

Exploring behavioural bias affecting investment decision-making: a network cluster based conceptual analysis for future research

Behavioural
bias and
investment
decisions

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Abstract

Purpose – This study systematically explores the patterns and connections in the behavioural bias and investment decisions of the existing literature in the Scopus database published between 2007 and 2022. The purpose of this paper is to address this issue.

Findings – In the article it was determined which contributed documents were the most significant in this particular subject area along with the citations, publications and nations that were associated with them. The bibliographic coupling offered more in-depth insights into the papers by organizing them into distinct groups. The pattern of the publications has been brought to light, and the connection between different types of literature has provided insight into the path that future studies should take.

Research limitations/implications – This study considered only articles from the Scopus database. Future studies can be based on papers that have been published in other databases.

Originality/value – The outcome of this study provides valuable insights into the intellectual structure and biases of investors and adds value to existing knowledge. This review provides a road map for the future trend of research on behavioural bias and investment decisions.

Keywords Behavioural biases, Emotional bias, Cognitive bias, Systematic literature review, Investment decision-making

Paper type Literature review

1. Introduction

The traditional economic theory assumes that investors behave rationally while making various kinds of decisions (Muhammad and Maheran, 2009). Standard financial practice



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consists of various concepts and theories, e.g. the expected utility theory (Bernoulli, 1738), Markowitz portfolio principles (Markowitz, 1952), the capital asset pricing model (Treynor, 1961) etc., to explain the efficiency of the market that contains all the available information while taking financial decisions; investors are assumed to be rational (Zahera and Bansal, 2018; Kumar and Goyal, 2015). Although all of the above theories are widely accepted by researchers, they have failed to provide answers to some questions, such as the causes of market bubbles and crashes and which variables are to blame for unpredictable situations (Sharma and Kumar, 2019; Zahera and Bansal, 2018). After analysing the results, they found that the role of behavioural finance that contradicts all the standard theories of concepts and assumptions of rational investors always leads to an optimal financial decision. Human emotions, attitudes and psychological biases that influence investors' decisions tend to be inefficient and irrational (Kahneman and Tversky, 1982; Kapoor and Prosad, 2017). Thus, in the 1980s, a new perspective on finance, i.e. behavioural finance, emerged from psychology, finance and sociology; this deals with the psyche of investors and also attempts to describe the impact of psychological errors on their decision-making process (Kahneman and Tversky, 1979; Kishor, 2020). Behavioural finance examines the puzzling behavioural aspects of individuals operating in financial markets while considering their emotions, psychology, sociology and other related factors. The emphasis is on the various behaviours shown by investors and how these behaviours influence the investors (Yoong and Ferreira, 2013). The introduction of the prospect theory, which replaces the expected utility traditional theory, is one of the major steps in the shift from the traditional concept to the modern concept of behavioural finance (Kahneman and Tversky, 1979). There have been many empirical studies conducted to solve the questions raised about traditional finance. Examinations have been conducted to identify the relationships between behavioural factors and classical factors and how they influence investment decision-making. The prior literature has found that the behavioural factors are affected by two major areas, i.e. the prospect theory and heuristics. The characteristics of these areas are explained through different kinds of biases, including loss aversion bias, risk aversion bias, regret aversion bias, mental accounting, overconfidence, self-control bias, herding behaviour, etc. Studies have explored and shown that the biases of overconfidence, expert bias and self-control bias have a positive significant impact on individual investors' behaviour, influencing their financial satisfaction levels (Sahi, 2017). A recent study, conducted with the help of an analytical hierarchy process, analysed behavioural factors such as overconfidence bias, representative bias, regret aversion, mental accounting and herd behaviour affecting investment decisions. The result concluded that bias overconfidence and regret aversion impact were much stronger than other biases. A similar study was conducted by Almansour and Arabyat (2017).

Various studies have been published in the subject area of behavioural biases and investment decisions (Kumar and Goyal, 2015; Rasheed *et al.*, 2018). There is a need to analyse the strength and association between the articles published in this area. Thus, the present study focusses on bridging the gap between the works of literature through bibliometric analysis, providing an intellectual structure in this area. To bridge this gap, the following questions are presented:

- RQ1. What is the publication trend in the area of behavioural biases and investment decisions? Year-wise, what was the greatest contribution made by authors, journals and countries?
- RQ2. Based on citations (co-authorship, co-occurrence and bibliographic coupling), what are the most important documents?
- RQ3. What are the emerging research themes on behavioural biases?
- RQ4. What are the directions for future research?

This provides a comprehensive review of behavioural biases and investment decision-making. The paper applies the following structure:

- (1) Explore how documents about behavioural biases and how they affect investment decisions are linked.
- (2) Understanding the adoption of systematic literature review (SLR) methodology by searching different databases and classifications.
- (3) Explain the research gap, findings and recommendations for a future research road map in behavioural finance.

In this article, the introduction is followed by the literature review in [Section 2](#); this reviews previous studies on behavioural bias, investment decision-making and the factors influencing the investment decision-making behaviour of investors. [Section 3](#) provides a brief discussion of the methodology adopted in this research. [Section 4](#) discusses the results of bibliometric analysis, followed by [Section 5](#) that reports on emerging research agendas. [Section 6](#) discusses the key findings and implications of the study. Concluding remarks are provided in [Section 7](#). [Section 8](#) presents the limitations and future direction of this study.

2. Literature review

Scholars have used a variety of methods to review literature, i.e. meta-analysis, weight analysis, scoping review, SLR and narrative review. The present research study is an integration of SLR and bibliometric analysis techniques, facilitating the identification of intellectual structure. The paper has looked at an SLR of the past 33 years regarding biases that impact investment decision-making. The main purpose is to analyse behavioural biases like herding, home bias, overconfidence and disposition effects of investors and their impact on returns, volatility and portfolio selection. This will provide a road map for future research.

The purpose of this research is to gain an understanding of the various behavioural biases that influence investors' investing decisions as well as the socio-economic factors that are taken into consideration; this is done by utilizing SLR and meta-analysis. Overall, 17 types of bias and 15 socio-economic items were identified in the outcome data set. The findings revealed that there was an interrelationship between behavioural biases and common biases like disposition and overconfidence ([Sharma and Nandi, 2018](#)). A few studies also found that there is a strong correlation between behavioural biases and socio-economic variables in different geographic areas ([Calzadilla et al., 2021](#); [Quaicoe and Eleke-Aboagye, 2021](#)). Research by [Fischer and Lehner \(2021\)](#) focusses on behavioural finance and its development by systematic literature from 36 finance journals published between 2009 and 2019; they set out to explore the field of neuro-finance and the human brain. Their research also analyses the impact of behavioural bias on rational investment decisions. The research work by [Clark et al. \(2019\)](#) focusses on foreign and domestic bias and portfolios in a bond market. They observe that foreign investors have a good return policy only because of their behaviour. Foreign investors have enough ideas to avoid the uncertainty and controlled volatility of the bond market. This paper provides insights into emerging markets so that investors can observe the behaviour of foreign investors and make wise decisions. Scholarly works by [Pradhan \(2021\)](#) and [Kishor \(2020\)](#) examined the impact of both financial literacy and behavioural biases like heuristic bias, herd mentality, framing effect and cognitive illusion on investment decisions. Their findings confirmed the existence of a significant positive association between heuristic bias and investment decisions. The study also found that there is a negative link between the framing effect, the herd mentality, and cognitive illusions and investment decisions. It came

to the conclusion that financial literacy has a significant effect on investment decisions in the stock market.

