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Research Article

More Than Twenty Years of Value-Belief-Norm Theory of Environmentalism: What Has Been and Yet to Be Done?

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ABSTRACT

It has been more than 20 years since the value-belief-norm theory of environmentalism has been conceptualized. The said theory has been used as a lens and has guided scholars in exploring and understanding pro-environmental behavior, however to date, there has been no study conducted that attempted to explore and report the bibliometric properties of studies related thereto. Aimed at determining research opportunities and future research directions, this paper reports a study that explored the bibliometric properties of studies conducted pertaining to the above-mentioned theory. Data were extracted from Scopus database and analyzed using Microsoft Excel, Publish or Perish, and VOSviewer. Results showed that while there is an increasing trend of studies using value-belief-norm theory, there is still considerably small and limited number of papers published, as well as scholars, institutions, and countries engaged on studies using the theory. Considering the inter/multidisciplinary nature of pro-environmental behavior, it may be necessary to encourage the conduct of more context-specific studies using available and more advanced methods across cultures, sectors, and levels.

Keywords: value-belief-norm theory, bibliometric analysis, pro-environmental behavior, environmentalism

INTRODUCTION

One of the tenets of many environmental studies includes environmentalism, that is the readiness of an individual to take pro-environmental actions (Stern, 2000), which is deemed essential considering its direct and or indirect impact or influence towards environmental protection, preservation, and sustainability. While there may be several behavioral theories that exist in psychology *(e.g., theory of reasoned action, theory of planned behavior, and norm activation theory)* (Ajzen, 1991; Hill et al., 1977; Schwartz, 1977, 2012), the value-belief-norm theory is one of the most recent theories in environmental psychology that has gained considerable attention in the last two decades (Stern, 2000; Stern et al., 1999). The said theory has successfully illustrated the antecedents to and dimensions of pro-environmental behavior. It has been used in modeling, explaining, predicting, and describing antecedents to pro-environmental behavior, as well as in determining the continuum of pro-environmental behavior.

Notably, the value-belief-norm theory has been in existence for more than twenty years, therefore it may be relevant to assess what has been achieved by the theory so far, to determine opportunities and direction for future research. To the best of the researchers' knowledge, there has been no existing study published that attempted to determine and characterize the bibliometric properties of studies published in the context of or anchored on the value-belief-norm theory, at least from all the papers reviewed and analyzed in this study.

Therefore, as an initial step towards gaining a holistic picture of what the theory has accomplished so far, this paper presents a study that attempted to analyze the bibliometric properties of studies that made use of the value-belief-norm theory as a theoretical lens and platform, published and indexed in Scopus database from 1999-2021 *(as of writing)*.

Environmentalism and the Value-Belief-Norm Theory

Environmentalism is defined *"behaviorally as the propensity to take actions with pro-environmental intent"* (Stern, 2000, p. 411) of which most literature refers to as pro-environmental behavior. In the same paper, Stern (2000) offered two definitions of pro-environmental behavior, the impact-oriented and intent-oriented definitions. The impact-oriented definition refers to the extent to which a behavior changes or alters the structure and dynamics of the ecosystem while the intent-oriented definition refers to behaviors that are undertaken with the intention to change or benefit the

Table 1. Alternative terminologies to pro-environmental behavior

Alternative terminology	Author
Environmentally relevant behavior	Erlene Parece et al. (2013)
Environmentally friendly behavior	van Riper and Kyle (2014)
Environmentally significant behavior	Stern (2000)
Environmentally sustainable behavior	Sharmin et al. (2020)
Eco-socially conscious consumer behavior	Saleem et al. (2021)
Green purchase behavior	Quoquab et al. (2020)
Environmentally sustainable product purchases	Kang and Moreno (2020)
Sustainability behavior	Topal et al. (2021)
Preparedness behavior	Corwin et al. (2017)
Preventive behavior	Ansari et al. (2021)
Ecologically-conscious behavior	Wynveen et al. (2011)
Energy conservation behavior	Sahin (2013); Scherbaum et al. (2008)
Sustainable consumption behavior	Angeles (2014); Ceglia et al. (2015)
Green consumption behavior	Cheng et al. (2014)
Climate change-related behavior	Wynveen and Sutton (2017)
Climate conserving behavior	Karpudewan (2019)
Climate change mitigation and adaptation behavior	Zhang et al. (2020)
Energy consumption behavior	Kotsopoulos et al. (2017)
Responsible consumption	Golob et al. (2019)
Greening of organizations	Papagiannakis and Lioukas (2012)
Green behavior	Chou (2014)
Sustainability support behaviors	Andersson et al. (2005)
Waste management behaviors	Janmaimool and Denpaiboon (2016)
Recycling behavior	Izagirre-Olaizola et al. (2015); Onel and Mukherjee (2017)
Environmental citizenship behavior	Chua et al. (2020)
Conservation behavior	Delaroche (2020; Bijani et al. (2019; Márquez-García et al. (2018)
Sustainable water consumption behavior	Cakır Yıldırım and Karaarslan Semiz (2019)
Sustainable stewardship	Kim et al. (2015)

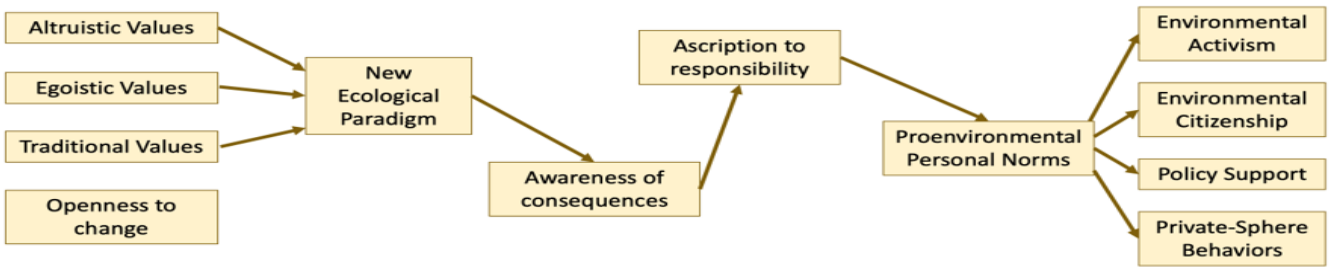

Figure 1. The initial value-belief-norm theory of support for social movements for the environment (adapted from Stern et al., 1999)

environment (Stern, 2000). Stern (2000, p. 408) pointed out that the former definition is important in identifying and targeting behaviors that can make an immediate and large difference to the environment while the latter is important as it focuses on people's beliefs and motives which are imperative in understanding and changing target behaviors. Be that as it may, it must be noted that different literature has used alternative terminologies for pro-environmental behavior as summarized in **Table 1**.

