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Altmetrics and social network analysis of economics, econometrics and finance research: the case study of Turkey

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Increase in the use of social media has enabled academic studies to be spoken and shared on these platforms. With the widespread use of these networks, concepts such as the number of shares, as well as the number of citations have been among the conspicuous determinants on the visibility, popularity or even usefulness of research works. In this study, Mendeley reader activities and features of 1560 articles that were written by Turkish authors in the field of Economics, Econometrics and Finance between 2016-2018 in Scopus were analysed. By calculating the correlation between citations and Mendeley readership counts, it has been investigated whether Mendeley reader statistics are able to be evaluated as an alternative metric for citations. International cooperation with social network analysis was also evaluated. According to Mendeley results, the articles have a wide audience from various disciplines and different statuses. Correlation between citations and readership counts was statistically significant. When network structure is evaluated, international cooperation has become more concentrated over the years.

Keywords: Altmetrics; Social Network Analysis; Mendeley; Readership Analysis

Introduction

Measuring the quality of a scientific publication, determining academic productivity on a personal basis or whether the publication reaches target audiences is a difficult process which requires evaluating various dynamics together. Despite the number of citations among the traditional methods is a strong performance indicator which is frequently used, it is not adequate to evaluate it alone. Requiring a certain period after the publication of scientific articles to increase the number of citations is the major disadvantage of this indicator.

Bibliometrics is a set of mathematical and statistical methods used as an indicator of the legibility, awareness and quality of books, articles, and other publications in terms of both quality and quantity[1]. Bibliometric indicators are based on three basic factors; quantity, quality and structural. Academic productivity is the indicator of the quantity factor, the performance of research products is the indicator of quality factor, the connection between the publications and the research area is the indicator of structural factor[2]. With the developing and widespread use of the internet and advances in infrastructure, many metrics of academic publications and publishers are now systematically and actively recorded. Correlation analyses, network analysis and mapping can be performed with various metrics such as citation networks among scientific journals, networks created by co-authors, analysis of key words and their word pools and relation structures of words[3].

The concept of altmetric has emerged as an area frequently encountered in bibliometrics especially in recent years. Altmetrics is a potential indicator of the impact found in a tweet and introduced through a manifest[4]. In addition to offering indicators discussed in other metrics, altmetrics offer more detailed criteria together such as viewing, clicking, recording, tweeting, likes, summary reading, full text reading and sharing[5]. The two most important advantages of altmetrics are; accessibility of the information on the effect of an article and observability of how metrics can change over time[6].

Altmetrics are gathered based on four different groups; scientific activity (Mendeley, CiteULike, Google Akademik, Academia.edu, etc.), scientific interpretation (Publons, F1000, Wikipedia, Youtube, Vimeo), social activity(Facebook, Twitter, Reddit,

Google+, Pinterest, LinkedIn and delicio.us) and mass media[7]. As social platforms have a very important role in the information flow, they have made articles which are cited in the first three days of publication with the tweets predictable, and social impact factors based on tweets are recommended to complete the traditional citation metrics[8].

Like bibliometric data, altmetric data can be used not only for research and evaluation purposes, but also for network analysis and science mapping. While Krakeret al (2014)[9] contributed to visualization based on reader statistics (from Mendeley), Haunschild et al (2015)[5] created a reader network based on Mendeley readers for different subdisciplines by using a large data set.

Altmetric data reflects reader data from Mendeley for social sciences and humanities. Altmetrics include summary information of the article and blogs, information related tabs such as Twitter, Facebook, Wikipedia, Google etc., information that article can see depending on which websites and social media organizations.

Mendeley is a large database which has a free online reference manager tool launched in 2009. It is also a web-based platform that provides academics and students to record, manage and share their personal bibliographies[10]. Altmetrics have been developed as a new measurement for research impact based on data entering the web and social media platforms such as Facebook, Twitter, LinkedIn, Mendeley and CiteULike[11]. In addition, information about reader statistics such as geographic and demographic data obtained from Twitter and Mendeley are also accessible. In brief, altmetrics is e defined as an umbrella where useful information is taken from the social platform to study the academy[12].

Although the counts of readers academic publication are found following-up by social reference sites, Mendeley stands out as a platform where this process can perform for different scientific fields. Mendeley comes into prominence in its altmetric studies thanks to providing data diversity in terms of reader information. A new metric in studies investigating the relationship between altmetrics and citations from different contexts has been tested by analysing its correlation with classical indicators such as journal impact factor or the number of citations[13]. In similar studies, the correlation between the citation numbers and the altmetric scores has been analysed and it has been found that it had a positive correlation[14]. As a result of the studies, it is indicated that finding a correlation with citations is a logical starting point before implementing other types of evaluation such as interviews or questionnaires, content analysis and pragmatic evaluations[15].

