

Evolution of Activity Based Costing (ABC) - A Bibliometric Analysis

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Abstract

Activity Based Costing is an advanced accounting technique that is widely discussed among cost controllers and managers. Through this study, an attempt has been made to identify the recent trends in its evolution and to see further research prospects by doing analysis of the numerous national and international published researches in the related domain. By applying bibliographic analysis technique, output extracted from the Scopus database is analyzed using bibliometric package in R-software. The results present a structured view of trends in scientific studies on Activity Based Costing in different countries, contribution of pioneer authors and major sectors/industries to which most of the researches catered to. The analysis is carried out using three field plot, most trending topics, a word cloud, arriving at a conceptual structure using co-occurrence map and finally drawing a thematic map. As an application, study may well be a guiding tool for the researchers working in similar area. They can get insights as to what sector to consider for performing further investigations such as case studies or quantitative analysis and to see the effect of applying Activity Based Costing on some particular thematic factors.

Keywords: Activity Based Costing, Bibliometric Analysis, Decision Making

JEL classification: D24, M40, M41

1. Introduction

Activity Based Costing (ABC) is a method that identifies the activities and cost drivers in the production process for assigning cost on the basis of actual resource consumption. Implementing ABC for cost computation prevents distortions in cost and provides a comprehensive understanding of desired and non-desired activities, which traditional cost accounting fails to provide¹. It is of vital importance to assess and analyze what cost model a company is using, its significance for that particular organization and what other alternative methods they could have used? For the better operations and effectiveness in business, companies use different cost models to get clear understanding regarding the cost structure². The functions that are generally performed

by a cost model are a) stock assessments b) estimating the cost of manufactured goods or services; c) providing information to decision makers and d) measuring the efficiency of costing technique in decision making. Research on accounting and costing techniques has a long tradition. If costing is not done in correct manner, it can create ambiguity while taking decisions relating to pricing and resource allocation³. There are growing appeals of inventing and implementing costing methods that can lead to accurate cost calculation of product or service and can also assist in taking decisions on operational parts of the organization thus improving the overall performance^{4,5}. ABC system may be considered as a system of measuring the cost effectiveness of different activities, products and services on the basis of resources usage in process of production^{6,7}. There have been seen

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noticeable effects in the firms after implementing ABC as a tool for computation of cost and for taking numerous other business decisions⁸.

The advantages of using ABC are double fold. On the one hand, thorough study of all the cost components is made that is usually not done under traditional costing methods as there is no concrete way to distribute expenses, especially indirect costs while computing per unit cost that most of the time gives faulty cost calculation⁹⁻¹². On the other hand, scrutiny of all other business operations is done to check the efficiency and effectiveness of activities being performed in production process and results are compared against the pre-specified benchmarks for controlling purpose. This study aims to consolidate the key themes of published work in Scopus since last three decades in the area of ABC by performing bibliometric analysis as it is considered one of the effective ways to depict the evolution of any specific research direction¹³. In contrary to any descriptive or systematic literature review, bibliometric analysis attempts to consolidate the fragmented published work with focus on geographical areas, pioneer authors, emerging themes and their industry inclination. There has been an increasing trend in studies applying this analysis technique in numerous areas such as financial literacy and behavior¹⁴, tourism management¹⁵, costing and accounting¹⁶, climate change¹⁷, economic research¹⁸, performance measurement¹⁹ and innovation²⁰. Thus, present study intends to understand the evolution of ABC on an objective basis and furnishes a sound base for future research directions in related area.

The paper is organized as follows: firstly, objectives of the study are mentioned, following to that a theoretical framework is established through review of literature, addressing the need for advanced costing technique and a comparative view of traditional vs. Activity Based Costing. The next section deals with the methodology applied for the study. The analysis and findings of the study have been discussed in the subsequent section followed by conclusions, limitations and further direction for future research.

2. Objectives

In order to assess the contribution made by particular literature, it is necessary to review it analytically¹⁶. The main objective of this article is to structure the available published literature on ABC in different areas and to

make the contribution known within the accounting and finance research community. The focus is on the evolution of ABC and ABC Management over time as managers aiming at successful application of these need clear and updated knowledge on as to how this concept is being perceived and applied in the industries/sectors around the world. Besides the identification of research gaps and to develop idea for future research possibilities, attempt is made to provide detailed and updated information about key themes, industries, countries and major contributors in the area of ABC. Thus, this review may be considered useful for future researchers along with the managers who are using or are intending to apply ABC in their organizations. On the basis of above objectives, the following research questions have been framed for the present study:

- What is the trend in terms of number of scientific studies done in relation to ABC?
- Who are the pioneer authors in the area of ABC and to highlight the most pioneer journals?
- What related areas of research are most common in this knowledge domain to find countries where most of the studies in the present domain are done?
- What are the most addressed issues in the area of ABC and how this concept is evolving further?

The above research questions are translated to following research objectives:

- To demonstrate the patterns and recent trends in development of knowledge domain related to ABC.
- To conglomerate the knowledge structure and present a synthesised view of the published researches on ABC.

3. Literature Review

Research on accounting and costing techniques has a long tradition²¹. If costing is not done in correct manner, it can create vagueness while taking decisions relating to pricing and resource allocation³. There are growing appeals of inventing and implementing costing methods that can lead to accurate cost of product or service and can also assist in taking decisions related to other operational parts of the organization, thus improving the overall performance²². Today, all organizations are working in an intense competitive and multidimensional environment. Global

competition and continuously advancing technology have made things more cumbersome. With increase in stakeholder's expectations and rising cost of inputs, it has become challenging for the businesses to meet their targets³. Profit maximization is the main guiding force for better performance that demands a reliable costing system that helps in achieving the objectives²³. Keeping in view the limitations that traditional costing has, the ABC method was designed in the United-States during the 80's²⁴. Concept of open innovation and ABC is based on the premise of process optimization and continuous improvement⁷. Johnson and Kaplan suggested that for implementation of ABC technique, a manager need to do two things. First, to analyze more deeply the organization activities and processes and second, to link together the strategic and the operational management²⁵. Such proposals announce the development of the Balanced Scorecard and a strategically oriented ABC²⁶.

