

SPICe—Determinants of consumer green innovation adoption across domains: A systematic review of marketing journals and suggestions for a research agenda

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Abstract

Over the last decade, the growth in demand for green innovations has become apparent. This can be linked to increased consumer awareness of the environmental problems that the world is facing. This review presents the determinants of consumer green innovation adoption across domains identified in marketing literature. We included and synthesized 47 articles published between 2010 and July 2021 in top marketing journals. After identifying the determinants, we grouped them into four categories: (1) Social, (2) Personal, (3) Innovation, and (4) Contextual and external level determinants, or what we refer to as the SPICe determinants. This categorization is based on the source of the motivation, which is social, individual, innovation-related, or contextual. We found a lack of focus on the consumer aspects in green innovation adoption studies, highlighting the need for more research regarding what motivates consumers to adopt these new environmental products. Furthermore, we showed that no sole determinant could predict green innovation adoption alone. Consequently, we outlined several agendas and questions that future studies could tackle and explore.

KEYWORDS

consumer behavior, innovation adoption, sustainable consumption, systematic review

1 | INTRODUCTION

With recent publications, such as the IPCC report (2021) outlining the possible ominous scenarios caused by climate change, there is growing environmental awareness and a call for consumers to shift to greener behaviors. Indeed, due to this awareness, a 2020 US survey showed that about two-thirds of US adults think senior government officials should prioritize environmental protection and that more stringent environmental regulations are worth the financial costs (Funk & Kennedy, 2020). In the EU, more than nine out of 10 citizens say that it is important for them to protect the environment,

and more than 8 out of 10 believe that EU laws are important in order to protect the environment (European Commission, 2020). However, despite consumers' increasing concern for the environment, many studies have demonstrated that they do not necessarily behave in ways that help protect it (Kollmuss & Agyeman, 2002; Matthews & Rothenberg, 2017).

Many consumers are unwilling to adopt green innovations because of uncertainties and risks related to product acquisition and use. Some researchers have pointed out that the premium cost of many green alternatives may deter consumers from adopting them (Claudy et al., 2013; Hustvedt et al., 2013). In some cases, green

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products have been regarded as inferior in quality and performance compared to their traditional counterparts (Lin & Chang, 2012; Luchs & Kumar, 2017; Sadiq et al., 2021). These negative attributions could help explain the attitude-behavior gap that has been identified in green consumer behavior studies (Claudy et al., 2013; Gleim & Lawson, 2014). While these arguments may be relevant, other streams of green product research have proven otherwise. Green products do not need to be inferior and expensive. Indeed, they can also offer more benefits in terms of economic and functional performance than their brown counterparts, such as the financial benefits offered by carsharing (Wang et al., 2019) and the energy- and water-efficiency of sustainable washers (Hustvedt et al., 2013).

Over the years and in many different countries, scholars have studied what drives firms and consumers to adopt green practices. Notably, there is a growing interest in exploring what motivates consumers to behave pro-environmentally in several research streams, and also in marketing and consumer behavior studies. Several notable works have examined how to understand and encourage consumers to behave in a greener manner. White and colleagues' (2019) literature review suggests ways to SHIFT consumers to act more sustainably. They argue that marketers could encourage more people to adopt green behaviors by influencing psychological factors, such as social influence, habits, perceptions of the individual self, feelings, cognition, and the tangibility of outcomes. In more specific contexts, such as the adoption of organic products, Schleenbecker and Hamm's (2013) review found that studies have mainly focused on the consumer perception of design and labeling in connection with consumers' demands for more sustainable products. The work also points to the consumer need for reliable information and awareness of labeling. Looking at organic food, Rana and Paul (2017) reviewed studies from different countries identifying factors—including health consciousness, quality and safety, environmental friendliness, fashion trends, and social consciousness—that influence behavior toward the product. They show that health consciousness significantly affects the decision to purchase organic food. In green transport innovations, Daramy-Williams and colleagues (2019) conducted a systematic review regarding how user experience affects the transition toward plug-in electric vehicles. They highlight that experiences of the range, noise, and other vehicle attributes are essential in user decision-making. In addition, they underline the significance of the social and symbolic aspects of use.

In addition to independent research, several special issues have been devoted to the topic in recent years. The Journal of Marketing's May 2021 special issue "Better Marketing for a Better World," in which key topics include sustainability and climate concern, and the Journal of Consumer Behaviour's 2022 call for papers on environmental values and sustainable consumption indicates the growing importance of marketing and consumer studies in understanding and encouraging individuals to adopt pro-environmental behavior.

However, as observed in previous literature reviews, this research and these calls focus on the broad aspects of green behavior or the determinants of adopting specific green products. The purpose of this systematic literature review is instead to examine

the determinants of green innovation adoption in particular across various behavioral consumer domains. We identified four categories based on the source of the motivation to adopt green innovations—(1) Social, (2) Personal, (3) Innovation, and (4) Contextual and external level determinants or what we call the SPICe determinants.

Studies regarding green innovations are essential for the future because, like numerous other innovations, many of them will likely fall short and fail. Hence, their environmental advantages are not realized. This review's contribution lies in its focus on green innovations or novel products that are promoted as green alternatives to traditional products. Unlike previous studies that aim to determine the motivations of consumers to act green, including recycling, adopting green electricity, choosing public transport over cars, etc., this review outlines the motivations of consumers to adopt green innovations across domains, including organic products, electric-powered vehicles, and sustainable household technologies. We also focus on the adoption of green innovations, by which we mean using or purchasing novel green products. Compared to the adoption of other forms of innovations, green innovation adoption differs as it is linked to the ecological benefits of using these products. Green innovations are being promoted as green alternatives to conventional products or products that have minimal impact on the environment. They also offer both advantages and disadvantages in relation to ordinary innovations. For example, green innovations rely to some extent on the condition that the greenness of the innovation is perceived by the (potential) adopter. Therefore, their adoption should be seen differently, given that their development is partly motivated by addressing ecological issues caused by traditional counterparts. We, therefore, review articles that present green innovations and the determinants included. As this review is about consumer drivers to adopt green innovations, we use Paparoidamis and Tran's (2019, p. 1549) definition of green innovations, which is "a firm's new product design that is perceived by consumers to be innovative and eco-friendly based on their evaluation of product attributes." This definition emphasizes the consumer perspective in green innovations, which makes it relevant to this literature review. It also points to the tangibility and physical aspects of innovations, thus excluding pure service innovations, although a large number of product innovations are currently connected to service innovations as well; consider, for example, the sharing of e-bikes and e-scooters (Flores & Jansson, 2021).

2 | RESEARCH METHODOLOGY

2.1 | Selection of database

The main objective of this paper is to present the determinants of green innovation adoption identified in the marketing literature. As a starting point, we first identified the database to be used. Following the argument of Paul and Criado (2020), we decided to use Scopus, as it captures more articles than Web of Science, therefore providing a more comprehensive set of articles that could potentially be

relevant. Although this decision may have resulted in the unintentional exclusion of other pertinent papers listed in databases other than Scopus, this does not undermine the overall significance of this review since we were interested in top marketing journals and papers, which are all listed in Scopus.

2.2 | Selection of keywords and journals

After selecting the database, we had to determine the keywords for identifying relevant journal articles. The keywords used when searching in the article title, abstract, and keyword fields were *sustain* OR eco* OR green OR environment**, AND *innovat**. The first set of words that connoted green was chosen based on the terms commonly used to refer to green products and was adopted from White et al. (2019). The second limiting term, *innovat**, aimed to capture articles dealing with innovations due to the focus of this review. The terms were reduced to *sustain** for articles with sustainable and sustainability, *eco** for eco-innovation(s) and ecological, *environment** for environment and environmental, and *innovat** for innovation(s) and innovative. These keywords were selected based on the scope of this review, green innovations, which in some cases are also called eco-innovations, ecological innovations, sustainable innovations, or environmental innovations, for example. To limit the results to marketing journals, we used the 2019 journal classification of the Australian Business Dean Council (ABDC). This report was the latest one at the time of review in July 2021. The classification of the ABDC journals is validated by distinguished panels explained by the council here: https://abdc.edu.au/wp-content/uploads/2020/03/abdc-2019-journal-quality-list-review-report-6-december-2019_2.pdf. Only journals classified as Marketing/Tourism/Logistics, i.e., those under categories 1504, 1505, 1506, and 1507 on the list with A* and A ratings, were included. Consequently, journals in other fields such as management and entrepreneurship were excluded since they do not primarily focus on consumer behavior and/or marketing issues.

This produced a list of 107 journals for further analysis. We then identified unique terms to limit the search to the relevant journals. The following terms were applied in the source field: *market* OR review OR quality OR promotion OR advertising OR consumer OR research OR retail* OR management OR macromarketing OR service* OR appetite*. Finally, we applied the time filter of research published during the last decade, thus between 2010 and July 2021. The timeline was narrowed down to these years because the growth in studies regarding green innovations started in 2010 (Oduro et al., 2021). The search produced a total of 602 articles.

2.3 | Selection of articles

To select the articles to be reviewed, we applied two main criteria: (1) focus on the consumer aspect and not company or organization

perspectives, and (2) introduction of green innovations. The main consideration for the decision on whether to consider the green product as an innovation was made by identifying whether the article presented the product or parts of the product as an innovation. Based on these criteria, a total of 47 articles were included in the final review. Table 1 presents the journals that published the articles we reviewed, their 2019 ABDC ratings, how many articles were included, and the authors of these articles. Despite the significant number of articles on green innovations, most of the articles were about firm and manufacturing perspectives. This lack of focus on the consumer aspect of green innovation adoption highlights the need for more studies regarding what motivates consumers to adopt these new environmental products.

