Nudges and choice architecture in public policy: A bibliometric analysis

Vijay Victor [a,*], Aparna M. Nair [b], Daniel Francois Meyer [c]

[a] Accounting, Economics and Finance Area, T A Pai Management Institute, Manipal Academy of Higher Education, Manipal 576104, India
[b] Department of Economics, CHRIST (Deemed to be University), Bangalore 560029, India
[c] College of Business and Economics, University of Johannesburg, Auckland Park 2006, South Africa

ABSTRACT

In recent years, nudges and choice architecture have gained significant attention amongst researchers, particularly in the domain of public policymaking. This study contributes to the existing literature on the application of nudges and choice architecture in public policy through a bibliometric analysis. A total of 419 documents from the Web of Science database from 2010 to 2021 were analysed, identifying the most prolific authors, foundational works, and sources, along with primary research themes. The study identifies keywords and themes that shape the current research trends and visualizes the intellectual structure of empirical works. The findings show an increasing focus on this subject area over the past decade, with a growing interest in themes such as dietary habits, healthcare, effectiveness of behavioral interventions, and sustainable choices. The application of nudges and choice architecture in policies related to health, food consumption, and diet management has also become increasingly prevalent as evidenced by the exponential growth in publications on these topics.

1. Introduction

Insights from behavioral economics have improved the design and effectiveness of public policies. In recent years, there has been an increasing interest in the literature on behavioral interventions such as nudges and choice architecture in public policy (Van Deun et al., 2018). Choice architecture has shown potential as an effective approach for influencing people's decision-making and encouraging socially desirable choices. This approach has become popular with the epoch-making book of Thaler and Sunstein (2008), which explores the theoretical and practical value of the nudge theory (Moseley, 2020). According to Thaler and Sunstein (2008, p.6) nudges are "any aspect of the choice architecture that alters people's behavior in a predictable way without forbidding any options or significantly changing their economic incentives." Further, they define choice architecture as "organising the context in which people make decisions" (Thaler and Sunstein, 2008, p.428).

The discussions on the applications of non-regulatory interventions in various areas like traffic safety regulation, environmental protection, and public health policies began as early as the 1970s (Graf, 2019). The past decade especially has seen a remarkable increase in behavioral studies and non-regulatory interventions in public policy. Governments such as the US and the UK have endorsed the use of behavioral insights

in policy-making, with the UK government setting up the Behavioral Insights Team in 2010 intending to "find intelligent ways to encourage, support and enable people to make better choices for themselves" (BIT, 2011, p. 4). The US government also encourages all agencies to integrate behavioral insights into policy framing (Kuehnhanss, 2019).

Nudges and choice architecture as policy instruments share traits with the traditional tools in the literature. For example, information nudges and information provision have several similarities in terms of their aim to influence behavior and decision-making. Similarly, nudges based on incentives and conventional policies such as grants and subsidies share common features (Kosters & Van der Heijden, 2015). However, nudges and choice architecture significantly differ from the traditional tools that are built on the foundational assumptions of rationality and utility-maximising behavior. Acknowledging that people are rationally bounded makes behavioral interventions like nudges and choice architecture a perfect complement to the existing policy toolbox (Van Deun et al., 2018; Kosters & Van der Heijden, 2015). This also means that behavioral interventions can work by supplementing the prevailing framework rather than replacing or substituting them. Such policies in the literature are termed "nudge-plus" or "hybrid" policies (Loewenstein & Chater, 2017; Banerjee & John, 2021).

The complex challenge of understanding human behavior and its significance to policymakers has led to a growing interest and

* Corresponding author.
E-mail address: vijay.victor@manipal.edu (V. Victor).

substantial attention towards the application of nudge theory in public policies. Improving the regulatory choice architecture is essential to ensure greater transparency, improve feedback mechanisms, and consider non-regulatory alternatives (Dudley & Xie, 2019). Non-regulatory behavioral interventions, such as nudges and choice architecture offer a cost-effective solution for addressing various policy issues when compared to many traditional public policy instruments (Maki, 2019; Congiu & Moscati, 2022).

The literature on nudges and choice architecture integrated public policy is proliferating. Nevertheless, this field of study is still young and developing (Van Deun et al., 2018; Leong & Howlett, 2022). Previous bibliometric analyses investigating the application of behavioral interventions in public policy have primarily focused on evaluating the scope and nature of behaviorally orientated publications on policy instruments, as demonstrated by the work of Leong and Howlett (2022). Another study by Rawat (2019) explored the nature of behavioral research in economics and public policy. Both studies provide evidence of a growing acceptance of behavioral insights in shaping policy, with Leong and Howlett (2022) also noting that this behavioral shift is uneven across different geographic regions and sectors.

Against this backdrop, a bibliometric analysis with a special focus on the applications of nudges and choice architecture in public policy-related research would assess the extent and nature of existing literature in the field. A comprehensive analysis of publications in this research area from 2010 to 2021, mapping the intellectual structure, scientific productions, and countries in terms of their sources and collaborations, would provide insights into the nature of the topics studied, emerging research areas and future research directions.

The primary research questions of the study are as follows;

RQ1. Who are the most prolific authors that contributed to the research in the field of nudges, choice architecture and public policy?
RQ2. Which prominent academic works, journals, and countries contributed to the growth of the research area?
RQ3. What are the prominent keyword clusters that originated within the domain of nudges, choice architecture and public policy research?

RQ4. What are the primary intellectual themes that emerged in the field of study between 2010 and 2021?

2. Methods

The objective of this study is to evaluate prior research relating nudges and choice architecture to public policy using a bibliometric approach. The study follows the guidelines set out by Donthu et al. (2021) on the requirements for performing a bibliometric analysis. The techniques used for the analysis are illustrated in Fig. 1.

The main techniques used in the analysis are categorised under two headings; performance analysis and science mapping. Performance analysis in bibliometric studies mainly focuses on quantifying the contributions of various research constituents such as researchers, journals, countries etc. Science mapping, on the other hand, is concerned with the structural and intellectual aspects of the study area, bringing out the 'state of the art' scientific knowledge in the research field (Pessin et al., 2022). Enrichment techniques are additional tools used to augment the main techniques.

The first and second research questions of identifying prominent authors, journals and countries are addressed using the publications and citations-related metrics. The keyword co-occurrence analysis along with keyword dynamics are used to map and classify salient keywords. This is done to answer the third research question. The bibliographic coupling technique and co-word analysis are used to address the fourth research question of identifying major intellectual themes in the area. Fig. 2 displays the linkage between research questions and the various bibliometric techniques employed in the study.