For the precise calculation of production cost, business organizations have been enforced to implement innovative approaches that could improve the operational efficiency⁶. Seminal contributions have been made by previous studies to demonstrate the advantages of using advanced costing technique such as ABC in cost computation²⁷. A large number of existing studies in the broader literature have examined the how ABC overweigh traditional costing methods and leads to better performance. Besides directly helping in cost computation in much more comprehensive way, ABC leads to overall profitability by helping in taking decisions, for instance, removing unprofitable products, updating product lines, checking customer profitability, transportation and material handling processes²⁸. The ABC literature also highlights the significance of having thorough understanding of cost drivers in eliminating "non-value-added" activities that lower down the efficiency and just add little or no value to the customer²⁹. ABC methodology of costing was conceptualized in the U.S. by Kaplan and Cooper (1988, 1991) and developed by Miller and Vollman (1985). It drastically changed the mindset of managers and academicians regarding computation of cost and analyzing cost structure. Vast literature is available on ABC and ABCM in which attempts have been made to study the usefulness of this advanced costing methodology. ABC is not design to take automated decisions rather it has provided a mean to furnish more comprehensive information regarding business activities to take better decisions³⁰. ABC helps in differentiating between value added and non-value-

added activities thus giving opportunity to remove non-necessary and non-profitable activities and leads to enhanced efficiency. It was experienced by many of the organizations that development of a model based on ABC can be done under the preview of Generally Accepted Accounting Principles (GAAP) without having additional burden in terms of cost, manpower or time²⁹. Taking as given the theoretical base of ABC and its popularity with companies, accounting academicians have turned to the question, 'do ABC implementations succeed in providing better information to managers and affecting their decisions in a positive way?'

ABC emerged as a tool for providing meaningful information and data to managers for support in decision making³¹. Many researchers have done surveys of companies implementing ABC to understand what factors explain success or failure of ABC implementation efforts. It was found that proportion of indirect cost, pressure to keep price competitive, diversification of products are some of the significant factors that affect the decision of implementing of ABC while the level of team commitment and cohesion, management support in change process, continuous education, compensation and quality of other information systems are recognized as some of the factors that affect the success of ABC^{6,12,32,33}. ABC has emerged as a tremendously useful guide to management actions that can translate efforts directly into higher profits. In the context of deciding which products to manufacture, the problem is formulated with the objective of determining the maximum profit from the mix of manufactured products, subject to constraints of the different available resources³⁴. ABC analysis highlights for managers where their action will probably have the greatest impact in term of revenue and permits managers to understand the sources of cost variability and reveals actions they can take to reduce burden on their organizational resources³⁵. Having reduced the demands, managers can then increase throughput or reduce spending to convert the savings into increased profits³⁶. There have been seen noticeable effects for the firms after the use of ABC as a tool for computation of cost and for taking numerous other business decisions³⁷. Keeping in light the objective of present study, use of bibliometric analysis was considered as an appropriate technique. The relevance of this methodology can be seen in its capability to draw a general profile of related scientific productions around the world²⁰. This technique can be widely applied in various areas ranging from finance, economics, accounting,

services, performance management and innovation¹³. The current research has implication for the practitioners and researchers providing a better understanding of evolution of ABC and giving a lead for future research work.

4. Methodology

Bibliometric analysis technique has been applied in the present study. This technique uses mathematical and statistical tools to analyse patterns and presents pictorial views of selected key points of already published literature. The main output of a bibliometric based research is data synthesis, which contributes new knowledge that is based on complete and concise data collection. In the further sections, the procedure followed to collect the data, the criteria followed for selecting the articles under study and methodology applied for extracting and analysing data are described in detail.

4.1 Selection of Database

Data has been extracted for the present study after identifying the suitable database. The data extracted such as the number of citations, co-authorship, number of patents, as well as major themes of scientific fields and countries can be mapped by performing Bibliomatrix analysis. The Portal selected for extraction of database is SCOPUS, as being multidisciplinary and comprehensive. Following to that, a query to search was run where the appropriate mix of key words was mentioned for data extraction. Once the data to be used for the study is defined using the appropriate criteria to include or exclude, suitable software and analytical tools were applied. An initial descriptive analysis of the data related

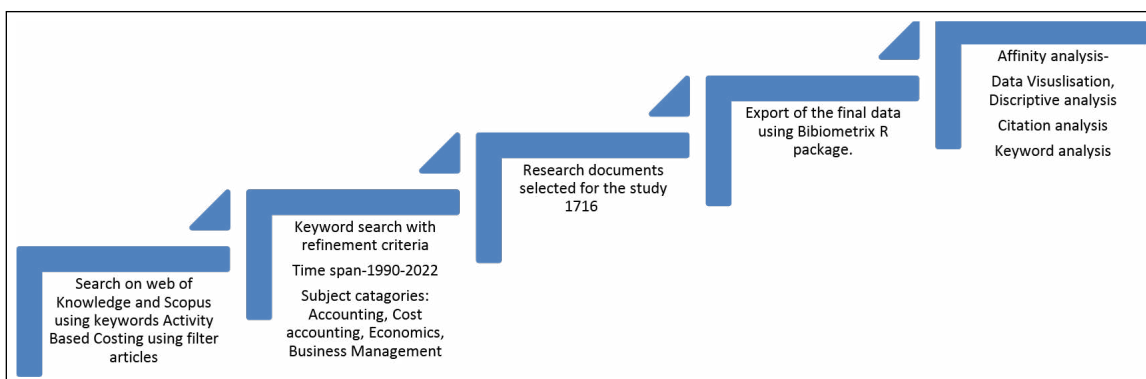
to established theories on ABC was done, followed by network maps, charts and diagrams created for depicting intellectual, conceptual structures and better visualisation of data.

4.2 Keywords for Search Strategy and Criteria for Documents Selection

The search for documents for the current study was initiated using the keyword 'Activity Based Costing' in SCOPUS. Filters for categories applied were accounting, economics, management, social science, and finance. Proceeding papers were not included while short listing the documents. In total, 1,716 documents were shortlisted for analysis that includes related articles, chapters from books and expert reviews. Further screening of the refined documents is done on the basis of language criteria. Relevant information from the documents including research title, keywords, and short abstract, main authors was transferred to Biblioshiny application in plain text format to perform analysis. Finally, after data get refined in suitable format and duplicate files have been removed, 1,716 files were considered for Bibliometric analysis. (Figure 1)

4.3 Tool Selection for Bibliometric Analysis

Bibliometrix R-package is adopted to perform overall scientific mapping of the selected data files. *Ariaa and Cuccurullo* developed this tool of analysis in language R in year 2017. Bibliometrix has gained popularity over time and is being used in almost all disciplines for the scientific collaboration networking and it facilitates bibliometric study in a comprehensive manner that



Source: Authors' compilation

Figure 1. Steps followed for selection of documents

analysis the data through visualisation techniques. It is open-source software for bibliographic analysis which can be upgraded on continuous basis and also can be easily integrated with other packages of R statistics and is highly recommended software. Biblioshiny application is used for the data in this study that is an application which is in built in Bibliometrix. This is easy to understand for non-coders as well and is quite user friendly. Mapping and networking is performed through automated workflow feature of this package.

