Bibliometric Analysis: Main procedure and guidelines

Reza Marvi, Aston Business School, r.marvi@aston.ac.uk

Mohammad Mehdi Foroudi, Foroudi Consultancy, mohammad@foroudi.com

Introduction:

Bibliometric analysis is a quantitative approach for conducting a literature review. This methodology shows the state of the art of the literature by using quantitative methods for exploring topics in the literature as a starting point for understanding the literature in depth and in more detail.

Key point: literature review, bibliometrics, multidimensional scaling, hierarchical clustering analysis, VOS viewer

Background

With this background, bibliometric analysis can be used by students and scholars for advancing a research field in a novel and meaningful manner. In more detail, it can help researchers to: (1) gain a general overview of the research field, (2) highlight the most important research gaps and future research questions that need particular attention, (3) propose novel and interesting ideas for future research, and (4) highlight their intended contribution to the research field.

Bibliometric assessments of the most cited works in any literature offer a future research agenda (Kuhn, 1996; Yadav, 2010). Different researchers have used bibliometric analysis (e.g., Randhawa et al., 2016; Stead et al., 2022; Subramony et al., 2021; Wilden et al., 2017). The bibliometric analysis method allows researchers to conduct an analysis of the most highly cited and important topics in any domain with a higher level of quantitative sophistication. Doing quantitative analysis means researchers obtain a specific and better understanding of the links between intellectual topics. Like other research domains, knowledge enhancement happens over time (Kuhn, 1996). Thus, the main objective of the bibliometric analysis is to provide a comprehensive analysis of any research topic.

Bibliometric analysis helps to overcome a number of limitations associated with traditional literature review. All types of literature review can help to advance the research topic. To this end, meta-analysis and review studies integrate, synthesize and offer summaries of a research topic. However, by their nature, such works treat all scholarly contributions as equal and the same. Despite this, the impact of different published works on any research domain can be very different. Researchers have used a number of different metrics for assessing the contribution by any given publication (e.g., survey of opinion leaders). But the most direct and objective assessment of any article contribution to a research field is the number of citations accumulated in the course of time. As such, articles that received higher citations

have a higher impact on the field (Samiee and Chabowski, 2021). Unlike common literature review, bibliometric studies tend to deal with a huge amount of data in an objective manner. Despite this, the interpretation of the results is often dependent on both subjective analysis, such as thematic, and objective evaluation through informed procedures and techniques. In other words, bibliometric studies are useful for showing deciphering and mapping of the scientific knowledge and evolutionary nuances of well-established articles by interpreting a large volume of unstructured data in a rigorous and quantitative manner.

Despite its great impact on any research domain, not many researchers have implemented bibliometric analysis and therefore there is still room for using the methodological potential. It is notable that authoritative and step-by-step guides in the business and marketing literature to guide bibliometric analysis still remain absent and therefore this poses a significant challenge for various business scholars who are willing to learn and implement bibliometric analysis. In the next section, the researcher provides step-by-step guidelines for conducting bibliometric analysis.

Research Approach

To find an integrative view of a research topic and understand how a research topic emerged, developed, and matured as a research domain, this research followed several steps: (1) identifying the focal data, (2) conducting analysis of the focal data, and (3) forming an integrated view of a research topic.

Identifying the focal articles

Adhering to the established co-citation protocol (Samiee and Chabowski, 2012; Chabowski et al., 2010; 2013; 2018), the identification of articles was initiated with a search for keywords. Often, researchers contact various scholars in the field to identify the most related keywordsAccordingly, researchers come with a pool of keywords that can be used to identify articles most closely related to the domain. For instance, in the case of customer experience, researchers can shortlist keywords like customer experience (along with its dimensions), consumer experience, service experience, brand experience, and retailing experience. Or, as in the work of Wilden et al. (2017), researchers have used key words such as resource integration, co-creation, or service ecosystem.

