

# Adoption of Technology-Based Product by Consumers: A Review

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## Abstract

Technology-Based Product (TBP) Adoption By The Consumers Is Now Widely Acknowledged As A Key Aspect Of Sustainable Consumption. TBP Has Been Studied By Several Researchers To Identify The Key Variables Of Its Adoption. This Article Describes The Analysis Of Selective Papers, Explaining Various Factors Affecting The Adoption Of TBP By The Consumers. A Few Models Proposed By Researchers Are Discussed For A Better Understanding Of The Consumer Behavior As Well As The Variables For TBP Adoption. This Review Paper Also Gives A Comprehensive List Of

Findings In The Area Of TBP Adoption. While Focusing On The Research Conducted In The Past, The Review Paper Emphasizes The Need For More Empirical Studies In The Area. The Article Brings Out The Research Gaps Pertaining To The Establishment Of The Relation Between Adoption Of TBP And Climate Change. The Paper Concludes With The Discussion Of Further Research Needed In The Area Of TBP Adoption In India.

**Keywords:** Technology-Based Product, Sustainable Consumption, Climate Change, India, Consumers

## **1. Introduction**

New products and services are offered to the customers every day, and companies around the world are competing with each other in order to increase their market share (Ansari and Riasi, 2016). However, many companies in the market are not environmentally friendly and do not adhere to international standards (Raisi and Amiri Aghdaie, 2013). Purchase and consumption decisions are an integral part of human life. Every purchase decision and consumption has some amount of Greenhouse Gas (GHG) emission that consequently, contributes to the global climate change (Shourmatoff, 2007).

Human consumption habits are one of the key factors contributing to the climate problem. The price paid is primarily for the goods and services consumed, but the price for GHG emissions and its impact remains hidden and is not paid by the consumers. This demonstrates that consumers' attention is focused on the attributes of the products, and rare consideration is given towards the adverse effects associated with the products. Considering both the desired and undesired attributes of the products during its purchase is a challenge for each and every individual (KSG Working Paper, 2003).

This review paper intends to collate the studies conducted on the adoption of Technology-Based Products. First, the literature review has been carried out, followed by a discussion on the specific frameworks proposed by the researchers. The review finally summarizes the previous research findings and proposes future research areas.

## **2. Method Used For Literature Survey**

### *2.1 Literature Search*

The concept of sustainable consumption and focusing on cleaner technology development has been accepted as the ultimate goal for all the nations and people to deal with environmental degradation and combat the global climate change (Rio de Janeiro in 1992).

This literature review has covered research studies from 1990 to 2016. Also, key articles from the cross references of main articles are included in the review, though these have not been published during the review period. There are three key focus areas in this review paper. The first focus area summarizes the studies conducted on TBP adoption. Second focus area correlates the studies on TBP adoption with climate change. The third focus area of this review paper sums up the research models on TBP adoption. The future research needs regarding TBP adoption, particularly for Indian consumers, have also been stressed in this

article.

## 2.2 Article Selection

Different keywords were used to select research articles related to TBP Adoption. These were, 'Technology-Based Product,' 'household appliances,' 'white goods,' 'electronic appliances,' 'consumer behavior,' 'sustainable consumption,' and 'individual GHG emission.' Google Trend was used to find out the global and Indian search trends for two related terms. The peak in global search traffic for the term \*sustainable consumption\* was found between 2006 and 2007, and the gradual decrease was seen till 2015 (Figure 1). A similar peak was also observed during 2004 in a developing country like India, but sudden fall in search for the term \*sustainable consumption\* was observed after 2011. Also, there were zero searches observed during recent days (Figure 3).

Similarly, the peak in global search traffic for the term \*electrical appliances\* was around end of 2004, with the number of searches being nearly constant since 2007 (Figure 2). For a developing country like India, the search for \*electrical appliances\* peaked during 2004 and 2005. Gradual fall was observed in the figure from 2007 to 2011, and a very low trend has been continuing after 2011 (Figure 4). All the following four trends were prepared through <https://www.google.co.in/trends/>.