5. Data Analysis and Findings

As per the objectives of the study, this study presents an analysis of the trend of research and publications in the field of ABC. Following results have been generated by the analysis through R package:

5.1 Number of Publications

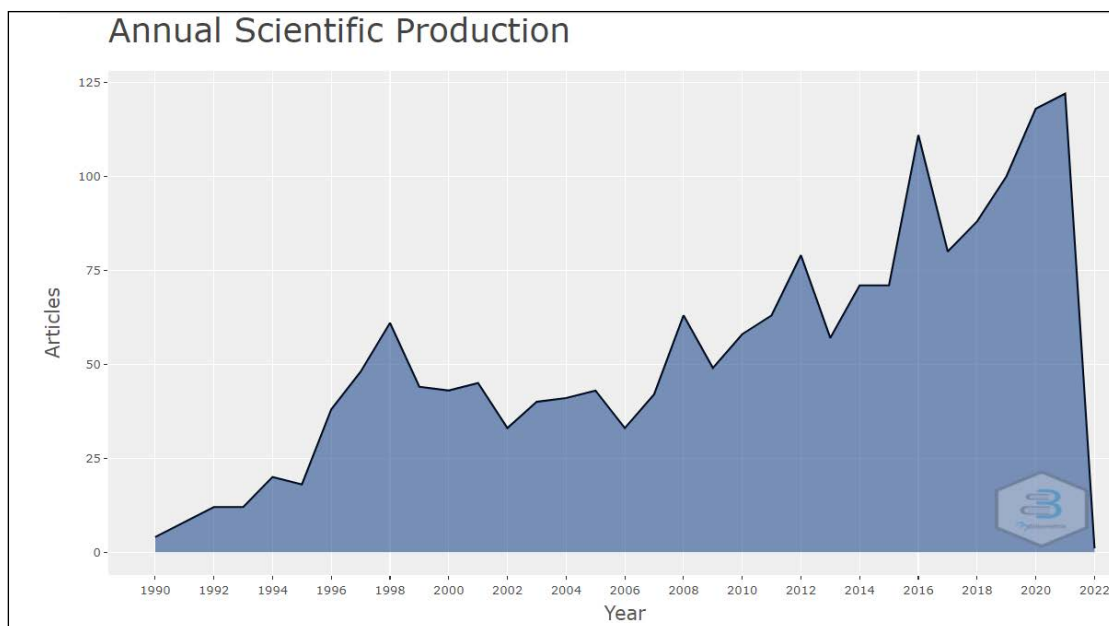
As presented by Figure 2, an upward trend was observed in scientific productivity in the research related to ABC during the period 1990-2022. A sharp surge is exhibited in volume of publications after year 1994, probable reason of which may be more and more studies related to advanced costing techniques were done during that period. Maturity phase of current topic is yet to come,

though a continuous upward trend was observed in the number of publications on present topic.

5.2 Three Field Plots

Relationship in three main items that are plotted on the three different plots is viewed through this pictorial presentation. In Figure 3, networking between the pioneer authors, their major research areas and respective countries of their research can be seen. In Sankey Plot, left side shows the authors. Keywords are mentioned on the middle column and major countries contributing to this particular research area are depicted on the right side of the diagram. Important keywords such as ABC; Time Driven Activity Based Costing (TDABC); cost effectiveness; management accounting; simulations are shown in the diagram. This diagram indicates the crucial role of ABC in analysing cost drivers. 'Right cost calculation', 'cost effectiveness', 'cost management' and 'cost analysis' are some of the important emerging sub-topics that have been rightly addressed in the research conducted by pioneer authors.

In the research domain, most cited authors are Tsai, Kaplan R.S., Feeley TW, Polanczyk C.A., Kontodimopoulos N., Raab C., with published literature in several nations that include USA, China, Italy, Brazil and U.K as prominent. Most approached areas under



Source: Authors' compilation using biblioshiny – R packages

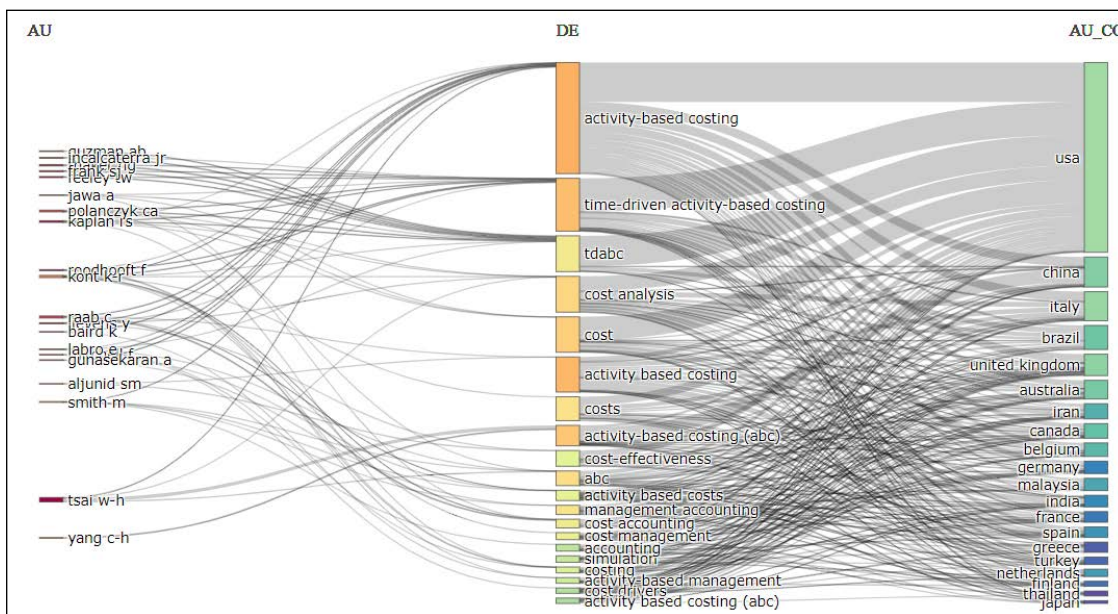
Figure 2. Scientific productivity

study we have is ABC, followed by TDABC, cost analysis and costs.