The 'Biblioshiny' function in the *Bibliometrix* package in R studio version 1.4.1717 and VOSviewer version 1.6.18 were used for the analysis. The corpus of documents for the analysis was obtained from the Web of Science (WoS) database. WoS was chosen considering the high quality of research published and the wide range of search analysis capabilities it offers. WoS employs citation indexing, which enhances the search capabilities across disciplines and allows for obtaining relevant trends and patterns in the research area. These trends are also visually represented. Additionally, WoS employs the top three ranked citation
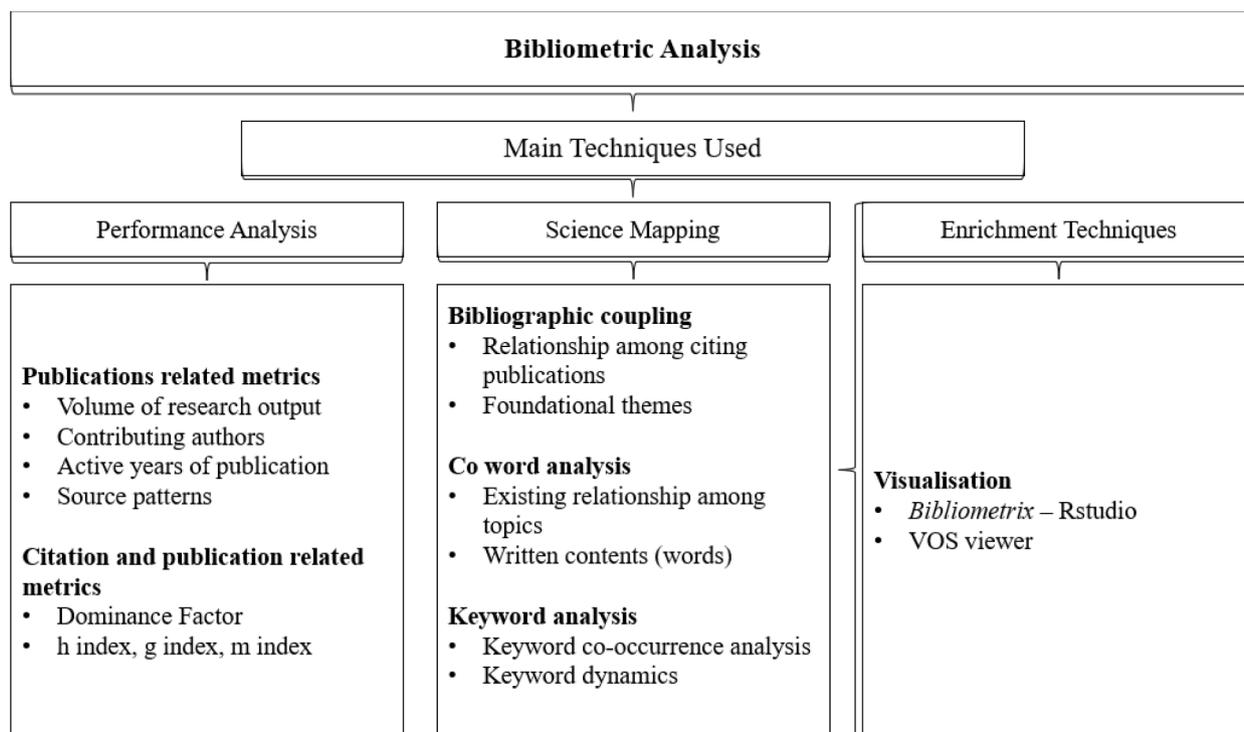

Fig. 1. Techniques used for the bibliometric analysis (Adapted from Donthu et al., 2021).
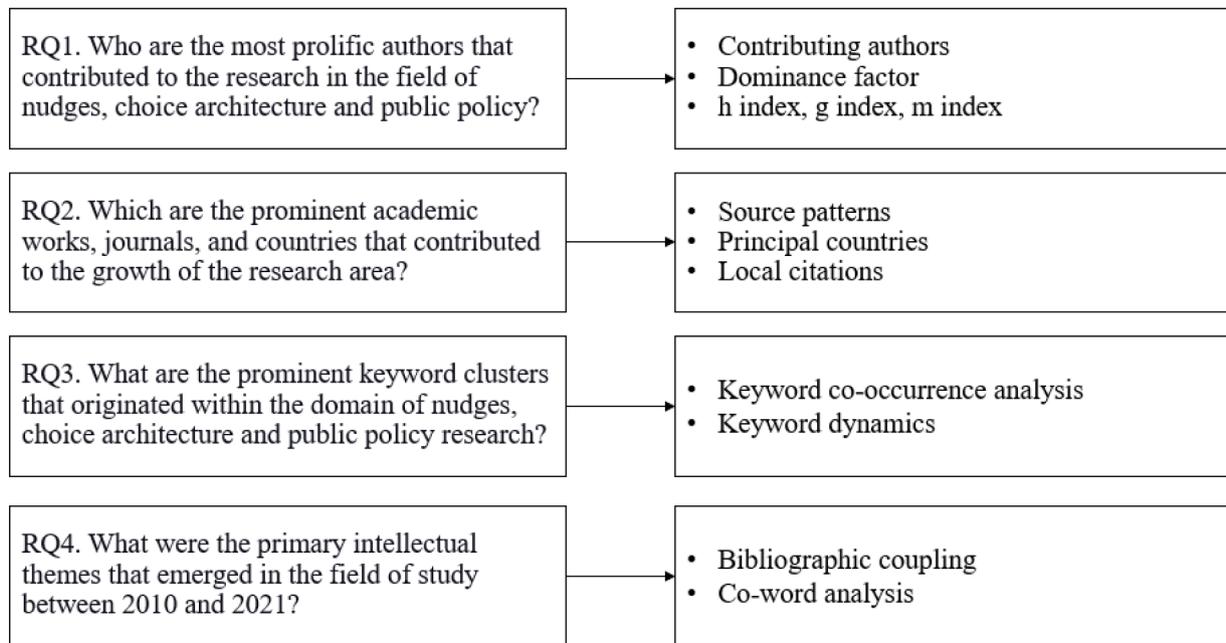
Fig. 2. Flowchart connecting research questions and the bibliometric techniques used.

indexes that are widely cited. To obtain a representative corpus of documents for the analysis, the following search profile was used in WoS.

TS = ("nudg*" OR "choice architecture") AND (public*polic*).

The search period for the study was from 2010 to 2021. The number of publications before 2010 for the specific search keywords was zero in the WoS database. The first study with this search keyword combination was published in 2010. The following-indexes within WoS such as Social Science Citation Index (SSCI), Science Citation Index Expanded (SCIE), and Arts & Humanities Citation Index (A&HCI) were considered for building the corpus of documents. After applying the screening criteria and excluding non-English publications, 419 documents were selected for analysis. Fig. 3 shows the flowchart of the investigation.
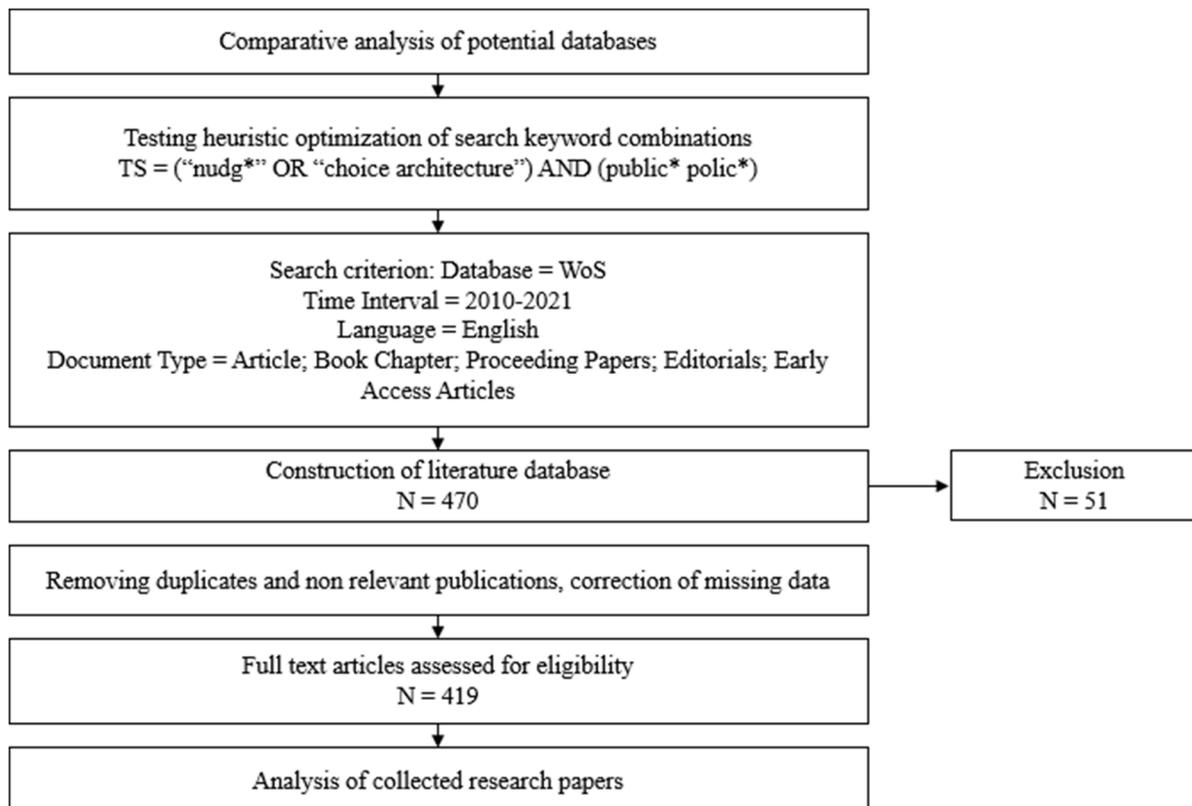

Fig. 3. Flowchart of investigation.