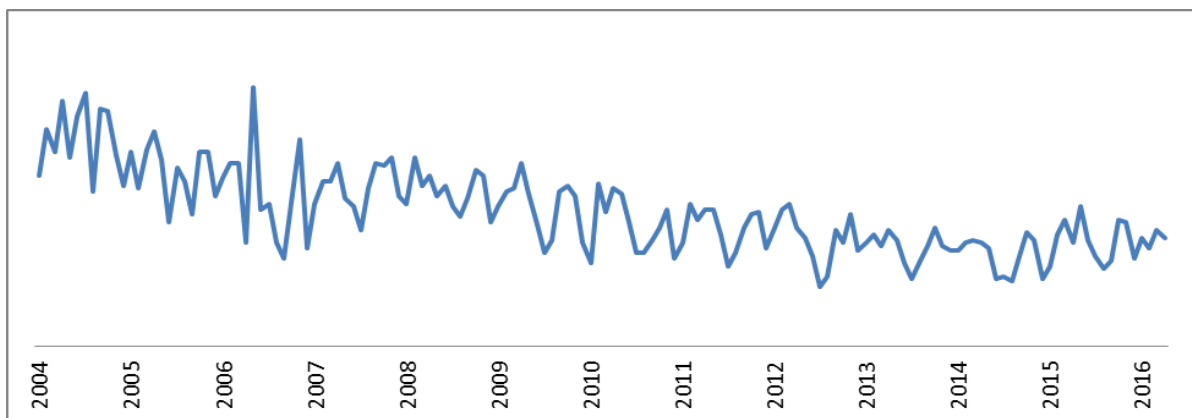


Figure 1. 'Sustainable Consumption' Worldwide Search Trend

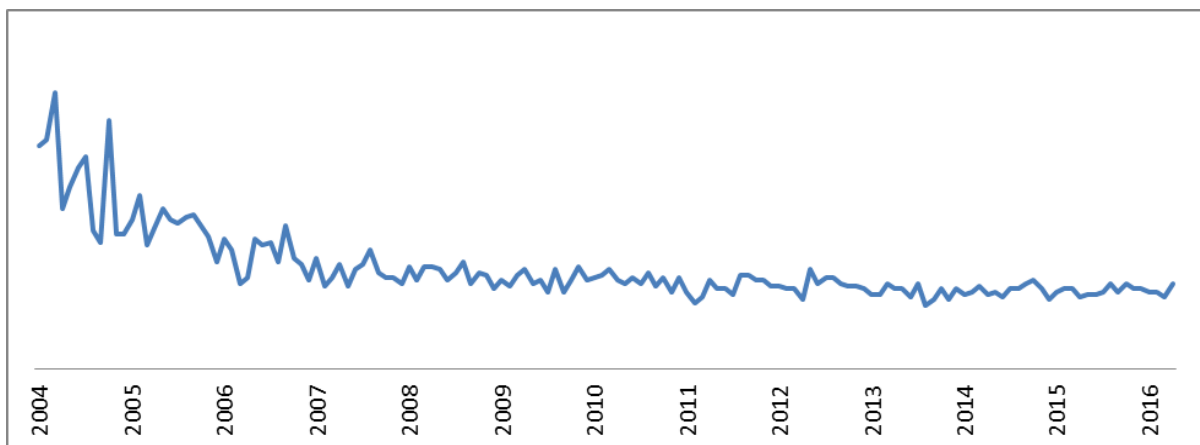


Figure 2. 'Electronic Appliances' Worldwide Search Trend

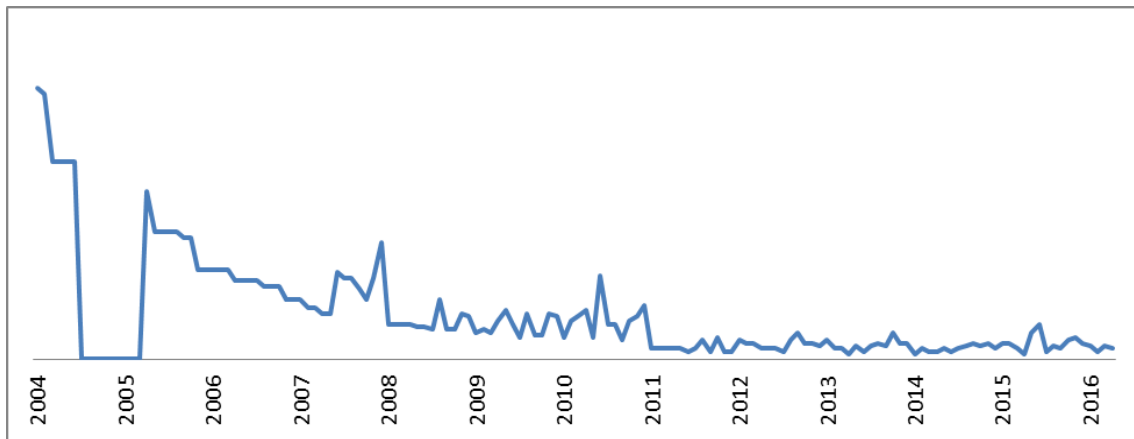


Figure 3. 'Sustainable Consumption' India Search Trend

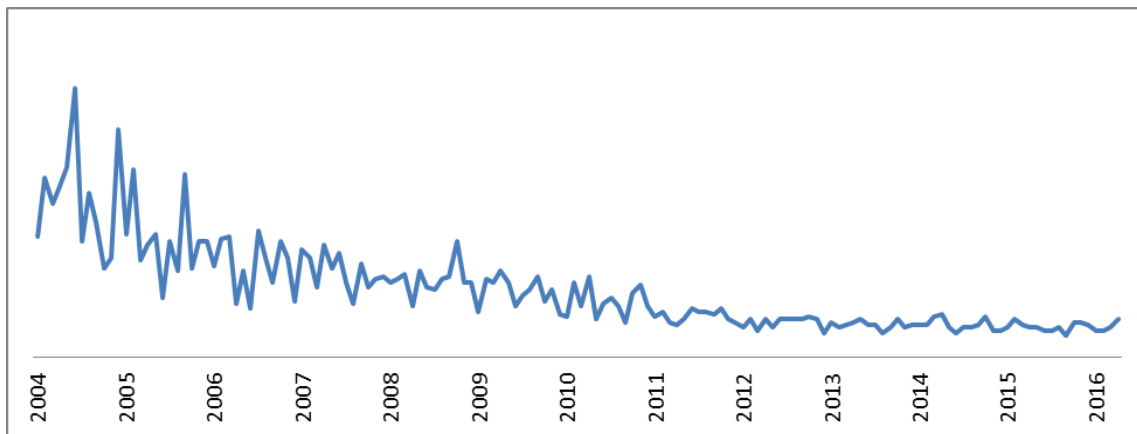


Figure 4. 'Electronic Appliances' India Search Trend

From an initial search of around 400 articles, filtration was done based on the abstract and conclusion to select 120 articles for further scrutiny. Finally, 38 articles (papers and reports) were considered for this review; most of these articles are related to TBP adoption around the world, and few are pertaining to studies conducted in developing countries like India and China. The most relevant journals for this study were found to be the Journal of Consumer Marketing, Sustainable Development, Business Strategy and The Environment, Journal of Consumer Behavior, International Journal of Retail and Distribution Management, Ecological Economics and International Journal of Research in Marketing. The review was focused on TBP adoption by consumers and not by industries. Articles referred for this review were only from well-known, internationally acclaimed publishers. Articles published by informal modes such as social networking and other websites were not included in the study.

### *2.3 Analysis and Synthesis*

The relevant data was collected to find out the key ideas and methodologies used and were finally summarized to fit a comprehensive review article. The data related to the title, author, year, country, sector, models, and methodology were carefully analyzed, and opinions were produced in respective sections of this review paper. Three models on TBP adoption were discussed in this review paper, and inferences were drawn for future studies needed in the