2.4 | Identification and categorization of green innovations and determinants

The next step was to identify the green innovations that these studies explored, the methods they employed, the context, and finally, the determinants they used. Given the vast range of determinants, we decided, after a thorough investigation of the topics, to group them into four categories, depending on the source of the motivation to adopt green innovations. These groups are the (1) Social, (2) Personal, (3) Innovation, and (4) Contextual and external level determinants or the SPICe determinants. Appendix A provides a summary of all this information.

Several steps were taken to categorize the factors of the analyzed papers. First, an overview table was created (see Appendix A) in which each study was thoroughly presented and analyzed. Based on this analysis, it was clear that several categories were present across the studies and across the determinants. We thus arrived at four categories with sufficient differentiation to be relevant. The main consideration was then the degree to which the determinants were related to the social, personal, and environmental factors surrounding the consumer, as well as the attributes of the green innovations. The first group is referred to as the social level determinants. This group comprises factors related to how other people surrounding a consumer can affect the decision to adopt green innovations. These are the factors connected with the social influence of family, friends, and society. This group also includes social expectations and normative beliefs. The second group is the personal level determinants. This group concerns individual factors that are inherent to consumers or acquired by consumers through experience and their social environment. These factors include personality traits and psychological characteristics. The third group of determinants is the innovation level determinants. This group consists of all the attributes of green innovation that influence the consumer adoption decision. Finally, the contextual and external level determinants relate to the peripheral settings around consumers, excluding the social environment, such as country-related factors, government support, and infrastructure, which impact green innovation adoption.

TABLE 1 Journal distribution of reviewed articles

Source title in alphabetical order	ABDC rating	Number of papers	Authors
Asia Pacific Journal of Marketing and Logistics	A	1	Perez-Castillo and Vera-Martinez (2021)
Appetite	A	2	Gravely and Fraser (2018), Vanhonacker et al. (2013)
European Journal of Marketing	A*	2	Paparoidamis and Tran (2019), Thøgersen et al. (2010)
Food Quality and Preference	A	7	Aschemann-Witzel and Peschel (2019), Bartels and Reinders (2010), Kushwah et al. (2019), Lang (2020), Sogari et al. (2021), Tandon et al. (2021), Torri et al. (2020)
Industrial Marketing Management	A*	1	Scarpi et al. (2021)
International Journal of Consumer Studies	A	5	Ahn et al. (2016), Broman Toft and Thøgersen (2015), Hustvedt et al. (2013), Matthews and Rothenberg (2017), Song et al. (2021)
International Journal of Contemporary Hospitality Management	A	1	Zhu et al. (2017)
Journal of Business Research	A	2	Confente et al. (2020), Wiedmann et al. (2011)
Journal of Consumer Behaviour	A	2	Flores and Jansson (2021), Jansson et al. (2011)
Journal of Consumer Marketing	A	2	Jansson et al. (2010), Moser (2016)
Journal of International Marketing	A	1	Tran and Paparoidamis (2020)
Journal of Macromarketing	A	1	Claudy et al. (2013)
Journal of Marketing	A*	1	Zhang et al. (2021)
Journal of Marketing Management	A	1	Thøgersen and Zhou (2012)
Journal of Retailing and Consumer Services	A	3	Chen (2015), Sandra and Alessandro (2021), Sadiq et al. (2021)
Transportation Research Part A: Policy and Practice	A*	6	Adnan et al. (2017), Jia and Fu (2019), Petschnig et al. (2014), Seebauer (2015), Wang et al. (2021), White and Sintov (2017)
Transportation Research Part C: Emerging Technologies	A*	1	Wang et al. (2019)
Transportation Research Part D: Transport and Environment	A	5	Chu et al. (2019), Jansson et al. (2017), Münzel et al. (2019), Potoglou et al. (2020), Qian and Yin (2017)
Transportation Research Part F: Traffic Psychology and Behaviour	A	3	Jain et al. (2021), King et al. (2019), Lee and Wong (2021)

3 | RESEARCH FINDINGS AND ANALYSIS

Surprisingly, although green marketing is becoming increasingly relevant and popular among researchers, studies about green innovation adoption in the top marketing journals have been limited in the last decade. Most of the articles focus on the company perspective, and those that look at consumers concentrate on limited industries. Therefore, despite the flourishing interest in consumer adoption of green products, further research and projects should still be undertaken to understand and capture the interest of marketing scholars and practitioners.

Table 2 summarizes the industries that have been studied in relation to green innovations. A few of the papers examined multiple innovations. Many papers focused on transport innovations (22), some on food innovations (12), others on retail and consumer technology products (9) and household technologies (5), and one each on hotels (1) and agriculture (1).

Table 3 summarizes the details of the ten most frequently cited publications in consumer green innovation adoption. Notably, 8 out of the 10 most frequently cited papers focus on innovations in transport and food. This focus can be attributed to how much the transport and food production industries are responsible for greenhouse gas emissions (cf. Ritchie & Roser, 2020) and, therefore, require green innovations to achieve long-term environmental sustainability. It can also be attributed to the increasing investments, resulting in the growing number of innovations in these sectors (UNCTAD, 2020).

4 | OVERVIEW OF THE DETERMINANTS OF GREEN INNOVATION ADOPTION

Below, we review the analyzed papers according to the grouping framework described above.

4.1 | Social level determinants

The social environment, or *interpersonal influence*, can be grouped into different social domains such as friends, family, neighbors, and coworkers (cf. Jansson et al., 2017). Based on a study about alternative fuel vehicles, neighbors were the most influential members of the social environment, whereas the influence of family and coworkers became weak or inconsequential when controlling for socio-demographic characteristics and voting behavior. The visibility of

car use was hypothesized to help explain the effect of neighbors in the decision to adopt alternative fuel vehicles (Jansson et al., 2017). Another significant interpersonal influence is social media influencers. With the growing relevance of social media, a study on eco-friendly pesticides in China demonstrated that social media influencers could help remove the barriers to a new product's credibility. Social media influencers did not have to be knowledgeable about the technology, but they did have to be renowned within their environment to have an influence (Zhang et al., 2021).

TABLE 2 Summary of industries and innovations

Industry	Innovation
Transport (n = 22)	<p>Alternative fuel vehicles (AFVs)/battery vehicles (BVs)/electric vehicles (EVs)</p> <ul style="list-style-type: none"> Adnan et al. (2017), Chu et al. (2019), Jansson et al. (2010), Jansson et al. (2011), Jansson et al. (2017), King et al. (2019), Petschnig et al. (2014), Potoglou et al. (2020), Qian and Yin (2017), Song et al. (2021), Tran and Paparoidamis (2020), Wiedmann et al. (2011), White and Sintov (2017) <p>E-bikes and e-scooters</p> <ul style="list-style-type: none"> Seebauer (2015) <p>Sharing economy (carsharing, (e-)bike sharing, e-scooter sharing)</p> <ul style="list-style-type: none"> Flores and Jansson (2021), Jain et al. (2021), Jia and Fu (2019), Lee and Wong (2021), Münzel et al. (2019), Wang et al. (2019), Wang et al. (2021), Zhu et al. (2017)
Food (n = 12)	<p>Eco-labels on food products</p> <ul style="list-style-type: none"> Thøgersen et al. (2010) <p>Edible jellyfish</p> <ul style="list-style-type: none"> Torri et al. (2020) <p>Organic food (products)</p> <ul style="list-style-type: none"> Bartels and Reinders (2010), Kushwah et al. (2019), Moser (2016), Tandon et al. (2021), Thøgersen and Zhou (2012) <p>Plant-based drinks</p> <ul style="list-style-type: none"> Aschemann-Witzel and Peschel (2019) <p>Plant-based protein/blended meat/meat substitutes</p> <ul style="list-style-type: none"> Gravely and Fraser (2018), Lang (2020), Sogari et al. (2021), Vanhonacker et al. (2013)
Retail and consumer technology products (n = 9)	<p>Biodegradable plastic</p> <ul style="list-style-type: none"> Confente et al. (2020), Scarpi et al. (2021) <p>Eco-friendly cosmetics</p> <ul style="list-style-type: none"> Sadiq et al. (2021) <p>Eco-smart TVs</p> <ul style="list-style-type: none"> Tran and Paparoidamis (2020) <p>Innovative smartphones/remanufactured cellphones</p> <ul style="list-style-type: none"> Paparoidamis and Tran (2019), Perez-Castillo and Vera-Martinez (2021), Tran and Paparoidamis (2020) <p>Organic apparel/bio-textile products</p> <ul style="list-style-type: none"> Matthews and Rothenberg (2017), Sandra and Alessandro (2021)
Household technologies (n = 5)	<p>Connected vacuum cleaners</p> <ul style="list-style-type: none"> Paparoidamis and Tran (2019) <p>Smart grid technology/solar panels</p> <ul style="list-style-type: none"> Broman Toft and Thøgersen (2015), Claudy et al. (2013) <p>Sustainable household technology</p> <ul style="list-style-type: none"> Ahn et al. (2016) <p>Sustainable laundry technology</p> <ul style="list-style-type: none"> Hustvedt et al. (2013)
Others (n = 2)	<p>Eco-friendly hotel with eco-technology</p> <ul style="list-style-type: none"> Chen (2015) <p>Eco-friendly pesticides</p> <ul style="list-style-type: none"> Zhang et al. (2021)

TABLE 3 Ten most frequently cited consumer green innovation adoption publications in selected ABDC journals