3. Results and discussion

The analysis section includes performance analysis, science mapping, and network analysis. The intention is to identify the primary sources of scientific works published, the authors who have made the highest contributions, and the countries that have played a significant role in terms of research contributions. Additionally, the results also show the intellectual themes and research areas in the field, providing a comprehensive overview of the existing literature on nudges, choice architecture, and their application in public policy.

3.1. General characteristics of the bibliometric analysis

Table 1 provides an overview of the key information regarding the data retrieved from the Web of Science through the keyword search.

A total of 419 documents were retrieved from the Web of Science database search spanning from 2010 to 2021. The authors of these publications were diverse, with 1135 individuals contributing to the corpus of literature. The documents were published in 274 different sources, demonstrating the breadth of research interest in this field. Fig. 4 depicts the number of publications over the study period.

The first phase of publications (2011–2015) showed a steady increase in the cumulative number of publications, which set the stage for subsequent growth. From 2015 to 2019, there was a remarkable increase in the number of publications, growing from 9 to 98 papers. The upward trend continued and the most number of documents (81) got published in 2019. However, a slight fall was observed in the total number of publications (62) in 2020, which picked up in 2021 (74). This drop in publications could be attributed to the disruption caused by the COVID-19 pandemic. The data beyond 2021 was not considered in this study.

3.2. Source patterns

Between 2010 and 2021, 419 scientific papers were published in 274 journals. Table 2 provides an overview of the top-ranked journals based on their local impact. Journal classification was done using the h-index, which takes into account both productivity and citation impact of publications. This metric provides an objective measure of a journal's influence in a specific field.

Table 1
Main information of the bibliometric data collected from WoS.

Description	Results
Time period	2010–2021
Sources (Journals, Books, etc.)	274
Documents	419
Annual Growth Rate (%)	19.98
Average citations per document	10.49
Average citations per year per doc	2.225
References	21451
Keywords Plus (ID)	1092
Author's Keywords (DE)	1384
Authors	1135
Author Appearances	1239
Authors of single-authored documents	102
Authors of multi-authored documents	1033
Single-authored documents	109
Documents per Author	0.369
Authors per Document	2.71
Co-Authors per Documents	2.96
Collaboration Index	3.33

Notes:.

ID - The frequency distribution of keywords associated with the Institute for Scientific Information (ISI) database.

DE - The frequency distribution of authors' keywords.

Author Appearances – The number of author appearances.

Collaboration Index - Total authors of multi-authored documents/Total multi-authored documents.

Table 2 highlights that the Proceedings of the National Academy of Sciences of the United States of America holds the highest h-index, with a total citation count of 207. This journal is ranked first out of the 274 journals identified based on productivity and is widely recognized as one of the world's most-cited multidisciplinary scientific serials, covering areas ranging from biological and physical sciences to social sciences. This indicates that the application of nudges and choice architecture is prevalent across different policy realms and disciplines. The second-ranked journal based on the h-index is Applied Economic Perspective and Policy, with an h-index of 4 and a total citation count of 141, signifying the widespread use of behavioral insights in economic policy-related papers.

3.3. Main authors

Table 1 identifies a total of 1135 authors, of which 8.9% (102) had single-authored documents, and the remaining 91.1% (1033) had multiple-authored documents. The Dominance Factor (DF) was used to calculate the author's dominance, which measures the proportion of publications where an author is the first author relative to the number of multi-authored publications.

Based on the Dominance Factor (DF) as shown in Table 3, the top-ranking author is Zhao RY with a score of 1.0. Small H, Ahlgren P, and Tsay MY hold the second position with a DF score of 0.666, as they were the first authors for two out of three papers.

Table 4 displays the authors' productivity over the years based on the h-index. It is used to measure the cumulative impact of an author's scholarly output and performance. The table displays the top ten authors based on their h-index. Other indexes like the g-index and m-index are also reported. The g-index was created as an improvement over the h-index to evaluate the overall citation impact of a group of documents published by an author (Egghe, 2006). On the other hand, the m-index is calculated by dividing the h-index by the number of years since the researcher's first publication, providing a measure of their average scholarly impact over time (Cabrerizo et al., 2010). Additionally, the table provides information on the total citations (TC), the number of publications (NP), and the year of the first publication (PY start).

The number of publications (NP) shows the top author's highest number of publications in this field. Marteau TM has the highest h-index (5) and with five publications cited 276 times. Ewert B ranks second with four publications cited 19 times with an h-index of 2.

3.4. Significant works

Ten documents with the highest local citations were identified to see the notable works in the research area that integrates nudges, choice architecture and public policy. Local citations refer to the number of citations a document receives from the corpus of works used for the bibliometric analysis. In contrast, global citation refers to the citations that a work receives from other works in the entire database, which in this case, is WoS. Local citation primarily evaluates the prominence of a document within the works related to specific search criteria, whereas global citation measures the general impact of the paper by assessing the citations received from different fields (Aria and Cuccurullo, 2017). The top ten documents with the highest local citations are listed in Table 5.

The work by Benartzi et al. (2017) is the most locally cited publication with 28 citations. This is followed by Hertwig and Yanoff (2017) with 16 citations. Tannenbaum et al. (2017), Saghai (2013) and Hollands et al. (2013) are in the third, fourth and fifth positions respectively. The broad theme of the top five papers is the relevance and significance of nudges in policymaking.

3.5. Principal countries

Table 6 shows the country-wise contributions, collaborations within the same country (Single Country Publications) and inter-country
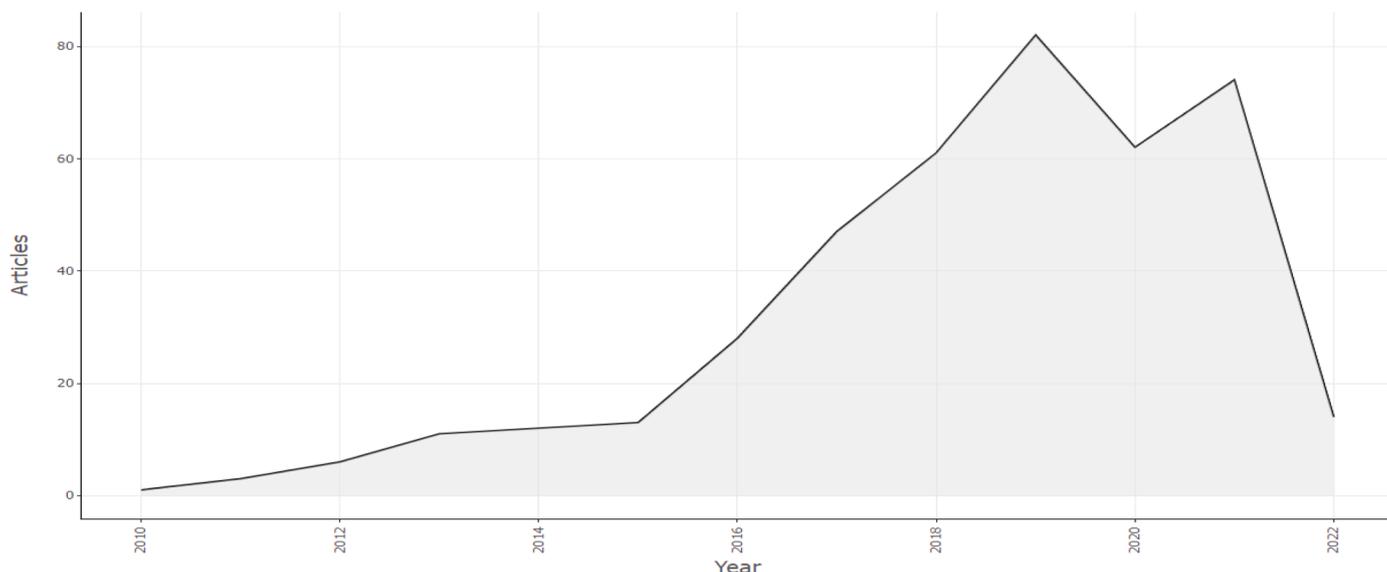
Fig. 4. Annual scientific production over the years.