5.3 The Top 20 Most Cited Journals

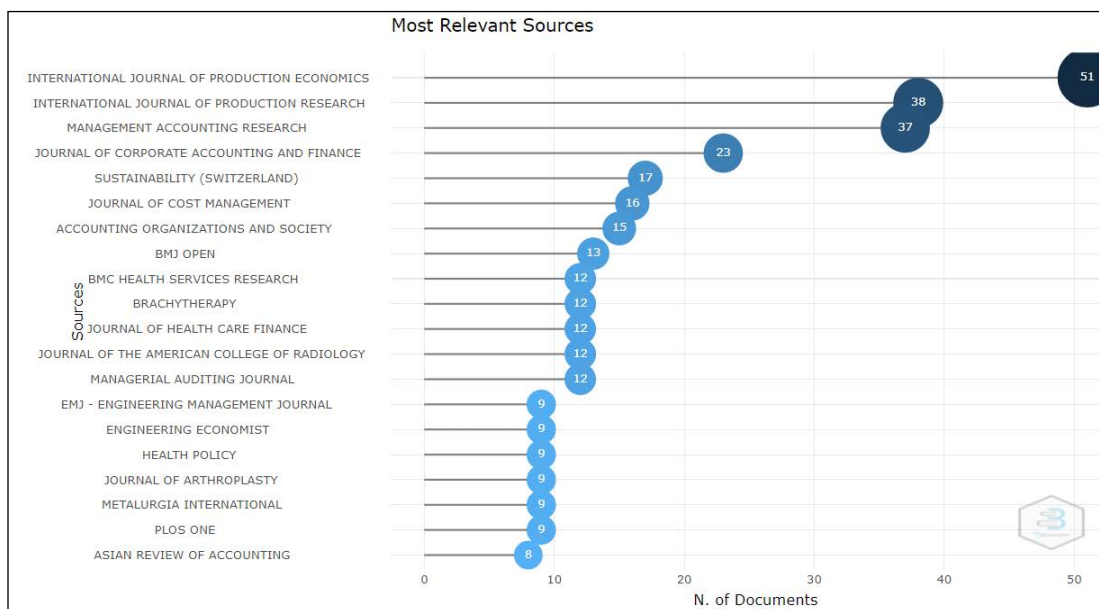
They indicate the quality of journal in the field of publication on ABC is shown in Figure 4.

Maximum citations have been noticed in International Journal of Production Economics and second by International Journal of Production Research that seems pioneer in the list of the most crucial sources (Figure 4). A closer look at these journals depict that most of the publication related to ABC are concerned in the



Source: Authors' compilation using biblioshiny – R packages

Figure 3. Three field plot



Source: Authors' compilation using biblioshiny – R packages

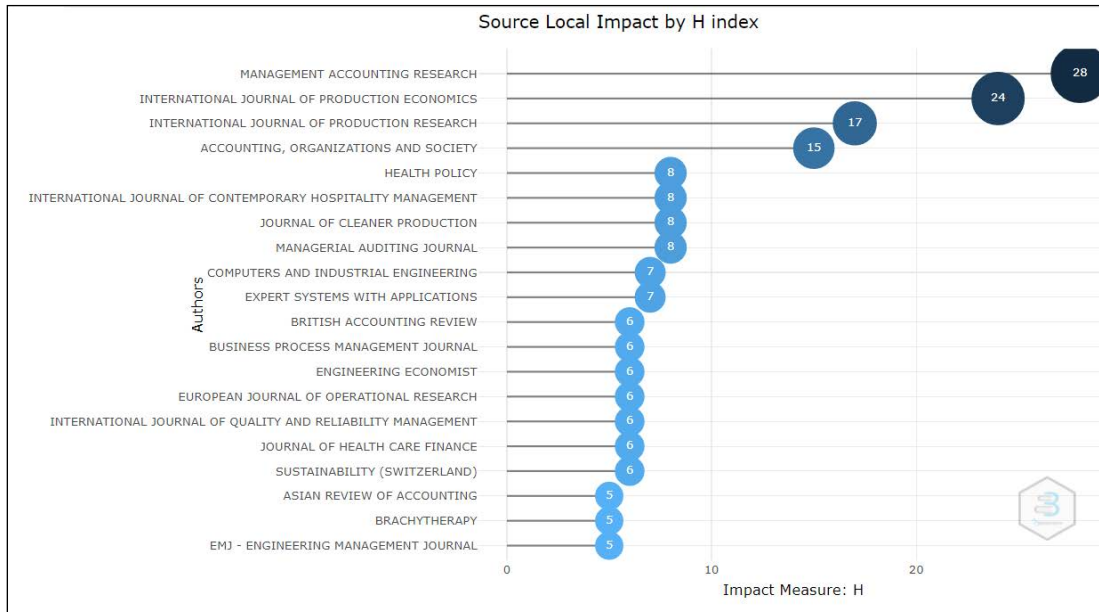
Figure 4. Most cited sources

journals related to operations, economics, production, management of cost and finance.

Sometimes, for analysing the contribution of journal in a particular domain is not reliable if only maximum number of articles or maximum citations is considered. Instead, presentation using H-index can be a reliable

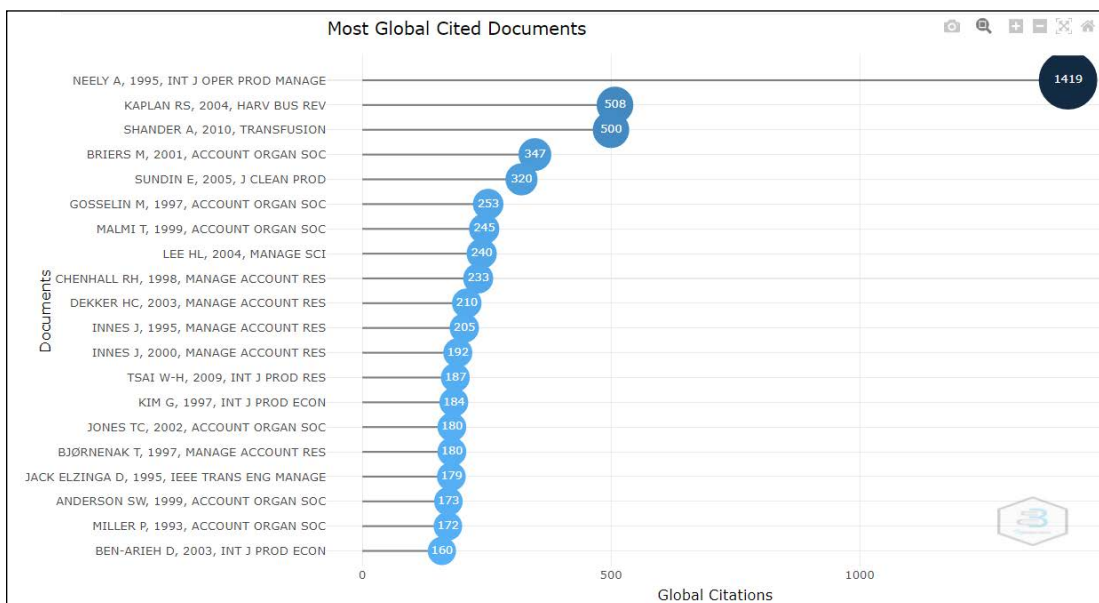
method depicting the quantity, quality and the impact of a journal.