Author(s)	Green innovation	Journal title	Publication year	Citations as of July 2021 (average citations per year)
Jansson et al.	Alternative fuel vehicles	Journal of Consumer Marketing	2010	275 (25)
Vanhonacker et al.	Meat substitutes and replacements	Appetite	2013	193 (24)
Thøgersen et al.	Ecolabels	European Journal of Marketing	2010	184 (17)
Jansson et al.	Alternative fuel vehicles	Journal of Consumer Behaviour	2011	142 (14)
Claudy et al.	Solar energy panels	Journal of Macromarketing	2013	123 (15)
Thøgersen & Zhou	Organic food	Journal of Marketing Management	2012	102 (11)
Bartels & Reinders	New organic food products	Food Quality and Preference	2010	78 (7)
Wiedmann et al.	Alternative fuels and engines	Journal of Business Research	2011	55 (6)
Chen	Ecofriendly practices and innovative technologies	Journal of Retailing and Consumer Services	2015	51 (9)
Kushwah et al.	Organic food	Food Quality and Preference	2019	37 (19)

Social norms reflect the degree to which an individual considers it is important for them to behave based on the expectations of others. In transport studies, social norms were found to be important in the decision to adopt electric vehicles in China (Song et al., 2021) and alternative fuel vehicles in Germany (Petschnig et al., 2014). For the Chinese, it was important to signal their values to their environment. Indeed, in a study comparing electric vehicle adopters in China and Korea, *reputation and interest from others* had a negative impact on user satisfaction in Korea, while for electric vehicle adopters in China, reputation and interest from others served as a strong motivator for purchase (Chu et al., 2019). Injunctive norms, or those that are directly communicated by the social environment, were found to be relevant in the diffusion of e-scooters in the short run, but not e-bikes. Nonetheless, these norms negatively impacted long-term e-bike diffusion due to the environmentalist attributes propagated by early adopters (Seebauer, 2015), which might not always be aligned with consumer identity.

Social norms were also important motivators for carsharing, as consumers with carsharing friends and family showed a more favorable attitude toward using such services. On the other hand, those surrounded by a social environment with a negative attitude toward carsharing felt compelled to stop using the service and buy a car (Jain et al., 2021). Social norms did not have a significant effect on the consumption of organic food (Thøgersen & Zhou, 2012). Subjective norms were also insignificant in technologies that are more familiar to consumers (Lee & Wong, 2021). In general, it has been argued that *societal pressure* was one of the most significant factors involved in the intention to adopt electric vehicles (Adnan et al., 2017). However, this pressure did not influence the adoption of sustainable household innovations, which in one study was attributed to the inconspicuous nature of the technology (Ahn et al., 2016).

The adoption of green innovations has also been investigated through the social identity theory lens, in which adopting innovations can communicate a person's social identity to their social environment. *Social identification*, which refers to the extent to which a person identifies themselves with a particular group, had a strong influence on the purchase of new organic food products (Bartels & Reinders, 2010). However, in the case of battery electric vehicles, drivers encountered stereotype threats, as they did not want to be regarded as someone who belonged to a stigmatized social group of environmentalists (King et al., 2019). Notably, one study found that consumers may feel intimidated by stereotypes because of non-identification with the social group, rather than having negative perceptions regarding the group characteristics (King et al., 2019).

4.2 | Personal level determinants

4.2.1 | Personality traits

In the study of innovations, one of the most widely adopted theories is the Diffusion of Innovations Theory. Indeed, several articles included in this review cite the theory as their primary theoretical reference

(cf. Hustvedt et al., 2013; Jain et al., 2021; Jansson et al., 2017; Matthews & Rothenberg, 2017; Münzel et al., 2019; Petschnig et al., 2014; Seebauer, 2015; Wang et al., 2021). A significant contribution of this theory is its argument regarding the importance of *consumer innovativeness (CI)* in the adoption of new products. Several studies have considered CI an important driver of green innovation adoption (cf. Flores & Jansson, 2021; Paparoidamis & Tran, 2019; Song et al., 2021). Consumer innovativeness refers to the adoption speed of new products by individuals compared to their social environment (Rogers, 2003).

Paparoidamis and Tran (2019) introduced a new domain-specific conceptualization of CI, *eco-friendly consumer innovativeness (ECI)*. ECI is the “consumer’s tendency to be knowledgeable about and adopt innovative products and services that are beneficial to the natural environment” (Paparoidamis & Tran, 2019, p. 1551). They showed that consumers with strong ECI had a more positive evaluation of green attributes of innovations, increasing their intention to adopt these products. Those who identified themselves as innovators or pro-environmental were likely to choose cars with a high level of automation (Potoglou et al., 2020).

Another type of domain-specific innovativeness is *food innovativeness*. Food innovativeness has been found to increase the acceptance of plant-blending in meat-based products. On the other hand, *domain-specific innovativeness relating to eco-labels* promoted the adoption of eco-labels (Thøgersen et al., 2010). In the adoption of organic apparel, consumers who considered themselves low innovators in fashion were more likely to buy environmental and organic t-shirts compared to those with high *fashion innovativeness* when other non-environmental product characteristics were considered (Matthews & Rothenberg, 2017). In a study comparing users and non-users of shared micromobility, users thought of themselves as innovative in the transport sector, whereas non-users did not (Flores & Jansson, 2021). However, *personal innovativeness* did not influence positive word of mouth, which reflected loyalty toward ride-hailing services (Lee & Wong, 2021).

Other *personality traits* can also affect the decision to adopt green innovations. For example, *food neophobia* and *sensitivity to disgust* negatively affected jellyfish consumption attitudes (Torri et al., 2020). By contrast, *technophilia* gives early adopters their *opinion leadership* status, as they were perceived as more knowledgeable about innovations than their peers. According to a study about e-scooters and e-bikes, opinion leadership strengthens efforts to adopt innovations, as opinion leaders were regarded as technically competent and morally credible (Seebauer, 2015).

4.2.2 | Psychological determinants

Environmental concern is one of the most studied psychological determinants in decision-making relating to green innovations. It has been shown to positively affect pro-environmental attitudes, perceived behavioral control, subjective norms, and personal norms (Adnan et al., 2017). Its effect, however, is inconsistent across studies. On the

one hand, environmental concern has been shown to positively affect the adoption process of new eco-labels (Thøgersen et al., 2010) and moderate the barriers related to values and image aspects of an innovation (Sadiq et al., 2021). However, no significant moderation could be demonstrated for barriers related to changes in lifestyle or habits related to green innovation use (Sadiq et al., 2021). In decisions to adopt sustainable household innovations (Ahn et al., 2016) and purchase organic apparel (Matthews & Rothenberg, 2017), consumers did not necessarily need to possess a high level of environmental concern. A closely related factor, *environmental consciousness*, which reveals the extent of a person’s environmental concern, has been demonstrated to adversely influence loyalty to ride-hailing services through word of mouth (Lee & Wong, 2021).

Environmental knowledge reflects awareness about the consequences of human actions on the environment. Adopters of alternative fuel vehicles had a higher awareness of the consequences of fuel consumption compared to non-adopters (Jansson et al., 2011). Moreover, environmental knowledge has been found to be related to how green consumers perceive innovations (Flores & Jansson, 2021). Nevertheless, environmental knowledge negatively affected perceptions of some green innovations, such as shared e-scooters, as consumers may see them as less green than other forms of transport such as cycling and public transport (Flores & Jansson, 2021).

Green identity, which signifies how pro-environmental individuals see themselves and how their actions reflect their values, increased the switching intention to use bioplastic products (Confente et al., 2020; Scarpi et al., 2021). The green identity effect was magnified if the behavior is congruent with a consumer’s personal values (Confente et al., 2020). In transport, pro-environmental identity positively affected green perceptions of autonomous vehicles (Potoglou et al., 2020).

Pro-environmental attitudes refer to the extent of an individual’s commitment to protecting the environment. As proxied by green voting, a more positive attitude toward the environment increased the likelihood of carsharing use (Münzel et al., 2019). Pro-environmental attitudes were also vital to the adoption intention for electric vehicles (Adnan et al., 2017). Closely linked to pro-environmental attitudes are *personal norms*, which refer to the feelings of personal moral responsibility for the environment. It has been shown that personal norms have a strong positive effect on the intention to adopt alternative fuel vehicles (Jansson et al., 2010; Petschnig et al., 2014). In the apparel industry, a study has demonstrated that fashion innovators possessed significantly high pro-environmental beliefs (Matthews & Rothenberg, 2017), and consumers who considered environmental issues in their purchasing decisions were willing to pay more for bio-textile products (Sandra & Alessandro, 2021).

Another psychological determinant, which reflects an individual’s tendency to purchase products based on ethical product attributes, is *ethical consumption intention* (Kushwah et al., 2019). Consumers with high ethical consumption intentions were more likely to buy and have more favorable choice behavior toward organic food (Kushwah et al., 2019). Moreover, individuals who had a favorable disposition toward sustainable diets were more likely

to buy meat-blended products (Sogari et al., 2021). Alternatively, *motivation to process information* regarding sustainability and nutrition has been linked to the consumption of blended meat products (Sogari et al., 2021).

A different way of examining how a consumer evaluates their moral obligation to protect the environment is through deontological ethical theory. The theory proposes that consumers who believe they are morally obliged to treat the environment fairly will be more inclined to adopt green products (Qian & Yin, 2017). Indeed, because one of the main sources of energy in China is coal, *deontological evaluation* mediated the effect of the human-nature relationship on the adoption of electric vehicles (Qian & Yin, 2017).