Medicine is one of the popular disciplines that examine the relationship between altmetric scores and citation numbers. It was found that there was a positive correlation coefficient between altmetric scores and citation number but there was no correlation between altmetric scores and daily impact factor in the studies older than five years in which the most cited studies from journals with the highest impact factor had been examined with Pearson correlation coefficient. In recent studies, it has been found that there was a positive correlation between altmetric scores and citations and the impact factor[16,17].

Although there are relationships between certain indicators, the existence or strength of this relationship may vary from field to field. In Mendeley, there are studies in which citation analyses are made for different social sciences and humanities disciplines by considering the number of readers. Studies have shown that there are significant correlations in some of the studies conducted for this purpose.

Shrivastava and Mahajan[18] investigated the relationship between Mendeley readers and citations by selecting the 100 most cited articles in Physics between 2005 and 2010 and found a positive relationship. Mohammadi and Thelwall[10] studied the relationship between the number of Mendeley readers and quotations for different disciplines in social science and humanities and as a result they found that this relationship was higher in the field of social sciences than in humanities. As a result of their research for articles published in *Nature* and *Science* in 2007, Li et al (2012)[19], found a statistically significant correlation between the number of users and the number of WoS citations. It is seen that the relationship between the counts of readership and citation number in social science is higher than the humanities[10]. Although altmetrics are relatively low for social science and humanities disciplines, it is also notable that Mendeley reader concentration is higher in various social sciences and humanities fields than the citations per article[20]. Moreover, according to the examinations of the altmetric indicators in the fields of psychology, history, and literature in the social sciences, it is seen that the

discipline, which is the most effective, potentially useful, and highly applicable is psychology but this impact decreases in the fields of literature and history[21].

There is no known study that systematically examines articles written by Turkish researchers and hence the present study.

Objectives of the study

- To examine the relationship between citations and Mendeley readership counts;
- To determine common reader types (e.g., professors, doctorate students, undergraduate students, non-academic users) by analysing Mendeley profiles;
- To analyse the distribution of Mendeley readers by country to understand the access and visibility of articles written by Turkish authors;
- To reveal the relationship structure between the number of Mendeley readers and citations; and
- To examine collaboration between countries with the help of social network analysis of articles taken from Scopus.

Methodology

The data set of the study consists of articles written by Turkish authors and indexed in Scopus for the years 2016,2017 and 2018. Book reviews and symposium papers are excluded from the scope of the study. The language of the studies in the data set is limited to English. The reason why the articles after 2018 are not included is that studies usually reach highest number of citations two, three or four years after they are published[22]. In determining the fields, the Social Sciences field in Scopus has been chosen and the economics, econometrics and finance disciplines in this field have been chosen to make a detailed analysis. Articles written by Turkish authors were found for each year according to these determined searching criteria and bibliographic information including citation numbers were recorded. Using the Mendeley application, Mendeley readership counts selected for each Scopus article were taken automatically by Webometric Analyst[23]. Since there may be more than one copy of an article in Mendeley, duplicate registrations were identified using Scopus IDs. It was determined that in total, 1560 articles were copied 197 times. It is also possible to see the number of articles without reader statistics by years in Table 1.

Table1 — Coverage of Scopus articles in Mendeley

Year	Articles indexed by Scopus	Duplicate Scopus records in Mendeley	Articles without readership statistics in Mendeley
2016	520	66	17% (89)
2017	554	89	20% (113)
2018	486	42	22% (110)

There were 312 studies without reader statistics in Mendeley. The year in which this ratio was the highest was 2018 with a rate of 22%. It can be said that the publication date being closer compared to other years may have effect on this ratio to be found this high.

Results

Readers' categories and occupations

With the user profile created in Mendeley, besides the information about the academic or professional status of the individuals, it is possible to obtain information about the details of the discipline, position, and country they are from. The availability of various statistics about the readers in Mendeley enables a rich database to be created and analysed.

Figure 1 shows the Mendeley readership categories of articles written by Turkish authors in the fields of economics, econometrics, and finance, collected under 13 headings. Figure 1 shows that PhD students are the main Mendeley readers of articles for all three years. After PhD students, it is graduate and undergraduate students. These students constitute 77% of the Mendeley readers.