A recent research paper by [Bhatia et al. \(2021a, b\)](#) analysed the theories of traditional finance and behavioural finance that are generated based on behavioural aspects. The authors' objective is to make all investors aware of the psychological factors and their impact on rational decision-making. Studies by [Sharma et al. \(2021\)](#) as well as [Dangi and Kohli \(2018\)](#) focus on the investment decisions of women entrepreneurs and attempt to explore the way women's behaviour affects their investment decisions. [Kappal and Rastogi \(2020\)](#) examined behavioural biases such as disposition effect, herding effect, and overconfidence bias and their impact on investment decisions using a moderating role, i.e. the investor type. Their results indicated that the moderating role is positive in overconfidence bias and negative in herding effect while making investment decisions. Research work by [Lather et al. \(2020\)](#) focusses on biases like overconfidence bias, reference point bias, self-attribution bias, framing effect bias, regret avoidance bias and overreaction amongst male and female investors and their impact on investment decisions. The study observed that the impact of gender was significant on overconfidence bias, self-attribution bias and regret avoidance bias. A study by [Hassan et al. \(2013\)](#) explains how the theory of traditional finance is different from the modern theory after observing the behaviour of people. The study explores positive and negative aspects of biases and also the way they are related to the financial satisfaction of individuals. The results were found to be positive and significant in the case of biases like overconfidence, reliance on expert bias and self-control. A study by [Sahi \(2017\)](#) considered both individual investors and professional investors and investigated their investment decisions by comparing them using different techniques and tools. They discovered that long-term investment decisions have 1.5 times the impact of short-term decisions. Short-term investors are being affected by heuristic biases. Heuristic bias affects investors in analysing their current financing situation and previous experience that shows how to deal with the behavioural biases for making rational decisions ([Rauwerda and De Graaf, 2021](#)).

We have utilized an organized procedure in order to locate the relevant literature. The intellectual dynamics of the research area can be better understood after science mapping has been carried out with the assistance of bibliometric tools. In addition, investors, analysts, practitioners and academics may find the comprehensive analysis of the content leadership, research gaps and future research directions to be of great value.

3. Methodology

SLR explores and offers a model for summarizing and critiquing literature to enhance the future research agenda. It is used as a standard for a road map to potential documents ([Davis et al., 2014](#); [Livinski et al., 2015](#)). The systematic review adopts a common protocol and is carefully documented to be transparent to other researchers, enabling them to access results and thus helping to maintain external validity. It combines findings from various studies and reveals the trends, patterns and themes in the current literature from the available body of knowledge ([Davis et al., 2014](#)). This provides reliable outcomes by reducing the existing bias ([Liberati et al., 2009](#)). SLR is a means of consolidating knowledge about a specific topic or research question. It has been used in exploring relevant research based on a research question on a particular research method systematically. This provides the most clarity, validity and reliability in relevant studies in the area. It tries to reduce the biases that occur during the review of research evidence. SLR clarifies documents by defining their structure, document methods and search process. SLR removes potential bias, e.g. selection and publication. In order to avoid publication bias, we have included a wide range of reviews, including the years 2007–2022. Accurate records are kept in order to provide an auditability

feature that enables the review to be consistent and systematic throughout. Articles published in English have more citations than articles in other languages; they are dominant in the area of behavioural finance and also make English accessible to a wider audience. Many researchers communicate their results to the global community in English.

The period considered has shown a high growth in published articles and also citations, all of which have increased over the time period. Identifying the trends and topics may give vital insight to researchers in the domain of behavioural finance. A number of researchers discussed the selection of different databases, e.g. Scopus and Web of Science (WoS), for bibliometric analysis. Each database has its own advantages. As per the rule of thumb, all databases should be used, but this demands huge data cleaning and merging of databases. There are several reasons for the choice of Scopus databases. One is that the coverage of Scopus is relatively larger, with more citations of peer-reviewed articles. Scopus had more weightage than Google Scholar databases and more extensive research, whereas Google Scholar provides limited bibliometric information for bibliometric analysis (Corbet *et al.*, 2019; Kumar *et al.*, 2020; Levine-Clark and Gil, 2008).

The systematic review helps to create questions or hypotheses and collect and analyse data from studies to find solutions; it also identifies paths to further research. This study focusses on the SLR process and bibliometric analysis; this implies structured, transparent, reproducible and iterative development in nature (Fischer and Lehner, 2021). Some keywords are required in the SLR process for the extraction of research articles. Primarily, data were provided by Scopus, the largest database that consists of abstracts and citations in the pertinent literature. To create the most relevant study, the searching process used a combination of a title, an abstract and a keyword. Furthermore, to understand the intellectual structure of this study, bibliometric analysis was used. To perform this bibliometric analysis, a variety of different pieces of software have been used. For this study, we used VOSviewer to perform bibliometric analysis.

During the process of searching, we will only take into consideration papers that have been published in Scopus journals and are written in English. The overall selection process that the researchers used in order to carry out the relevant investigations is depicted in Figure 1. From the published articles, the ones that do not have a full-text version, do not pertain to the subject at hand, or are articles such as conference papers, proceedings, and book chapters which are not included in this research. The detailed criteria for inclusion/exclusion of papers are summarized in Table 1. The records that were imported in the “.csv” and “.bibtext” formats were disregarded for the sake of the subsequent study. In addition, selected articles were taken into consideration for additional bibliometric research.

4. Bibliometric analysis

4.1 Data extraction process

It could be observed from Table 2, that there are a total of 63 authors who have contributed to the publication of 27 articles in 20 reputable journals that have been subjected to peer review. These authors come from a wide variety of fields, including business, management, accounting, economics, econometrics, finance plus arts and humanities. Overall, 60 authors have contributed to multiple documents. In addition, there are just three authors who have a single research document.

The study activity that was associated with this topic began in 2007. From 2019, an upward trend was observed in the publication frequency. This results in a collaboration index of 2.5 between the authors. Annual scientific productivity is increasing at a rate of 27.54% per year. Bibliometric analysis was used to obtain this information.

Behavioural biases and their influence on financial decisions are increasingly becoming the focus of attention amongst researchers and other experts, who endeavour to better