Another important factor in the adoption of green innovation literature is *values*, which encompass biospheric, altruistic, and egoistic values. Whereas biospheric values were higher for adopters of alternative fuel vehicles, only egoistic values had an influence, albeit negative, on adoption decisions (Jansson et al., 2011). In attitude formation toward and adoption intention for solar energy panels, ecological values were relevant. Nevertheless, in one study, values did not directly affect attitude but rather influenced attitude via reasoning (Claudy et al., 2013). Another relevant way of looking at values is through human values, which are beliefs about how desirable specific behaviors are to an individual and their social environment. A study about food labeled with environmental footprints showed how human values could influence consumer decision to adopt green products (Greibitus et al., 2015).

Two conceptually related determinants are *perceived consumer effectiveness* and *perceived behavioral control*. Both relate to how easily and effectively an individual can perform an action. Self-efficacy increases the perceived value of and favorable attitude toward innovations, as consumers feel confident to use the innovation and can decrease the learning effort (Zhu et al., 2017). By contrast, a lack of perceived behavioral control reduces the likelihood of use, as shown with carsharing (Jain et al., 2021).

Regarding personal interest, *health concern* was found to moderate the barriers to adopting eco-friendly consumer products. In particular, health concern played an influential role when consumers considered the risks associated with use because eco products were considered healthier than alternatives (Sadiq et al., 2021). In addition, health concern was more important than environmental concern for the adoption of bio-textile products (Sandra & Alessandro, 2021). In the context of buying behavior for organic food, health-consciousness acted as a stimulus to facilitators and barriers for purchase behavior (Tandon et al., 2021).

4.2.3 | Product attitude, knowledge, involvement, and experience

Expectancy-value attitude theory and Bem's self-perception theory can help to explain how attitudes are formed toward green innovations (Thøgersen & Zhou, 2012). According to expectancy-value attitude theory, consumers form their *perceptions toward products* by

acquiring information about the products and assessing the benefits and drawbacks of using them. On the other hand, self-perception theory relies on a person's previous experience with the product in attitude formation. Instead of conflicting with each other, Thøgersen and Zhou (2012) argued that they serve as complements. Indeed, studies have shown that those who were *aware of the advantages* of innovations or who have *experience using* them were more likely to adopt these innovations (Broman Toft & Thøgersen, 2015, 2015; Hustvedt et al., 2013; Thøgersen & Zhou, 2012). For example, families who did not have relevant experience with smart grid technology were not as willing to adopt the innovation compared to others who had tried it (Broman Toft & Thøgersen, 2015). Consumers were also more willing to accept products from bioplastics once they became aware of their value and green attributes (Confente et al., 2020). A study about eco-labels has shown that the more knowledgeable a person was and the more experience an individual had about eco-labels, the more likely they were to adopt eco-labels (Thøgersen et al., 2010).

Attitude formation toward the innovation is significant in consumer decisions to adopt green innovations. *Attitude toward the product* positively influenced the intention to buy organic vegetables (Thøgersen & Zhou, 2012). This was also true in the case of vegetable-blended meat products, in which attitude was significant in the consumption intention (Sogari et al., 2021). Consumers who saw the positive environmental benefits of electric vehicles and had strong environmental concerns exhibited a more positive attitude toward electric vehicles (Adnan et al., 2017). Nevertheless, attitudes are context-specific and can be influenced by many factors (Petschnig et al., 2014), and their effects are, therefore, difficult to ascertain across domains.

Involvement pertains to the degree of importance an individual attaches to a certain behavior or product. It can also refer to the level of engagement, i.e., how actively a person pursues or purchases a product. A study has shown that food involvement positively influenced the acceptance of plant-based ingredients in meat-based foods (Lang, 2020). Moreover, consumers who were involved in organic food were able to make the cost-benefit trade-off of buying the green innovation, while non-involved consumers could not make this distinction, hindering them from buying the product (Kushwah et al., 2019). In transport, it has been demonstrated that those who had high car involvement were the ones with low environmental awareness and highly perceived the risks involved in adopting natural gas vehicles (Wiedmann et al., 2011).

4.2.4 | Consumption behavior and habits

Consumption behavior and habits have also been investigated in the adoption of green innovations. For instance, *green purchase behavior* has been shown to significantly influence the intention to switch to remanufactured products (Perez-Castillo & Vera-Martinez, 2021). These green consumers put more emphasis on the socio-environmental benefits of the products they consume than

the financial benefits. *Traveling behavior* (traveling abroad or locally at least once a year) positively affected jellyfish consumption attitude, as exposure to different kinds of food resulted in more openness to trying new food products (Torri et al., 2020). In the case of *organic buying behavior*, the behavior could be significantly predicted by social identification and domain-specific innovativeness related to organic food (Bartels & Reinders, 2010). *Past pro-environmental behavior*, although significant, only weakly predicted the willingness to lease or buy an electric vehicle (White & Sintov, 2017).

Consumption frequency of traditional burgers did not significantly affect purchase intention for burgers with blended meat (Sogari et al., 2021). On the other hand, high fashion and low fashion innovators did not differ in terms of how often they bought organic apparel (Matthews & Rothenberg, 2017).

Car habits had a strong negative influence on the willingness to adopt alternative fuel vehicles (Jansson et al., 2010). Habits are defined as routinized behaviors carried out with a certain frequency and with less cognitive effort than one-off or new behaviors. Car ownership served as a barrier to the adoption of car sharing (Jain et al., 2021) or as an encouragement as car owners see the positive environmental impact of carsharing, while non-car owners, who are less dependent on cars, perceived the negative consequences to a higher degree (Münzel et al., 2019).

4.2.5 | Socio-demographic characteristics

Socio-demographic variables such as *age, gender, income, and level of education* have been commonly cited as important factors that affect the adoption of green innovations. However, their effects are often ambiguous and, in many instances, marginal. A study of new organic food products demonstrated that demographic characteristics did not have a clear effect on buying behavior (Bartels & Reinders, 2010). In the intention to buy organic vegetables, gender and age did not significantly affect knowledge about the green product. However, adopters tended to have more years of education and higher income (Thøgersen & Zhou, 2012). Similarly, years of school education were shown to have a significant influence on the adoption of a high involvement green innovation (Jansson et al., 2010). On the other hand, education level did not significantly influence the decision to purchase bio-textile products (Sandra & Alessandro, 2021), but it did have a significant impact on the adoption of alternative fuel vehicles (Jansson et al., 2011) and car sharing (Münzel et al., 2019).

Interestingly, males have been shown to have a higher willingness to pay for bio-textile products, although females were shown to be more environmentally concerned (Sandra & Alessandro, 2021). Males were also more inclined to accept new ingredients in plant-based drinks, even though females had a more favorable assessment of these drinks (Aschemann-Witzel & Peschel, 2019). Additionally, males had a more favorable attitude toward jellyfish consumption than females (Torri et al., 2020). These findings are congruent with the findings for organic food, which showed that males were more affected by facilitators and inhibitors of purchase behavior than

females (Tandon et al., 2021). From these results, we can infer that even though it has been demonstrated that females are more environmentally conscious, males seem more open to innovations.

Household characteristics have also been included in several green innovation studies. Household characteristics affected the decision to adopt a sustainable washer (Hustvedt et al., 2013) and an alternative fuel vehicle (Jansson et al., 2011). According to a study of car share users, consumers discontinued using the service after becoming parents or when they expected to have a bigger family, although they valued the environmental and financial benefits (Jain et al., 2021). Nevertheless, household characteristics did not affect knowledge about organic food (Thøgersen & Zhou, 2012).

4.3 | Innovation level determinants

4.3.1 | Instrumental attributes

The *relative advantages* of green innovations compared to traditional products could encourage users to switch (Hustvedt et al., 2013; Song et al., 2021; Wang et al., 2021). These advantages can be in the form of economic benefits, performance, effort, and compatibility. *Economic benefits* were consistently regarded as important in the adoption of green innovations in various studies (Song et al., 2021; Wang et al., 2019). In fact, in the purchase of bio-textile products, the price was the most significant consideration (Sandra & Alessandro, 2021). Then again, in some situations, the costs associated with purchasing green innovations hindered the widespread adoption of the products (Hustvedt et al., 2013; Sandra & Alessandro, 2021).

Apart from price considerations, consumers also valued the health and taste aspects of plant-based ingredients in meat-based products. These findings suggested that blended products should taste better and be cheaper in order to increase consumer acceptance (Lang, 2020). *Health and taste benefits* also strongly influenced the decision to adopt organic products (Moser, 2016). Nonetheless, the value disadvantage or the unclear benefits of organic food over conventional alternatives affected the ethical consumption intention and choice behavior among Indian consumers (Kushwah et al., 2019) and the purchase behavior of Japanese consumers (Tandon et al., 2021). In the case of ridesharing, *convenience* increased the intention to adopt the service (Wang et al., 2019).

A study about sustainable household technology showed that *performance expectancy* and *compatibility expectancy* influenced the decision to adopt a household innovation (Ahn et al., 2016). *Effort expectancy*, on the other hand, was not significantly related to the adoption of green household technology (Ahn et al., 2016).

4.3.2 | Green attributes

Green product attributes can be grouped into *resource use reduction/efficiency features*, *resource use elimination features*, and *resource use*

substitution features (Paparoidamis & Tran, 2019). Green innovations that focus on resource use reduction or efficiency are designed to lower energy use and carbon emissions, while green innovations that aim to eliminate resource use emphasize the removal of harmful products or natural resources in the production process. Finally, green innovations that focus on substitution are those that replace environmentally harmful inputs with greener substitutes. According to one study, consumers had a more positive evaluation of green innovations that eliminate or substitute the use of harmful inputs than those that reduce resource use (Paparoidamis & Tran, 2019).