The reader categories in Mendeley are saved based on their own statements. Therefore, some people who sign in as professors may not actually be professors[24]. The correlation coefficient between the number of Mendeley readers and citations for all articles with at least one reader in Mendeley was calculated for three years and are given in Table 2.

The Spearman correlation coefficient calculated between the number of Mendeley readers and citations for 2016, 2017 and 2018 was statistically significant (Table 2). The year in which the relationship is highest is 2017.

Analysis of readers by country

In addition to analysing the professions of the readers in the information taken from Mendeley, information about the countries of the readers can also be accessed. The distribution of readers studying the works of Turkish authors in Mendeley by country is shown in Table 3.

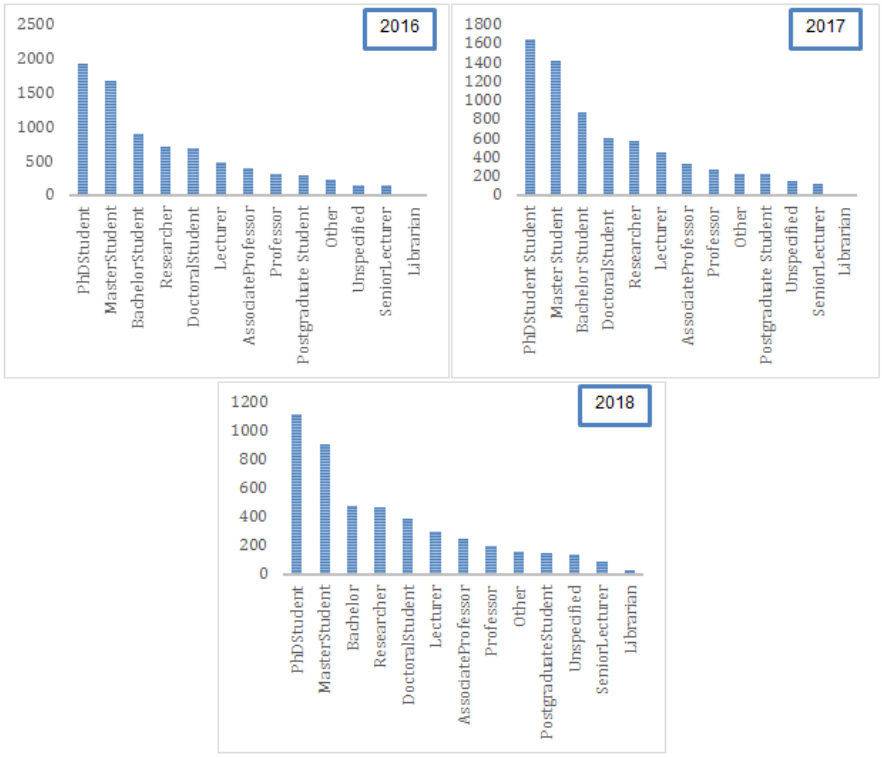

Fig. 1 — The categories of Mendeley readership between 2016-2018

Table 2 — Spearman correlations between Scopus citations and Mendeley readership counts

Year	Spearman correlation Mendeley and citation
2016	0.521*
2017	0.664*
2018	0.255*

** Significant at p=0,01*

Table 3 — Mendeley readers by country

2016	2017	2018
United Kingdom	United States	United Kingdom
United States	United Kingdom	Mexico
Turkey	Switzerland	United States
Germany	Turkey	South Korea
Malaysia	Japan	Portugal
Japan	Malaysia	Spain
Spain	Poland	Turkey
Brazil	Canada	Malaysia
Colombia	India	Switzerland
Iran	Colombia	Colombia

Table 3 shows that United Kingdom and United States are among the top three countries with the most Mendeley readers. While Turkish readers were in the third place in 2016, they have ranked lower on the list in later periods. Not only the ranking of the countries but at the same time different country readers are included on the list. Canada and Switzerland have been included on the list in 2017 whereas South Korea and Portugal have been included on the list in 2018. It is not always possible to obtain exact numbers of reader data from a particular country in Mendeley. The reason for that may be Mendeley does not update their information nor give the name of the countries[25].

Readers' discipline data

It is possible to access information about the disciplines - field of studies - of readers in Mendeley data. In Figures 2-4, the distribution of readers according to their fields of study is presented for each year. It is seen that there are readers from 14 different disciplines in Mendeley for the period has been examined in the study.