In Figure 5, 20 most impactful scholarly journals based on *h-index* are this metric shows the comparative position of the journals considering their citation impact, quality and productivity. Through H-index, we can represent n's



Source: Authors' compilation using biblioshiny – R packages

Figure 5. Top 20 impactful journals



Source: Authors' compilation using biblioshiny – R packages

Figure 6. Most cited documents

maximum value; where 'n' means number of journals with 'n' number of publications having least 'n' citations¹⁴.

5.4 Most Cited Documents

The 20 most cited publications in the field of ABC are shown in Figure 6. These are the articles which are having more than 100 citations. Four of the top most publications were authored by Neely, that indicates considerable contribution of Neely A. to the field with more than 1400 citations, followed by Kaplan RS and Shander A. with more than 500 citations. Importance of advanced costing technique and its financial impact on various business decisions is discussed in both of these articles. These top cited published articles and papers could be considered as pioneer references in the discipline of ABC.

5.5 Most Cited Authors

Tsai., Kaplan RS, Feeley TW, Roodhooft F and Thaker NG are found to be most contributing authors with maximum number of articles published in the field of ABC (Figure 7). Tsai; Kaplan. RS are having above 20 articles published in the concerned field.

By analysing h-index of the authors also revealed that Tsai., Kaplan RS and Roodhooft F were few among the

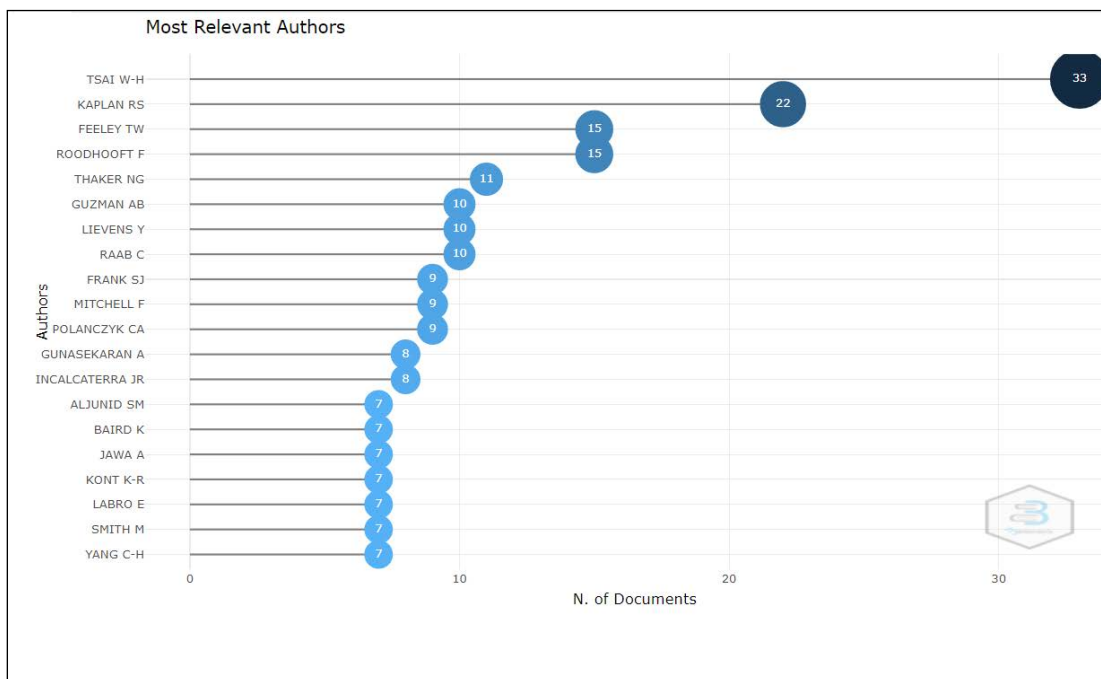
most impactful writers (Figure 8). Contribution made by them is exceptional. These articles can be counted as crucial pieces of work that can guide regarding direction of further research in this discipline.

5.6 Most Relevant Affiliations

The most relevant affiliations are shown in Figure 9. University of Texas MD Anderson Cancer Centre is the highly affiliated organisation with the research domain, followed by National central University, Harvard Business School, Harvard Medical University and University of Virginia Medical School. This trend shows that use of advanced costing technique is not limited to manufacturing or service industry rather medical field is one of the most affiliated domain using this costing technique.