Another green attribute that can be considered is the country where the green innovation was manufactured. Tran and Paparoidamis (2020) introduced the concept of *ecological country of manufacture* (COM), which refers to the extent to which consumers perceive a country is addressing environmental issues. Based on their experimental studies, they showed that with publicly consumed products, congruence between product eco-friendliness and ecological COM positively affected consumer perception. On the other hand, with privately consumed green innovations, the incongruence of eco-friendliness and ecological COM had a greater impact on consumer adoption intention.

In the case of remanufactured products, their environmental benefits increased consumers' willingness to pay, perceived value, and switching intention (Perez-Castillo & Vera-Martinez, 2021). By contrast, in the case of blended meat products, environmental benefits were one of the least important factors affecting the acceptance of the innovation (Lang, 2020).

Another factor related to green attributes is the *ecological welfare of the product*, which considers not only the environmental impact but also the impact on animals. Ecological welfare has been shown to drive the purchase of organic food in Japan (Tandon et al., 2021). Nevertheless, while users of a green innovation tended to see the green attributes of the product, this may not be the situation for non-users, as in the case of shared e-scooters (Flores & Jansson, 2021).

4.3.3 | Symbolic and hedonic attributes

The *symbolic aspect* of green innovations can also make them more attractive to consumers (Song et al., 2021; White & Sintov, 2017). By signaling a person's characteristics through product consumption, a person could be motivated to adopt conspicuous products that strongly communicate unobservable characteristics. *Perceived visual appeal* in connection with the image and symbolic meaning were important factors in the intention to adopt AFVs (Petschnig et al., 2014). Electric vehicle adoption among Chinese consumers could be linked to the capacity of the innovation to communicate a consumer's environmental concern (Chu et al., 2019). Perceiving the environmental and social innovation attributes of electric vehicles mediated the relationship between concern for climate change and intent to buy electric vehicles (White & Sintov, 2017). Curiously, symbolic attributes had a stronger influence on adoption intention for electric vehicles than for hybrid vehicles (White & Sintov, 2017).

In the case of car sharing, the use of the service signals an identity aligned with transforming culture in inner cities (Jain et al., 2021). Nevertheless, although instrumental, economic, and hedonic values were important in the attitudinal loyalty toward ride-hailing, the social value of ride-hailing was found to be insignificant (Lee & Wong, 2021). This finding may have been due to the high acceptance of technology in the social environment (Lee & Wong, 2021). As for status-oriented drivers, they were skeptical about the adoption of natural gas vehicles because of the risk of losing status among their group (Wiedmann et al., 2011).

A further important determinant is *hedonic expectancy* (Ahn et al., 2016). The hedonic attributes of a green innovation relate to the experiential aspect of the product. In the case of ridesharing, awareness of the hedonic advantages of the service increased the willingness to ride among users (Zhu et al., 2017) and non-users (Wang et al., 2019).

4.3.4 | Risk and tradition attributes

According to innovation resistance theory, the risks related to the use of a new product hinder its adoption. The theory presents five barriers that deter consumers from adopting innovations. These are usage, value, risk, tradition, and image barriers (Kushwah et al., 2019; Sadiq et al., 2021). Usage, value, and image barriers pertain to the instrumental and symbolic barriers of innovation adoption. On the other hand, risk and tradition barriers are linked to other product attributes that are more concerned with uncertainties and lifestyle change. In the adoption of eco-friendly cosmetic products in India, barriers relating to value and image barriers were reduced by environmental concerns, while barriers connected with tradition and risk were reduced by health concerns (Sadiq et al., 2021).

The *risk barriers* in green innovations reflect the uncertainties behind the use of new products and the skepticism toward green marketing (Sadiq et al., 2021). Flemish consumers were unwilling to consume and pay more for insect protein-based products, partly due to a lack of familiarity or the risks associated with consuming products that were not traditionally seen as a food source (Gravelly & Fraser, 2018).

Risks can also be related to financial investments, performance issues, health concerns, the time needed for adoption, social acceptance, and psychological discomfort (Wiedmann et al., 2011). Although learning and economic risks were found not to be relevant in the adoption of ridesharing applications (Zhu et al., 2017), the effects of perceived economic, hedonic, and social value on the intention to use ridesharing increased when ridesharing services posed higher risks. One reason could be that consumers' value perceptions increase to overcome the risks associated with the use or that some consumers found the risks involved in using the service appealing (Wang et al., 2019). Physical and functional risks were found to be insignificant in the attitude formation toward alternative fuel vehicles, as they were not considered equally important as other characteristics (Petschnig et al., 2014). While reasons against

the adoption of solar panels—such as costs, risk, and incompatibility with the house—had a negative direct impact on intention to adopt the innovation, reasons for adoption, such as economic and environmental benefits, had no direct influence on solar panel adoption intention (Claudy et al., 2013).

Other risks could relate to the lack of or unclear compensation when accidents arise from the use of the innovation (Wang et al., 2019). Privacy issues are also an important risk factor. However, a study about ride-hailing in many countries demonstrated that privacy risk did not pose a significant barrier, as consumers trusted that their personal data would be managed correctly (Lee & Wong, 2021). While trialability allows consumers to experience the product without having to invest too much money, it did not seem to be important in the diffusion of shared bikes (Wang et al., 2021) and alternative fuel vehicles (Petschnig et al., 2014). Observability of infrastructure, on the other hand, was found to decrease risk perception concerning shared bikes (Wang et al., 2021). Nonetheless, risks perceptions are generally more focused on the disadvantages of a product and not on consumers' risk aversion. Regardless, a study on the resistance against natural gas vehicles showed that risk-averse drivers had low ecological awareness and high car involvement (Wiedmann et al., 2011).

Tradition barriers relate to how the adoption of green innovations could change an individual's lifestyle. As such, tradition barriers strongly influenced the decision of Indians to purchase eco-friendly cosmetic products, as these products were perceived to be incompatible with the values and beliefs that a person and a social environment hold (Sadiq et al., 2021). Compatibility also had the strongest influence on the intention to adopt sustainable household technology (Ahn et al., 2016) and alternative fuel vehicles (Petschnig et al., 2014). In another case, switching intention in shared bike systems was linked to the compatibility of the innovation with lifestyle and habits (Wang et al., 2021). Complexity also influenced risk perception and switching intention for shared bikes (Wang et al., 2021). Nevertheless, despite being important, compatibility and complexity only proved to be of minor significance compared to relative advantage in the decision to adopt sustainable laundry technology (Hustvedt et al., 2013).

4.3.5 | Brand and product package attributes

Not much attention has been given to the role of brands and product packaging in the adoption of green innovations. However, some studies have pointed to the relevance of such attributes in the diffusion of novel green products. According to Aschemann-Witzel and Peschel (2019), the *brand and product packaging* are important in the development of consumer perception of green innovations. Research about *eco-labels and brands* on the packaging has shown that information about the environmental benefits of green innovations could help promote the market for such products, although the brand mitigated this effect (Van Loo et al., 2020). However, information about environmental characteristics could backfire, such as in the case of

organic beer, in which green attribute information created a negative bias against the product (Waldrop & McCluskey, 2019). In another domain, lodging facilities that had a green image were preferred by consumers who had high environmental concerns. These facilities include those with green buildings that use green products, such as LED lightning and eco climate controls (Chen, 2015).

4.4 | Contextual and external level determinants

A *country's cultural and economic characteristics* can accentuate the adoption of green innovations. One study demonstrated that in countries where autonomy, egalitarianism, and high mastery are important, incongruence between green attributes and ecological country of manufacture increases the likelihood of adoption, while the opposite is true in countries that emphasize embeddedness, hierarchy, and harmony (Tran & Paparoidamis, 2020). In countries where collectivism is high, social responsibility is more relevant in the decision to purchase electric vehicles (Song et al., 2021). A study on the adoption of electric vehicles in China showed that cultural values of human-nature relationships, long-term orientation, and face consciousness significantly affected the decision to adopt the green transport innovation. This result was connected with the belief that green products are compatible with their values and beliefs (Qian & Yin, 2017). In a study in six countries comparing willingness to pay for and consumer interest in alternative fuel vehicles and autonomous vehicles, the Japanese had the greatest willingness to pay for full automation because of the country's high technology-based economy and aging population (Potoglou et al., 2020).

Geographical areas of residence also play a part in the decision to adopt green innovations. For example, people living on islands have been found to have a more positive attitude toward jellyfish as a food source (Torri et al., 2020). Area of residence can also be linked to ease of access to public transportation. Urban residents were found to be more likely to adopt dockless bikes (Jia & Fu, 2019). However, dockless bicycles replaced walking, particularly for those who lived between one and two kilometers away from a bus stop (Jia & Fu, 2019). In a study on carsharing, the authors argue that carsharing is not only a "big city phenomenon" (Münzel et al., 2019, p. 288), implying the broader context and effects of the innovation.

Related to this is the effect of the *country of origin* of a consumer. Country of origin affected the intention to consume blended meat products. Consumers from North America, where burgers are a usual part of the diet and culture, were less likely to consume blended meat than those from other countries where burgers are not such a prominent part of the food culture (Sogari et al., 2021).

External measures such as government incentives and subsidies can encourage the adoption of green innovations (Song et al., 2021). The incentives are strongly dependent on the country and related policies, for instance, those given to electric vehicle adopters in Korea (Song et al., 2021). However, concerning

the intention to switch to remanufactured products, government incentives did not appear to have a significant effect in one study (Perez-Castillo & Vera-Martinez, 2021). Firm-initiated customized support could also motivate consumers to try new innovations, as shown in a study about eco-friendly pesticides. The personalized support that consumers had received helped to overcome uncertainties regarding the unfamiliarity of the product (Zhang et al., 2021).