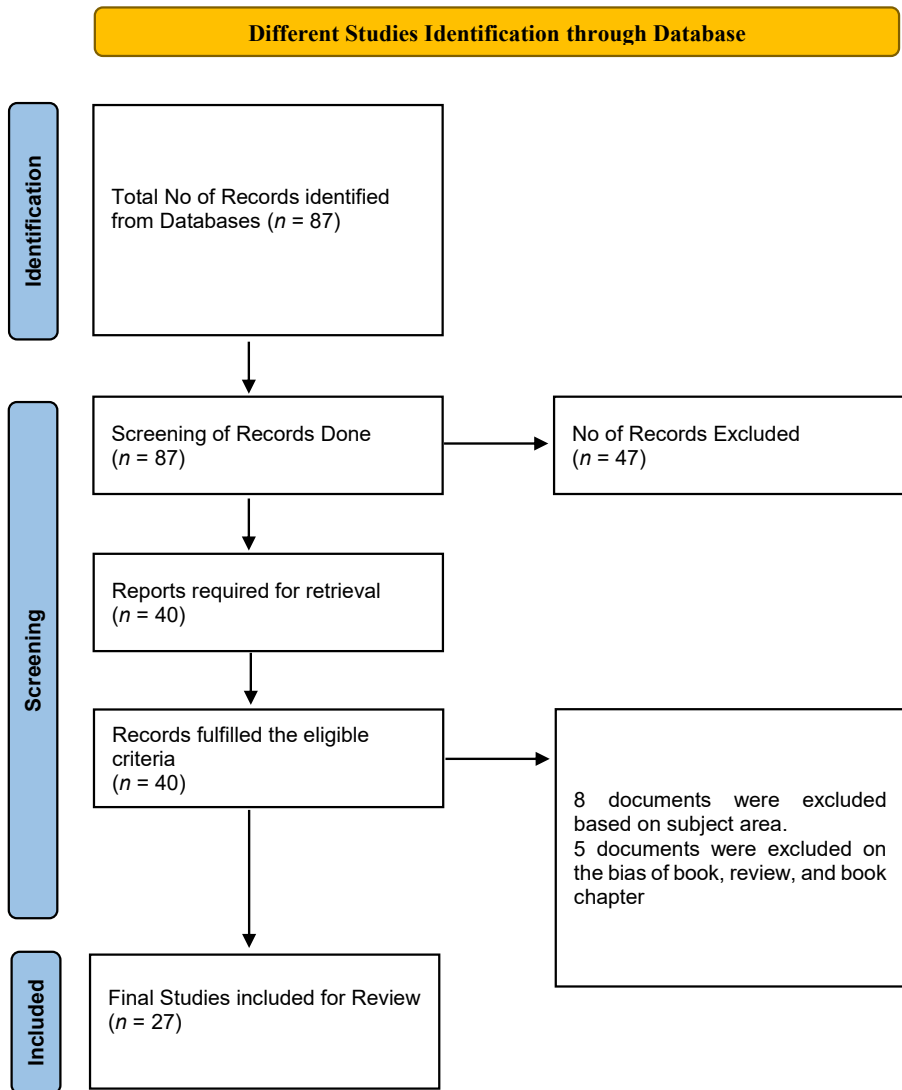


Figure 1.
Flow diagram
[Preferred Reporting
Items for Systematic
Reviews and Meta-
Analyses (PRISMA)]

Inclusion criteria	Exclusion criteria
Articles indexed in Scopus database	Book chapters, conference papers, conference review and articles outside the scope of behavioural finance
English language	
Both global and local documents	

Table 1.
Criteria for inclusion/
exclusion of papers

understand both. In both of the years 2020 and 2021, there are a total of seven articles published that could be observed from Figure 2. It was also observed that in addition, three articles were published in 2019. This indicates a greater emphasis being placed on research in this sector beginning in 2019.

In this field, most of the research work was done in India ($n = 51$) followed by Iraq and Pakistan ($n = 3$). But if we observe citations of the paper, then the USA, i.e. ($n = 2$) with 215, has the highest number of citations compared to India (119) and Pakistan (5); refer to Figure 3. In contrast, the publications from China and other remaining countries are not able to create sufficient citations. It is essential to understand how behavioural biases influence investors in making investment decisions.

4.2 Most influential works

These chosen papers are listed in Table 3, in ascending order of the number of citations they received. In addition, the author's name, the title of the work, the journal in which it was published and the h index of the publication are given. This knowledge is very important to

Parameter	Outcome
Period	2007–2022
Sources (Journals)	20
Documents	27
Avg. years from publication	2.78
Avg. citations/document	13.44
Avg. citations per year per doc	1.764
Keywords	12
Author keywords	92
Authors	63
Documents per author	0.429
Collaboration index	2.5

Table 2.
Descriptive data
regarding scientific
papers retrieved from
Scopus Database

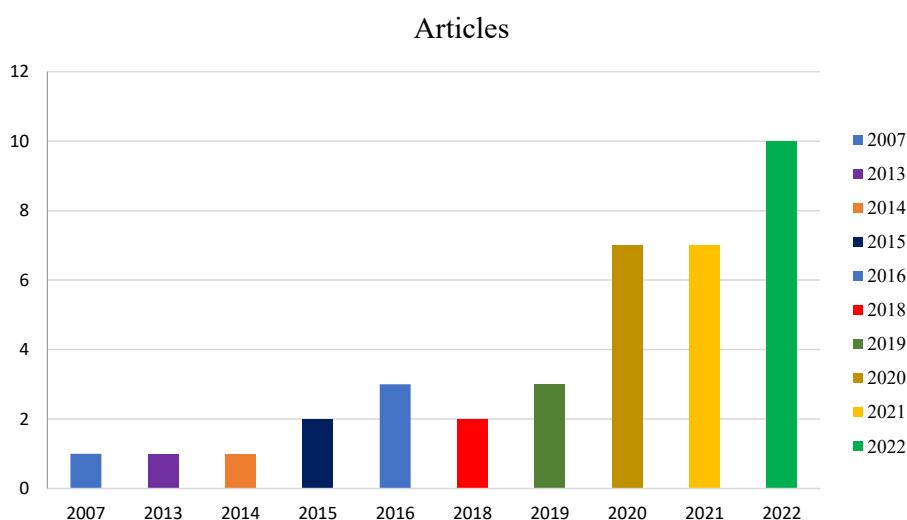


Figure 2.
Article publication
per year

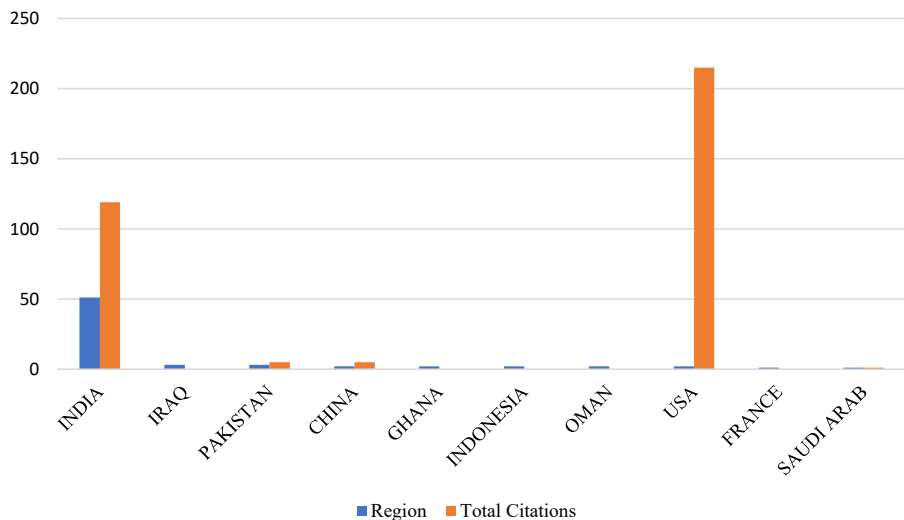


Figure 3.
Country-wise scientific
production and
citations

pave the way for new research directions for those working on this subject. The material also sheds light on the author's contributions to their work in this field and provides insights into those contributions. In addition, the name of the journal which contains highly referenced works is also stated. When it comes to obtaining useful information, one of the best sources is found in highly referenced publications. Knowledge regarding behavioural biases and investing choices can be gained by analysis of those papers which have received a significant number of citations. The authors highlight the illogical investment decisions that are made by investors due to their biases (Chen *et al.*, 2007). As a result, this creates a direction for researchers to explore more deeply with the assistance of existing frameworks and even tries to extend the framework with a new construct after identifying a gap that is presented in the previous paper (Kumar and Goyal, 2015). A number of researchers then improved and broadened the scope of the study by incorporating both primary and secondary data, as well as a wide variety of tools, methods and more advanced levels of statistical analysis. This was done in an effort to validate the underlying framework and theory (Singh *et al.*, 2016; Sharma and Nandi, 2018; Zahera and Bansal, 2019; Kappal and Rastogi, 2020; Abdullah and Naved Khan, 2021; Barber and Odean, 2001; Fischer and Lehner, 2021). The scope of the research was expanded to include looking into how investors think and how they do business. This helped to develop a theory and build a structure using advanced statistical skills.