While "Economics, Econometrics and Finance" has the highest rate in terms of the disciplines of the readers in all three periods, it is followed by "Business Management and Accounting" and "Social Sciences". The presence of other disciplines apart from these disciplines reveals that articles in economics, econometrics and finance are read not

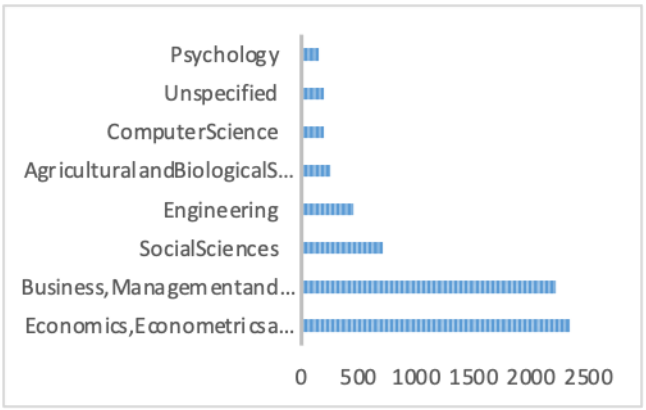

Fig. 2 — Readers' study fields (2016)

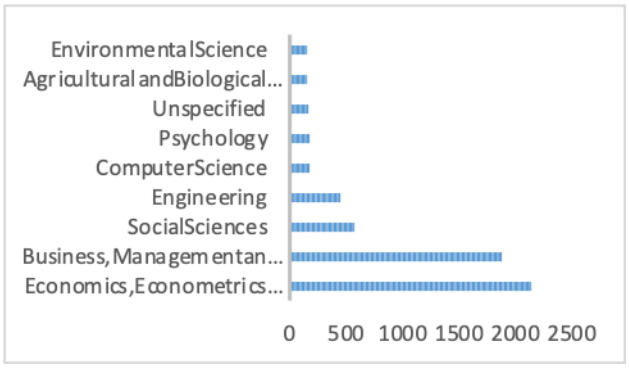

Fig. 3 — Readers' study fields (2017)

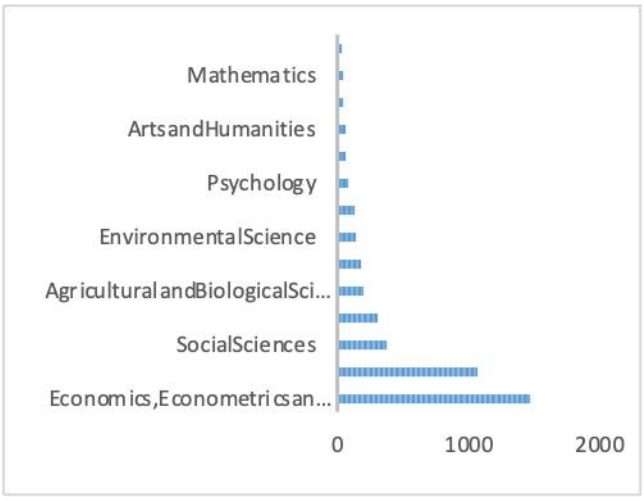

Fig. 4 — Readers' study fields (2018)

only by those studying in these disciplines, but also by readers from different disciplines.

Other altmetrics

With the widespread use of altmetrics, it has been investigated in many studies that to what extent altmetrics help with impact assessments. Xia et al[26], in a study on bibliographic analysis of *Nature* articles based on altmetrics, found that these articles had more and faster growing effect on Twitter than Facebook and tweets and citations were related. Hassan et al[27] determined that blogs are the most important sources, and they are followed by Twitter in a study conducted to measure social media activities of 15 disciplines indexed in Scopus using "Altmetric.com" data. They also showed that altmetric indices may be a great indicator to distinguish highly cited publications.

Apart from the studies in the literature, not only Mendeley readers but also the social media parts of the studies have been examined. When the citation in articles in social media platforms such as Twitter, Facebook, Google+ are examined, Twitter (87%) ranked first in the citations for the periods given, followed by Facebook (4%) and Wikipedia (2%).

Network structure of international cooperation with Turkish authors

Social network has been utilized to determine and visualize the authors which Turkish writers mostly cooperate with. Co-authoring network diagrams were drawn with VOSviewer.

Figures5-7 show that the cooperation between the countries, which is not very frequent in 2016, has increased over the years. The looser network structure in 2016 has been replaced by a tighter network structure with the addition of different countries to the network in 2018. The countries with the most cooperation in all three years are United States, United Kingdom and France. A wider network structure has been created with the cooperation of South Africa and Canada in 2017 and Malaysia and the Netherlands in 2018.