Apparently, these alternative terminologies may either refer to broad range of pro-environmental behaviors such as environmentally-relevant behavior, environmentally-friendly behavior, environmentally-significant behavior, green behavior among others or referring to more specific context such as energy consumption behavior, waste management behavior, recycling behavior, among others. In this study, the researchers used the term pro-environmental behavior in the later part of this paper for consistency.

While it may be challenging to see the effect of individual pro-environmental behavior, public environmentalism may be an important determinant of a successful effort towards environmental protection, preservation, and sustainability. Related thereto, the work of Stern et al. (1999) entitled *"A value-belief-norm theory of support for social movements: The case of environmentalism"* perhaps is one of the behavioral theories that best illustrates the antecedents to and dimensions of pro-environmental behavior. Stern et al. (1999) claimed that *"individuals who accept a movement's basic values, has the belief that valued objects are threatened and believed that their actions can help restore those values, they experience an obligation for pro-environmental action that creates a predisposition to provide support, the particular type of support that results are dependent on the individuals' capabilities and constraints"* (p. 81). The said theory is an amalgamation of the values theory and norm-activation theory founded by Schwartz (1973, 1992), and new ecological paradigm founded by Dunlap and Van Liere (1978).

Figure 1 illustrates the initial conceptualization of the value-belief-norm theory.

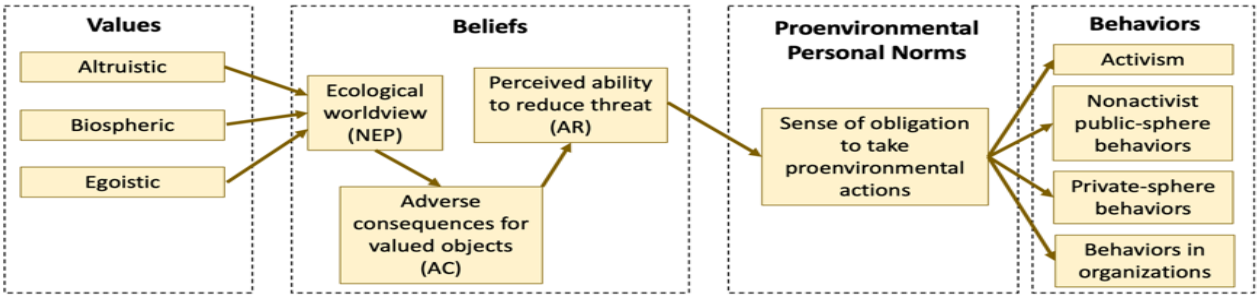

Figure 2. An illustration of the refinement of value-belief-norm theory of environmentalism (adapted from Stern, 2000)

Table 2. Table on top of a page

Variables	Conceptualization
Altruistic values	Values that reflect on concern for welfare of other people or their well-being (Stern 2000; Stern et al., 1993)
Biospheric values	The feeling of being concerned for the biosphere including other non-human species; caring for nature and the environment (Steg & De Groot, 2012; Stern et al., 1993)
Egoistic values	Values that reflect the individual's concern for the environment for their own sake and self-interest (Steg & De Groot, 2012; Stern et al., 1993)
Openness to change	Stimulation and self-direction based on the motivation of independent thought and action (Stern et al., 1999)
Awareness of consequences	Adverse consequence for the objects valued or belief that environmental circumstances will improve to benefit or deteriorate to harm everyone including other living species (Stern, 2000; Stern et al., 1999)
Ascription to responsibility	Perceived ability to reduce threat; the belief that individual's action can promote or prevent potential negative impact to the environment (Stern, 2000; Stern et al., 1999)
Personal norm	The feeling of moral obligation to protect and preserve the environment (Kiatkawsin & Han, 2017)

A year later, Stern (2000) further refined and elaborated on the value-belief-norm theory. He explicated on the different types of environmentally-significant behavior he later classified as environmental activism, non-activist behaviors in the public sphere, private sphere environmentalism, and other environmentally significant behavior *(e.g., influencing actions of organizations)*. **Figure 2** depicts the refinement of the value-belief-norm theory of environmentalism.

In the same paper, Stern (2000) enumerated the different causal variables that influence pro-environmental behaviors such as

a. attitudinal which includes general environmentalist predisposition, behavior-specific norms and beliefs, non-environmental attitude, and perceived costs and benefits for action;
b. personal capabilities which includes literacy, social status, financial resource, and behavior-specific knowledge and skills;
c. contextual factors such as material costs and rewards, laws and regulation, available technology, social norms, and expectations, supportive policies, and advertising; and
d. habit routine.

Table 2 shows the conceptualization of the different variables of the value-belief-norm theory.

The causal chain of variables in the value-belief-norm theory has determined and understand the continuum of pro-environmental behavior in different contexts, illustrated and modeled the same that became the basis of making policy recommendations (Zhang et al., 2020) to considerable number of environmental efforts ranging from pro-environmental behaviors at household levels (Fornara et al., 2016), workplaces (Yusliza et al., 2019), energy and transportation (Brosch et al., 2014; Havlícková & Zámecník, 2020), tourism (Lee & Jan, 2018), production and consumption (Kang & Moreno 2020), climate change adaptation and mitigation (Karpudewan, 2019), biodiversity conservation and protection (Fornara et al., 2020), among others.