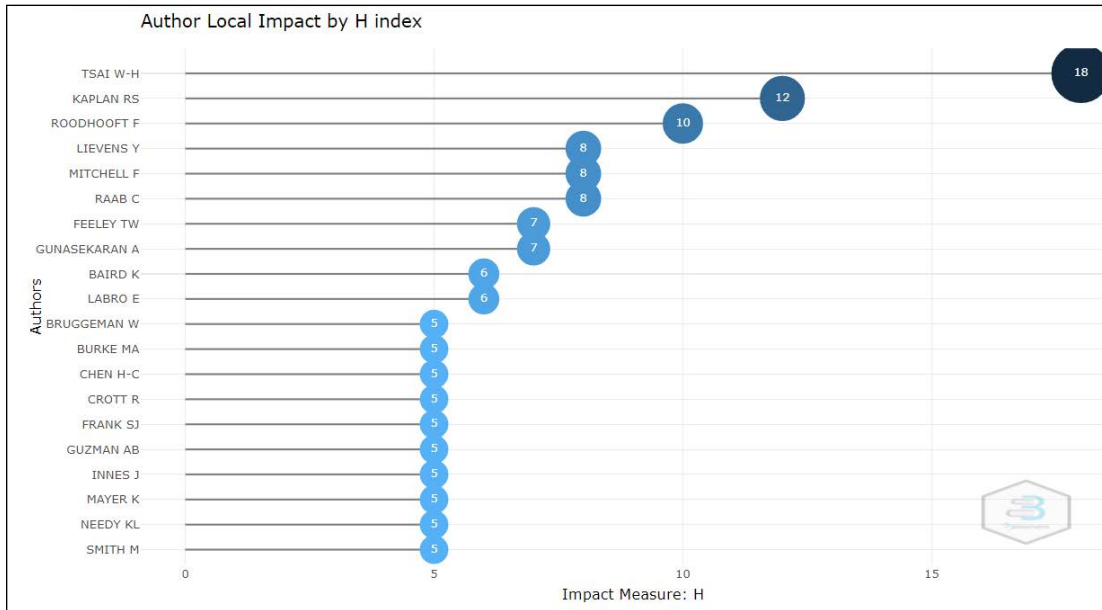
5.7 Trend Topics

An overview of most trending topics in affiliation with ABC is given in Figure 10. It shows that health care is one of the highest affiliated sectors with ABC which proves that use of advanced accounting techniques is not limited to manufacturing sector. TDABC, cost benefit analysis, cost efficiency, costing, cost management are other areas



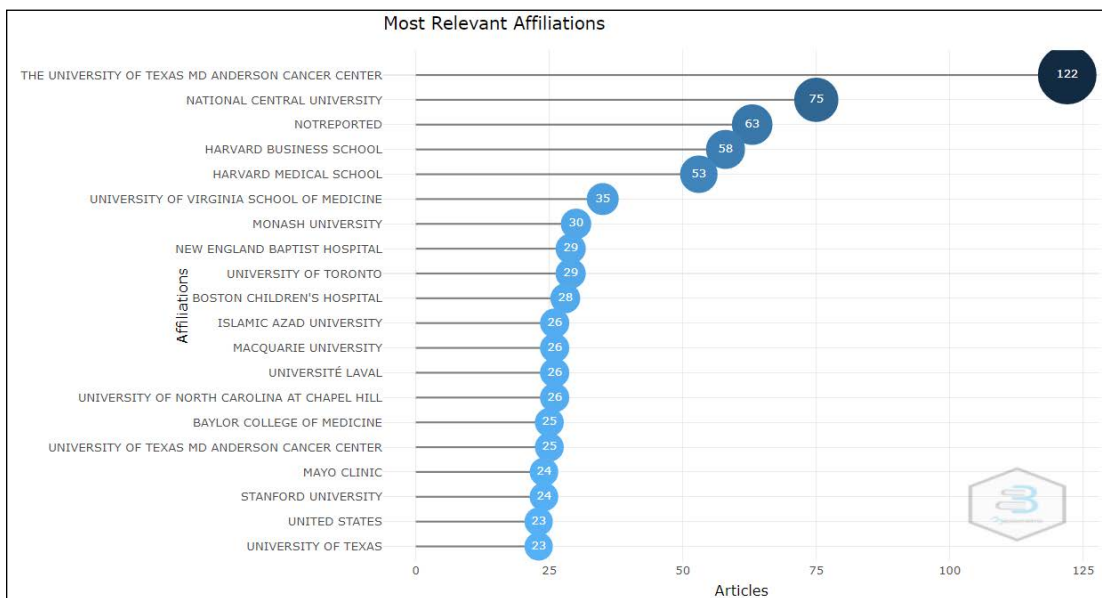
Source: Authors' compilation using biblioshiny – R packages

Figure 7. Most cited authors



Source: Authors' compilation using biblioshiny – R packages

Figure 8. Author impact by H Index



Source: Authors' compilation using biblioshiny – R packages

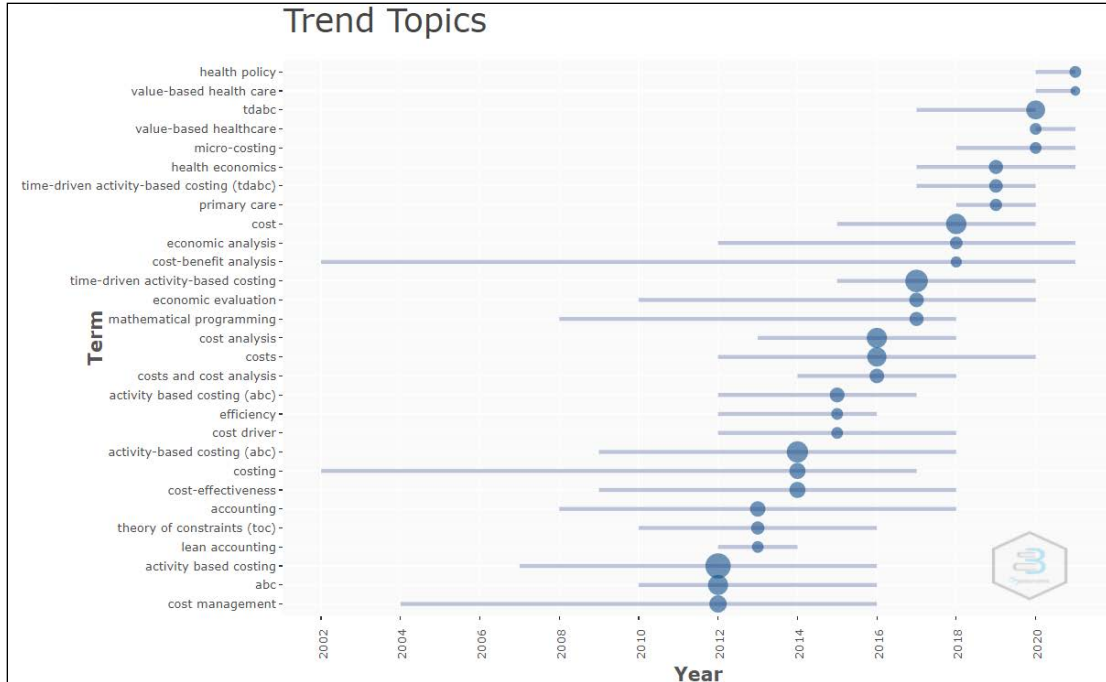
Figure 9. Most relevant affiliations

that are used in most of the published works in the ABC domain.