Accordingly, the keywords were searched for in the Web of Science (WOS) database, which yielded a number of scholarly works related to the research domain. Previous researchers (e.g., Akarsu et al., 2021; Foroudi et al., 2021; Samiee and Chabowski, 2021) used WOS as their main database for searching the keywords. WOS is considered to be one of the most comprehensive and complete databases, covering most of the electronically published and available articles (about 10,000 journals). WOS database offers access to features like citations, or cited references (Leydesdorff et al., 2013). Furthermore, among other available databases, previous researchers (e.g., Balstad and Berg, 2019; Foroudi et al., 2021) revealed that WOS provides comparable and comprehensive data in the business and management domain in comparison to Google Scholar and Scopus. Importantly, Google Scholar cannot

provide the necessary and correct form of data necessary for conducting bibliometric analysis. Therefore, following previous researchers (e.g., Chabowski et al., 2018; Chabowski et al., 2013) it is recommended to use WOS for data collection.

Following suggestions by previous scholars (McCain, 1990; Ramos-Rodríguez and Ruíz-Navarro, 2004; Schildt et al., 2006), articles will be based on a keyword being found in one of the four fields in the WOS database: author keywords, abstract, title, and reference-based article identifiers. It is important to note that in some cases, to increase the validity and accuracy of the results, researchers limit their database to top tier journals (journals rated as 3, 4 and 4*). Following previous studies (e.g., Mabey, 2013; Leonidou et al., 2020), the choice of these journals is based on the Association of Business Schools' Academic Journal Quality Guide (ABS, 2018) list of management, marketing, and international business journals. The rationale for limiting the analysis to focus on 3, 4 and 4* journals is based on two factors. First, the articles in these journals would raise the quality level of the focal articles to the highest level, which could aid in identifying articles that had undergone a rigorous and appropriate process. Secondly, choosing articles from these journals is a common method among researchers (e.g., Baldacchino et al., 2015; Chabowski et al., 2011; Leonidou et al., 2020), which helps researchers to capture the most reliable scholarly works and research trends in a research domain. The choice of limiting the database to top tier journals in journal rankings is often left to researchers. Following this step, the initial sample of potentially related academic articles in the business and management domain will be formed. In this step, researchers limit their studies to article categories in WOS, and non-academic scholarly works that had not undergone a peer-review process, such as book chapters and editorial notes, should be excluded. Furthermore, any articles that are not related, or are duplicated, should remove from the focal data.

At the beginning researchers need to log into the WOS by logging into http://www.webofknowledge.com/.

As such, in the Topic section, search for the identified keywords that you found in the previous section, for instance, customer engagement, brand engagement behaviour, consumer engagement, affective engagement, behavioural engagement, social engagement, cognitive customer engagement.

In this stage, researchers need to go through the paper and choose the most relevant publications to their study. Researchers need to know that a number of times a researcher had mentioned a word in the abstract without any reference to the main topic in the article. Therefore, in this stage, researchers are highly recommended to read and review each article thoroughly.

After choosing the most appropriate article for the research in WOS, researchers need to save the papers and form their focal data by choosing export, plain text. Researchers then should choose "full record and cited references" in the record content. It is vital to note that WOS does not allow more than 1,000 articles per each save to be extracted. Therefore, for the database more than 1,000 researchers need to divide their data into groups of 1,000 and accordingly extract their data. For instance, if a data is 1,573 articles, researchers first need

to extract the data from 0-1000 and then extract 1001-1573. Afterwards, researchers have to combine these outputs into a single file. After choosing the articles, researchers need to click on “save the file”. By doing the previous steps, researchers should now have the necessary focal data for conducting their analysis.

Network Analysis Using VOSviewer

Network analysis, also known as network visualisation, is a method which allows researchers to show the link and nodes between articles. This method has received less attention in comparison to other network analysis techniques. However, in recent years, researchers have started using software such as VOSviewers (Agapito, 2020; Subramony et al., 2021) or Gaphi (e.g., Baker et al., 2020; Donthu et al., 2020; Loureiro et al., 2021). This software presents a graphic-based user interface which enables data to be analysed using a more graphic and visual approach (Hook., 2017). Recent researchers (e.g., Subramony et al., 2021; Van Eck et al., 2010; Van Eck and Waltman, 2017) have started using VOSviewer as visualisation bibliometric software. An important aspect of VOSviewer is its ability to handle and analyse a large amount of data (Subramony et al., 2021). Unlike other bibliometric methods (e.g., MDS, EFA, or HCA) which use SPSS, VOSviewer pays great attention to graphical representation of the findings. Accordingly, VOSviewer provides functions for zooming, scrolling, and searching through the results, which can be useful for examining larger data sets and make it easier to interpret the findings. Despite these advantages, VOSviewer is limited to finding a number of clusters and community algorithms which can be employed within the software (Zupic and Čater, 2015). In addition, the flexibility of the identified network is considered to be another main drawback of the software.