Network structure among the keywords

Figure 8 shows that along with the decrease in the number of articles scanned in Scopus by years, there is also a decrease in the number of determined keywords and in 2018, there is more concentration of certain keywords and topics than the variety of keywords. It is seen the terms economic growth, convergence, capital flows, financial stability, monetary policy, emerging markets were more used in 2016; economic growth, capital flows, commodity markets, emotions and behaviour, uncertainty, volatility, entrepreneurship, institutions, house prices were more used in 2017; economic growth, Islamic banks, bitcoin, structural break, risk aversion,

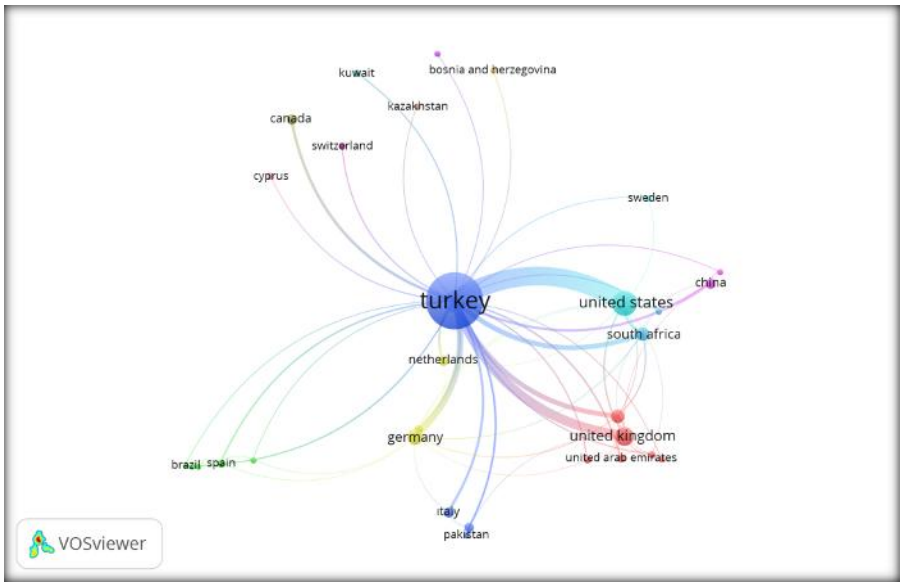

Fig. 5 — Network structure of authors' countries which publish articles with Turkish authors (2016)

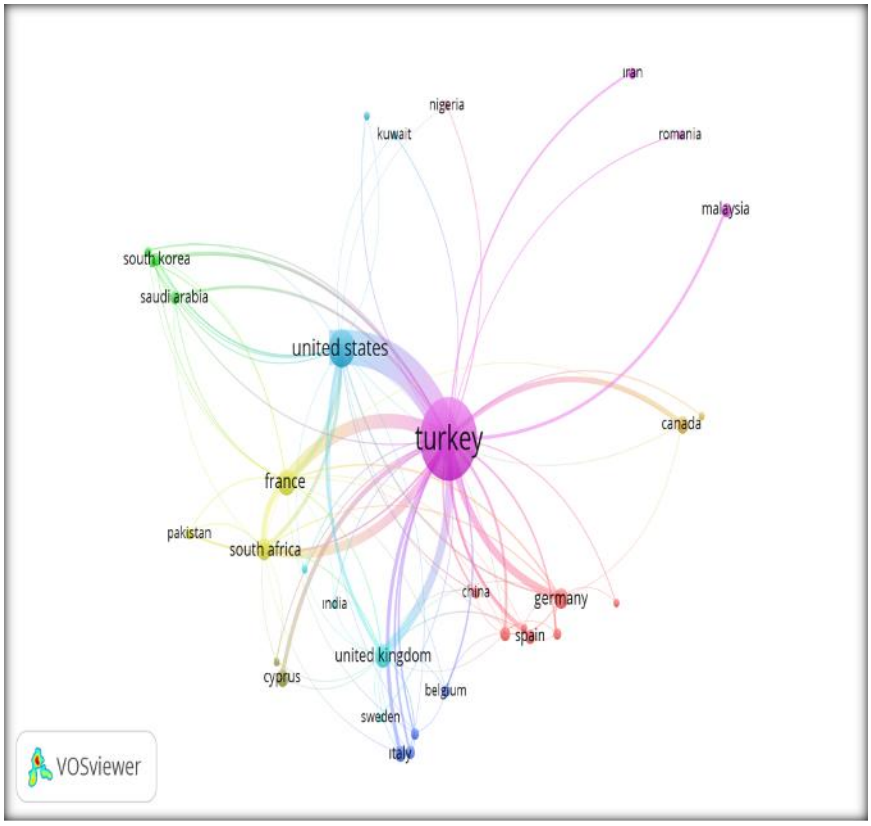

Fig. 6 — Network structure of authors' countries which publish articles with Turkish authors (2017)

portfolio optimization, privatization, asset pricing and civil society were more used in 2018.

