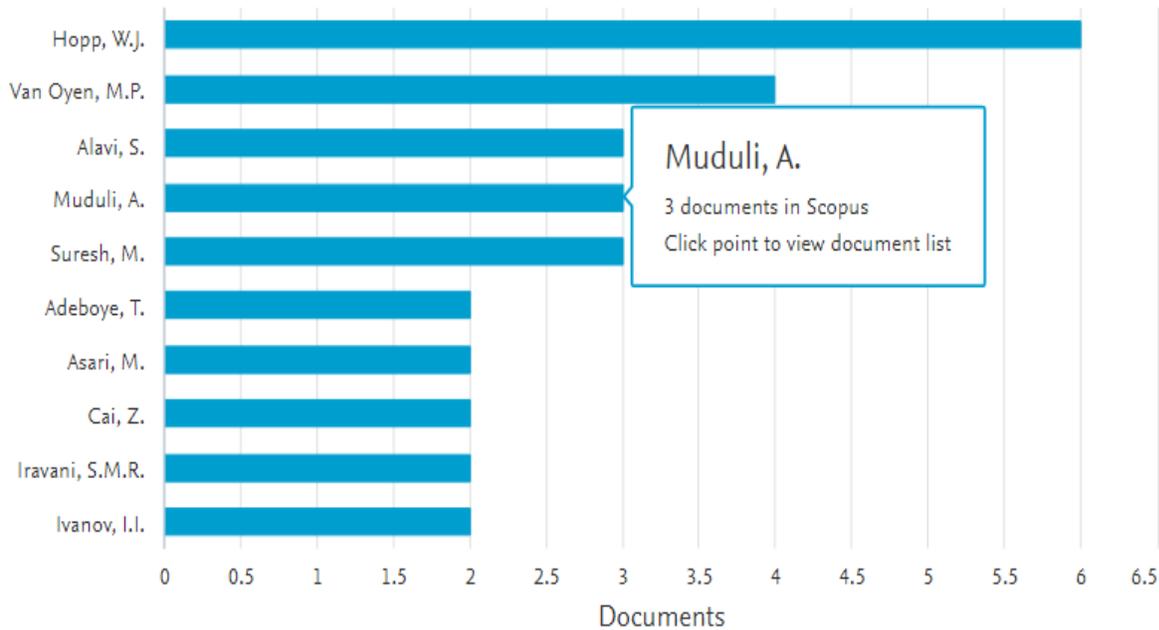


Figure 7: Top Ten Workforce Agility Authors

In conducting research, funding is the aspect most awaited by researchers and academics. With good funding, they can focus more on carrying out their tasks, so many foundations, institutions, and sponsors allocate their money to support the research related to the WA in different projects. The top ten sponsors and funders in the research related to the WA are the National Science Foundation (5 articles), General Motors Corporation (2), International Business Machines Corporation (2), Alcoa (1), Anna University (1), Australian Research Council (1 article), Bangladesh Council of Scientific and Industrial Research (1), Center National pour la Recherche Scientifique et Technique (1 article), Connecticut State Emergency Response Commission (1 article), and Conselho Nacional de Desenvolvimento Científico e Tecnológico (5). They are presented in Table 7 and Figure 8.

Table 7: Top Ten Funding Sponsor Workforce Agility

Sponsor	Total Article
National Science Foundation	5
General Motors Corporation	2
International Business Machines Corporation	2
Alcoa	1
Anna University	1
Australian Research Council	1
Bangladesh Council of Scientific and Industrial Research	1
Centre National pour la Recherche Scientifique et Technique	1
Connecticut State Emergency Response Commission	1
Conselho Nacional de Desenvolvimento Científico e Tecnológico	1
Source: Scopus, 1993-2020 (30 November 2020)	