To analyse the relationships between co-author, co-occurrence, co-citation analysis and bibliographic coupling, we used VOSviewer. With the help of VOSviewer, a co-occurrence map can be created based on network data, allowing us to understand the flexibility and integrity of collected information. WoS, Scopus, Dimensions, Lens and PubMed are the databases that are taken into account for visualization.

4.3 Analysis of the author co-authorship network

A study was made of the relationships amongst authors, organizations and countries. We used VOSviewer to examine the relationship between authors' works and how collaborative work provides a new direction and better quality of research papers.

To analyse this, a minimum number of documents was set; the threshold was at least one research paper co-authored and the number of citations at least four times between

Authors	Journal title	Research article title	Country	Citations	h index	Behavioural bias and investment decisions
Chen <i>et al.</i> (2007)	<i>Journal of Behavioural Decision Making</i>	Trading Performance, Disposition Effect, Overconfidence, Representativeness Bias and Experience of Emerging Market Investors	The USA	215	1	27
Kumar and Goyal (2015)	<i>Qualitative Research in Financial Markets</i>	Behavioural Biases in Investment Decision Making – A Systematic Literature Review	India	62	3	
Kumar and Goyal (2016)	<i>Qualitative Research in Financial Markets</i>	Evidence on Rationality and Behavioural Biases in Investment Decision Making	India	24	1	
Lakshmi <i>et al.</i> (2013)	<i>International Journal of Economics and Management</i>	Assessing the Linkage of Behavioural Traits and Investment Decisions Using Sem Approach	India	8	1	
Mangala and Sharma (2014)	<i>Indian Journal of Finance</i>	A Brief Mapping of Theory and Evidence of Investors' Behavioural Biases	India	7	1	
Dangi and Kohli (2018)	<i>Indian Journal of Finance</i>	Role of Behavioural Biases in Investment Decisions: A Factor Analysis	India	6	1	
Singh <i>et al.</i> (2016)	<i>Indian Journal of Finance</i>	Behavioural Biases in Investment Decisions: an Exploration of the Role Of Gender	India	6	3	
Zhou and Yang (2020)	<i>Empirical Economics</i>	Investor sentiment, investor crowded-trade behaviour, and limited arbitrage in the cross section of stock returns	China	5	1	
Ahmad (2020)	<i>Management Decision</i>	Does Under confidence Matter in Short-Term and Long-Term Investment Decisions? Evidence From an Emerging Market	Pakistan	5	1	
Kappal and Rastogi (2020)	<i>Qualitative Research in Financial Markets</i>	Investment Behaviour of Women Entrepreneurs	India	4	1	
Raut <i>et al.</i> (2018)	<i>Asian Journal of Business and Accounting</i>	Extending the Theory of Planned Behaviour: Impact of Past Behavioural Biases on the Investment Decision of Indian Investors	India	4	1	
Madaan and Singh (2019)	<i>International Journal of Financial Research</i>	An Analysis of Behavioural Biases in Investment Decision-Making	India	3	1	
Khawaja and Alharbi (2021)	<i>International Journal of Social Economics</i>	Factors influencing investor behaviour: an empirical study of Saudi Stock Market	Saudi Arab	1	1	
Jain <i>et al.</i> (2021)	<i>Management Review Quarterly</i>	Mapping the Field of Behavioural Biases: A Literature Review Using Bibliometric Analysis	India	1	2	
Lather <i>et al.</i> (2020)	<i>International Journal of Management</i>	An Empirical Examination of the Impact of Locus of Control on Investor Behavioural Biases	India	1	1	

(continued)

Table 3. Highly cited research papers in the field of behavioural biases and investment decision-making (2007–2022)

Table 3.

Authors	Journal title	Research article title	Country	Citations	h index
Jamil and Khan (2016)	<i>International Journal of Economics and Financial Issues</i>	Does Gender Difference Impact Investment Decisions? Evidence From Oman	Oman	1	1
Compen et al. (2022)	<i>Decision Support Systems</i>	How to elicit and cease herding behaviour? On the effectiveness of a warning message as a debiasing decision support system	Belgium	3	5
Liu et al. (2022)	<i>Journal of Financial Economics</i>	Taming the bias zoo	Hong Kong	31	5

2007 and 2022. This resulted in 25 authors in nine clusters (Figure 4) with 26 links between them. Each cluster is represented by a different colour. Goyal N. and Singh S. have the strongest co-authorship network with three documents followed by Jain who has a co-authorship network of two documents.

Figure 5 represents the co-authorship network amongst affiliated countries; the minimum number of documents is set at one. This found that there are 11 countries present which have at least one paper; the countries are India, China, Hong Kong, Pakistan, Saudi Arabia, the USA, Ghana, France, Indonesia, Iraq, Norway, Bangladesh and Oman. India has the highest number of documents, 19, with the strongest co-authorship network, followed by China and Pakistan both having two documents.

4.4 Co-occurrence of author's specific keyword

Here co-occurrence means the situation occurs at the same time, or one thing has a connection with others. In the literature review, we have to understand how the keywords of all the

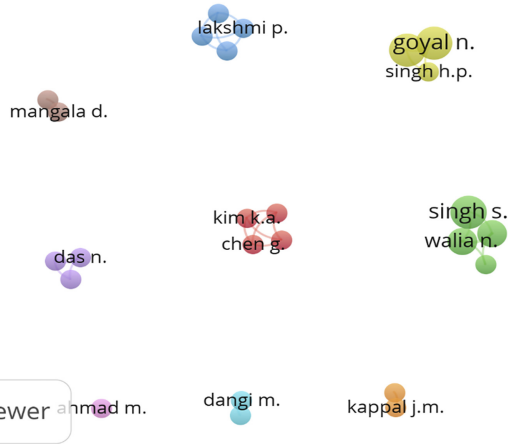


Figure 4. Co-authorship network

Figure 5. Co-authorship network amongst affiliated countries



authors are connected, so we can clearly understand the connection. This is essential for further analysis. To analyse more deeply and examine strong bonding between the papers, we have considered author keyword analysis. We used the VOSviewer of co-occurrence analysis with the help of author keywords. We set a minimum of three keywords of occurrences. The result found that out of the 92 keywords, ten keywords met the threshold criteria.

Figure 6 shows the keywords network that is frequently used by authors in their papers. The result found that the disposition effect had the strongest link and highest occurrence, i.e. 6, with behavioural biases, herding, heuristics and investment decisions. This modern model can better investigate the topic with regard to behavioural biases and investment decisions.

4.5 Co-occurrence network of abstract

To analyse more strongly the connection of authors' work, we consider abstract in conceptual structure in biblioshiny for bibliometrix. Figure 7 shows 49 nodes, with these nodes grouped under three clusters. **Cluster 1** (red colour) is the largest cluster having 22 nodes. Out of 49 nodes, 22 nodes are grouped. These nodes have a strong connection with each other. This includes biases, investment, research, data, decision-making, etc. **Cluster 2** (blue) is the second-largest cluster with 18 nodes. In this cluster, nodes such as the individual, cognitive, questionnaire, finance, impact etc. are prominent. **Cluster 3**, in green, contains nine nodes; this includes findings, implications, model, influence etc. As there are so many authors, researchers who have adopted the process of SLR to validate new models and hypotheses for this new concept of behavioural finance must establish which theories are different from traditional theories. Our examination shows that much more research work on the modern concept of behavioural biases has been carried out in India recently.