In the case of organic food, Gravely and Fraser (2018) highlighted the importance of the supermarket environment, *the point of purchase*, when buying plant-based protein. They showed how the material environment, accessibility based on product placement, presentation, and promotion of plant-based protein products to consumers all influenced consumption habits.

Communication channels and *persuasive messaging* have also been found to be critical in the adoption of green innovations. Early adopters of green washing machines were found to rely more on more technically accurate information channels, such as manufacturer websites, consumer advice websites, and magazines. Non-adopters, on the other hand, got their information from traditional communication channels like newspapers and radio (Hustvedt et al., 2013). Persuasive messaging had no effect on the adoption intention for electric vehicles. This inconsequentiality could be linked to the observability of electric vehicles in the community, pointing to social norms of using innovations (White & Sintov, 2017).

To sum up, we present the SPICe determinants identified as relevant in green innovation studies from the consumer perspective in Figure 1, which shows how consumer decisions to adopt green innovations are affected by the different factors uncovered in the literature review of top marketing journals. The effects vary, and their influence could be interactional or independent from each other. The large circle with broken lines behind represents the potential interaction between the factors. Not surprisingly, as the researchers looked at the consumer aspect of green innovation diffusion, many of the determinants identified belong to the personal level determinants group, which points to the crucial role of consumers. Other factors are concerned with the innovation's attributes, while some determinants refer to the context of adoption. Interestingly for future research, only a few studies in the sample have looked at the role of the social environment in the adoption decision.

5 | RESEARCH AGENDA

5.1 | Research and theoretical contributions

Based on the reviewed articles, the most dominant theory applied in the study of green innovations is the Diffusion of Innovations Theory (cf. Hustvedt et al., 2013; Jain et al., 2021; Jansson et al., 2017; Matthews & Rothenberg, 2017; Münzel et al., 2019; Petschnig et al., 2014; Seebauer, 2015; Wang et al., 2021). It is unquestionable that its applicability has provided the groundwork for much empirical research. Nevertheless, although the theory—and its related

concepts, such as consumer innovativeness—has been dominant in the studies of green innovation adoption, there are still unanswered questions in relation to the adoption and use of green products. For example, the operationalization of the innovativeness concept diverges to a great extent, and the question of whether consumer innovativeness is a personal trait or a trait that is highly dependent on the product domain in question needs to be explored further. Based on these gaps, we propose the following research propositions:

Research proposition 1: To what extent does consumer innovativeness predict the adoption of different green innovations? At which level of consumer innovativeness can the adoption of green innovations be better predicted—global, domain-specific, or product-specific level?

Research proposition 2: In the adoption of green innovations, how well do different operationalizations of innovativeness—such as social, environmental, hedonic, and functional—predict behavior by themselves and across operationalizations?

Several other theories have also been cited in the articles, including innovation resistance theory (cf. Kushwah et al., 2019; Sadiq et al., 2021; Tandon et al., 2021), expectancy-value theory (cf. Thøgersen & Zhou, 2012), and complexity theory (cf. Scarpi et al., 2021). While innovation resistance theory looks at the barriers to innovation adoption, expectancy-value theory partly explains the extent to which consumers perceive that green innovations could help them and the environment. On the other hand, complexity theory argues that an outcome can be produced using different variables, depending on the situation. Therefore, no single antecedent can completely capture or predict whether an individual will adopt a green innovation (Scarpi et al., 2021). Some studies have also recommended looking at constructs from different theories. For instance, Bartels and Reinders (2010) recommend examining social identification based on cognition and emotional aspects rather than focusing solely on a cognitive approach. Based on these recommendations, we propose the following:

Research proposition 3: Among the theories that have been applied in the study of green innovation adoption, which theory or combination of theories could substantially predict green innovation adoption?

Research proposition 4: In which areas do these theories complement each other, and in which do they conflict in their predictions of consumer adoption of green innovations?

By applying theories such as social identity theory (King et al., 2019) and social cognitive theory (Zhu et al., 2017), some studies

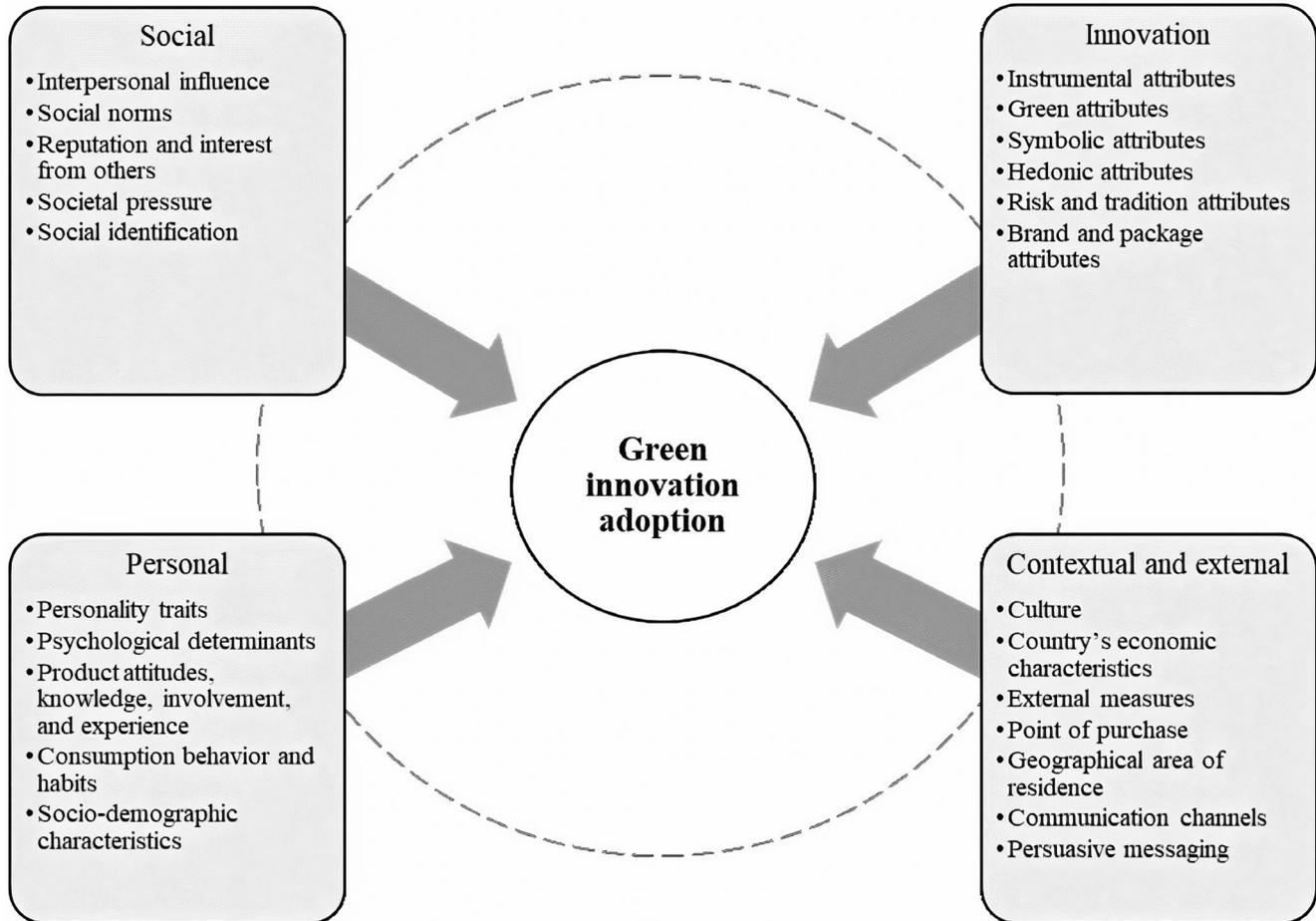


FIGURE 1 The SPICe determinants and their influence and potential interaction in the adoption of green innovations

have examined the role the interpersonal influence in the adoption of green innovations. In studies that looked at the social implications of green innovations, scholars suggest examining the extent to which green innovations reflect identity (White & Sintov, 2017), as self-perception and external perception are not necessarily the same (Seebauer, 2015). Furthermore, they also recommend looking at referent influence, or how consumers strive to become like the people they look up to (Zhang et al., 2021), and how opinions continually change between early adopters and innovators and the social environment in which they move (Seebauer, 2015). Based on these recommendations, we propose the following:

Research proposition 5: What kinds of identities do green innovations communicate, and how well do green innovations reflect identities?

Research proposition 6: What is the role of the social environment, especially the digital referent environment such as social media influencers, in the diffusion of green innovations, and how is it different from their roles concerning innovations that are not promoted as green?

5.2 | Research on determinant interactions and interrelatedness

This review outlines the significant determinants of green innovation adoption that have been identified and explored in marketing journals. As presented in the previous sections, no single determinant can fully predict green innovation adoption. More research is therefore needed on how these determinants, in particular their interrelatedness and interactions, affect consumer decisions to adopt green innovations.

For instance, there are many psychological determinants that reflect an individual's concern and feeling of moral obligation to the environment. However, it remains vague how environmental concern, pro-environmental attitudes, personal norms, and green identity, for example, are interrelated and how their interrelatedness affects a person's decision to adopt green innovations. It has been demonstrated that the effect of consumer environmental awareness depends on the target and the product (Perez-Castillo & Vera-Martinez, 2021). When faced with only environmental attributes, fashion innovators were more likely to buy the greener option. However, when other attributes were introduced, low fashion innovators had a higher tendency to adopt green apparel (Matthews & Rothenberg, 2017). Based on these findings, we propose the following:

Research proposition 7: Given the unclear interrelatedness of an individual's pro-environmental determinants in the adoption of green innovations, how should the green personal determinants be further conceptualized and measured, i.e., in what combination of the current constructs?