Purpose of the Study

The study presented in this paper was aimed at reviewing and analyzing studies that made use of the value-belief-norm theory of environmentalism as a theoretical lens and platform, published and indexed in Scopus from 1999 to present *(i.e., as of writing)* to gain a broad and holistic picture on what the theory has achieved so far. Specifically, it intended to determine and characterize the bibliometric properties of studies anchored on the value-belief-norm theory including

a. basic profile of the studies published,
b. trends of publications per year and document type,
c. top subject areas and top contributing journals,
d. top contributing authors, institutions, and countries,
e. most cited papers,
f. most frequently used keywords, and
g. keywords co-occurrence clusters.

The final section of the paper provides a reflection on research opportunities and future research directions.

METHODOLOGY

This study was basically informed by bibliometric analysis, a recognized strategy that brings into limelight a quantitative overview of a specific research area, such as the value-belief-norm theory. Such study takes the external characteristics of scientific literature and analyzes research status, frontier

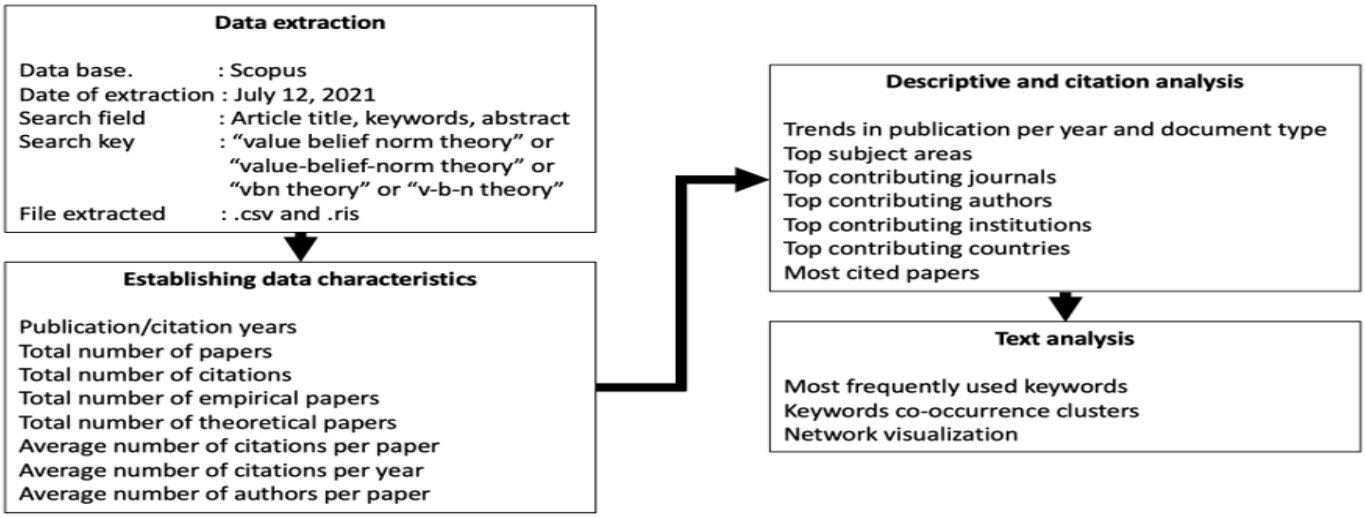

Figure 3. Flowchart of the study

directions, and development trends, therefore being able to predict future research directions (Wang & Su, 2020). It provides a comprehensive macroscopic overview of impactful academic literature of a specific field or topic in terms of top authors, journals, institutions, and countries (Kasavan et al., 2021). The flowchart illustrated in **Figure 3** shows the data collection and analysis process.

Data Extraction

The documents selected for this study were extracted from Scopus database on July 12, 2021. While there are other databases available for extracting data such as Web of Science, Scopus was found to yield more articles unique to the database (Losse & Geissdoerfer, 2021, p. 4). Some recent studies on bibliometric analysis that made use of Scopus database include the work of Chakraborty et al. (2021), Choi et al. (2021), and Losse and Geissdoerfer (2021).

Moving on, it made use of the following search key: "value belief norm theory" or "value-belief-norm theory" or "vbn theory" or "v-b-n theory". The search field included article title, keywords, and abstract. A total of 204 documents underwent preliminary review of which the researchers decided to include all for analysis. A .csv and .ris file was extracted as inputs to descriptive and citation analysis using Microsoft Excel, Publish or Perish, and VOSviewer respectively.

Establishing Data Characteristics

To establish data characteristics, Publish or Perish software was used (Harzing, 2007). The said software is capable of generating publication/citation years, total number of papers (TP), total number of citations (TC), average number of citations per paper, average number of citations per year, and average number of authors per paper. To classify the published papers into empirical or theoretical/conceptual, the research methodology of each paper was examined. An empirical paper are those studies that collected data directly from participants while a theoretical paper is conceptual, synthesis, or reflection paper that involved secondary sources of data *(e.g., publications)*.

Descriptive and Citation Analysis

For descriptive and citation analysis, it used Microsoft Excel where frequency counts and percentages may be generated and extracted for reporting. Using the .csv file, data extracted for reporting in this part of analysis include

a. trends in publication per year and document type
b. top subject areas and top contributing journals,
c. top contributing authors, institutions, and countries, and
d. most cited papers.

Analysis of Keywords

Analysis of keywords combined the use of Microsoft Excel to determine the most frequently used keywords and VOSviewer to establish keywords co-occurrence clusters and network visualization (Eck & Waltman, 2019). Note that while Microsoft Excel was able to generate the frequency of the keywords for the former, it was necessary to regroup considering that some keywords that refers to the same meaning were spelled with slight difference *(e.g., the researchers need to combine value belief norm theory, value-belief-norm theory, and VBN theory together)*.