4.6 Co-citation of cited references

When two documents are cited together by another one, the frequency of citation is known as co-citation. The high strength of co-citation means that they are more semantically linked. The citing literature motivates the author as it generally occurs when the document contains academically relevant material.

For analysis, the citation of reference used the VOSviewer of co-citation and full counting method. Further, the minimum number of citations set as three, results in the 18 thresholds

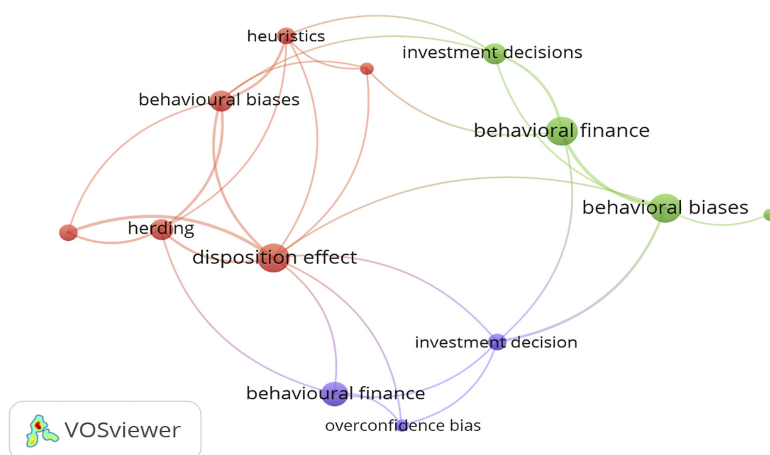


Figure 6.
Keyword
co-occurrence map

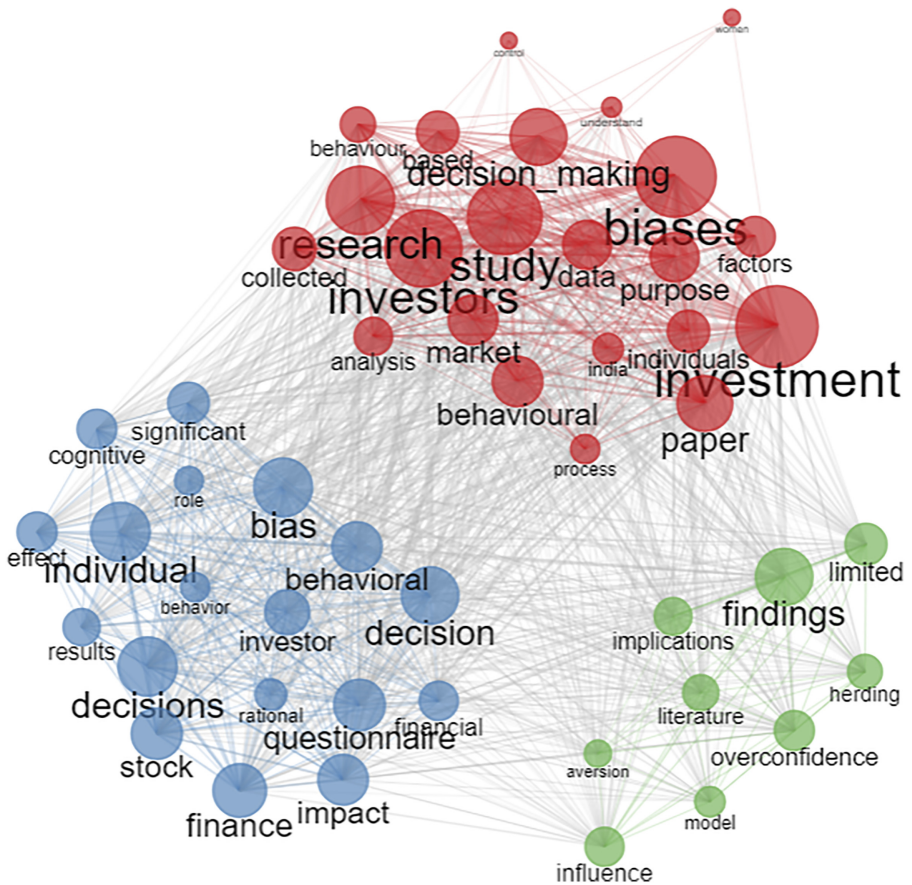


Figure 7.
Co-occurrence network
of abstract

classified into three clusters. Each cluster is represented by a different colour (Figure 8). Cluster 1 (in red) consists of highly co-cited references and is the largest cluster. Odean, T., Shefrin, H., Fama, E.F., Nofsinger, J.R. and Sataman, M. have more citations in Red Cluster 1. Similarly, Cluster 2 (in green) includes Ritter, J.R., Glaser, M., Barberis, N., Shiller, R.J. and Prosad, J.M. with the second highest number of citations. Cluster 3 (in blue) has 5 references, i.e. Kahneman and Tversky (1979, 1982), Waweru *et al.* (2008). This co-citation of references has 133 total link strengths.

4.7 Author level – co-citation analysis

Co-citation analysis was also carried out by considering all the authors with the help of VOSviewer and presented in Figure 9; this gave co-citation of the full counting process. There are 2,144 authors present. A minimum number of citations of ten produced 25 thresholds grouped into three clusters. Cluster 1 (red) includes authors like Kahneman, D. who has the highest number of citations (71) with 1,573 link strengths; Odean, T. has 53 citations with 1,342 strengths; Tversky, A. has 58 citations with 1,287 strengths. Cluster 1 has the strongest bonding. Similarly, Cluster 2 (in green) consists of Shleifer, A. who has 17 citations with 429 link strengths and Subrahmanyam, A. who has 14 citations with 416 strengths; Cluster 3