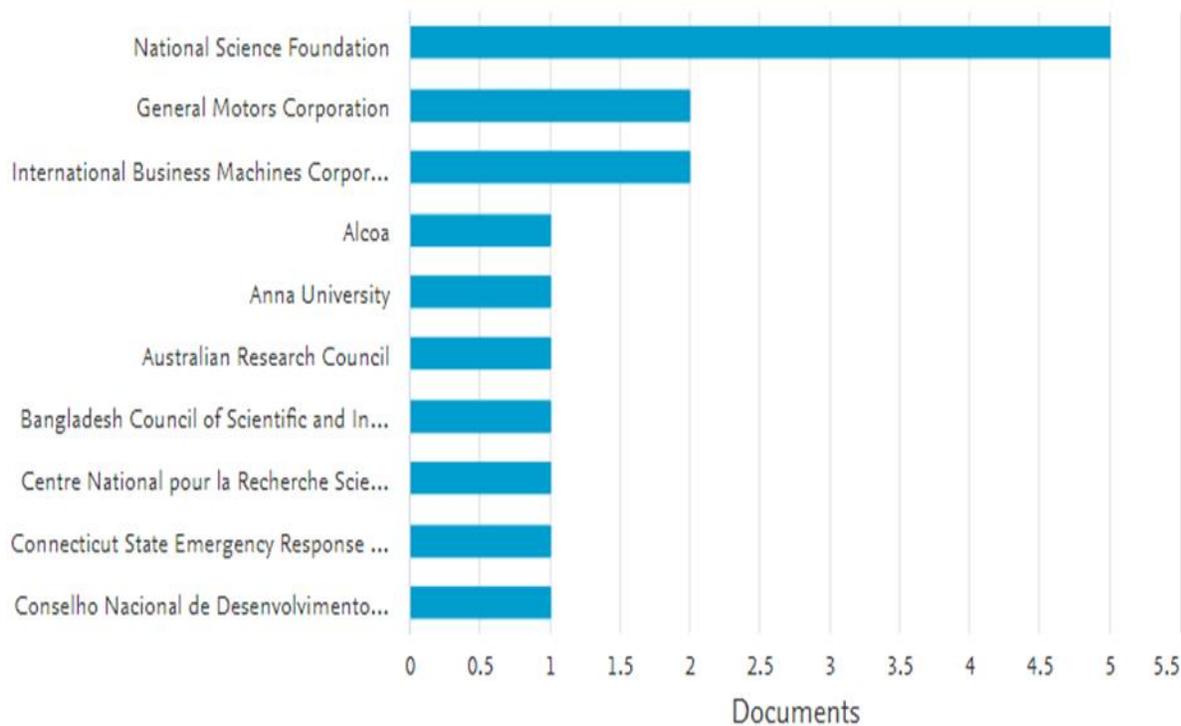


Figure 8: Top Ten Funding Sponsor Workforce Agility

The next is about the top ten articles that are most cited by subsequent studies and show the total number of cited titles, and publisher of the journal. The highest number of citations is an article published in 2007 (Sherehiy, B., Karwowski, W., Layer, J.K.) with the title A review of enterprise agility: Concepts, frameworks, and attributes published by the International Journal of Industrial Ergonomics (295 citations). It is still the most cited article to date. The next ones are Sanchez, L.M., Nagi, R. (2001) (200 citations), Hopp, W.J., Tekin, E., Van Oyen, M.P. (2001) (189 citations), Breu, K., Hemingway, C.J., Strathern, M., Bridger, D. (2002) (128 citations), and other presented in Table 8.

Table 8: Top Five Most Agility Workforce Citations

Author(s)	Title	Journal	Total citation
Sherehiy, B. Karwowski, W. Layer, J.K. (2007)	A review of enterprise Agility: Concepts framework and attributes	International Jurnal of Industri Ergonomic	295
Sanchez, L.M., Nagi, R. (2001)	A review of agile manufakturung system	International Jurnal of production research	200
Hopp, W.J. Van Oyen, M.P Tekin, E. (2004)	Benafits of Skill Chaining in Serial Production Lines with Cross Trained Workers	Management Science	189
Hopp, W.J. Van Oyen, M.P Tekin, E. (2004)	Agile workforce evaluation: A framework for cross Trainingand Coordination	IIE Transaction(Institute of Industrial Engineers)	188
Breu, K. Hemingway, C.J., Strathern, M., Bridger, D. (2002)	Workforce Agility: The new employee strategy for the knowlerge economy	Jurnala of Information Tchnology	128
Source: Scopus, 1993-2020 (30 November 2020)			

4 Results and Discussions

This research presents a bibliometric analysis of WA using the Scopus database. The results of the citation analysis provide some useful insights into understanding the influence and interrelationships of the authors in future WA studies. Citation analysis is commonly used in bibliometrics in citations with authors and documents. Citation analysis provides and helps detect shifts and developments in the paradigm of thinking in a study (Gallardo-Gallardo et al., 2015). Table 9 presents the top five rankings of the most cited articles and authors. The most cited articles are Sherehiy, B, Karwowski, W, Layer, J.K, entitled A review of enterprise agility: Concepts, frameworks, and attributes published by the International Journal of Industrial Ergonomics in 2007 (cited by 295 authors); Sanchez, L.M., Nagi, R. with the title A review of agile manufacturing systems published by the International Journal of Production Research in 2001 (cited by 200 authors); Hopp, W.J., Tekin, E., Van Oyen, M.P. entitled Benefits of Skill Chaining in Serial Production Lines with Cross-Trained Workers published by Management Science in 2004 (cited by 189 authors); Hopp, W.J., Van Oyen, M.P. with his article entitled Benefits Agile workforce evaluation: A framework for cross-training and coordination published by IIE Transactions (Institute of Industrial Engineers) in 2004 (cited by 188 authors), and; Breu, K., Hemingway, C.J., Strathern, M., Bridger, D. with an article entitled Workforce agility: The new employee strategy for the knowledge economy published in the Journal of Information Technology in 2002 (cited by 128 authors).

After presenting the number of citations, the next step is to analyze the most often-used keywords using the VOS Viewer software. This software was developed in 2010 by Van Eck and Waltman to provide map visualization in bibliometrics and network, overlay, and depth visualizations. There are three times of document filtering processes for keywords. There are 1,019 keywords found and 56 keywords are included in the threshold. Figure 9 shows the classification of the VOS Viewer on the keyword "agility workforce" by visualizing and identifying six different colors, namely Cluster one with red (12 keywords), Cluster two with green (12 keywords), cluster three with yellow (10 words) key), cluster four with blue (10 keywords), and cluster five with purple (9 keywords).