The same was done during the cluster analysis of keywords co-occurrence for the same cluster. In addition, .ris file was used as input for VOSviewer to generate the network visualization and keywords co-occurrence. The type of analysis was specified as co-occurrence, unit of analysis was keywords, counting method was full counting, minimum number of occurrences of keyword was five, therefore generating 74 keywords that met the threshold out of 1,171 keywords.

RESULTS AND DISCUSSION

Data Characteristics

Using the search key and field described in the former section, it generated 204 papers published and indexed in Scopus database between years 1999 to 2021 *(i.e., at the time of*

Table 3. Data profile

Parameter	Values
Publication/citation years	1999-2021 (22 years)
Total number of papers (TP)	204
Total number of empirical papers	189
Total number of theoretical papers	15
Total number of citations (TC)	12827
Average number of citations per paper	62.88
Average number of citations per year	583.05
Average number of authors per paper	2.86

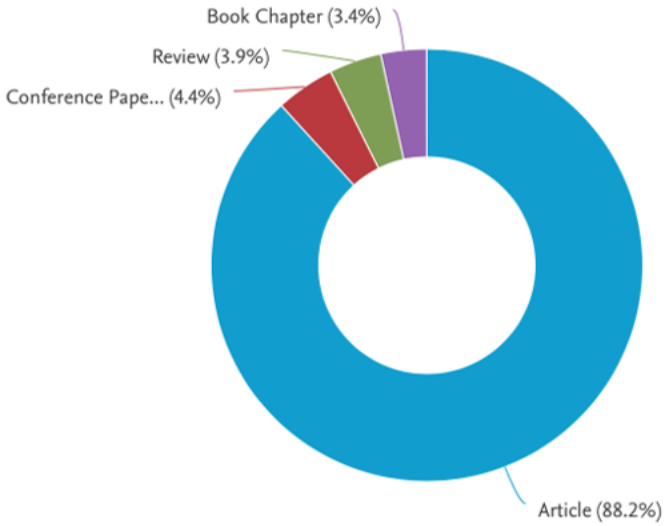

Figure 4. Distribution of publications based on document type

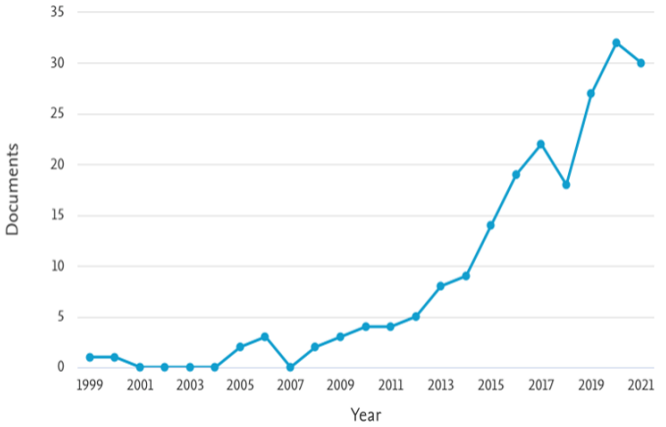

Figure 5. Trends in publications per year

data extraction). A total of 189 papers were found to be empirical while 15 papers were theoretical. For about 22 citation years, all the paper has generated 12827 total citations averaging 62.88 citations per paper and 583.05 citations per year. Results also revealed that each paper is co-authored by three scholars by average (see **Table 3**).

Figure 4 illustrates the distribution of publications according to document type. It shows that 88.2% of all the papers were articles, 4.4% were conference papers, 3.9% were review papers, while 3.4% were book chapters. Notably, the sum of articles and conference papers approximately equals the total number of empirical papers while the sum of review papers and book chapters approximately equals the total number of theoretical papers.

Table 4. Total number of publications produced per year

Year	Total number of publications	Percentage
2021	30	14.71%
2020	32	15.69%
2019	27	13.24%
2018	18	8.82%
2017	22	10.78%
2016	19	9.31%
2015	14	6.86%
2014	9	4.41%
2013	8	3.92%
2012	5	2.45%
2011	4	1.96%
2010	4	1.96%
2009	3	1.47%
2008	2	0.98%
2006	3	1.47%
2005	2	0.98%
2000	1	0.49%
1999	1	0.49%

Table 5. Top ten subject areas

Subject area	TP	Percentage
Social sciences	95	46.57%
Environmental science	78	38.24%
Business, management and accounting	59	28.92%
Energy	29	14.22%
Psychology	28	13.73%
Engineering	24	11.76%
Economics, econometrics and finance	19	9.31%
Agricultural and biological sciences	10	4.90%
Computer science	9	4.41%
Arts and humanities	8	3.92%
Medicine	8	3.92%

Descriptive and Citation Analysis

Figure 5 and **Table 4** shows the trends in the number of publications produced per year. Results show that from the conception of the value-belief-norm theory in 1999 to date, the trend has been generally increasing. From a handful until 2014 and more than or equal to 30 in 2020 and in 2021. In fact, about 63.24% of the total publications were published between 2017 and 2021. This may confirm that increasing number of scholars and researchers have recognized and therefore used value-belief-norm theory through the years.

Table 5 and **Table 6** show the top subject areas and top contributing journals respectively. It revealed that almost 50% of the published papers were from social sciences followed by environmental science (38.24%). This is not surprising considering that studies on human behavior generally is within the continuum of the social sciences while environmentalism specifically lies within the auspices of environmental science. Other subject areas are either within the domain of behavioral studies *(e.g., psychology, art, and humanities)* or domain of environmentalism in specific contexts *(e.g., business, management, and accounting; energy; engineering; economics, econometrics, and finance; agricultural and biological sciences; computer science; and medicine, among others)*.