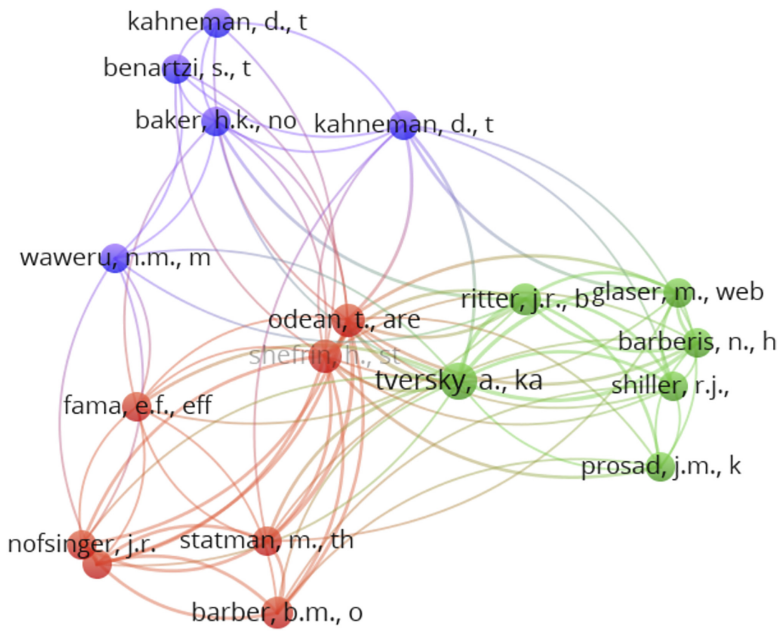


Figure 8.
Co-citation map

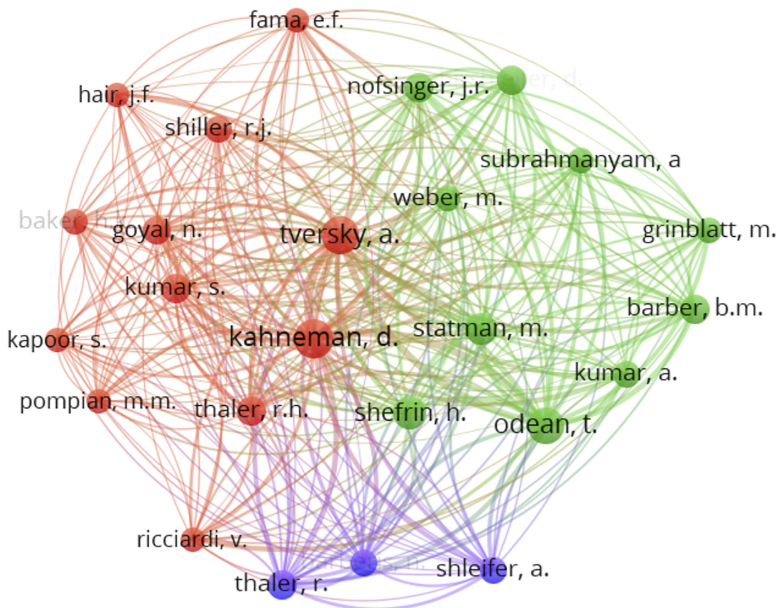


Figure 9.
Co-citation analysis at
the author level

(in blue) includes the author Hair, J.F. who has ten citations with 196 link strengths. Overall, the three clusters have a total of 300 links and 6,886 total link strengths.

4.8 Thematic map of authors abstract

A thematic map is known as a statistical map. A thematic map describes the dimensional variability of a specific theme including the major information. Here, we used all the abstracts of selected documents and analysed the information by biblioshiny for bibliometrics. Here the thematic map provides four elements: a base map, a network diagram, statistical data and clusters' information.

Figure 10 shows that there are four clusters present. There are 195 nodes present, and these nodes are divided into four clusters. **Cluster 1** (red colour) shows the strongest bonding; words like investment, biases, behaviour, decisions, etc. have a connection with each other and provide major information. **Cluster 2** (purple) has a connection and information like findings, implications, publishing, practical, methodology approach etc. **Cluster 3** (green) shows words like research, decision-making, individuals, analysis, understanding, etc. **Cluster 4** (blue) contains factors, trading, future, risk, etc.

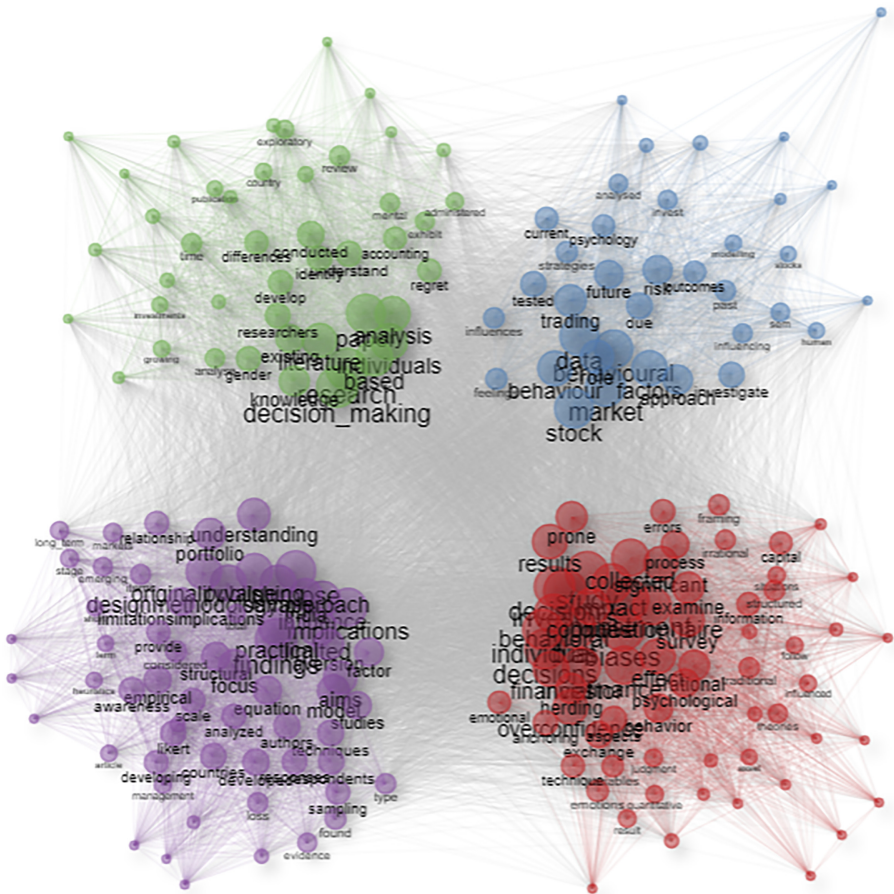


Figure 10.
Thematic map of
authors abstracts

4.9 Bibliographic coupling of countries

Bibliographic coupling occurs when two research work references are common in a third one. When one document cites another document, the strength of other documents also increases. There is a similar strategy in the form of documents, authors, organizations and countries. To see the connection between countries we used the VOSviewer of bibliographic coupling of the full accounting method, and results shown in Figure 11. As per Figure 1, this showed that India had 19 documents with 142 citations and 530 link strengths, China had two documents with 215 citations and 413 link strengths while Pakistan had two documents with five citations and 250 strengths. It could be observed from Figure 11 that Cluster 1 (red colour) includes India, Indonesia, France, Ghana and Iraq. It has the strongest bonding. Cluster 2 comprises Saudi Arabia, Pakistan, Oman and China. Cluster 3 has two countries – Hong Kong and the USA. This clustering provides future directions for collaboration and academic research network development.

4.10 Factorial analysis in the field of titles

We used multiple correspondences and factorial analysis by biblioshiny of bibliometrics to develop the conceptual structural map. The factorial analysis was administered by considering the field of titles of papers. The number of terms is set as 20. Dim. 1 and Dim. 2 showed 40.23% and 18.85% correlated variables, respectively.

Figure 12 shows the word map of factorial analysis. This factorial analysis was also explained with the help of dendrogram parameters (Figure 13).

5. Emerging research theme on biases

In the behavioural finance literature, the consensus view is that influence on investors makes for poor judgment and pricing in the practical field (Barber and Odean, 2001; Fischer and Lehner, 2021). The bounded rationality theory describes how individuals have limited rationality while making an investment decision; the limitation includes the cognitive