When examining the methods used in the analysis of the data by years; it is seen that in 2016, panel data, causality, fuzzy sets, ordered probit; VECM in 2017; ARDL, fuzzy AHP, panel data, VIKOR methods in 2018 were prevalent. This shows that there has been an increase in the variety and number of keywords in recent studies.

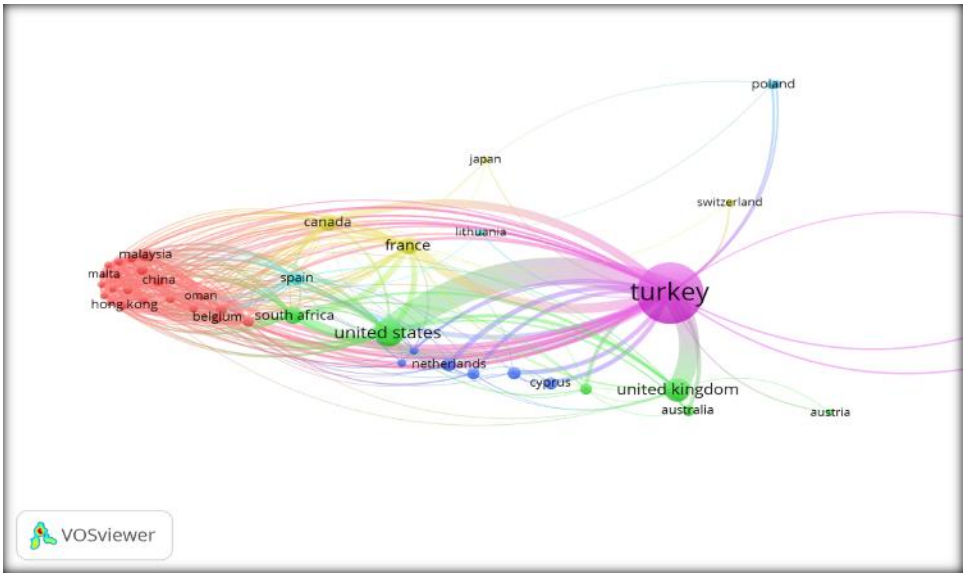

Fig. 7 — Network structure of authors' countries which publish articles with Turkish authors (2018)