area of TBP adoption for climate proactivity, particularly in India.

### 3. Literature Review

With growing global attention towards environmental concerns during end years of the 20th century, it was also quite clear that technical as well as social improvements are the key approaches for providing environmental and social sustainability. Comprehensive research has been conducted in the past 25 years in the field of TBP adoption in different countries. This section summarizes the key determinants responsible for TBP adoption. The elements acknowledged by the research studies could be drivers and (or) barriers of TBP adoption based on the condition, period, and perspectives in which they are considered.

#### 3.1 Research Outcomes

The literature survey suggests that the adoption of Technology-based Products is influenced by different variables such as product quality, price of the product, brand name, energy efficiency, credible product information, availability, consumer behavior, consumer knowledge & awareness, peer pressure, and social status. A review by Faiers et al. (2007) classifies the various factors affecting TBP adoption. These factors are consumer choice, needs, social learning, buying process and product attributes (quality, cost and brand). Similarly, studies by Wheale and Hinton (2007), Biel and Dahlstrand (2005), and Sener and Hazer (2008) have identified different determinants that could influence the consumer behavior towards sustainable consumption. The identified determinants by these researchers are brand strength, culture, finance, habit, demographic characteristics, lack of information, lifestyle, personalities and ethical factors. The variables identified in the literature review are listed in Table 1 below.