Table 6. Top contributing journals

Source title	Rank and subject index	TP	%	Publisher	h-index
Journal of Environmental Psychology	Q1 Applied psychology Q1 Social psychology	10	4.90	Elsevier Ltd.	137
Sustainability	Q1 Geography, planning and development Q2 Energy engineering Q2 Management, monitoring, policy and law Q2 Renewable energy, sustainability and the environment	10	4.90	MDPI	85
Journal of Cleaner Production	Q1 Environmental science (miscellaneous) Q1 Industrial and manufacturing engineering Q1 Renewable energy, sustainability and the environment Q1 Strategy and management	6	2.94	Elsevier Ltd.	200
Journal of Environmental Management	Q1 Environmental engineering Q1 Management, monitoring, policy and law Q1 Medicine (miscellaneous) Q1 Waste management and disposal	6	2.94	Elsevier Ltd.	179
Environmental Education Research	Q1 Education	4	1.96	Taylor & Francis Ltd.	71
Journal of Sustainable Tourism	Q1 Geography, planning and development Q1 Tourism, leisure and hospitality management	4	1.96	Taylor & Francis Ltd	103
Transportation Research Part A Policy and Practice	Q1 Civil and structural engineering Q1 Management sciences and operations research Q1 Transportation	4	1.96	Elsevier Ltd.	133

Table 7. Most productive and influential authors

Author name	TP	%	Affiliation	Country	TC
Steg, L.	7	3.43	University of Groningen	The Netherlands	581
Han, H.	6	2.94	Sejong University	South Korea	922
Dietz, T.	5	2.45	Michigan State University	the US	2,155
Mohammad, J.	4	1.96	Qatar University	Qatar	31
Nordlund, A.	4	1.96	Umeå Universitet	Sweden	31
Quoquab, F.	4	1.96	Universiti Teknologi Malaysia	Malaysia	110
Wynveen, C. J.	4	1.96	Baylor University	the US	1
Angeles, R.	3	1.47	University of New Brunswick	Canada	108
Fornara, F.	3	1.47	Università degli Studi di Cagliari	Italy	81
Hwang, J.	3	1.47	Sejong University	South Korea	18
Jaini, A.	3	1.47	Universiti Teknologi MARA	Malaysia	169
Jansson, J.	3	1.47	Umeå Universitet	Sweden	169
Stern, P. C.	3	1.47	Social and Environmental Research Institute	the US	5315
Sutton, S. G.	3	1.47	Atlantic Salmon Federation	Canada	65

Notably, about 44 papers (21.57%) were published by the top seven contributing journals with Journal of Environmental Psychology and Sustainability on top of the list publishing 10 papers each. These journals belong to known and established publishers such as Elsevier Ltd. (4 journals), Taylor and Francis Ltd. (2 journals), and MDPI (1 journal).

Examining further the rank and subject index of the above-mentioned journals through Scimago Journal Ranking, results revealed that almost all of the top contributing journals are indexed in quartile one (Q1) in selected subject areas apart from Sustainability which is also indexed quartile 2 (Q2) in energy engineering; management, monitoring, policy and law; as well as in renewable energy and sustainability of the environment. Three of the journals are currently indexed in four subject areas *(e.g., Sustainability, Journal of Cleaner Production, Journal of Environmental Management)*; one journal in three subject areas *(e.g., Transportation Research Part A Policy and Practice)*, two journals in two subject areas *(e.g., Journal of Environmental Psychology, Journal of Sustainable Tourism)*, and one journal in one subject area *(Environmental Education Research)*.

Table 7 shows the most productive and influential authors. On top of the list of most productive authors include Steg, L. from University of Groningen in the Netherlands, Han, H. from Sejong University in South Korea, and Dietz, T. from Michigan State University in US.

Examining further in detail, it was found that the four contributions of Mohammad, J. and Quoquab, F. refers to the same papers (Chua et al., 2020; Jaini et al., 2019, 2020; Quoquab et al., 2020) while the contribution of Jaini, A. are the same with the three contributions of Mohammad, J. and Quoquab, F. (Jaini et al., 2019, 2020; Quoquab et al., 2020). Similarly, the three contributions of Sutton, S. G. are the same with the three of the four papers of Wynveen, C. J (Wynveen & Sutton, 2015, 2017; Wynveen et al., 2015). Finally, two papers were co-authored by Han, H. and Hwang, J. (Han & Hwang, 2017; Han et al., 2017).

Moving on, with a total of 5,315 citations, Stern, P. C. is considered the most influential author followed by Dietz, T. with a total of 2,155 citations. This is not surprising considering that the most cited papers were the first two papers that laid the foundations of the value-belief-norm theory. The first paper was entitled *A value-belief-norm theory*

Table 8. Most cited papers

Title	Author/s & year of publication	TC
Toward a coherent theory of environmentally significant behavior	Stern (2000)	3,468
A value-belief-norm theory of support for social movements: The case of environmentalism	Stern et al. (1999)	1,774
Factors influencing the acceptability of energy policies: A test of VBN theory	Steg et al. (2005)	535
A comprehensive model of the psychology of environmental behaviour-A meta-analysis	Klöckner (2013)	427
Predicting pro-environmental behavior cross-nationally: Values, the theory of planned behavior, and value-belief-norm theory	Oreg and Katz-Gerro (2006)	382
Travelers' pro-environmental behavior in a green lodging context: Converging value-belief-norm theory and the theory of planned behavior	Han (2015)	337
Personal values, beliefs, and ecological risk perception	Slimak and Dietz (2006)	261
Factors related to household energy use and intention to reduce it: The role of psychological and socio-demographic variables	Abrahamse and Steg (2011)	174
Organic and local food consumer behaviour: Alphabet theory	Zepeda and Deal (2009)	159
Young travelers' intention to behave pro-environmentally: Merging the value-belief-norm theory and the expectancy theory	Kiatkawsin and Han (2017)	154

