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
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 latter 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.

**Table 1. Alternative terminologies to pro-environmental behavior**

| Alternative terminology | Author |
|-------------------------|--------|
| Environmentally relevant behavior | Erlene Parece et al. (2015) |
| 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 (2015); 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-Olazola 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 | Cakir Tildirm and Karaarslan Semiz (2019) |
| Sustainable stewardship | Kim et al. (2015) |
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; Havlicková & 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 2. An illustration of the refinement of value-belief-norm theory of environmentalism (adapted from Stern, 2000)](image-url)
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                            | 5.92%      |
| 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).
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 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, I. | 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. | 5 | 1.47 | University of New Brunswick | Canada | 108 |
| Formara, F. | 5 | 1.47 | Università degli Studi di Cagliari | Italy | 81 |
| Hwang, J. | 5 | 1.47 | Sejong University | South Korea | 18 |
| Jaini, A. | 5 | 1.47 | Universiti Teknologi MARA | Malaysia | 169 |
| Jansson, I. | 5 | 1.47 | Umeå Universitet | Sweden | 169 |
| Stern, P. C. | 5 | 1.47 | Social and Environmental Research Institute | the US | 5315 |
| Sutton, S. G. | 5 | 1.47 | Atlantic Salmon Federation | Canada | 65 |

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*
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 52.35% 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 the 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 (8.53%), and China (7.55%). 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-

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**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 (2015) | 427 |
| Predicting pro-environmental behavior cross-nationally: Values, the theory of planned behavior, and value-belief-norm theory | Oreg and Katz-Gerro (2006) | 582 |
| 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 | 8.53 |
| 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 |

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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                                    | 15  | 6.57 |
| Sustainable development                       | 10  | 4.90 |
| Environmental management                      | 9   | 4.41 |
| Environmental planning                        | 8   | 3.92 |
| Environmental policy                          | 8   | 3.92 |
| Car use                                       | 7   | 3.45 |
| 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) | 35  | 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 clinical 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.

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=53), 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=50), 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=50), planning theory and new ecological paradigm (TP=4 each) (see Table 16), as well as 52 papers included keywords
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
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;

| 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 |
| Female | Environmentalism | Behavior | Conceptual framework | Values |
| Male | Altruism | Environmental values | Attitude | Beliefs |
| Consumer behavior | Social norms | Environmental attitude | Knowledge | Personal norm |
| 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 | | | |
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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the results and conclusions.

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