Table 1. Variables for Technology-based Product Adoption by Consumers

Variables for the TBP Adoption	Author & Year
Product Quality/ Product Performance	Luchs et al., 2010; Ottman and Jacquelyn A., 1998; Sheth et al., 1991; Sen and Bhattacharya, 2001; Webb et al., 2008; Sweeney et al., 1999; Baker et al., 2002; Cronin et al., 2000; Sirohi et al., 1998; 1996; Keller, 1993; Matzler and Hinterhuber, 1998; Forest L. Reinhardt, 1998; Tracy Tuten, 2013; Zeithaml et al.,
Product Cost	William Young et al., 2010; Sheth et al., 1991; Zou, Fang, and Zhao, 2003; Morgan et al., 2004; Sweeney et al., 1999; Zeithaml, 1988; Lutzenhiser, 1994; Hauge et al., 2012; Matzler and Hinterhuber, 1998; Tracy Tuten, 2013; Williams and Dair, 2007;
Product Brand	Sheth et al., 1991; Moliner et al., 2007; Dodds et al., 1991; Dorsch et al., 1998; Fletcher et al., 2000; Kumar et al., 1995; Hennig-Thurau et al., 2002; Palmatier et al., 2006; & Fournier, 1998; Garbarino and Johnson, 1999;

Energy efficiency	Williams and Dair, 2007; Lutzenhiser, 1994; Hauge et al., 2012; Hassett and Metcalf 1993; Greene et al. 2006; Heinzle 2012; Heinzle and Wüstenhagen 2012; Ölander and Thøgersen 2014; Sammer and Wüstenhagen 2006; Kotler, 2011
Credible Information, Green Marketing/ Eco-Claims	Forest L. Reinhardt , 1998; Srivastava, 2007; Leonidou et al., 2013; Darnall and Daniel, 2006; Miles and Kovin, 2000; Bellesi et al., 2005; Hultman et al., 2011 & Leonidou and Katsikeas, 1996; Tracy Tuten, 2013; De Pelsmacker et al., 2005; Luchs et al., 2010; William Young et al., 2010; Shafaat & Sultan, 2012; Sigal et al., 2016
Person's Behavior (Ethical, Routine, Tradition, Pro Environmental Behavior)	Dobson, 2007; Luchs et al., 2010;; Kilbourne and Beckmann, 1998; Nordlund and Garvill, 2002; Bamberg, 2003; Krystallis et al. 2011 & Martha & Nalin, 2009; Kilbourne and Pickett, 2008; Vermillion and Peart, 2010
Consumer Knowledge/Awareness (Technology, Performance, Recycling, Non Toxic, etc...)	Ottman et al., 2006; Schultz, 2001; Zimmer et al., 1994 & Jody & Annie, 2014; Follows and Jobber 2000 & Lee, 2009; Kurk and Eagan 2008; Tracy Tuten, 2013; De Pelsmacker et al., 2005; Biel and Dahlstrand, 2005
Availability	Quelch and Harding, 1996; De Pelsmacker et al., 2005; Kotler, 2011; Quelch and Harding, 1996; Simon, 1972); Stern, 2000, p. 408
Peer Pressure	Janssen and Jager, 2002; Menon et al., 2002; Buss & Craik, 1983; Gannon & Ostrom, 1996; Dagher and Itani, 2012; Khan 2007; Janssen and Jager (2002); Heinz and Jan, 2009
Social Status	Jerrell Richer, 1995; Grunert and Juhl 1995; Kim, Choi, and Rifon 2009; Vermeir and Verbeke 2008; Schwartz, 1992; Lee, 2008: 582; Todd, 2004; Baker and Ozaki (2008); Nyborg et al. 2006; Ajzen and Fishbein, 1977

The variables for TBP adoption was discussed in this section. The particular findings of the various studies on TBP are discussed in the following section.

### *3.2 Major Findings from Literature*

While analyzing various research studies, the key findings were identified and summarized in a comprehensive way. The major findings of the literature study are presented in the below Table 2.