Table 9. Top contributing institutions

Institution	Country	TP	%
University of Groningen	The Netherlands	8	3.92
Sejong University	South Korea	7	3.43
Norges Teknisk-Naturvitenskapelige Universitet	Norway	5	2.45
Umeå Universitet	Sweden	5	2.45
Michigan State University	the US	5	2.45
Kansas State University	the US	4	1.96
North Carolina State University	the US	4	1.96
Baylor University	the US	4	1.96
University of New Brunswick	Canada	4	1.96
James Cook University	Australia	4	1.96
Texas A&M University	the US	4	1.96
University of Georgia	the US	4	1.96
The University of Queensland	Australia	4	1.96
Qatar University	Qatar	4	1.96

Table 10. Top contributing countries

Country	TP	%
United States	57	27.94
United Kingdom	20	9.80
Australia	17	8.33
China	15	7.35
Germany	13	6.37
Netherlands	11	5.39
Malaysia	10	4.90
South Korea	10	4.90
Sweden	10	4.90
India	9	4.41
Taiwan	9	4.41
Canada	8	3.92
Norway	7	3.43

of support for social movements: The case of environmentalism first published in 1999 by Paul Stern, Thomas Diets, Troy Abel, Gregory Guagnano, and Linda Kalof which at the moment has 1,774 citations (Stern et al., 1999). The paper entitled *Toward a coherent theory of environmentally significant behavior* authored by Stern and published in 2000 has the highest number of citations reaching to a total of 3,468 (Stern, 2000) (see **Table 8**). This paper presents the refinement of the former paper. Both papers provided the foundations of the value-belief-norm theory.

Table 9 shows that 32.35% of the total papers were published by the top four contributing institutions with Norges Teknisk-Naturvitenskapelige Universitet, Umeå Universitet, and Michigan State University sharing the third spot while Kansas State University, North Carolina State University, Baylor University, University of New Brunswick, James Cook University, Texas A&M University, University of Georgia, The University of Queensland, and Qatar University sharing the fourth spot. Notably, six of the 14 institutions were all from US and two from Australia.

Table 10 shows that 96.08% of the total papers were contributed by the top 10 contributing countries. On top of the list include the US (27.94%), UK (9.8%), Australia (8.33%), and China (7.35%). The seventh spot was shared by Malaysia, South Korea, and Sweden while the eight spot was shared by India and Taiwan. Of the top contributing countries, five were from Europe, five from Asia, and US, Canada, and Australia.

Analysis of Keywords Results

Using the parameters described in the methodology section for the analysis of keywords, frequency of the different author keywords used was analyzed. **Table 11** shows that 44% of the papers include value-belief-norm theory as one of the keywords. Moreover, it included the main variables of the theory such as pro-environmental behavior (29%), value orientation (26%), beliefs (5%), and norms (19%). Although it must be noted that the said variables appeared in different forms using alternative terminologies such as consumer behavior, consumption behavior, and tourist behavior for pro-

Table 11. Most frequently used keywords

Keywords	TP	%
Value-belief-norm theory	90	44.12
Environmentalism (7), pro-environmental behavior (31), consumer behavior (8), consumption behavior (7),tourist behavior (5)	65	31.86
Value orientation (5), environmental values (9), values (22), personal value (4), altruism (8), biospheric values (5)	53	25.98
Belief/s	11	5.39
Norms (5), personal norm (20), social norm (14)	39	19.12
Study context	175	85.78
Methodology	95	46.57
Participants	61	29.90
Other behavioral attributes	83	40.69
Other behavioral theories	38	18.63
Locale	32	15.69

Table 12. Keywords related to study context (n=175; 85.78%)

Keywords	TP	%
Sustainability	18	8.82
Environmental education (10), education (7)	17	8.33
Climate change	16	7.84
Environmental issue (6), concern (5), problems (4)	15	7.35
Ecotourism	13	6.37
Sustainable development	10	4.90
Environmental management	9	4.41
Environmental planning	8	3.92
Environmental policy	8	3.92
Car use	7	3.43
Sustainable tourism	6	2.94
Transportation policy	6	2.94
Environmental protection	6	2.94
Environmental sustainability	5	2.45
Ecology	5	2.45
Energy conservation	5	2.45
Waste management	5	2.45
Agriculture	4	1.96
Animals	4	1.96
Biodiversity	4	1.96
Business	4	1.96

Table 13. Keywords related to methods (n=95; 46.5%)

Keywords	TP	%
Questionnaire (8), surveys (8), surveys & questionnaires (6), questionnaire survey (7), attitudinal survey (4)	33	16.18
Theoretical study	16	7.84
Structural equation modeling (9),, modeling (5)	14	6.86
Conceptual framework	8	3.92
Human experiment	5	2.45
Behavioral research	5	2.45
Numerical model	5	2.45
Participatory approach	4	1.96
Major cinical study	4	1.96
Integrated approach	4	1.96
Models, theoretical	4	1.96

environmental behavior; and environmental values, personal values for values/value orientation. Notably, while the value-belief-norm theory has established the influence of personal norms being an antecedent to pro-environmental behavior, 14 papers explored the influence of social norms which is basically another dimension of norms. Importantly, it must be noted too that there is limited or no occurrence of the dimensions that make up values and beliefs such as altruistic values, biospheric values, egoistic values, and openness to change, as well as awareness of consequences and ascription to responsibility, respectively.

Table 14. Keywords related to participants (n=61; 29.90%)

Keywords	TP	%
Human	30	14.71
Adult	9	4.41
Female	8	3.92
Male	8	3.92
Stakeholder	6	2.94

Table 15. Keywords related to other behavioral attributes (n=83; 40.69%)

Keywords	TP	%
Attitude (7), public attitude (10), environmental attitudes (5), consumer attitude (4)	26	12.75
Perception (14), risk perception (5)	19	9.31
Knowledge (6), environmental knowledge (4)	10	4.90
Decision making	10	4.90
Psychology	8	3.92
Cognition	6	2.94
Intention	4	1.96

Moving on, keywords representing the study context appeared in about 175 papers as enumerated in **Table 12**. On top of the list include sustainability (TP=18), environmental education, education (TP=17) environmental issue, concern, problems (TP=15), climate change (TP=16), ecotourism (TP=13), and sustainable development (TP=10), among others.