Table 2
Journal classification based on their impact.

Source (Journal)	h-index	Total Citations	Start Year
Proceedings of the National Academy of Sciences of the United States of America	5	207	2012
Applied Economic Perspectives and Policy	4	141	2013
BMC Public Health	4	216	2013
Frontiers in Psychology	4	56	2017
Policy and Politics	4	55	2018
American Journal of Bioethics	3	278	2012
Ecological Economics	3	92	2018
Energy Efficiency	3	25	2018
Energy Policy	3	29	2017
Energy Science & Social Science	3	20	2018

Table 4
Authors' productivity classification by total h-index.

Author	h-index	g-index	m-index	TC	NP	PY start
Marteau TM	5	5	0.556	276	5	2013
Ewert B	2	4	0.4	19	4	2017
Feitsma J	3	3	1	18	3	2019
Hollands GJ	3	3	0.333	260	3	2013
Mazar N	2	3	0.2	178	3	2012
Reisch LA	3	3	0.6	90	3	2017
Straßheim H	2	3	1	13	3	2020
Thunstrom L	2	3	0.5	26	3	2018
Andor MA	2	2	0.5	55	2	2018
Ball S	2	2	1	6	2	2020

orientations of the journals and publications also do have an influence on the geographical spread of the studies. This study corroborates the results of Leong and Howlett (2022) that the USA, the UK, Germany, Australia and the Netherlands are top contributors in the field. The presence of China in the top 10 with 14 publications supports the findings of Schwartz and Cheek (2017) showing that countries like China extensively use choice architecture in public policy as compared to many other developed countries. However, the results of Leong and Howlett (2022) did not include China. The reason would be the search keywords used; this study specifically looked at nudges and choice architecture integrated public policy whereas the former looked at studies relating policy to behavioral interventions, behavioral insights and behavioral change in general.

Fig. 5 illustrates the global collaborations. The blue colour on the map depicts research collaboration amongst nations. The extent of the collaborations amongst authors is shown by the lines linking the countries.

The map displays significant collaborations between the United States of America and the United Kingdom. Germany, the Netherlands, Sweden, Denmark, Australia, and Canada are other countries with a considerable number of publications resulting from collaborative research. The result substantiates the dominance of developed countries in this field of study. There are intangible benefits the developed countries accrue in terms of the expertise/knowledge, data, and other resources that are potentially useful for exploring research interests and validating the existing theories and policies.

The three-field plot in Fig. 6 displays the top 10 publication sources with the most prolific countries and affiliated institutions. The size of the rectangular node represents the importance of the word: the bigger the

Table 3
The dominance of authors.

Ra	Author	Dominance Factor	Multi-Authored	First-Authored	Rank by Documents	Rank by DF
1	Zhao RY	1.000	3	3	6	1
2	Small H	0.666	3	2	1	2
3	Ahlgren P	0.666	3	2	6	2
4	Tsay MY	0.666	3	2	6	2
5	Zitt M	0.600	5	3	2	5
6	Glatzel W	0.600	5	3	3	5
7	Huang MH	0.600	5	3	3	5
8	Thijs B	0.500	4	2	5	8
9	Boyack KW	0.500	2	1	10	8
10	Qiu JP	0.333	3	1	6	10

collaborations (Multiple Country Publications). The principal countries are determined based on the institutional affiliation of the corresponding author. The institutional affiliation of all authors is considered to determine single country and multiple country publications.

The results show that the scientific productions included in this study originate from 47 countries. Nevertheless, this does not imply that the study was carried out in the country where it originated. The results only show the countries in which the institutions of the authors are located. Leong and Howlett (2022) further explain that the locations,

Table 5
Most cited documents.

Document Title	Authors and Year of publication	Source	Total Local Citations	Total Global Citations
Should Governments Invest More in Nudging?	(Benartzi et al., 2017)	Psychological Science	28	164
Nudging and Boosting: Steering or Empowering Good Decisions	(Hertwig and Grüne-Yanoff, 2017)	Perspectives on Psychological Science	16	90
On the misplaced politics of behavioral policy interventions	(Tannenbaum et al., 2017)	Nature Human Behavior	15	31
Salvaging the concept of nudge	(Saghai, 2013)	Journal of Medical Ethics	12	83
Altering micro-environments to change population health behavior: towards an evidence base for choice architecture interventions	(Hollands et al., 2013)	BMC Public Health	11	158
Nudging For Health: On Public Policy And Designing Choice Architecture	(Quigley, 2013)	Medical Law Review	10	50
Making the Blue Zones: Neoliberalism and nudges in public health promotion	(Carter, 2015)	Social Science & Medicine	7	33
Under consumers' scrutiny - an investigation into consumers' attitudes and concerns about nudging in the realm of health behavior	(Junghans et al., 2015)	BMC Public Health	7	29
The TIPPME intervention typology for changing environments to change behavior	(Hollands et al., 2017)	Nature Human Behavior	7	82
Brokering behavior change: the work of behavioral insights experts in government	(Feitsma, 2019)	Policy & Politics	7	12

Table 6
Classification of corresponding author's country and scientific productions.

Country	Total Publications (SCP + MCP)	Single Country Publication (SCP)	Multiple Country Publication (MCP)	Frequency
USA	129	103	26	0.31084
UK	78	55	23	0.18795
Germany	30	23	7	0.07229
Australia	23	13	10	0.05542
Netherlands	23	19	4	0.05542
China	14	7	7	0.03373
Canada	12	7	5	0.02892
Denmark	10	7	3	0.0241
Italy	10	7	3	0.0241
Belgium	9	5	4	0.02169

Hospital).

The United States has published the highest number of documents in the public policy domain applying nudge and choice architecture. As shown in the figure above, the University of Pennsylvania, Harvard University, Massachusetts General Hospital, Stanford University and John Hopkins University are the ones that contributed the most to this research area. For the UK, it is the University of Cambridge, the University of Oxford and the King's College, London. From the results, it could also be seen that there are authors who have multiple affiliations. For example, the National University of Singapore has a link with the US, implying that some of the authors working in this area are affiliated with one of the US universities and the National University of Singapore.

3.6. Keywords and network analysis

3.6.1. Keyword dynamics

Fig. 7 highlights the cumulative frequency of keywords used in research related to this field.

The usage of keywords such as obesity, interventions, information and consumption has rapidly increased over the past few years. This implies that there is a significant focus on these study areas. The figure also shows that behavioral research in areas like food, health, and social norms has experienced exponential growth only in the last few years.

3.6.2. Keyword co-occurrence analysis

Keyword co-occurrence analysis is a helpful tool for understanding the knowledge structure of a field by assessing the association amongst keywords in a particular domain Radhakrishnan et al. (2017). Each co-occurrence of a pair of words is represented as a link between the keywords. The network constructed represents the cumulative knowledge and helps understand the knowledge components and structure of the domain. A colour-coded cluster represents nodes with common attributes. The links between the circles show the strength of the relationship between each keyword (Law et al., 1988). Out of 1129 keywords, 31 were finalised based on the inclusion criterion of a minimum of 10 co-occurrences. Fig. 8 shows the keyword co-occurrence network.