Further research should also focus on cultural values (Potoglou et al., 2020). Indeed, cultural aspects are relevant in the consumer adoption of green technology (Song et al., 2021). The inclusion of contextual factors, including external barriers and motivators, has been suggested in the study on high involvement green innovations (Jansson et al., 2010). Several researchers also propose the impact of contextual barriers in the study of organic products (Kushwah et al., 2019; Tandon et al., 2021). The effect of contextual factors can be linked to social norms. Given that green innovations are really new in some contexts, no social norms have yet been formed toward the product (Thøgersen & Zhou, 2012).

Others have also suggested conducting more research on the influence of trade-offs in the intention to adopt green innovations (Paparoidamis & Tran, 2019). Negative antecedents, such as fear of loss of control and privacy, can deter consumers from adopting new technologies (Ahn et al., 2016). Another interesting area for further research is the role of brands in the acceptance of green innovations (Flores & Jansson, 2021; Lee & Wong, 2021). Indeed, provider brand image and reputation can influence how consumers trust and perceive green innovations. Given that the review covers marketing journals, it is surprising that so little attention has been paid to how branding and brands influence green innovation adoption in contrast to or in combination with other factors. Research on how consumers perceive brand extensions, multi-brands, co-branding, and product line extensions with green, innovative features seems a ripe area for further research in the marketing literature.

Research proposition 8: Given the significance of many determinants in the green innovation adoption decision, what are the primary conditions and determinants that activate other motivators of consumers to act pro-environmentally?

Research proposition 9: What are the effects of branding efforts on consumer green innovation adoption and how do (perception of) brands interact with other determining factors in forming a potential adoption decision?

5.3 | Research on different green innovations and sectors

Research in marketing regarding consumer adoption of green innovations is limited to very few categories and industries. However, it has been argued that different types of green innovations elicit different

psychological and behavioral responses (Paparoidamis & Tran, 2019). Future research can explore how the different product types could affect how consumers evaluate the greenness of these innovations. For example, it could compare the type of ownership—whether the innovation is part of the sharing economy or owned by the consumer—as a way to understand its influence on the adoption decision. Comparing low- and high-involvement innovations, such as electric cars and bikes, may also provide fruitful outcomes. Research regarding other high involvement products, such as electronic goods and other green innovations, could likewise be conducted to ascertain how different types of involvement influence adoption (Jansson et al., 2010). Other ways of distinguishing between innovations include whether they are considered “totally new” in the industry and the social nature of the green innovation, i.e., how the degree of observability of consumption could stimulate the adoption of green innovations.

Research proposition 10: In which sectors do consumers see the need for green innovations, and to what extent are they willing to adopt green innovations across different sectors?

Research proposition 11: How do the novelty, involvement, and social nature of green innovations predict their adoption?

Researchers could also evaluate the degree to which these green innovations replace their brown counterparts. One way would be to differentiate the purpose of use, for instance, commuting and non-commuting using shared transport. Studies could compare the determinants for free-floating vehicles and those that have to be returned to a specific area (Jain et al., 2021). Indeed, dockless bicycles are better at promoting cycling than traditional bicycle sharing in China (Jia & Fu, 2019). Further research could also look at symbolic, environmental, or functional aspects in the adoption of green innovations, such as new food products or eco-cosmetics. Likewise, potential studies could examine the synergies or spill-over effects between different green innovations, for example, how sustainable household technologies could help reinforce the adoption of other green innovations like electric cars or vice versa.

Research proposition 12: To what degree do consumers replace brown products with their green innovation counterparts? Do green innovations completely replace the traditional products, or do they serve as complements and, if so, for how long?

Research proposition 13: To what degree do consumers perceive that adopting green innovations helps (or hinders) the fulfillment of societal goals, such as the sustainable development goals, in the short and long terms? Are technological innovations (for example, electric cars) related to different adoption determinants compared to social and/or service innovations?

Research proposition 14: Do consumers perceive synergies and/or spill-over effects between green innovations, or do they consider the advantages of these innovations separately from each other?

5.4 | Research in other contexts and over longer periods

Even though this review has focused on the determinants of green innovation adoption, it is relevant to present the methodological aspects that could be further explored by forthcoming research, as this would serve as a guide and provide ideas for improving the field. Indeed, several studies suggest replicating their research in other contexts and over longer periods (cf. Bartels & Reinders, 2010; Qian & Yin, 2017; Tandon et al., 2021). Researchers acknowledge that their findings are culturally and temporally dependent (King et al., 2019). They also recognize the effects of policies and market initiatives on the diffusion of green innovations (Chu et al., 2019; Jansson et al., 2017). Replicating studies about green innovations are relevant as there are continuous changes in the innovations, which consequently affect consumer perception and behavior (Petschnig et al., 2014).

Researchers could conduct more longitudinal research focusing on the development of these determinants (Tran & Paparoidamis, 2020). Less is known about how motives for adoption among innovators develop over time. Furthermore, motivators during adoption and usage may differ (Song et al., 2021) as consumers gain more knowledge and experience with the innovation. According to Broman Toft and Thøgersen (2015), construal level theory can provide better insights into the interpretation of how consumers assess the costs and benefits of a product based on the timing of the decision to purchase. When the time of the decision draws closer, consumers tend to focus on the costs rather than the benefits. Based on our review, we also find that there appear to be very few studies using experimental methods and controlled experiments.

Research proposition 15: Using experimental, controlled, and longitudinal approaches, how do the determinants of green innovation adoption develop over time, i.e., do the main drivers for adoption remain the important motivators for continued use?

Research proposition 16: How do the determinants affect the different stages of adoption—from being aware of the innovation to regular use?

Most of the studies have been conducted in developed countries. Only a few studies have looked directly at country perspectives, i.e., how culture, governments, and other situational factors specific to an area could affect the intention or adoption of green innovations. Even within a country, differences should be explored. Heterogeneity

in terms of preference exists within and between countries (Potoglou et al., 2020). As shown in a study of car sharing, the innovation is not only important for large cities (Münzel et al., 2019). Therefore, studies comparing urban and rural areas should also be conducted.

Research proposition 17: What is the difference between consumer adoption of green innovations in developed and developing countries, and between rural and urban areas?

Research proposition 18: What country-specific and contextual factors promote and hinder green innovation adoption?

6 | CONCLUSIONS AND LIMITATIONS

The literature on consumer adoption of green innovations is currently fragmented and presents inconsistent findings. This review aimed to present the determinants of green innovation adoption across various domains as published in top marketing journals. We categorized these determinants into social, personal, innovation, and contextual and external level determinants or the SPICe determinants. Our review provides an overview of what we currently know and what might be valuable in terms of future research. First, we demonstrate that there is a lack of focus on the consumer aspect of green innovation adoption, highlighting the need for more studies regarding what motivates consumers to adopt these new environmental products. Second, our study provides evidence that no single determinant can predict the adoption of green innovations; rather, this is predicted by interaction among various factors. Third, we show that different types of green innovations elicit different consumer reactions and therefore require different considerations. Fourth, we reveal how important contextual factors are in the diffusion of green innovations. Last but not least, we outline some potential research propositions that can help to further the understanding of consumer green innovation adoption.

In order to compile this review, several choices needed to be made, which to some extent limit the conclusions that can be drawn. Although the review included a wide range of marketing journals, other journals that would have been relevant were not analyzed, as we followed the ABDC classification and categorization. It should be noted that marketing and consumer behavior studies are not only published in marketing journals, especially concerning the topic of sustainable consumption. However, in this review, we were interested in the findings present in marketing journals. Furthermore, most of the analyzed papers have borrowed from other areas outside core marketing. Nonetheless, we recommend that syntheses be carried out in the future to explore the studies published in other ABDC categories, such as the management field. We also suggest conducting a meta-analysis of the findings for each green innovation or domain identified to quantify the effects of the various determinants that have been studied as more studies become available.

Additionally, it is important to note that the developed categories of determinants are not entirely distinguishable from each other. For example, there are overlaps between the determinants, particularly the psychological determinants and innovation attributes, which present a challenge in terms of understanding each determinant separately. Future studies could approach this issue more systematically to tease out similarities and differences between theories and factors, as also discussed in the research agenda. In any case, it is important to have a better understanding of consumer green innovation adoption, given the pressing sustainability issues currently facing the planet and humankind.