Table 2. Findings on Technology-based Product Adoption by Consumers

Author & Year	Title	Major Findings
Sheth et al., 1991	Why we buy what we buy: a theory of consumption values.	<ul style="list-style-type: none"> <li>• Non-green criteria such as brand name, cost, reliability, look, services, routine habits and desires reduces the consumers' green criteria while making a purchase decision.</li> </ul>
Sriram and Forman, 1993	The relative importance of products' environmental attributes: a cross-cultural comparison	<ul style="list-style-type: none"> <li>• Consumers give less importance to the environmental performance while purchasing high value products compared to the low value products purchased routinely.</li> </ul>
Jerrell Richer, 1995	"Green Giving: An Analysis of Contributions to Major U.S. Environmental Groups,"	<ul style="list-style-type: none"> <li>• Rich countries and rich individuals spend a higher fraction of their income on environmental goods.</li> <li>• Wealthier people feel better social status by using environmental goods and also able to bear the high cost.</li> </ul>
Quelch and Harding, 1996	Brands versus private labels: fighting to win.	<ul style="list-style-type: none"> <li>• Consumers are more interested in buying green products when they are available in plenty of varieties instead of one off availability.</li> </ul>
Forest L. Reinhardt, 1998	Environmental Product Differentiation: Implications for Corporate Strategy	<ul style="list-style-type: none"> <li>• It is always difficult to technically differentiate "environmentally preferable" products in an explicit way.</li> <li>• Companies have adopted various methods to communicate the green features of the products. Companies use Government-sponsored eco-labels, third-party certification, and self-certification initiatives to make their green claims.</li> <li>• Credible Communication is a critical factor for acceptance of products.</li> </ul>
Ottman and Jacquelyn A., 1998	Green Marketing: Opportunity for Innovation	<ul style="list-style-type: none"> <li>• Environmentally sustainable products have performed poorly compared to the non-green products. Poor performance is a significant barrier to the consumers.</li> <li>• It is observed that few consumers are associated eco-friendly products having inferior performance.</li> </ul>
De Pelsmacker et al., 2005	Do consumers care about ethics? Willingness to pay for fair-trade coffee.	<ul style="list-style-type: none"> <li>• Less availability, mistrust on the green labels and absence of flawless information are the reasons for less consumption of green products.</li> </ul>
Biel and Dahlstrand, 2005	Values and habits: a dual-process model	<ul style="list-style-type: none"> <li>• Most of the time large household products are bought during shifting of houses where there is paucity of time to think of the green issues.</li> <li>• Purchasing of large Technology-based Products need more thoughtful approach than routine habits.</li> </ul>

Author & Year	Title	Major Findings
Ottman et al., 2006	Avoiding green marketing myopia: ways to improve consumer appeal for environmentally preferable products	<ul style="list-style-type: none"> <li>• Awareness need to be increased among the consumers on the green product claims of Technology-based Products and their benefits to the consumer and to the society.</li> </ul>
Dobson, 2007	Environmental citizenship: towards sustainable development	<ul style="list-style-type: none"> <li>• For creating behavioural change in the society environmental beliefs need to be created through education and awareness. This education must include essential investigation, information analysis and decision making skills.</li> </ul>
Luchs et al., 2010	The sustainability liability: Potential negative effects of ethicality on product preference	<ul style="list-style-type: none"> <li>• The positioning of a green product acceptance or non-acceptance depends on the manufacturer's claims on the product's efficiency and performance.</li> </ul>
William Young et al., 2010	Sustainable Consumption: Green Consumer Behaviour when Purchasing Products	<ul style="list-style-type: none"> <li>• Even though green consumers are ready to pay higher cost, lack of trust on green product claims is a significant barrier for the acceptance of the products.</li> <li>• Incentive from the Government on the premium cost and more authentic green claims can help green consumers to buy green products without much hassle.</li> </ul>
Shafaat & Sultan, 2012	Green Marketing	<ul style="list-style-type: none"> <li>• One of the key challenges faced by green product market is common standard to differentiate the green products from the non-green products. The awareness on green products is a key challenge for its acceptance.</li> </ul>
Tracy Tuten, 2013	Promoting Sustainability by Marketing Green Products to Non-Adopters	<ul style="list-style-type: none"> <li>• The concerns about the global environmental issues have increased very fast and the consequences are very much visible. But the adoption of green products is relatively very slow.</li> <li>• The perception of high cost and low quality is persisting with the consumers for a longer period.</li> </ul>
Sigal et al., 2016	Is Your Product Really Green? A Content Analysis to Reassess Green Advertising	<ul style="list-style-type: none"> <li>• Green-washing is very much present in the market which deceives the average consumers due to lack of awareness. Government need to intervene to deal with the green-washing.</li> </ul>