The keywords in each part of the cluster have a research flow on the topic of WA. It shows the trend of the relation of the WA research with other keywords. The trend will be a good reference for future research based on topics developed based on existing keywords presented in Table 10.

The next step is to analyze the collaboration network among authors in the WA study. Of the 309 authors with the criteria set at two documents per author, eleven have met the threshold and collaborated in the WA research. Figure 10 shows the results of the analysis with Vos Viewer. Five authors collaborate in cluster one, namely Hopp, W.J, Van Oyen, M.P, Tekin, E, and Gel. EG. The authors who collaborate on cluster two are Shou. B, Lien R, Irawani, S. and M.R, Krishnamurthy.V. Meanwhile, in cluster five, there is Oyen. M.P.V and Gel, E.G.S.

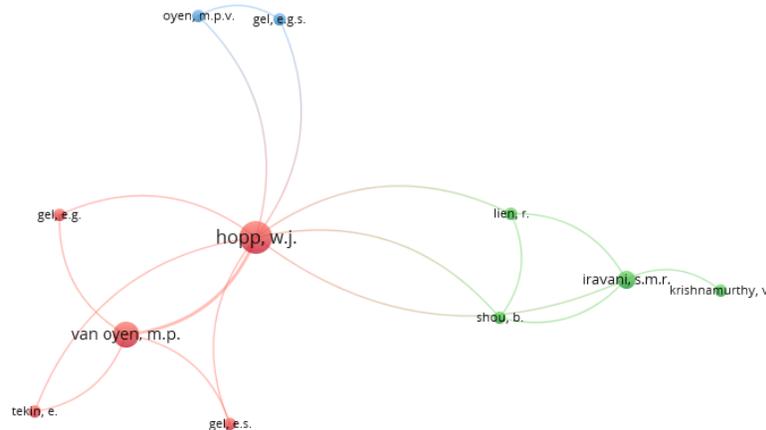


Figure 10: Author Collaboration Network Based on Workforce Agility Keywords

5 Conclusion

The analysis using the Scopus database reviews 140 documents using the keyword "workforce agility". The results conclude that the research on WA is relatively new. It was published at the beginning of 1993. However, the development of organizational and management science and unpredictable global markets and business environments has forced all people in organizational and academic fields to join the era of agility. In 2016, the research on this theme experienced a significant increase until the end of this year (21 articles). Meanwhile, the country that has conducted the most research is the United States (52 articles) as the starting point for agility. The IIE Transactions Institute Of Industrial Engineers is the publisher on this theme (7 articles) and the top affiliation is Northwestern University (7 articles). The top author is Hopp, W.J. (6 articles). In terms of funding, the sponsor with the most spending on the research is the National Science Foundation (5 articles). Since the first study about WA was published, the most cited authors are Sherehiy, B., Karwowski, and W., Layer, J.K. with their article entitled A review of enterprise agility: Concepts, frameworks, and attributes published by the International Journal of Industrial Ergonomics in 2007 (295 citations).

The Vos Viewer analysis using the keyword "workforce agility" has found five clusters. In each part, there is a research flow on the WA which shows the trend of linkages among the WA studies and other keywords. They can function as the reference for future research based on the topics developed and the existing keywords. This research implies that the keyword "workforce agility" can provide a deeper understanding related to the topic and obtain other rare keywords so that they can be the references in future research on different topics. Therefore, there will be new findings that can fill the gaps and can enrich references in this field which have so far been very little published.

This research has several limitations related to the use of limited keywords and the use of only one database (Scopus) so there are limitations in the articles collection. Future authors should use a more diverse database to obtain a larger sample and broader keywords to find a more perfect analysis.

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Authors Biography



Fajar Cahyo Utomo

Fajar Cahyo Utomo received a Bachelor of Economics and a master of management from Universitas Krisnadwipayana in 2008 and 2012, and a graduate doctoral program from the Universitas Merdeka Malang in 2019. His research interests include tools for social science analytics, human resource management, economics, management, and entrepreneurship.

E-mail: fajarcahyoutomo@unkris.ac.id

ORCID: <https://orcid.org/0000-0003-3576-9226>



Tatag Herbayu
Latukismo

Tatag Herbayu Latukismo, SE, MM. born August 30, 1976 in Blitar. Graduated from the Management Department at Krisnadwipatana University, Jakarta in 1999. Continuing post-graduate (S2) Management at the Faculty of Economics, Kridsnadwipayana University, Jakarta Graduated in 2016. Since 2019, he has been studying Doctor of Management Science at Airlangga University, Surabaya. This Muslim motorcycle adventure enthusiast has been a permanent lecturer (faculty member) at the Faculty of Economics, Krisnadwipayana University, Jakarta since 2017. His area of interest is human resource management and development.

E-mail: tatag@unkris.ac.id

ORCID: <https://orcid.org/0000-0002-5452-135X>