The three broad clusters generated after the co-occurrence analysis are listed as 'Health and Lifestyle', 'Behavioral Decision Making' and 'Behavioral Interventions' (with the frequency of occurrence of each keyword given in parentheses). The keywords mapped to the 'health and lifestyle' cluster are mainly related to behavioral interventions such as nudges and choice architecture that could improve food choices, physical activity and nutritional outcomes.

The second cluster involves keywords such as libertarian paternalism, behavioral economics, decision-making, rationality, psychology, etc. The keywords psychology, rationality, and libertarian paternalism are largely related to decision-making and could be brought under the broader theme of 'behavioral decision-making'. The third cluster, named 'behavioral interventions', represents keywords related to the
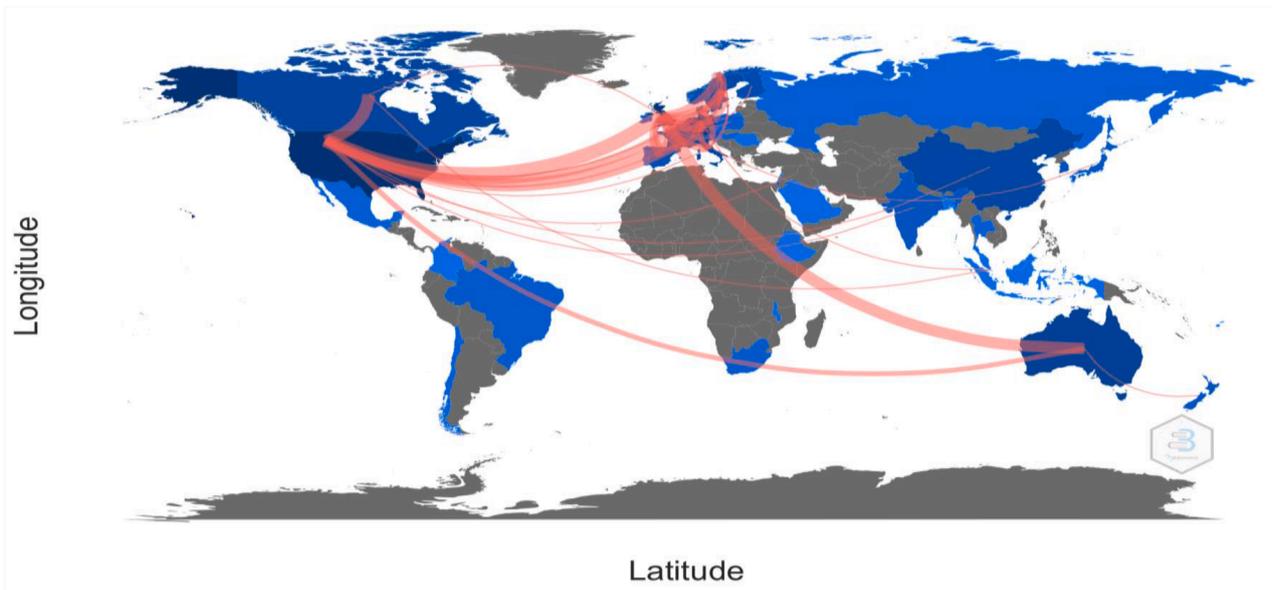
rectangle, the greater the importance of the country, affiliated institution, and publication source. The analysis of top countries, sources, and affiliations identifies the top journals based on the number of publications (BMC Public Health, Public Health Nutrition, Public Administration Review and Policy and Politics), the four main countries (the USA, the UK, the Netherlands and Canada) and the four top affiliated institutions of the authors that contribute most to each country's contribution to the research in this field (University of Pennsylvania, Harvard University, University of Cambridge and Massachusetts General

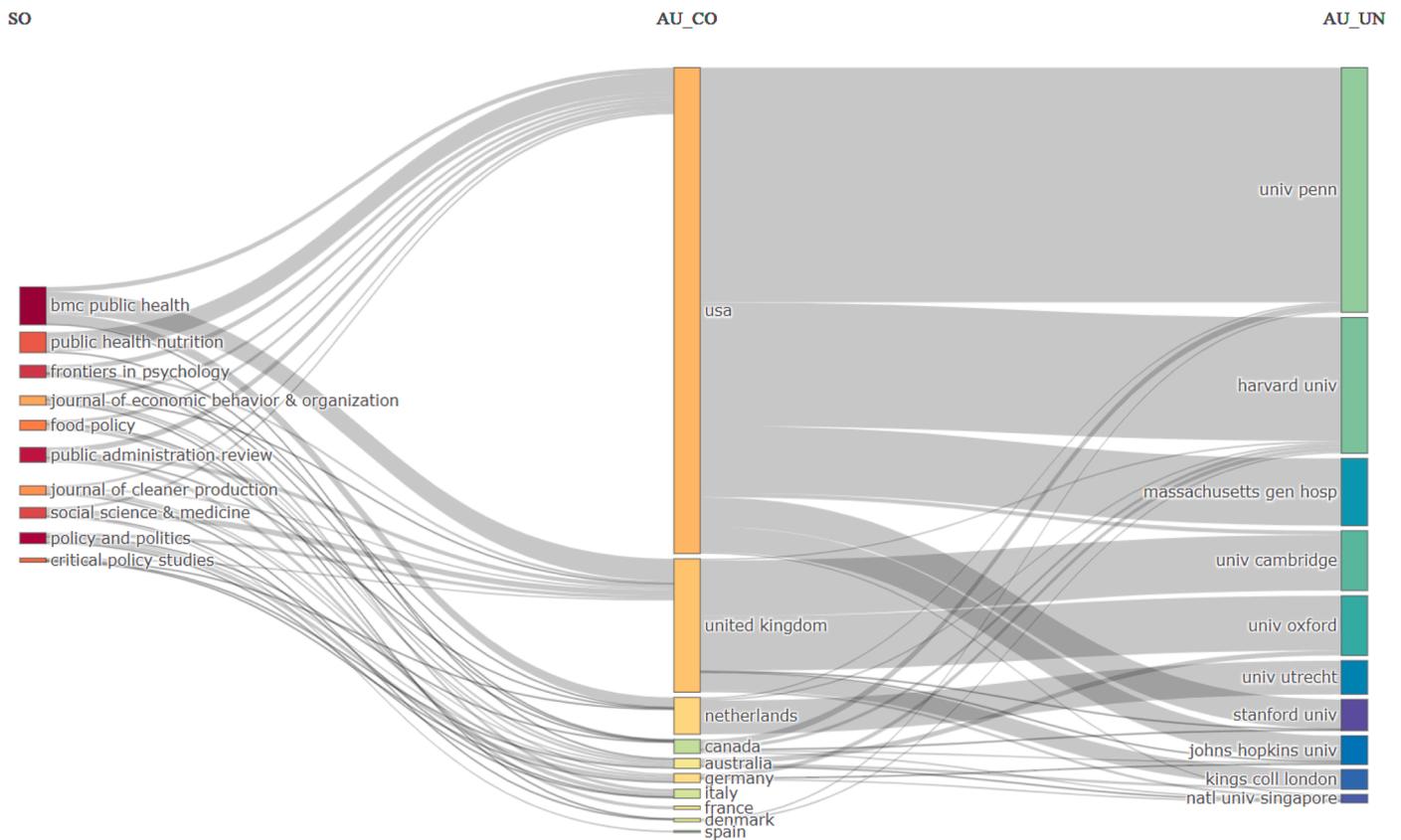**Fig. 5.** Country collaboration map.

Fig. 6. Three fields plot: the relationship between publication sources (left), countries (middle), and affiliations (right). Note: AU_CO - Country in which the corresponding author's institutional affiliation is located AU_UN – Corresponding author's affiliation (institution) SO – Publication Source (Journal).

design, application, and outcomes of behavioral interventions. The cluster includes terms such as attitudes, behavior, information, preferences, field experiment, social norms, etc., which are all directly or indirectly related to behavioral interventions. The clusters and the keywords mapped to each cluster are listed in Table 7.