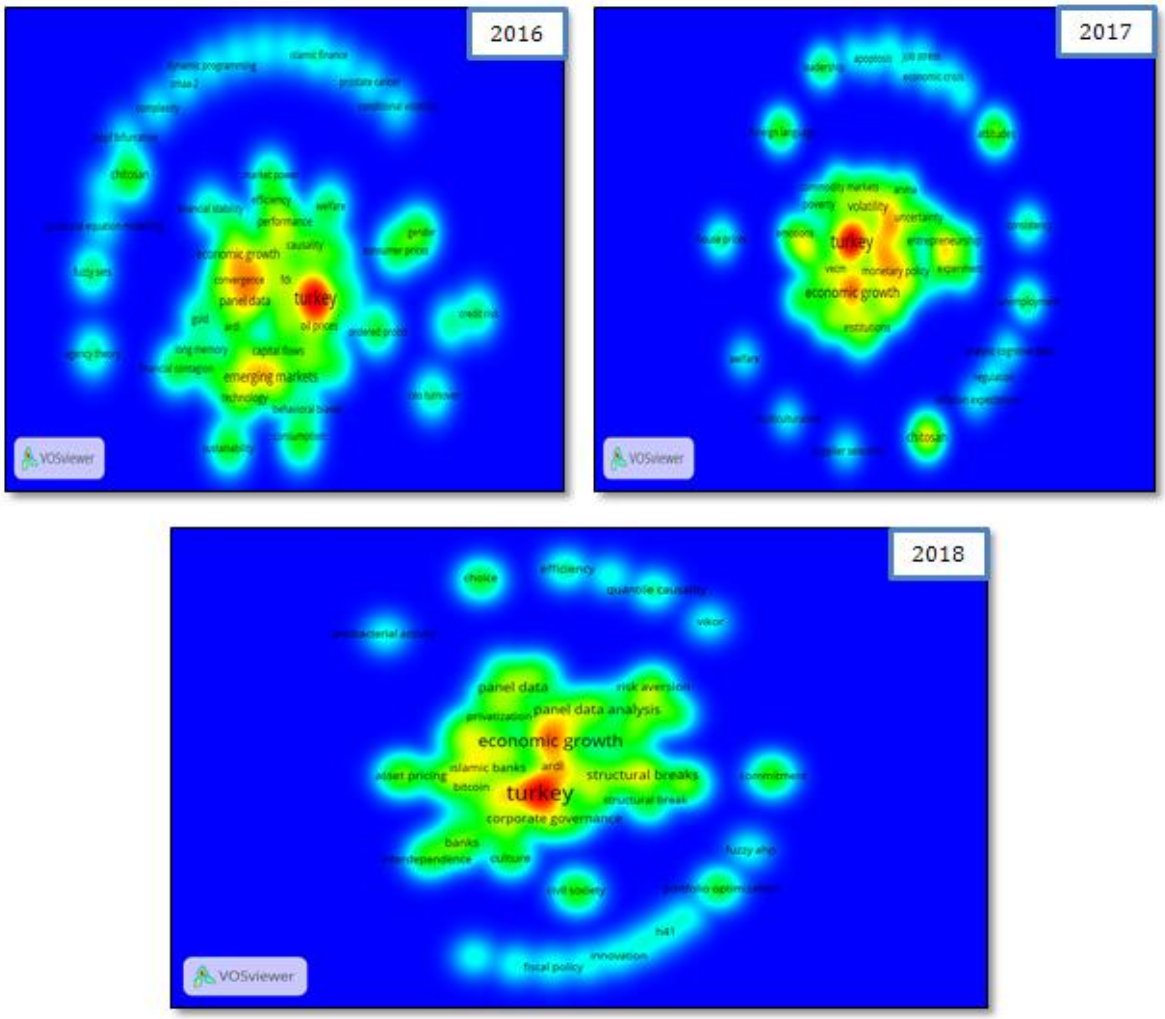

Fig. 8 — The network structure among the keywords by years

Conclusions

Mendeley is a platform where a lot of information such as user profiles, academic and professional status as well as country information are created in accordance with the declaration of a person. Although there are studies in the literature using data from Mendeley or other platforms, there is no article that studies the Mendeley readers of studies by Turkish authors in Economics, Econometrics and Finance. In addition to bibliometric studies conducted frequently, the originality of this study is that a detailed examination has been made by using the disciplines selected with altmetric concepts.

As a result of the research, as in many previous studies, it has been determined that Mendeley reader statistics are important and there is a positive correlation between the number of citations used to measure the impact of scientific research and the number of readers. Obtaining statistics on types of various readers in Mendeley enabled the determination of who read the works of Turkish authors.

It is concluded that the articles written by Turkish authors have a huge variety of worldwide readers who have different social status and different disciplines. Availability of information about the disciplines of the readers is an important resource for determining the characteristics of the readership and revealing the interdisciplinary interaction. When the reader profiles are analysed, it has also been determined that user countries are different. Also, similarity between the countries of the authors whom Turkish authors cooperate with and the countries of Mendeley readers shows the importance of co-authoring. This can be examined in more detail in future studies.

References

1 Pritchard A, Statistical bibliography or bibliometrics? *Journal of Documentation*, 25(4) (1969) 348-349.

2 Durieux V and Gevenois P A, Bibliometric indicators: quality measurements of scientific publication, *Radiology*, 255(2) (2010) 342-351.

3 Van Eck JN and Waltman L, Visualizing bibliometric networks, Ding Y, Rousseau R, Wolfram D (Eds.) Measuring scholarly impact. (Springer International Publishing; Switzerland) 2014, p.285–320.

4 Priem J, Taraborelli D, Groth P and Neylon C, Altmetrics: a manifesto. Available athttp://altmetrics.org/manifesto/ (Accessed on 12 February 2020).

5 Haunschild R, Bornmann L and Leydesdorff L, Networks of reader and country status: an analysis of Mendeley reader statistics, *PeerJ Computer Science*, 1 (1) (2015) e32.