Bibliometric analysis using VOSviewer

As discussed earlier, VOSviewer is becoming one of the most common ways for conducting bibliometric analysis among researchers. Furthermore, it is also regarded as one of the easiest methods for identifying clusters. VOSviewer is free software which can be downloaded from http://www.vosviewer.com/download.

After downloading the most appropriate version of VOSviewer, researchers need to open the software.

On the left side, click on “create” to start creating the clusters in a research domain. At the next stage, please click on “create a map based on bibliographic data”.

Then, you need to upload the file that you had previously downloaded from WOS. Please upload the necessary file into the software and click “next”.

Next, in “type of analysis” choose “co-citation”, in “counting method” choose “full counting”, and in “unit of analysis” choose “cited references” and then click on next.

At the next stage, you can choose the minimum number of citations of a cited reference to be included in your analysis. Below the threshold, you should be able to see how many cited references match with your threshold. Often researchers choose 10 citations, but this

number can vary depending on the nature of your work and research domain. Then click on next.

At the next stage, you need to verify and select your cited references. Here it is very important for researchers to remove any methodological articles as they will cause bias in researchers' findings. In this table, researchers should be able to see the number of citations of each reference in a database and how many times one particular article is cited with another article in their focal data (total link strength).

Then, by choosing the most appropriate articles, you should be able to see your clusters. Each cluster should be in a different colour. Furthermore, on the left side of the software, you should be able to see which article is related to each particular cluster. In the visualisation section, you can change the resolution parameters. The default parameter for resolution value is 1.00. This parameter can help researchers to determine the level of their clusters generated by VOS clustering techniques. Applying a higher value of the parameter can result in largening the number of clusters produced by VOS clustering method. It is often recommended to try various values for resolution parameters and accordingly choose the most suitable value that can help researchers to yield the most appropriate level of details for a particular research domain. Researchers then need to go through the articles in each cluster identified by VOS clustering technique to understand any given research domain.

Multidimensional Scaling

MDS is the next common quantitative bibliometric approach that researchers use to determine the interrelationship of the research domain in addition to checking the robustness of the relational data by testing the probability of the model (Burt, 1993). MDS can be employed to analyse the similarity metrics. It produces a configuration in a two-dimensional space by optimising the distance between each item. MDS aims to generate a two-dimensional configuration map from 'approximate matric' to analyse the knowledge structure of a particular research topic. Furthermore, it creates a configuration map for analysing and studying the underlying structure of a given research domain. As such, it helps researchers to generate and investigate the intellectual structure of any given research domain. In more detail, intellectual structure shows particular scientific research traditions, patterns of interrelationship between highly cited articles, disciplinary compositions, and influential research topics (Shafique, 2013). MDS is often favoured by previous researchers (Chabowski et al., 2011; 2013; 2018; Di Guardo and Harrigan, 2012; Marcussen, 2014; Foroudi et al., 2022; Pilkington and Meredith, 2009; Samiee and Chabowski, 2021; Vogel and Guttel, 2013) as it can help researchers to find the intellectual structure of a given domain and its interrelationship. As such, this information can provide meaningful findings and provide a great deal of analysis, based upon which researchers can establish a theoretical foundation in a specific research domain (Chabowski and Mena, 2017). Furthermore, MDS can help researchers to determine the statistical proficiency of a model through identifying stress value (Chabowski et al., 2013; 2018). Stress value can act as a goodness of fit in MDS technique and values below 0.25 are considered to show great fit. Researchers (e.g.,

Chabowski and Samiee, 2020; Samiee and Chabowski, 2021) employ stress value known as goodness of fit below the most common threshold of 0.10.