3.7. Bibliographic coupling and generation of clusters

The identification of major themes was done through bibliographic coupling analysis and co-word analysis using the VOSviewer. If two publications cite a common work, then they are bibliographically coupled. The strength of the coupling between the two publications is determined by the number of commonly cited works (Kessler, 1963).
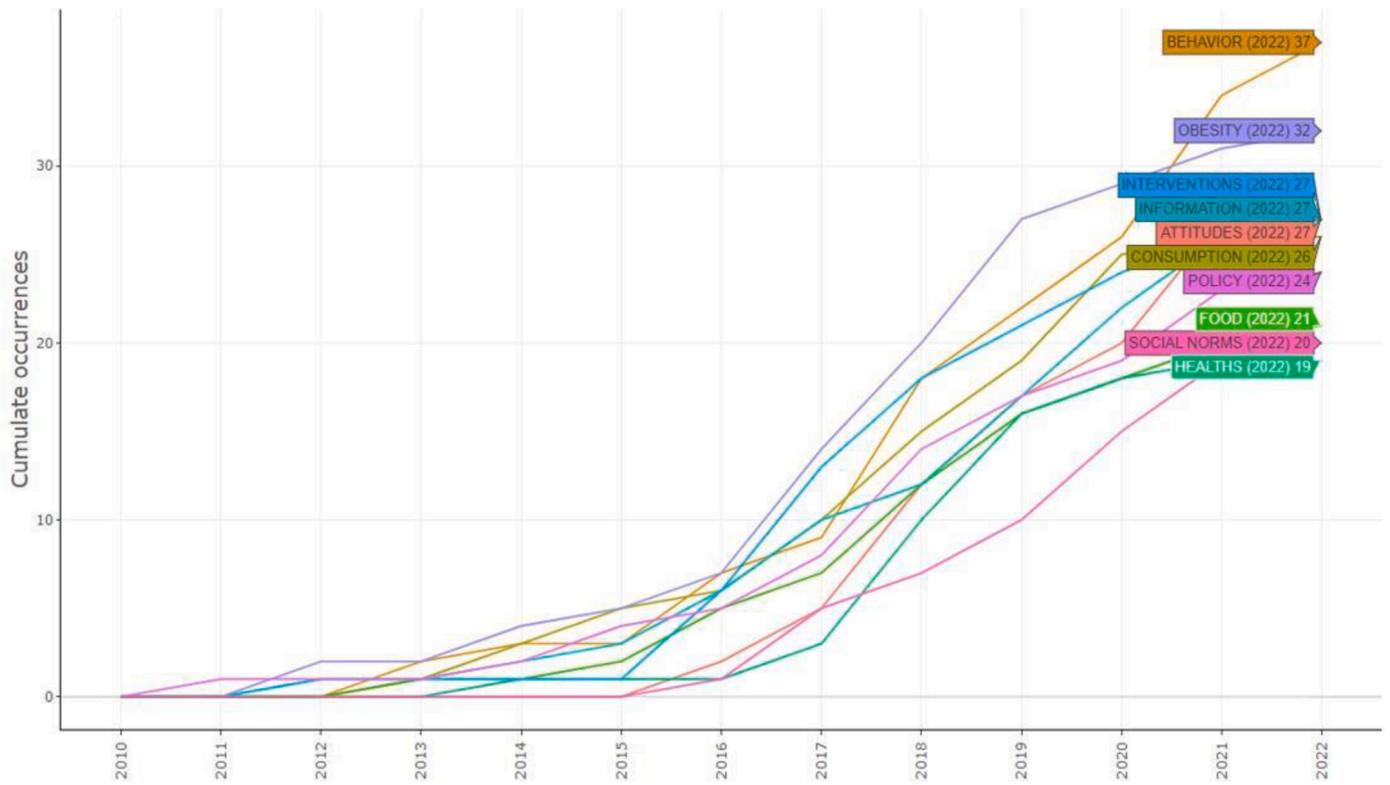
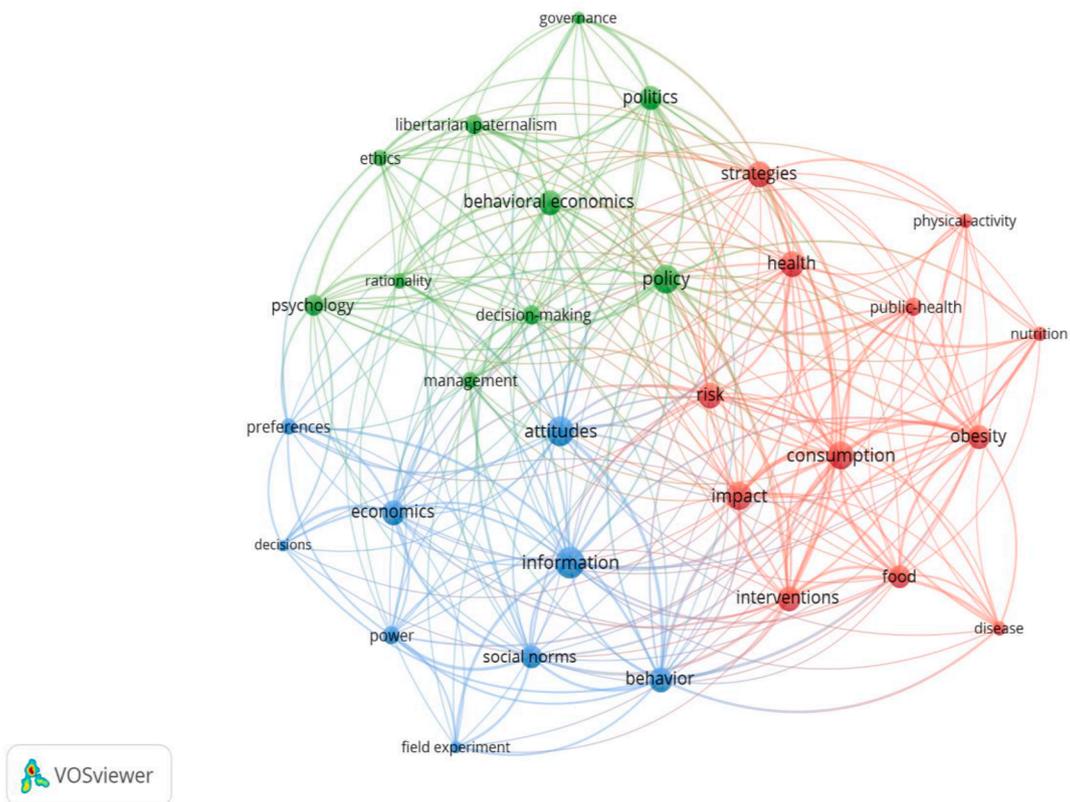**Fig. 7.** Change and evolution of keywords over the study period.

Fig. 8. Keyword co-occurrence network analysis map.

Table 7
Keyword clusters identified using keyword co-occurrence analysis.

Health and lifestyle	Behavioral decision making	Behavioral interventions
Consumption (26)	Behavioral Economics (21)	Attitudes (27)
Disease (10)	Decision Making (13)	Behavior (37)
Food (21)	Libertarian Paternalism (15)	Decisions (12)
Health (24)	Management (11)	Economics (24)
Impact (23)	Policy (24)	Field Experiment (10)
Interventions (27)	Politics (19)	Information (27)
Nutrition (11)	Psychology (12)	Power (13)
Obesity (32)	Rationality (13)	Preferences (12)
Physical Activity (10)		Social Norms (20)
Risk (16)		
Strategies (16)		

Bibliographic coupling is generally used to understand the domain better and to unearth particular themes evolving in the domain Saini, Lievens and Srivastava (2022).