### 3.3 Government Policies in India

The Government of India (GOI) under the National Action Plan on Climate Change (NAPCC) has formulated the Bureau of Energy Efficiency (BEE), which regulates the energy star rating for electronic appliances (refrigerators and air conditioners etc...) in India. BEE is an autonomous body under the Central Electricity Rules, 2001. The star-rating system developed by the BEE helps consumers differentiate between the energy efficiency of appliances, with



the appliance bearing fewer stars being less energy-efficient and vice versa.

Also, E-waste (Management and Handling) Rules, 2011 have ‘Extended Producer Responsibility’ (EPR), which puts the onus on the manufacturers to take responsibility for their products beyond manufacturing. The rule compels the manufacturers for environmentally sound management even after the end of life cycle of the product.

#### **4. Models on TBP Adoption**

There are a few models proposed by researchers on TBP adoption. These models are discussed below.

According to the framework “The Central Role of Private Investment Decisions” by Martha & Nalin, (2009), the two main drivers of human emissions are behavior and capital stock. Behaviors such as switching off the lights when not in use, setting the temperature of air conditioners and cycling or walking the short distance travels are flexible, and can help reduce the emission by a simple change in behavior. Similarly, our capital investments such as purchasing a fuel-efficient car and acquiring an energy-efficient building are fixed in the short run, and lead to persistence in long term emissions.

Jody and Annie (2014) in their model suggest that firms should provide information about the product that is easy to understand for the average consumers. Their study suggests that manufacturers must not give technologically complicated information that is difficult to comprehend. The study states that high-level technical information hinders the adoption of Technology-based Products. As it is perceived that sustainable products and services are inferior (e.g., Luchs et al. 2010), information on quality, reliability and efficiency should be stressed while communicating the product information.

A research model by Tanushri and Arindam (2015) derives four major conclusions for Indian consumers on the purchasing of electronic appliances such as refrigerators and air conditioners. First, the influencing factors in decision-making on the purchase of energy-efficient star-rated appliances are primarily the brand name, look and feel, gifts and schemes, feedback provided by relatives and friends and their personal research work before the purchase. Second, the consumers are realizing the value of energy saving and clean environment as an outcome of using home appliances that are eco-friendly. Third, the consumers who believe in energy saving also consider environmental friendliness as an important factor while making a purchase decision. Fourth, the consumers give priority to star-rated appliances during the purchase of refrigerators and air conditioners in India.

#### **5. Discussion and Remarks**

Research reveals that individual consumptions contribute significantly to the Greenhouse Gas emission that is responsible for climate change. As discussed in the previous section, consumer behavior and capital stock are two primary reasons for human emissions. Only green product development and stricter environmental standards might not necessarily benefit the environment. Both low-tech and high-tech solutions are available for individuals, which will contribute towards lower human emissions. Little work is reported in the literature (for

example; Heinz Welsch & Jan Kuhling, 2009) about what motivates / demotivates consumers to adopt green products. There is a lack of guidance or framework that can help to promote green Technology-based Products amongst consumer groups.

This study on the consumers is based on the Technology-based Product adoption where there is medium range investment. The study does not include the low-cost consumer goods such as stationaries, eatables and cosmetics and high-cost investments such as procuring a vehicle or acquiring a house, which involves continuous GHG emissions throughout its lifetime. Specific studies can be conducted to ascertain the determinants for low and high capital investments. The consumer studies can be extended further to analyze the role of Governments towards the adoption of different products by the consumers, because apart from industrial GHG emissions, domestic GHG emissions also contribute significantly to climate change. As discussed in section 3.3, Government policies in India are not sufficient to help consumers adopt Technology-based Products. The Government must usher innovative, well-planned policies to encourage consumers to adopt green products. Most of the research studies on climate change are industry-oriented. This study suggests that equal emphasis needs to be given to the consumers and extensively focused research has to be carried out to enhance the consumer awareness to deal with the global climate problem.

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