Despite this, MDS is also mainly used for smaller datasets (Wilden et al., 2017) and cannot generate any graphical configurations compared to VOSviewer. The items are also not clearly assigned to any particular groups and the linkages between items are not explicitly shown (Zupic and Čater, 2015). Therefore, the decision to choose different groups based on distance of items is left to the researcher (Arora, and Chakraborty, 2021). Researchers often use distance between 0.25 (Chabowski and Samiee, 2022; Foroudi et al., 2022) to 0.30 (Samiee and Chabowski, 2021). Researchers carry out MDS to find a map of objects for the representation of the proximities of items, their similarities, and their relationship in the multidimensional configuration (Zupic and Carter, 2015). As such, MDS allows researchers to visualise the network of previously published articles by investigating dis/similarities or distance between them in a particular research context (Yang, 2014).

To start, please download the BibExcel software. BibExcel is designed to help researchers to analysis bibliographic data. BibExcel can be downloaded free from the https://homepage.univie.ac.at/juan.gorraiz/bibexcel/.

After downloading the data as explained earlier in the previous stage, you need to add files into BibExcel by double-clicking on "select file here" and then find your WOS extracted data. Make sure that you only choose the text format file.

Select a 'text-file' and then run Edit doc-file/replace line feed. This should result in creating a file called "txt2-file".

After choosing the "txt2-file", click on Misc and choose Convert to "Dialog-format/Convert" from Web of Science. This should result in creating the file which BibExcel can analyse.

The next step will help researchers to find their cited documents. Next to prep option, please choose "Any; separated field". Then in the left bottom, in old tag section, please write "CD".

Now you should have a file called OUT. To edit this file, click on "***Edit out-File/select Remove DOI***", then to keep only author initials please click on **"*Edit out-File/ Keep only author first initial*"**, and then click on **"*Edit out-File/convert upper lower case/ good for cited reference*".**

Now researchers should be able to conduct citation analysis and extract the most highly cited articles in a research domain. By choosing whole string as frequency distribution and choosing sort descending, you should be able to see the list of highly cited articles in a research domain.

Researchers on the left side can see the number of citations. Researchers then need to decide their citation threshold for conducting the bibliometric analysis. For instance, if it is 10, you should copy all the articles with a threshold of 10 is and more. Copy these articles (you can do so by clicking on ctrl+c) and then paste the list in an Excel sheet. In the Excel file, go through the articles and remove those which are methodological. It is quite common for researchers to choose between 25–30 articles as more than that can become too complicated to analyse.

In BibExcel, click on “clear” to clear your list of tables. Copy and paste your list of articles that you had edited instead.

Then click on “***Analysis/co-occurance/Make pair with listbox”.*** For the first question, choose no, and for the next question click on ok. You should have now a file called “filename.coc”.

Now by selecting filename.coc and then clicking on “***Analyze/Make matrix for MDC etc”,*** you should be able to see the co-citation matrix.

At the next stage, by obtaining the co-citation matrix, researchers can create their MDS configuration.

First, open your MDS matrix from BibExcel in Excel. It is recommended to code the authors as it will be much easier for further analysis. Open SPSS and open your matrix in the SPSS “***Analyse/scale/multidimensional scaling”*** *(Proxscal)* (don’t forget to choose distance box in the output).

Click on OK and look for the configuration map. The configuration map can be edited, and it is advised that researchers clean the picture as they wish. To draw the groups, researchers need to look at the distance table and accordingly draw a line between articles for which the distance is less that their chosen distance threshold (explained in previous section). For drawing the groups, researchers can use tools like PowerPoint. Each article in the group should then be read and analysed. Accordingly, researchers can identify the knowledge blocks of a research domain.