The intention is to formulate thematic clusters portraying the current state of research over the period under study. The unit of analysis is 'document', and the *LinLog/modularity* method has been used to generate the clusters. After setting the inclusion criteria as 50 citations, a total of 34 documents were obtained, and 4 broad clusters were identified. A few omissions were made in clusters 1 and 2 to ensure content harmony. The publications omitted were unrelated to the broader theme of the other documents in a particular cluster identified. A total of six documents were omitted. Fig. 9 and Table 8 show the details of the final clusters identified.

3.7.1. Cluster 1: behavioral interventions—efficacy and effectiveness

In cluster 1, most of the works mapped are meta-analysis/literature reviews assessing the effectiveness and efficacy of various behavioral interventions like nudges and choice architecture. Hummel and Maedche (2019) and Fernandes et al. (2014) conducted a meta-analysis to assess the effectiveness of behavioral interventions quantitatively, the latter is particularly related to financial decision-making. Battaglio et al. (2019), Duckworth, Milkman and Laibson (2018), and Szaszi et al. (2018) are review papers, examining the effectiveness of interventions in diverse contexts. Hertwig and Yanoff (2017), and Yan et al. (2020) are conceptual papers where the former explores the effectiveness of nudges

Table 8
Clusters identified through bibliographic coupling.

Cluster Identified	Sources	Brief Description
Cluster 1: Behavioral Interventions - Efficacy And Effectiveness	Battaglio et al. (2019); Duckworth, Milkman and Laibson (2018); Hertwig and Yanoff (2017); Hummel and Maedche (2019); Milkman et al. (2021); Szaszi et al. (2018); Yan et al. (2020); Fernandes et al. (2014); Castleman and page (2016); Damgaard and Gravert (2018)	Effectiveness of behavioral interventions like nudges and choice architecture in bringing out a desirable behavioral change in areas such as financial decision making, social behavior, self-control etc.
Cluster 2: Dietary Habits	Arno and Thomas (2016); Chandon (2013); Liu et al. (2014); Sturm and An (2014); Thorndike et al. (2012); Thorndike et al. (2014)	The studies mainly focus on tackling obesity-related challenges through behavioral interventions - improving dietary behavior by shifting to healthy food choices.
Cluster 3: General Healthcare	Bluementhal-barby and Burroughs (2012); King et al. (2016); Quigley (2013); Saghai (2013); Shemilt et al. (2013); Vlaev et al. (2019)	The studies look into the design and applications of behavioral interventions in improving general healthcare outcomes.
Cluster 4: Sustainable Choices	Bovaird et al. (2016); Filimonau and Gherbin (2017); Higham et al. (2016); Lehner et al. (2016); Oostindjer et al. (2017)	Choice architecture and nudges are used as tools to frame sustainable policy decisions in many areas such as climate change, sustainable consumer choices, participatory governance etc.

and boosting in improving decision making and the latter shows the significance of tailor-made interventions. The two empirical studies in the cluster, Damgaard and Gravert (2018); Castleman and page (2016), attempted to assess the effectiveness of nudges in the form of personal messages. Milkman et al. (2021) was a mega study testing the effectiveness of different interventions in a single sample population of 61, 293.

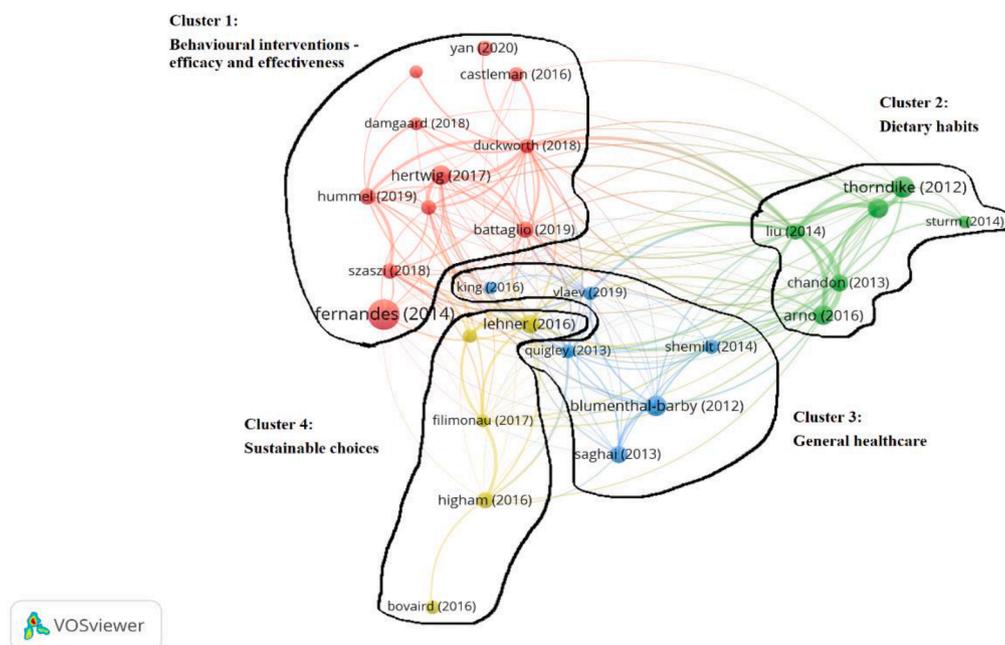**Fig. 9.** Bibliographic coupling of the documents with more than 50 citations.

3.7.2. Cluster 2: dietary habits

The works mapped to cluster two are mainly concerned with policies that could help deal with obesity-related issues and improve food choices. Arno and Thomas (2016) and Chandon (2013) are meta-analyses identifying and assessing behavioral interventions that improve dietary choices. Sturm and An (2014) and Liu et al. (2014) are conceptual papers analysing various economic and behavioral factors that lead to increased obesity and suggest policy changes to address them. Thorndike et al. (2012) and Thorndike et al. (2014) are two empirical studies assessing healthy food choices in a hospital cafeteria using choice architecture intervention.

3.7.3. Cluster 3: general healthcare

In cluster 3, Vlaev et al. (2019) and Shemilt et al. (2013) are scoping reviews examining the role of behavioral interventions in improving physical activity and corollary outcomes. Quigley (2013) and Saghai (2013) are conceptual papers giving insights on leveraging nudges to improve general healthcare outcomes. Bluementhal-barby and Burroughs (2012) is another conceptual paper discussing the ethical aspects of nudges in the healthcare context. King et al. (2016) is an empirical study exploring behavioral interventions to improve hand hygiene in a clinical set-up.

3.7.4. Cluster 4: sustainable choices

The works mapped to cluster 4 primarily connect behavioral interventions with sustainable decision-making. Lehner et al. (2016) and Oostindjer et al. (2017) are review papers where the former discusses how nudges promote sustainable consumption practices, and the latter is concerned with the role of behavioral interventions in making children's diets sustainable. Filimonau and Gherbin (2017) explored ways to improve food waste management practices using behavioral interventions. Bovaird et al. (2016) examine the role of nudges in encouraging collective co-production of public services for sustainable

public administration. Higham et al. (2016) studied the role of nudges in reducing air travel emissions and improving the climate change situation.

3.8. Co-word analysis

Co-Word analysis is a tool used to figure out the existing or future relationships amongst key topics in a research area by using the relevant words appearing in the title and abstract of the studies (Emich et al., 2020). Unlike bibliographic coupling and co-citation analysis, the co-word analysis uses the actual content of the publication, wherein, frequently appearing words are identified, assuming they are thematically related (Donthu et al., 2021). The potential downsides of co-word analysis mainly pertain to using words with context-specific meanings. This makes it difficult to understand the relationship between keywords without a detailed inspection of the publications. General words could also be a problem as they would be a good fit for several clusters identified (Chang, Huang & Lin, 2015).