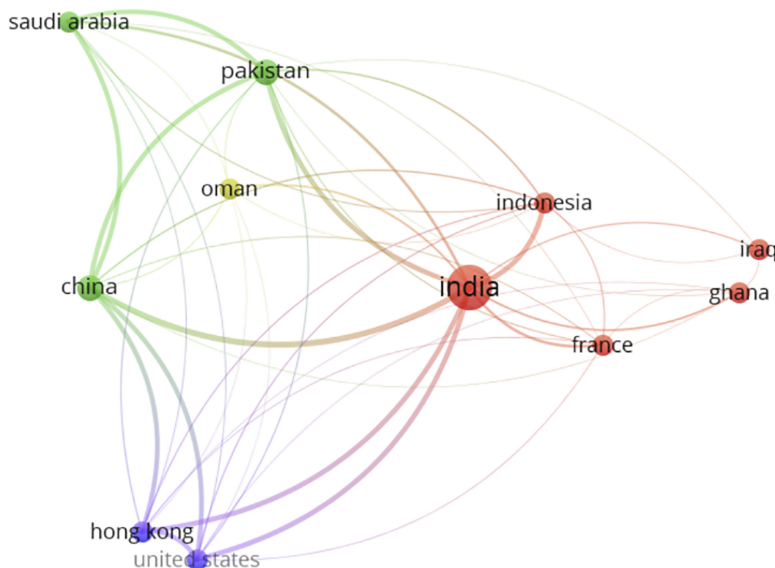


Figure 11.
Coupling of countries

Conceptual Structure Map - method: MCA

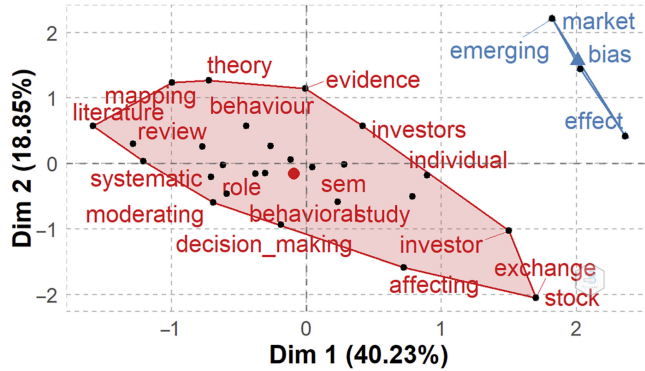


Figure 12.
Conceptual
structural map

Topic Dendrogram

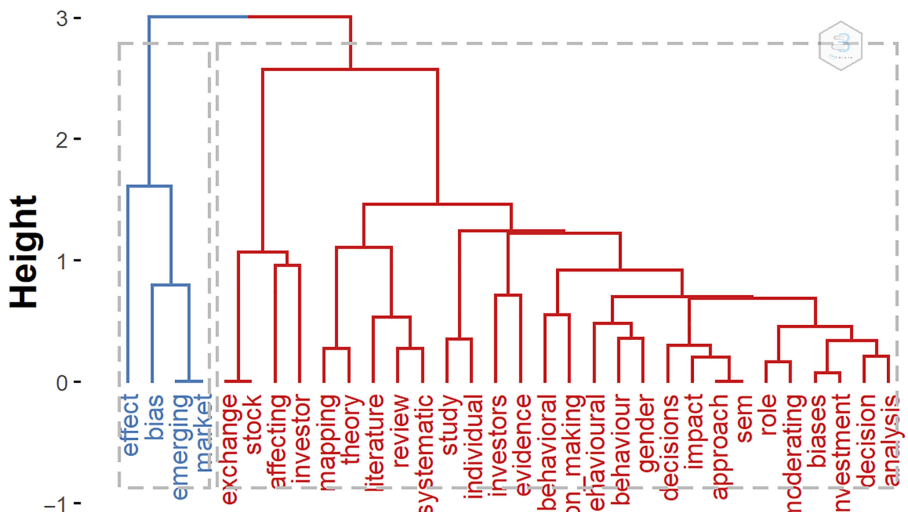


Figure 13.
Topic dendrogram

capability of the mind to make satisfactory solutions rather than making the best possible solution. When influenced by behavioural bias, people make irrational decisions. Behavioural biases consist of cognitive errors or emotional biases. When reasoning is faulty or errors are present in the memory or information processing, this defect is known as a cognitive error. Whereas some bias, e.g. emotional bias, is influenced by feelings which are very difficult to change; these include biases such as regret aversion, overconfidence, loss aversion and many more.

5.1 Mental accounting

Mental accounting is the process of evaluating and differentiating your own money into various mental accounts (Thaler, 1985); this is known as your two-pocket theory. This bias

was proposed by [Thaler \(1985\)](#). [Chandra \(2008\)](#) stated that the investment decisions' process is influenced by mental accounting bias. Male investors are more influenced by mental accounting than female investors ([Lee et al., 2004](#)). Thus, after reviewing the literature, for future research we can make the following propositions:

- Proposition 1.* We need to examine the role of mental accounting in the decision-making process.
- Proposition 2.* We need a strategy development to identify the bias and monitor the investor's decision-making process in investment.

5.2 Herding behaviour

The behaviour of an investor falls under this category when he is highly influenced by emotions and follows others' decisions rather than making his own independent analysis ([Kahneman et al., 2011](#); [Shiller, 2003](#)). [Dennis and Strickland \(2002\)](#) stated that individual investors are more influenced by herding behaviour than institutional investors whereas this case is reversed in the unpredictable market ([Lee et al., 2004](#)). With this bias, investors ignore the available information they have and decide by following others ([Trueman, 1994](#)). Herding also makes the market inefficient ([Kallinterakis et al., 2010](#)). In this case, investors follow the crowd rather than their analysis. Thus, after reviewing the relevant literature, for future research we can make the following propositions:

- Proposition 3.* Influential barriers should be identified to facilitate personal research and strategies in the process of investment decision.
- Proposition 4.* We need to investigate the linkage between herding behaviour and investment decision-making, targeting how to control bias and avoid an irrational investment decision.

5.3 Representative bias

Representative bias is bias where an investor thinks that a good company always makes good investments and profits. The future is predicted based on the representativeness script ([Tversky and Kahneman, 1981](#)). However, it may not be true in all cases. A decision is based mostly on recent events ([Ritter, 2003](#)). Sometimes investors suffer from this bias due to referring to a limited number of samples ([Grether, 1980](#); [Chen et al., 2007](#)). Investors make the wrong choice since decisions must be made based on something more representative. Representative bias helps in making the decision easier and faster, but it might be the reason for wrong conclusions. For future research, we can make the following propositions:

- Proposition 5.* Proper criteria that measure the bias must be set before making any investment decision.
- Proposition 6.* A computation method must be proposed that helps in an empirical experiment by identifying the representative behaviour to control the bias and provide optimized portfolio selection for better returns.

5.4 Availability bias

Availability bias is the bias that persuades investors to have more trust in personal trends and assume them to be the market reality. It is an information processing error that depends on the experiences which are readily available rather than verifying the actual scenario of the market. Sometimes the decision-making process is affected by some irrelevant information ([Harris and Raviv, 2005](#)). There is a significant positive relationship between availability bias

and decision-making as noted by many researchers (Rasheed *et al.*, 2018; Waweru *et al.*, 2008; Javed *et al.*, 2017). The study by Rehan and Umer (2017) stated that bias negatively impacts decision-making. Thus, after reviewing the literature, for future research we can make the following propositions:

Proposition 7. We need to explore and analyse the role of this bias and how it affects the investment decision.

Proposition 8. We need to devise a strategy to measure the actual conditions and reality of the market before making an investment decision, ignoring any irrelevant information without verification.

5.5 Emotional bias

Emotional bias is the kind of impulse or intuition which is based on feelings that are very difficult to change. This emotional bias includes loss aversion, regret aversion and overconfidence etc.

5.5.1 Overconfidence bias. Overconfidence is a situation in which people are highly optimistic about the outcome result. When the market performance is high, investors think this is due to their performance (Zahera and Bansal, 2018). This bias makes investors less cautious about their investment. Due to the illusion of control and illusion of knowledge, mistakes are made by investors. Barber and Odean (2001) found that males are more confident than females. To make a perfect investment decision, investors require skills, intellect or talent. Investors may have a false and misleading notion of their abilities, believing that their ability, skills and intellect are higher than they actually are (Budiartha, 2017; Barber and Odean, 2001). People can find this bias in others but most fail to identify it in themselves. Based on the above arguments, we can propose the following:

Proposition 9. We propose a strategy through which an investor can think of the consequences, reflect on personal limitations and give attention to feedback before any kind of investment is made.

Proposition 10. We need to examine the role of overconfidence in investment decisions.