Hierarchical Cluster Analysis

Like MDS Analysis, Hierarchical Cluster Analysis (HCA) is also regarded as one of the most common bibliometric approaches for identifying clusters in a research domain (e.g., Hepsen and Vatansever 2012). HCA permits researchers to find the research cluster as it is mainly focused on the similarities between set of studies in a research domain. Researchers employ HCA Analysis to provide additional insight into MDS and compare their findings with MDS. As such, the results of HCA Analysis offer researchers a basis to understand the “predecessor and successor research clusters” (Chabowski et al., 2011, p. 272). To employ HCA, previous researchers (e.g., Foroudi et al., 2021; Samiee and Chabowski, 2012; Zha et al., 2021) suggest that Ward’s method is the most appropriate technique for producing clusters (Zupic and Carter, 2015). Like MDS technique, researchers should choose where to cut the dendrogram, since this technique does not offer any accepted rules for choosing the best set of clusters. Unlike MDS, which is limited to a small set of data, previous researchers (e.g., Arora, and Chakraborty, 2021; Samiee and Chabowski, 2012) suggested that HCA can be efficient and practical for a larger set of data.

With this discussion on the different techniques and methods used in the bibliometrics, in the next stage, researchers explain the associated steps for aforementioned techniques in more detail.

HCA Analysis

Open SPSS and open your matrix in the SPSS "***Analyse/classify/Hierarchical cluster analysis***". It is important to note that researchers need to click on the dendogram box in the plot. Furthermore, in the method section, please choose **Wards** method as it is regarded as the most common method used for clustering.

The output of this analysis would be the dendrogram figure. Based on the researchers' distance threshold, researchers can identify their cluster. Similar to MDS analysis, for drawing the clusters, researchers can use tools such as PowerPoint.

Case Study: Customer Engagement

To gain a deeper understanding of the customer engagement literature, researchers decided to employ bibliometric analysis to understand the literature in more depth. A vital purpose is to distinguish the customer engagement terms currently in use and develop a method which allows the researcher to identify the publications related to customer engagement.

We searched the WOS database using the words 'customer engagement'. The search found 286 articles and 4779 citations for the period ending in 2022. The WOS database searched for the following information about each article: (1) title, (2) keywords, (3) abstract, and (4) article-specific reference identifier. The researcher removed all book reviews, editorial notes, and other irrelevant text from the data since this research primarily concerns published articles related to customer engagement. We found customer engagement data by using general keywords across all journals (Schildt et al., 2006). To identify the most cited documents and journals, 286 articles were exported from WOS and transferred into BibExcel software.

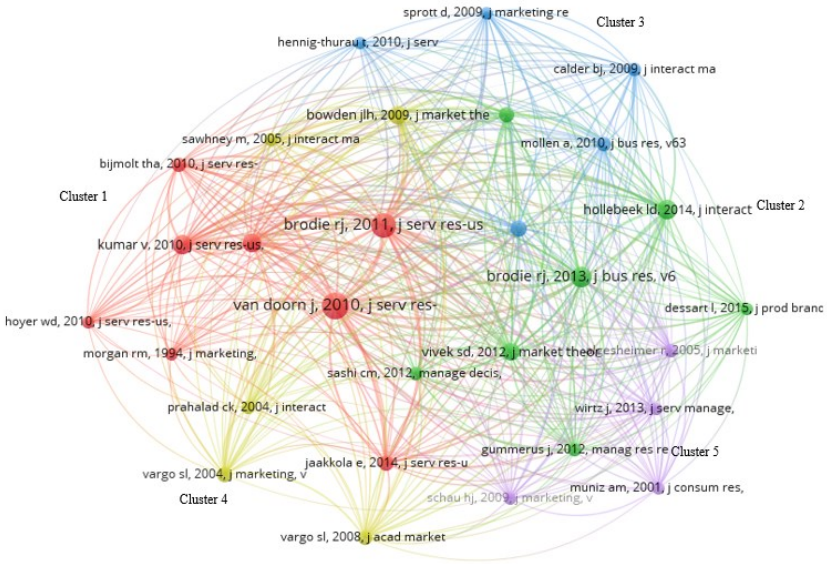
1. Network Analysis using VOS

A network analysis was performed using the mapping software VOS in order to gain a better understanding of the most highly cited works. The result of the VOS analysis can be seen in Figure 1. The cluster analysis revealed five clusters. Cluster 1, the red cluster, named Customer engagement development, has eight members. The marketing literature regards this cluster as fundamental to customer engagement. The classic view of the customer is that they are passive recipients of firm value creation (Deshpande, 1983). Recently, a new perspective in marketing has emerged which suggests that firms and customers can work together to develop products and services that create value. This perspective emphasizes customer engagement.