To overcome the potential downsides of co-word analysis, Donthu et al. (2021) recommend using it as a supplement to enrich bibliographic coupling analysis. This would help in verifying and understanding the themes identified better by adding details to the content of each thematic cluster. The abstracts and titles of the studies identified are analysed in the co-word network analysis. An inclusion criterion of the 30 most frequent words was set. Fig. 10 shows the co-word network analysis map.

The three broad themes identified in the co-word analysis are health and dietary habits, behavioral interventions and public policy, and sustainable decision-making. The theme, health and dietary habits, directly correspond to the second and third clusters identified using the bibliographic coupling. The terms associated are found in papers discussing the eating habits of children in school and tackling obesity using behavioral insights.
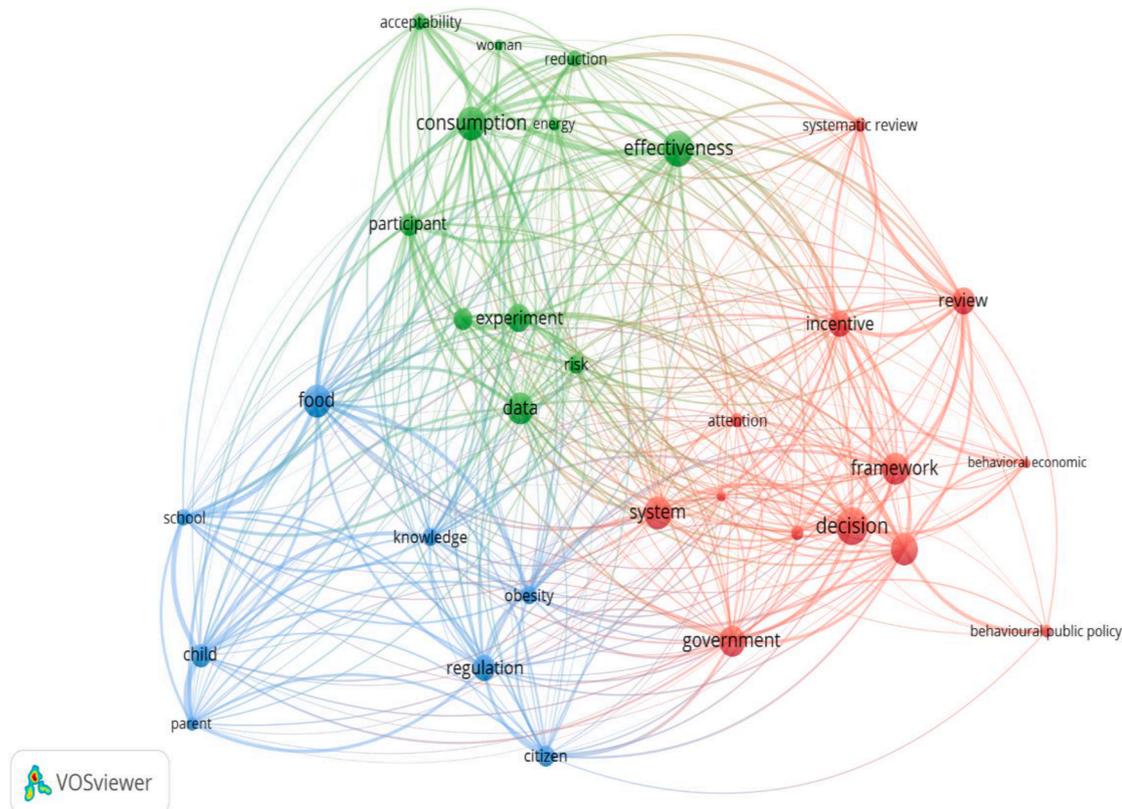

Fig. 10. Co-word network analysis map.

The second theme, behavioral interventions and public policy correspond to the first cluster identified earlier (Behavioral interventions - Efficacy and Effectiveness) using the bibliographic coupling, wherein meta-analyses and systematic review papers are found discussing the effectiveness of behavioral interventions in various contexts. The third broad theme obtained is named sustainable choices after inspecting the works with the words mapped to the cluster. The terms 'Energy', 'Reduction', and 'consumption' are particularly related to environmental studies like Lehner et al. (2016); Higham et al. (2016), Grilli and Curtis (2021) etc. Terms like 'participant', 'effectiveness' and 'acceptability' are general in nature, however, they are increasingly found in studies discussing sustainable decision-making. The clusters generated and the words mapped are given in Table 9.

4. Conclusion and future research directions

This study performed a bibliometric analysis of research works that draw on nudges and choice architecture in public policy. The study identifies prolific authors, works, journals and countries contributing to the research field that integrates nudges, choice architecture and public policy. The study also classifies and visualises the intellectual structure of empirical works by identifying keywords and themes that influence the current research and research trends.

The findings indicate that most publications in the study area are from developed countries. The top 5 countries with the highest publication output are the USA, the UK, Germany, Australia and the Netherlands. Nevertheless, it should be noted that the country from which a publication originates may not always correspond to the country where the study was conducted. The findings of this study corroborate the results of other bibliometric studies that have shown geographically uneven acceptance of behavioral interventions in public policies (Leong & Howlett, 2022). The five journals with the highest local impact (based on the h-index) are the Proceedings of the National Academy of Sciences of the United States of America, Applied Economic Perspectives and Policy, BMC Public Health, Frontiers in Psychology, and Policy and Politics. The major keyword clusters identified based on the keyword network analysis are health and lifestyle, behavioral decision making and behavioral interventions. Trending keywords in nudges and choice architecture research that integrates public policy are information, behavior, policy, consumption and health.

Bibliographic coupling analysis and co-word analysis were used to identify the themes evolving in the research domain. The five major clusters identified are 1. Behavioral interventions - Efficacy and Effectiveness 2. Dietary Habits 3. General Healthcare 4. Sustainable Choices. Exponential growth is seen in the number of published works in areas like health, food consumption, and diet management, wherein the concepts of nudges and choice architecture are applied widely. One of the emerging areas identified is sustainability. Studies related to sustainability broadly discuss interventions that could bring out sustainable choices in various contexts.

A common cluster found in all major analyses is the studies related to health and dietary habits. These works mainly deal with improving healthy food choices, increasing physical activity and addressing obesity related challenges using behavioral interventions. This suggests that over the past decade, a significant portion of research in this domain has focused on improving health outcomes and dietary habits through the application of behavioral insights. Another common cluster of studies identified from the keyword network analysis and bibliographic coupling is related to the effectiveness of behavioral interventions. The studies pertaining to this theme have focussed on assessing the effectiveness of nudges and choice architecture in various areas including financial decision-making, social behavior, self-control etc.

Future studies involving bibliometric analysis should also attempt to perform in-depth systematic literature reviews to build upon the findings of this study. The scope of this study is mainly confined to identifying and explaining various intellectual themes in the study area. A

Table 9
Clusters generated using co-word analysis.

Health and Dietary habits	Behavioral Interventions and Public Policy	Sustainable Decision Making
Child (61)	Attention (38)	Acceptability (44)
Citizen (56)	Behavioral Economics (26)	Energy (36)
Food (87)	Behavioral Public Policy (34)	Effectiveness (93)
Knowledge (50)	Decision (99)	Reduction (43)
Obesity (50)	Framework (85)	Experiment (59)
Parent (36)	Government (81)	Message (59)
Regulation (70)	Incentive (68)	Participant (60)
School (43)	Insight (83)	Consumption (40)
	Public Health (30)	Risk (52)
	Review (71)	Woman (28)
	System (87)	
	Systematic Review (38)	
	World (40)	

systematic literature review would supplement the results by throwing light on the effectiveness and efficacy of policies driven by behavioral interventions like nudges and choice architecture. Additionally, incorporating publications from other databases, such as Scopus, could expand the bibliometric corpus and provide a comprehensive understanding of the research domain. More focus should be given to understanding the nature and trends of studies emerging in this research domain, such as climate change, politics, ethics etc.

Data availability

Data will be made available on request.

Acknowledgment

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.socec.2023.102020.

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