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CONFLICT OF INTEREST

No conflict of interest has been declared by the authors.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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APPENDIX A

Overview of the reviewed articles sorted in alphabetical order on authors

Green innovation	Authors	Methods	Context	(Tested) determinants			Contextual and external level determinants
				Social level determinants	Personal level determinants	Innovation level determinants	
Electric vehicles	Adnan et al. (2017)	Online survey (Structural equation modeling)	Malaysia	Interaction for information gathering Knowledge sharing Response of vehicle owners Subjective norms	Perceived behavioral control Personal norms Environmental concern		
Sustainable household technology	Ahn et al. (2016)	Online survey (Structural equation modeling)	USA	Social pressure	Sustainable innovativeness Environmentalism	Expected product attributes (performance expectancy, effort expectancy, compatibility expectancy, and hedonic expectancy)	
Plant-based cocoa drink	Aschemann-Witzel and Peschel (2019)	Experimental survey (ANOVA)	Denmark		Attitude toward product Gender	Expected quality Brand	
New organic food products	Bartels and Reinders (2010)	Online panel study (Regression analysis)	USA, UK, and Germany	Social identification	Demographic characteristics Domain-specific innovativeness	Social representation of new foods	Communication of product information
Smart grid technology	Broman Toft and Thøgersen (2015)	Semi-structured interviews (Conventional content analysis)	Denmark			Perceived relative advantage Perceived complexity	
Ecofriendly practices and innovative technologies	Chen (2015)	On-site surveys (Chi-square, ANOVA, t-test)	USA		Attitude toward green behaviors Gender and age	Consumer perception of hotel	
Electric vehicles	Chu et al. (2019)	Online survey (t-test, ANCOVA, regression analyses)	China and Korea	Reputation and interest from others	Environmental concern Normative need for EV. Consumer innovativeness Knowledge of EV. Socio-demographic variables (age, income, education)	Motives for car use (functional, symbolic, experiential) Product attributes (environmental-friendliness, economic, innovativeness) Image related to EV usage Satisfaction (range, usage)	Country differences
Solar energy panels	Claudy et al. (2013)	Exploratory qualitative study and computer-assisted telephone survey (Structural equation modeling)	Ireland		Attitude toward solar panels Consumer values	Reasons for adoption (economic, environmental, independence) Reasons against adoption (cost, risk, incompatibility)	
Chairs made of bioplastic	Confente et al. (2020)	Survey (Moderated mediation analyses)	USA		Green identity Self-congruity with green products Product involvement	Perceived value	

(Continues)

APPENDIX (Continued)

Green innovation	Authors	Methods	Context	(Tested) determinants			Contextual and external level determinants
				Social level determinants	Personal level determinants	Innovation level determinants	
Battery electric vehicles	King et al. (2019)	Telephone interviews (Thematic analysis)	UK	Environmental social identity Technophile social identity			
Organic food	Kushwah et al. (2019)	Face-to-face survey questionnaire (Structural equation modeling)	India		Ethical consumption intention Purchase intention Choice behavior Buying involvement Environmental concern	Image, value, and risk barriers	
Plant-based ingredients in meat-based foods	Lang (2020)	Online survey (Structural equation modeling, ANOVA)	USA		Food-related values and lifestyle factors (knowledge, involvement, cooking habits, innovativeness, healthy eating)	Product attributes (taste, health, sustainability, cost, novelty)	
On-demand ride-hailing	Lee and Wong (2021)	Survey (Structural equation modeling)	Austria, Canada, China, Hong Kong, India, Malaysia, Singapore, Thailand, UAE, USA	Subjective norms	Personal innovativeness Environmental consciousness Price consciousness	Perceived usefulness Perceived ease of use Perceived safety risk Perceived privacy security Perceived value	
Organic apparel	Matthews and Rothenberg (2017)	Survey (Multinomial logit model, conjoint analysis)	USA		Fashion innovativeness Environmental concern Pro-environmental beliefs	Organic apparel attributes (technology, fabric, production, sustainability, price)	
Organic food products	Moser (2016)	Nationwide panel data (Structural equation modeling)	Germany		Self-interested beliefs Environmental belief Animal welfare Decision-making heuristic		
Carsharing	Münzel et al. (2019)	Survey dataset by Dutch Institute for Public Opinion and Market Research (Logistic regression analyses, ANOVA)	Netherlands		Attitude (green party voter, lending attitude) Socio-demographic variables (age, gender, education, income, household characteristics)	Cost, convenience, environment Access to transportation set Living area	
Connected vacuum cleaner and innovative smartphone	Paparoidamis and Tran (2019)	Online experiments	USA		Eco-friendly consumer innovativeness	Green innovation attributes (resource reduction/efficiency, elimination, and substitution)	
Remanufactured cellphone	Perez-Castillo and Vera-Martinez (2021)	Online questionnaire (Structural equation modeling) In-depth interviews (Narrative analysis)	Mexico		Attitude toward remanufactured products Green purchase behavior	Price Perceived environmental benefits	Perceived government incentives

(Continues)

APPENDIX (Continued)

Green innovation	Authors	Methods	Context	(Tested) determinants			Contextual and external level determinants
				Social level determinants	Personal level determinants	Innovation level determinants	
Alternative fuel vehicles	Petschnig et al. (2014)	Online survey (Structural equation modeling)	Germany	Subjective norms	Personal norms Attitude toward AFVs	Product attributes (relative advantage, compatibility, ease of use, observability, triability, ecology, image, design, profitability, physical risk, functional risk)	Cultural orientation
Autonomous and alternative-fuel vehicles	Potoglou et al. (2020)	Survey comprised of discrete choice experiment (Latent class model)	Germany, India, Japan, Sweden, UK, and USA	Pro-environmental identity Innovativeness Product knowledge		Product attributes (price and running cost, functionality/practicality—size, fuel availability, acceleration, environmental credentials—fuel type, materials, and design, and autonomous driving capability)	Cultural orientation
Electric vehicles	Qian and Yin (2017)	Online survey (Structural equation modeling)	China	Risk attitude Deontological evaluation			Cultural value (human-nature relationship, long-term orientation, face consciousness)
Eco-friendly cosmetic products	Sadiq et al. (2021)	Online survey (Structural equation modeling)	India	Environmental concern Health concern		Functional (usage, value, risk) and psychological barriers (tradition, image)	
Bio-textile products	Sandra and Alessandro (2021)	Structured questionnaire administered face-to-face (Cameron and Huppert model)	Italy	Environmental concern Socio-demographic variables (age, gender, income, education)	Price		
Biodegradable plastic (chairs)	Scarpi et al. (2021)	Questionnaire (Qualitative comparative analysis, contrarian case analysis)	Spain	Awareness of bio-based products Green self-identity	Perceived value Perceived risk Product involvement		
E-bike and e-scooter	Seebauer (2015)	Mail survey and online survey (Structural equation modeling)	Austria	Technophilia Opinion leadership Personal norms	Product performance		
Blended meat products	Sogari et al. (2021)	Paper and pencil survey (Linear regression)	USA	Motivation to process nutrition information Motivation to process sustainability information Perception of a healthy diet Perception of a sustainable diet Attitude toward food innovation Consumption behavior Socio-demographic variables (Gender and age)			Country of origin

APPENDIX (Continued)

(Tested) determinants							
Green innovation	Authors	Methods	Context	Social level determinants	Personal level determinants	Innovation level determinants	Contextual and external level determinants
Electric vehicles	Song et al. (2021)	Survey actual EV users (Mann-Whitney test)	China and USA	Social norms	Environmental concern Consumer innovativeness Knowledge of EV.	Total cost of owning Range anxiety Instrumental, symbolic, and experiential motivations Usage satisfaction	
Organic food	Tandon et al. (2021)	Panel survey (Structural equation modelling)	Japan		Health consciousness Buying behavior Gender	Ecological welfare Natural content Nutritional content Usage, risk, and value barriers	
Eco-label	Thøgersen et al. (2010)	Intercept survey (Correlation analysis, multiple and hierarchical regression analyses)	Denmark		Environmental concern Label knowledge Subjective knowledge Domain-specific innovativeness Needs and goals Gender		
Organic food	Thøgersen and Zhou (2012)	Mail-intercept questionnaire survey (Structural equation modeling)	China	Social norms (injunctive and descriptive – friends and strangers)	Product knowledge and experience Universal values Socio-demographic variables (education, gender, age, income) Attitude toward product Behavioural control	Product attributes (health, taste, environmental)	Purchase difficulty
Edible jellyfish	Torri et al. (2020)	Online questionnaire (ANOVA, Correlation, hierarchical multiple liner regression)	Italy		Food neophobia Core disgust sensitivity Attitude toward consumption of jellyfish Socio-demographic variables (age, gender, education level, income, occupation, international trips) Anthropometric variables (weight, height) Health status (food allergies) Habits (smoking, food diet)		Geographical areas of residence Modalities of using and preparing product
Electric cars, eco-smart T.V.s, wireless speaker, eco-smartphones	Tran and Paparoidamis (2020)	Experimental studies (ANCOVA)	India and USA			Ecological country of manufacture (COM) Product eco-friendliness	Consumption context (private versus, public) National setting (socio-economic development, cultural values)

(Continues)

APPENDIX (Continued)

Green innovation	Authors	Methods	Context	(Tested) determinants			Contextual and external level determinants
				Social level determinants	Personal level determinants	Innovation level determinants	
Meat substitutes and replacements	Vanhonacker et al. (2013)	Web-based survey (Bivariate analyses t-tests and ANOVA, Hierarchical clustering)	Belgium	Social level determinants	Personal level determinants Ecological footprint Sustainable food consumption choices Perceived consumer effectiveness Ethical food choice motives Socio-demographic characteristics (gender, age, education level, financial situation)	Innovation level determinants	Living environment
Ridesharing services	Wang et al. (2019)	Online questionnaire (Structural equation modeling)	China	Social level determinants	Personal level determinants	Innovation level determinants	Contextual and external level determinants
Public bicycles	Wang et al. (2021)	Face-to-face and web-based surveys (OLS path analyses)	China	Social level determinants	Personal level determinants	Innovation level determinants	Contextual and external level determinants
Alternative fuels and engines	Wiedmann et al. (2011)	Internet survey (Cluster analysis, path modeling analysis)	Germany	Social level determinants	Personal level determinants	Innovation level determinants	Contextual and external level determinants
Electric vehicles	White and Sintov (2017)	Mail survey (Regression analyses, causal chain path diagrams)	USA	Social level determinants	Personal level determinants	Innovation level determinants	Contextual and external level determinants
Eco-friendly pesticide	Zhang et al. (2021)	Randomized controlled field experiment	China	Social level determinants	Personal level determinants	Innovation level determinants	Contextual and external level determinants
Ridesharing application	Zhu et al. (2017)	Paper-based questionnaires (Partial least square modeling)	China	Social level determinants	Personal level determinants	Innovation level determinants	Contextual and external level determinants