Keywords related to research methods have also appeared in 95 papers (see **Table 13**). This includes questionnaire and survey (TP=33), theoretical study (TP=16), structural equation modeling (TP=9), conceptual framework ((TP=8), among others.

Similarly, keywords related to participants or description of participants appeared in 61 papers (**Table 14**). On top of the list include human (TP=30), adult (TP=9), male and female (TP=8 each), and stakeholder (TP=6).

Meanwhile, 83 papers included other behavioral attributes that are not necessarily part of the value-belief-norm theory as enumerated in **Table 15**. This includes attitude (TP=26), perception, risk perception (TP=19), knowledge (TP=10), decision making (TP=10), among others.

Finally, 38 papers included keywords related to other behavioral theories such as theory of planned behavior (TP=30), planning theory and new ecological paradigm (TP=4 each) (see **Table 16**), as well as 32 papers included keywords

Table 16. Keywords related to other behavioral theories (n=38; 18.63%)

Keywords	TP	%
Theory of planned behaviour	30	14.71
Planning theory	4	1.96
New ecological paradigm	4	1.96

Table 17. Keywords related to location (n=32; 15.69%)

Keywords	TP	%
United States	12	5.88
China	10	4.90
Australia	5	2.45
India	5	2.45

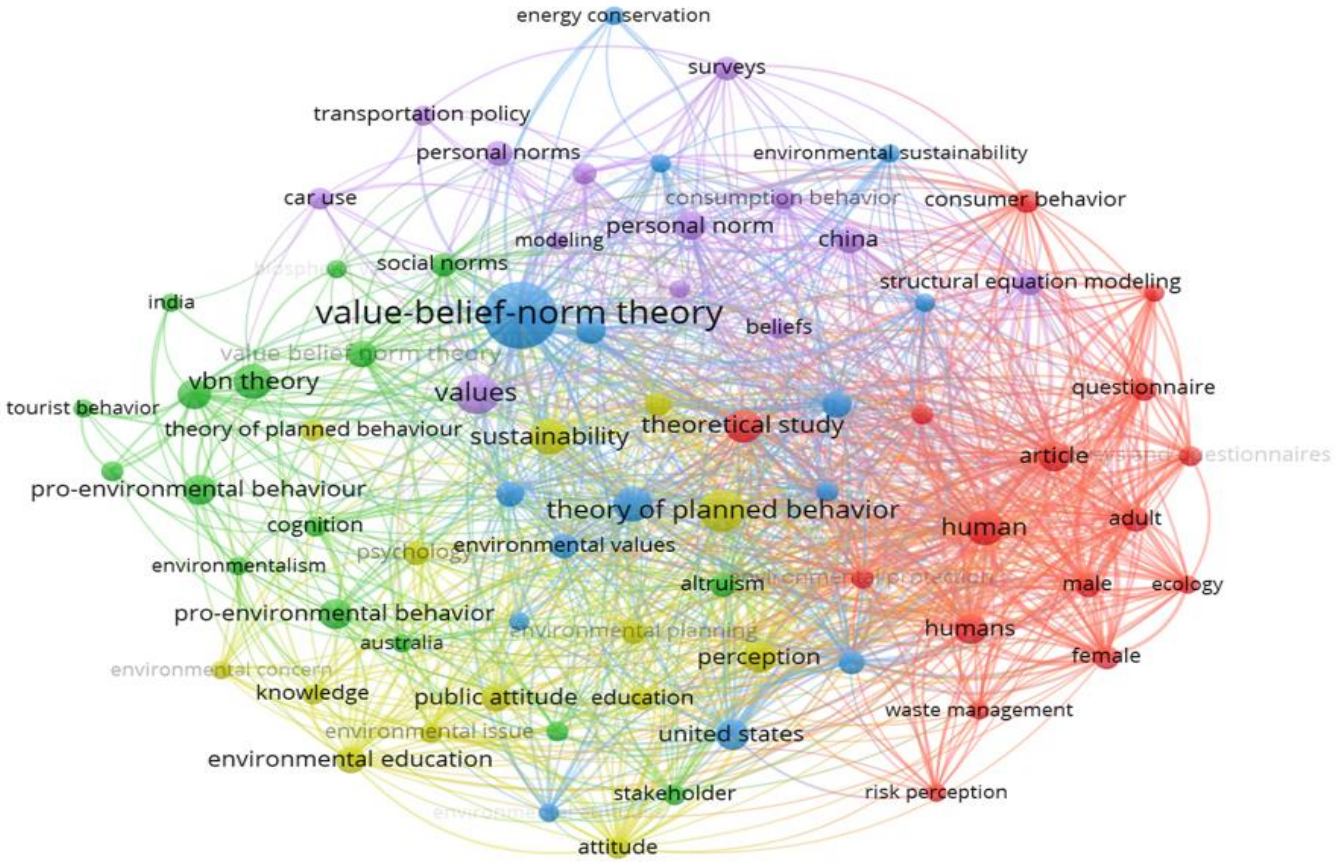

Figure 6. Network visualization

related to locale such as the US (TP=12), China (TP=10), Australia, and India (T=5 each) (**Table 17**).

Figure 6 and **Table 18** show the network visualization and keywords co-occurrence cluster.

Network visualization using VOSviewer revealed five clusters. Cluster 1 in red highlights the study participants (e.g., adult, human, female, and male) and research methods *(e.g., human experiment, surveys, questionnaires, and theoretical study)*. Study context include ecology, environmental protection and waste management. Meanwhile, cluster 2 in green highlights the variables of the value-belief-norm theory *(e.g., pro-environmental behavior/environmentalism, altruism, biospheric values, and social norms)*. The study context within the cluster includes sustainable tourism, tourist behavior, and ecotourism. Cluster 3 in blue include the value-belief-norm theory in broad environmental contexts such as environmental management, environmental policy, environmental sustainability, energy conservation, and climate change while cluster 4 in yellow highlights other behavioral attributes such as psychology, knowledge, perception, environmental concern, and public attitude. The study context included in the cluster includes environmental education, environmental issue, environmental planning, and sustainability. Finally, cluster 5 in purple highlights the variables of the value-belief-norm theory *(e.g., behavior, values, beliefs, and personal norm)*, coupled with research methods *(e.g., modeling, questionnaire, survey, and structural equation modeling)*. Study context included in the cluster includes transportation policy and car use.