5.5.2 Loss aversion. This occurs when an investor feels greater pain for losses rather than feeling happiness for the same amount of profit gain. The bias of loss aversion causes the downside impact of loss to be greater than the upside impact of gain. Kahneman *et al.* (1991) found that loss aversion bias influences investors into making an irrational investment decision. Female investors have more loss aversion bias than male investors (Hassan *et al.*, 2014; Blavatsky and Pogrebna, 2008). There is a significant positive relationship between loss aversion bias and investment decision (Lather *et al.*, 2020; Lim, 2012; Khan, 2017). Thus, we can make the following propositions:

Proposition 11. We need to examine the role of loss aversion and its effect on the decision-making process.

Proposition 12. We must prepare an innovation portfolio approach, appropriate frameworks and methods in the investment project.

5.5.3 Regret aversion. This happens when an investor refuses to make any kind of decision due to fear of a negative outcome; this leads to feelings of regret. This regret is the reason for the emotional pain that affects future decisions of the investor. Regret aversion bias has been researched in many papers (Loomes and Sugden, 1982; Bell, 1982). According to Muermann and Volkman Wise (2006), those investors with regret aversion bias usually invest their funds according to set plans. Many researchers (Kengatharan and Kengatharan, 2014; Lim, 2012;

Khan, 2017) found that regret aversion can impact positively on the investment decision-making process. For future research, we can propose the following:

Proposition 13. Before investing, we must prepare a diversified portfolio approach and strategy to avoid bias.

Proposition 14. We need to analyse the role of this bias and its effect on investment decisions by procuring the help of unbiased analytics and financial planners.

5.6 Research gap

After performing a comprehensive review of the literature from 2007 to 2021 on behavioural biases and investment decisions, we have found that there has been ongoing progress in the body of literature. Research gaps identified for future research include the following:

- (1) There is a requirement for more advanced statistical techniques that can identify the biases present in investors and provide the most suitable and optimized solutions.
- (2) Behavioural bias is a modern concept that is different from traditional concepts. Nowadays it is essential to understand all biases before making any kind of investment. There is no specific organization or procedure available to make investors aware of the impact of biases. Theory-based quantitative research needs to be thoroughly addressed in future research.
- (3) The quantity of research on different biases like emotional bias, status quo, representative bias etc. is lacking. So, more work is needed in this area to observe these biases and their consequences.

6. Discussions

An SLR and a bibliometric analysis were conducted. This allowed us to analyse the research trends in behavioural biases and investment decisions and to segregate documents into different clusters to observe their themes and the association between them; this identified gaps for further research. For bibliometric analysis, VOSviewer and bibliometrics software were employed. To address the first objective, the relevant literature published between 2007 and 2022 was reviewed to gain a thorough understanding of the characteristics of identified behavioural biases and their impact on decision-making. We considered 27 articles for analysis. SLR was conducted in an effort to understand how existing research work is connected and to provide valuable information for future study. It was observed that research work on behavioural biases and investment decisions around 2007 was very limited as it was a relatively new concept then. However, after 2009, research has steadily demonstrated an upward swing. India has the highest number of documents under study, i.e. 19, with the strongest co-authorship network. This is followed by China and Pakistan with 2 documents. The most influential journal is *Journal of Behavioural Decision Making* with authors, Chen *et al.* (2007) having the highest number of citations – 215. We set up the network map with the help of co-authorship, co-occurrence, the thematic map through VOSviewer and biblioshiny of bibliometrix. This creates interesting patterns and themes of behavioural biases and investment decision-making and provides the intellectual structure of this study through clusters. This was accomplished by forming a thematic map by biblioshiny of bibliometrics. The thematic map considered the abstracts of all the authors and observed the dimensional variability present in the research study. Finally, a demonstration was made with four clusters with different colours showing how their abstract information bonded with each other. The SLR helps in understanding the role and effect of cognitive and emotional biases on

investment decisions. The cognitive error generated from memory includes biases like mental accounting, herding behaviour, representativeness and availability bias. Biases based on feelings known as emotional bias include overconfidence, loss aversion and regret aversion. From the review and information gathered, the study found that investors are influenced by these biases resulting in irrational investment decisions being made.

6.1 Implication

Behavioural biases play a vital role in the cognitive thinking process of investors. This creates a perceptual map of biases in the minds of investors, influencing irrational decisions. Findings from the study reveal both academic implications and business implications. For academic purposes, behavioural bias provides key insights of biases affecting all investors, suggesting how outcomes will be shaped. The study also identifies the progress made over the years from traditional concepts to modern concepts. It is recommended that financial plans of individual investors should include a proper strategy to ensure a quality investment. The study suggests that institutional investors or financial brokers should create a strategic retention programme, building a portfolio by considering the impact of biases and all risk factors. This will guarantee that the decision for investment will be rational and returns from the portfolio will be optimum. Governments can make a societal contribution by running various programmes of “investor awareness” to increase the knowledge base regarding biases, financial markets and important practical insights into this concept.

7. Conclusion

The main contribution of this article is to give an insight into the themes and associations present in the subject of behavioural biases and investment decisions by analysing those highly cited research documents published by top contributing authors from top journals and a range of countries. To achieve this, the study has conducted a review of the literature from Scopus indexed journal publications that investigate behavioural biases and investment decision-making to identify the existing gaps and provide optimized solutions. From these observations, we have found that most of the research has been contributed by authors from India, China, Pakistan and the USA as per the country-wise scientific production analysis. The analysis conducted in this area, with the help of various frameworks like VOS viewer and biblioshiny of bibliometrix gives an overview of the researched topics and identifies the proposed dimensions. Under bibliometric analysis, we have identified the trends in this area, classifying the topmost authors' publications with their citations, journals, countries and bibliographic coupling by clustering these documents. The dimensions cover most related articles on behavioural biases and investment decisions. These findings will help decision-makers to create a framework that helps individuals to identify their biases and make rational investment decisions. The proposition of biases includes the emerging research themes of biases that give direction for future study. With the help of this study, some propositions are made by analysing the biases for future study and developing the best framework and strategy for rational investment. Moreover, future researchers can explore the areas identified and give more effort and understanding to creating models or tools to identify the characteristics of biases. This will provide a feasible solution to every kind of investor – individual investors, financial advisors and experts – to avoid irrational decisions by mitigating the biases.

8. Limitations and scope of future work

This study has some limitations. It has considered only Scopus database journal publications, excluding conference publications, editorials and book chapters. For reviewing and analysing the literature, only the tools of VOSviewer and bibliometrics were used. Through these tools, we get to know the connection between authors, documents, organizations and countries; this

reveals the relationships between authors' works, and how collaborative working provides a new direction and better quality of research papers. Further, the study can be extended by practitioners as well as academicians to explore how behavioural biases impact investment decisions. Future research could also expand this study by considering other databases like WoS and Institute of Electrical and Electronics Engineers (IEEE) Xplore. We can extend this study to different types of tools like Cite space, Bib excel, Histocyte, Gephi, etc., rather than VOSviewer and bibliometrics; this may give better understanding and review. More study is required on a global basis. Cross-cultural considerations can better understand behavioural biases like recency, house money effect, self-attribution and status quo and all biases that affect investors. Advancing the present models will provide optimized solutions for investors. Future research can progress in the direction of stock markets and investors who are more inclined towards investment in the stock market aligned to the derivatives market. Work can be extended to empirical research based on primary data in analysing the biases impacting investors' decision-making. Further, along with cognitive and emotional biases, other biases should be taken into consideration. A comparative analysis can be carried out amongst institutional and retail investors with the moderating and mediating effect of demographic variables impacting the biases in the investment decision-making process.

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