6 Elmore S A, The altmetric attention score: what does it mean and why should I care? *Toxicologic Pathology*, 46(3) (2018) 252-255

7 Colledge L, Snowball Metrics Recipe Book, 3rdedn (Elsevier, Snowball Metrics Program Partners; Amsterdam), 2017, p. 133-137

8 Eysenbach G, Can tweets predict citations? Metrics of social impact based on Twitter and correlation with traditional metrics of scientific impact, *Journal of Medical Internet Research*,13 (4) (2011) https://doi.org/10.2196/jmir.2012

9 Kraker P, Weißensteiner P and Brusilovsky P (2014), Altmetrics-based visualizations depicting the evolution of a knowledge domain, *In Proceedings of the paper presented at the 19th International Conference on Science and Technology Indicators (STI 2014)*, Leiden, 3-5 September 2014, pp. 330–333.

10 Mohammadi E and Thelwall M, Mendeley readership altmetrics for the social sciences and humanities: Research evaluation and knowledge flows, *Journal of the Association for Information Science and Technology*, 65 (8) (2014) 1627-1638.

11 Pradhan P, Analysis of Mendeley readership activities of Indian information and library science literature indexed in Web of Science, *In Proceedings of the paper presented at the International Conference* KIIT University *on Marching Beyond the Libraries: The Role of social media and Networking*, Bhubaneswar Odisha, India, 16-17 November 2016,

12 Repiso R, Castillo-Esparcia A and Torres-Salinas D, Altmetrics, alternative indicators for Web of Science Communication studies journals, *Scientometrics*, 119 (2) (2019) 941-958.

13 Htoo T H H and Na J C, Disciplinary differences in altmetrics for social sciences, *Online Information Review*, 41(2) (2017) 235-251.

14 Bornmann L, Alternative metrics in scientometrics: A meta-analysis of research into three altmetrics, *Scientometrics*, 103 (3) (2015) 1123-1144.

15 Sud P and Thelwall M, Evaluating altmetrics, *Scientometrics*, 98 (2) (2014)1131-1143.

16 Nocera A P, Boyd C J, Boudreau H, Hakim O and Rais-Bahrami S, Examining the correlation between Altmetric score and citations in the urology literature, *Urology*, 134(2019) 45-50.

17 Chang J, Desai N and Gosain A, Correlation between altmetric score and citations in paediatric surgery core journals, *Journal of Surgical Research*, 243 (2019) 52-58.

18 Shrivastava R and Mahajan P, Relationship between citation counts and Mendeley readership metrics: A case of top 100 cited papers in Physics, *New Library World*, 117 (3/4) (2016) 229–238.

19 Li X, Thelwall M and Giustini D, Validating online reference managers for scholarly impact measurement, *Scientometrics*, 91 (2) (2012) 461-471.

20 Zahedi Z, Costas R and Wouters P, How well developed are altmetrics? A cross-disciplinary analysis of the presence of 'alternative metrics' in scientific publications, *Scientometrics*, 101 (2) (2014) 1491-1513.

21 Htoo T H HH and Na J C (2015), Comparison of altmetrics across multiple disciplines; Psychology, History and Linguistics, *In Proceedings of the paper presented at the 4th International Conference of Asian Special Libraries (ICoASL 2015)*, Seoul, Korea, 22-24 April 2015.

22 Web of Science, Web of Science core collection help, WoS (2018), Available at: https://images.webofknowledge.com/WOKRS533JR18/help/WOS/hs_citation_applications.html (Accessed on09 April 2020).
23 Statistical Cybermetrics. Webometric analyst. Available at http://lexiurl.wlv.ac.uk/(Accessed on 24 January 2020).
24 Mohammadi E, Thelwall M, Haustein S and Larivière V, Who reads research articles? An altmetrics analysis of Mendeley user categories, *Journal of the Association for Information Science and Technology*, 66(9) (2015) 1832-1846.
25 Eldakar M A M, Who reads international Egyptian academic articles? An altmetrics analysis of Mendeley readership categories, *Scientometrics*, 121(1) (2019) 105-135.
26 Xia F, Su X, Wang W, Zhang C, Ning Z and Lee I, Bibliographic analysis of nature based on Twitter and Facebook altmetrics data, *PloS One*, 11 (12) (2016)
27 Hassan S U, Imran M, Gillani U, Aljohani N R, Bowman T D and Didegah F, Measuring social media activity of scientific literature: An exhaustive comparison of Scopus and novel altmetrics big data, *Scientometrics*, 113(2) (2017)1037-1057.