5.8 Keywords

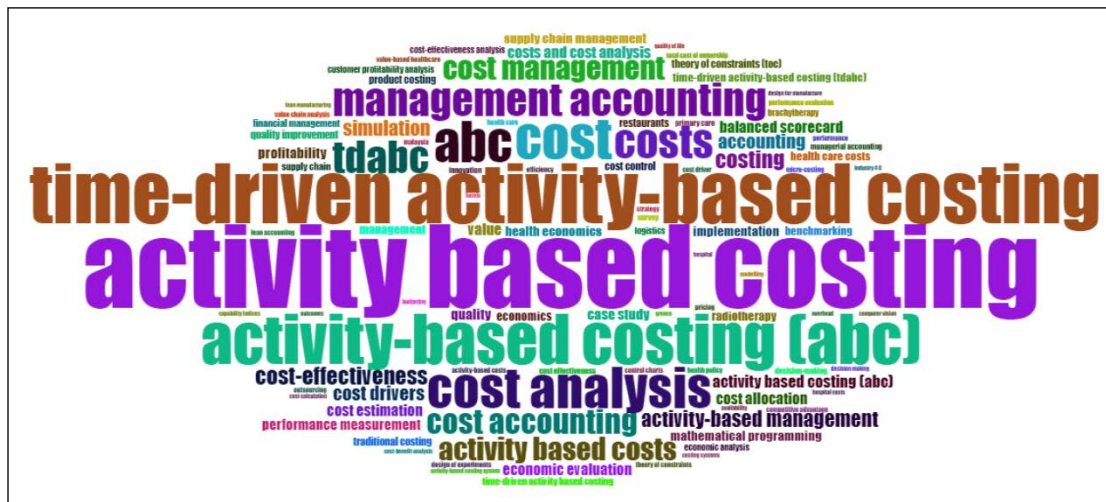
By analysing the frequency of keywords used in the publications depicted that the term 'ABC' is the most

cited word, followed by 'TDABC', 'cost analysis', 'cost accounting', 'management accounting' and 'cost effectiveness'. In Figure 11, a pictorial presentation of frequency of the terms is shown by framing word cloud in the document that indicates the most cited words by the size.



Source: Authors' compilation using biblioshiny – R packages

Figure 10. Most trending topics



Source: Authors' compilation using biblioshiny – R packages

Figure 11. Word cloud

5.9 Co-occurrence Map

The interaction between trends; topics and themes can be shown by analysing co-words or using co-occurrence network¹⁴. Only this method uses the content of the publications. This conceptual structure in the bibliometrix package is derived through applying Multiple Correspondence Analysis (MCA). It is drawn

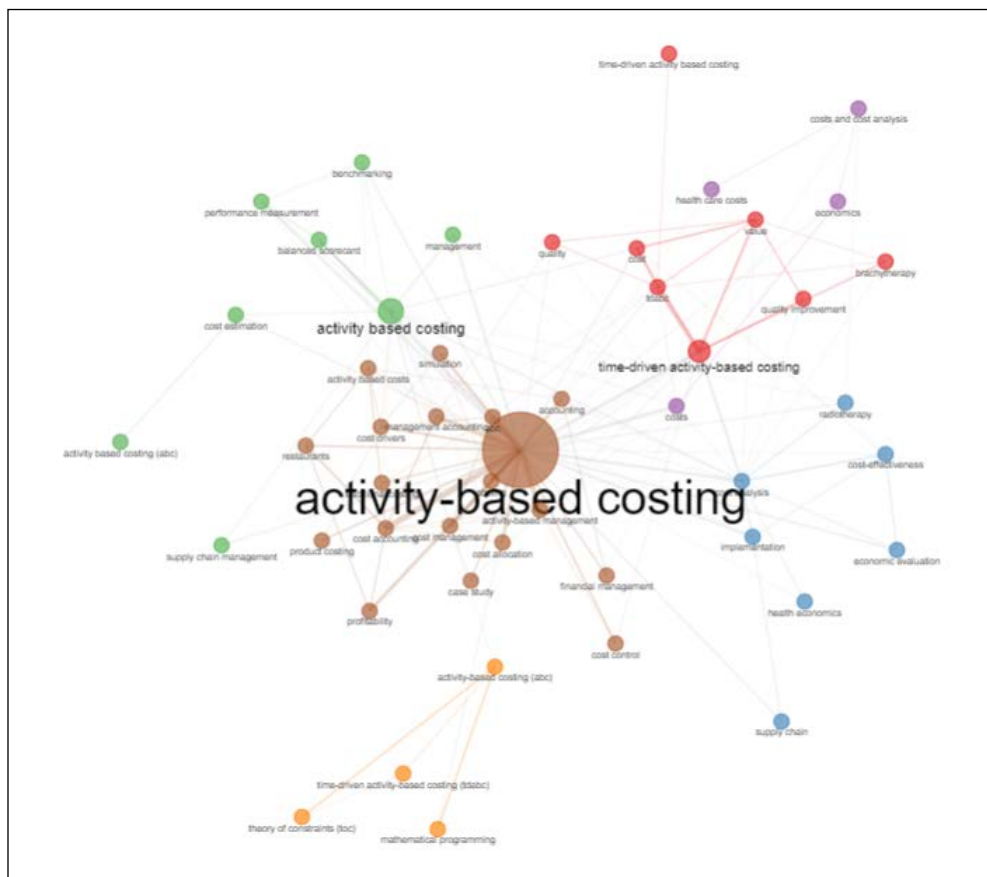
for the mentioned keywords along with analysis unit under study, where normalisation was performed by use of Louvain's clustering algorithm and automatic layout was taken as default setting that gave output in the form of network of co-occurrence with 50 nodes as shown in Figure 12. 'Keyword Plus' are the words that are extracted through a computer algorithm that is based on common terms found either in the extracted titles or/and in the

list of references mentioned in the documents. This technique is considered more reliable as the content in the document is captured more diversified and profound manner. Figure 12 shows six clusters emerged from the data are presented in different colours; red, orange, brown, green, blue and purple. Different clusters are represented through different colours; relatedness is depicted through distance; words represent the vertex and the size of the node is in proportion with its occurrence.