IMPLICATIONS, RECOMMENDATIONS, AND LIMITATIONS

Results showed that there is considerably small and limited number of studies published that made use of the value-belief-norm theory in the last 22 years. This may imply that while advocacy and efforts pertaining to environmental protection, preservation, and sustainability has gained more attention, therefore significantly increased towards the turn of the twenty-first century, empirical studies specific to pro-environmental behavior remains limited. Although there is generally an increasing trend in the number of publications per year from then till now, there is small and limited number of

Table 18. Keyword co-occurrence clusters

Cluster 1 (red)	Cluster 2 (green)	Cluster 3 (blue)	Cluster 4 (yellow)	Cluster (purple)
Human experiment	Value-belief-norm theory	Value-belief-norm theory	Theory of planned behavior	Consumer behavior
Adult	Pro-environmental behavior	Behavioral research	Psychology	Value orientation
Human	Environmentalism	Behavior	Conceptual framework	Values
Female	Altruism	Environmental values	Attitude	Beliefs
Male	Biospheric values	Environmental attitude	Knowledge	Personal norm
Consumer behavior	Social norms	Decision making	Perception	Modeling
Ecology	Cognition	Environmental management	Public attitude	Questionnaire survey
Environmental protection	Sustainable tourism	Environmental policy	Environmental concern	Surveys
Waste management	Tourist behavior	Environmental sustainability	Environmental education	Structural equation modeling
Risk perception	Ecotourism	Energy conservation	Education	Transportation policy
Social norm	Stakeholders	Climate change	Environmental issue	Car use
Surveys & questionnaires	India	Sustainable development	Environmental planning	China
Questionnaire	Australia	Numerical model	Sustainability	
Theoretical study		United States		

contributing scholars, institutions, and countries that undertook studies in the context of the value-belief-norm theory. Six of the top contributing institutions were from the US, three from Europe, and two from Asia, among others while five of the top contributing countries were from Europe and five from Asia. It is remarkable that significant number of institutions from developed countries recognize and are taking initiatives on advancing scientific work on pro-environmental behavior in the context of the value-belief-norm theory; however, it may be necessary for developing and environmental degradation-prone countries to hasten their effort in conducting empirical studies related thereto as they appear to be lagging behind. These include central and south American states, Caribbean states, Pacific-island states, African states, and many Asian states. It must be noted that while the main pillars of environmentalism may be uniform, the impact of its antecedents are context-specific, that is, they vary according to location, sector, level, culture, among others, therefore there is no one-fit-all solutions to gaps associated thereto.

Analysis of author keywords co-occurrence revealed that among the most frequently used keywords include the variables of the value-belief-norm theory such as values, beliefs, norms, and pro-environmental behavior although some alternative terminologies has been adopted by researchers. In addition, keywords related to study context, methods, participants and locale, as well as other behavioral attributes were noted. Reflecting from these keywords and network visualization clusters generated, it may be interesting to further explore the specific influences of the dimensions that make up values such as altruistic values, biospheric values, egoistic values, and openness to change, as well as the dimensions that make up belief such as awareness of consequences and ascription to responsibility. Meanwhile, social norm has appeared in 14 papers. It may be interesting to find out how social norm, as one of the dimensions of norms, maintains with consistency its impact on pro-environmental behavior across the different context of environmentalism.

Moving on, 86% of the papers included in their respective list of keywords the study context (see **Table 12**). It is indeed remarkable that various study contexts have been reported, still it is comparatively small and limited considering the inter/multidisciplinary nature and scope of pro-environmental behavior. Coupled with differential participants and locale background, it may be necessary to promote proactively the conduct of empirical studies along this line. In addition, skimming the abstracts and examining the keywords co-occurrence related to methods, it may be necessary to explore the use of other advanced and holistic methodologies apart from surveys and modeling per se. Further, with other behavioral attributes factored-in, in about 41% of the papers (see **Table 15**), it is enticing to explore the consistency of their influence on pro-environmental behavior across contexts.

Interestingly, only about five studies were found to be interventional in nature, that is developing or encouraging pro-environmental behavior from among the participants of the study. While certainly studies on assessing or evaluating the antecedents to pro-environmental behavior is important to inform environmental policies or as basis for conceptualizing environmental initiatives and advocacies, it may be necessary to increase research and documentations of interventions, as well as initiatives and advocacies pertaining to pro-environmental behavior including its effectiveness, efficiency, and inclusivity among others, in view of the fact that, no matter how small or indirect a behavior could be, its impact may be meaningful in aggregate, therefore significant towards achieving sustainable development. In addition, it may also be interesting to explore the continuum and or categories of pro-environmental behavior in the context of the value-belief-norm theory, as well as synthesize the empirical findings related thereto.

Finally, among the limitations of this study that is generally inherent to bibliometric studies include

a. only data obtained from Scopus database from 1999 to the date of data extraction,
b. the search key was also limited to “value-belief-norm theory” “value belief norm theory”, “vbn theory” and “v-b-n theory”,
c. the search field only included article title, abstract, and keywords,
d. the bibliometric properties explored and analyzed were limited to basic profile of the studies published; trends of publications per year and document type; top subject areas and top contributing journals; top contributing authors, institutions, and countries; most cited papers;

most frequently used keywords; and keywords co-occurrence clusters as these parameters were considered the most relevant for the time being, and

e. the tools used for analysis included Microsoft Excel, Publish or Perish and VOSviewer.

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