The new perspective of customer engagement has been more explicitly discussed in this cluster. Van Doorn et al. (2010) and Brodie et al. (2011) provide a broader and more comprehensive theoretical analysis of customer engagement. Based on relationship marketing theory (which is a part of the cluster) (Morgan and Hunt, 1994) and service-dominant logic (Vargo and Lusch, 2004), these researchers attempt to propose a general definition and define the conceptual domain of customer engagement. The cluster also illustrates the relationship between customer engagement and customer value. The article by Kumar et al. (2010) suggests that value resulting from interactions and engagement between firms and customers is comprised of four components, namely, customer lifetime value, customer referral value, customer influencer value, and customer knowledge value.

The role of new product development as a manifestation of customer engagement was explored by Hoyer et al. (2010).

Figure 1: Cluster visualization by VOS



Note: *r* parameter = 1.2; Min cluster number = 4

Green indicates the second cluster, consisting of seven members. It is titled Brand Engagement in Social Media Conceptualization. As a result of the internet, many firms try to engage with their customers via social media in order to create value. By analysing online communities such as Facebook, this cluster aims to shed light on their importance. There are three distinctive engagement dimensions (behaviour, cognition, and affect) identified by researchers in this cluster (Dessart et al., 2015; Hollebeek et al., 2014; Vivek et al., 2012). The behaviour dimension encompasses the customer's behavioural manifestation, which is driven by motivation and has a brand focus. Customers, for instance, tend to use a particular brand more than others. Engagement from the cognitive perspective refers to the continuous and vigorous mental states that customers experience in regard to the subject of their engagement. For instance, customers can learn about a brand by using it, or they can think of it while they are using it. Regarding the last point, affective engagement refers to the emotion customers experience about their engagement. A customer may feel happy when using a certain brand. With five members, the blue cluster is the third cluster. It is named customer brand engagement. The study by Sprott et al. (2009) proposes a programme called Brand Engagement in Self-Concept (BESC) in order to introduce scale. In BESC, brands are incorporated into the self-concept of the customer, which is how the customer defines brands as important to them.

As a result of the rise of social media channels, such as Twitter and YouTube, customers are becoming more active. Hennig-Thurau et al. (2010) propose a pinball framework to study the impact of these novel channels on the customer–firm relationship. The pinball metaphor implies that managing customers and trying to engage them is similar to playing pinball.

Customers, like the ball in pinball, don't always go where they are supposed to go. Yellow indicates the five members of cluster 4. It is called co-creation through customer engagement. The value has been analysed as one of the key outcomes of co-creation in cluster one. In particular, this cluster investigates co-creation as a result of engaged customers. In their articles published in 2004 and 2008, Vargo and Lusch analysed service-dominant logic as a theoretical basis for value co-creation in marketing. In this framework, a service provider can act as a social actor (e.g., suppliers, customers, and stakeholders). This can result in a co-creation of value. Furthermore, Sawhney et al. (2005) suggested that firms can engage their customers in co-creation and product development through internet platforms.

The fifth cluster, in purple, is online brand community engagement. People's communities have changed considerably due to drastic changes in both societies and economies. Consumer communities existed before online communities because of mass media. As a result of these recent developments, some old organizations are adopting online communities to make their customers become more engaged. Furthermore, this cluster addresses the question of what motivates customers to participate in these communities. Toward answering this question, Wirtz et al. (2013) investigated three dimensions of brand communities, including: 1) brand orientation, 2) online/offline communities, and 3) funding of online brand communities. According to Muiz and Schau (2007), online communities can encourage customers to create attention-grabbing advertising for their chosen brands. According to their study, customers were quite adept at creating advertisements by applying logic and different styles of advertising.

Case Questions:

1- Conduct MDS and HCA analysis and try to compare the results with the identified results.
2- Based on reviewing the most recent articles in the customer engagement domain, what research gaps/questions do you think should be investigated further?
3- By comparing the MDS, HCA, and VOSviewer outcome, try to propose a model for future scholars.

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