5.10 Thematic Map

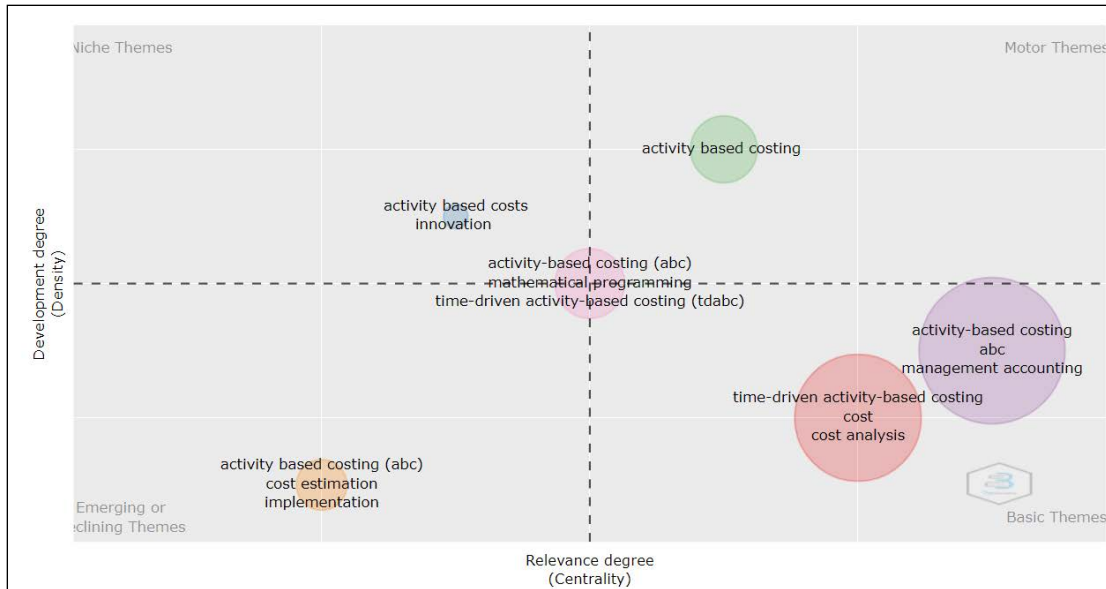
Typological themes are presented through thematic map on a two-dimensional plot. This is based on co-word analysis after which keywords clusters are recognised that generate themes in any particular research domain. Four quadrants can be made after classifying the themes on the basis of their centrality or density that also represents the two dimensions of the graph. Bubbles in this two-dimensional graph show different themes. In Figure 13,

different themes namely 'ABC Innovation', 'ABC', 'cost estimation implementation', 'TDABC' and 'management accounting' are plotted in the form of bubbles. Theme 'ABC and management accounting' is the motor theme that is shown in the upper quadrant in the right side, which is having high density and centrality and is considered to be at the core of the domain as major topic under discussion. The basic theme 'TDABC and cost analysis is shown in the lower quadrant at right, which may be counted as signalling but under developed area. A niche theme-'ABC innovation' is depicted in quadrants that are in upper left side, indicating the theme which is well-developed in association with internal links but not in relation to external ties and is not of much importance. Theme 'cost estimation implementation' having less importance and which is not strongly developed is presented in Lower left quadrant. It represents both emerging as well as declining ties.



Source: Authors' compilation using biblioshiny – R packages

Figure 12. Co-occurrence map



Source: Authors' compilation using biblioshiny – R packages

Figure 13. Thematic map

6. Findings

ABC is quite a buzzing topic among researchers in the area of accounting and costing. Looking at the limitations of traditional costing and to sustain in an intensively competitive environment, managers are moving from traditional costing to other advanced costing methods that can help in controlling the overheads and production cost. Analysis of data set gives an observation regarding number of publications that there has been an increase in published research work in the area of ABC with a spurt in trend after 1994 and a further increase afterwards as well. As identified through chart of most trending topics, it is found that ABC has contributed significantly in strategic decisions namely effective cost calculation, cost management and control, value based analysis, lean accounting and cost benefit analysis. The three field plot of pioneer authors, their major research areas and respective countries of their research shows that in US, TDABC is getting more popular than ABC while in all other countries such as China, Italy and Brazil, ABC is still preferred. Tsai is the major contributor in published work on ABC in USA and Kaplan, who is considered as father of ABC, has researched diverting more towards TDABC. Majority of the publications in the field of ABC are found to be related to industries that are involved in operations management, engineering including health sector, thus paving a path

towards interdisciplinary approach rather than a domain specific approach. The co-occurrence network map shows the terms that are repetitively used in abstracts of the published papers on ABC and the clusters formed in graph represents the linkage between these terms. Six important clusters depicting different significant aspects of ABC are visualised through this map that are shown in different colours in Figure 12. Green cluster represents key areas where ABC is being implemented, for instance, costing, performance measurement, benchmarking; red shows the benefits of ABC; violet cluster is for other allied areas such as economics where ABC can be helpful; blue represents strategic areas where ABC assists, for example supply chain, economic evaluation; brown cluster shows probable methods to evaluate effectiveness of ABC such as performing case study and orange shows other complimentary tools that can improve efficiency in operations, as for example, mathematical programming and theory of constraints. An analysis of the ‘word cloud’ shows that in the pre-existing literature, ABC is the word that is having highest frequency, followed by TDABC, management accounting and cost analysis that again proves the increasing popularity of TDABC. Through thematic map, a wider view of evolution of the concerned field over the time has been presented that shows that ABC innovation is the niche theme, while ABC and TDABC are major themes captured in the published literature.

7. Conclusion

Discrete patterns have been observed in the studies done in relation to ABC and its implications over a time span from 1990-2022. These patterns pertain to published work with major countries, sources, areas of research, most cited articles, authors and their collaborations. Through observed patterns, it can be concluded that there is much scope of further multidisciplinary research work related to advance costing methods. This study demonstrates progress of research done in the area of ABC along with providing useful insights to practitioners broadening their vision with regard to application of such advanced costing technique in different areas of management as exhibited by different themes and trending topics such as healthcare, operations management, performance measurement and economics. While TDABC has caught the attention of most researchers, ABC innovation is a new sub-theme in addition to lean accounting, value based analysis together with basic application of cost management and control and cost benefit analysis in diverse industries. This study finally maps a comprehensive view of current scenario of worldwide research related to ABC with themes and sub-themes highlighting several opportunities for further research.

8. Future Research Directions

For future researchers, this study may be a guiding tool in selecting the sector to perform further scientific analysis to see the effect of applying ABC or to assist in selecting some industry for case-based analysis. Present bibliometric study is done using only SCOPUS database, so other database available that may include WoS and Springer can also be used for extracting the data. For obtaining the in-depth understanding of the domain, the graphical presentations drawn can be supplemented with meta-analysis involving reading the abstracts and then selecting and including the articles manually for the research purpose. The limitation of this study is that it presents the evolution of ABC as an advanced costing technique and an assisting tool for decision making, so it may be considered more useful for future researchers. Additionally, using the relevant analytics and graphs, managers in the organisations can also assess the relevance of implementing ABC in their particular industrial sector e.g. healthcare is one of the emerging sector using ABC and TDABC. Thematic analysis can be done through

expert's interviews with possible themes namely most preferred costing methods, assistance in decision making and the respective limitations, Further, various considerations of practitioners can be consolidated by applying further analytical and scientific tools that can provide more relevant output in the concerned area.

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