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# BE INNOVATIVE TO BE GREEN: HOW CONSUMERS RESPOND TO ECO-INNOVATIVE PRODUCT DESIGNS

# ÊTRE INNOVANT POUR ÊTRE ÉCOLOGIQUE: COMMENT LES CONSOMMATEURS RÉPONDENT AUX CONCEPTIONS DE PRODUIT ÉCO-INNOVANTES

THESE EN VUE DE L'OBTENTION DU TITRE DE DOCTEUR EN SCIENCES DE GESTION

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## GENERAL ABSTRACT

Growing environmental challenges have resulted in mounting pressures on people to minimize ecological footprint by shifting to more sustainable lifestyles, shopping habits, and consumption patterns. Given persistent campaigns by governments and other parastatal organizations to raise awareness about critical sustainability issues, product eco-friendliness has become an increasingly important factor affecting consumers' buying decisions. The idea of sustainable consumption, which has captured the interest of the public and private sectors, needs to be understood as an entire process of decisions and actions from purchasing, using, and handling physical parts of the products after use based on a holistic comprehension of all potential impacts on the natural environment and the society.

This dissertation contributes to the existing literature by providing insightful understandings into *when*, *how*, and *under what conditions* consumers evaluate and respond positively to the introduction of eco-innovative products with a focus on three categories of contextual variables: product-design specific, adopter-specific, and situation-specific factors. As with all innovations, eco-innovation faces a high rate of technology failure. While new product failure statistics do not provide a complete picture of the reasons why so many new products fail in the market, existing research attributes this phenomenon to inappropriate product designs, insufficient levels of consumer demand, and failure to localize marketing strategies for different market types. This dissertation addresses these issues in the context of eco-innovation introduction by focusing on three main research questions:

*1. What product-design factors lead consumers to respond positively to eco-innovation? Or what factors have contributed to the success of the eco-innovation introduction?(Study 1, 2, 3, and 4)*

*2. Which segments of consumers are likely to respond more positively to different types of eco-innovation?(Study 3)*

*3. How consumer responses to eco-innovation might vary on the basis of the ecological match between ecological country-of-manufacture (ECOM) and product eco-friendliness (PECO) in the globalized marketplace? (Study 5)*

This dissertation employed the scenario-based experiments to collect data across various product categories—particularly high-tech products (based on "Internet-of-things" [IoT] technologies)—to provide rigorous answers about the extent to which the introduction of eco-innovative product designs significantly affects various consumer responses and to rule out alternative explanations of the underlying mechanisms while controlling extraneous variables. The findings of the dissertation would have considerable impact in the academic world and in the society as it shines new lights on how firms create values by rendering technologies that are both state-of-the-art and eco-friendly. This, in turn, could solve environmental issues and rise life expectancy in an interconnected world.

**Keywords:** eco-innovation; new product design; trade-offs; eco-friendly products; types of eco-friendly attributes; locus of eco-friendly attributes; consumer innovativeness; country-of-manufacturer; need for cognition; adoption intention.

## RESUME GENERAL

Les défis environnementaux croissants ont entraîné des pressions croissantes sur les populations afin de minimiser leur empreinte écologique en adoptant des modes de vie, des habitudes d'achat et des modes de consommation plus durables. Étant donné les campagnes persistantes menées par les gouvernements et d'autres organisations parapubliques pour sensibiliser aux questions critiques de durabilité, l'éco-respect des produits est devenu un facteur de plus en plus important pour les décisions d'achat des consommateurs. L'idée de consommation durable, qui a suscité l'intérêt des secteurs public et privé, doit être comprise comme un processus complet de décisions et d'actions découlant de l'achat, de l'utilisation et de la manipulation de parties physiques des produits y compris les impacts potentiels sur l'environnement naturel et la société.

Cette thèse contribue à la littérature existante en fournissant des explications pertinentes sur quand, comment et dans quelles conditions les consommateurs évaluent et réagissent positivement à l'introduction de produits éco-innovants en mettant l'accent sur trois catégories de variables contextuelles: facteurs spécifiques et spécifiques à la situation. Comme pour toutes les innovations, l'éco-innovation est confrontée à un taux élevé d'échecs technologiques. Bien que les statistiques sur les défaillances de nouveaux produits ne donnent pas une image complète des raisons pour lesquelles tant de nouveaux produits échouent sur le marché, les recherches existantes attribuent ce phénomène à des conceptions de produits inappropriées, à des niveaux insuffisants de consommation et un échec à localiser des stratégies de marketing pour différents types de marchés. Plus précisément, cette thèse aborde ces questions dans le contexte de l'introduction de l'éco-innovation en se concentrant sur trois questions de recherche principales:

*1. Quels facteurs de conception des produits amènent les consommateurs à réagir positivement à l'éco-innovation? Ou quels facteurs ont contribué au succès de l'introduction de l'éco-innovation (Études 1, 2, 3 et 4)*

*2. Quels types de consommateurs sont susceptibles de répondre plus positivement aux différents types d'éco-innovation (Étude 3)*

*3. Comment les réponses des consommateurs à l'éco-innovation peuvent varier sur la base de combinaisons écologiques de produits fabriqués dans le pays (COM) sur le marché mondialisé? (Étude 5)*

Cette thèse est basée sur les résultats de différentes expériences faites sur plusieurs catégories de produit. - en particulier les produits de haute technologie (basés sur les technologies de l'Internet des objets) afin de fournir des réponses rigoureuses sur la conception de produits innovants affectant de manière significative les différentes réponses des consommateurs et élimine les explications alternatives des mécanismes sous-jacents tout en contrôlant les variables externes. Les conclusions de la thèse auront un impact considérable dans le monde universitaire et dans la société, car elles éclairent la création de valeurs en rendant les technologies à la pointe de la technologie et respectueuses de l'environnement. Cela, à son tour, pourrait résoudre les problèmes environnementaux et augmenter l'espérance de vie dans un monde interconnecté.

**Mots-clés:** éco-innovation; conception de nouveaux produits; les compromis; produits écologiques; types d'attributs écologiques; lieu d'attributs écologiques; innovation du consommateur; pays du fabricant; besoin de connaissance; intention d'adoption.

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# INTRODUCTION

## 1.1. Importance of the study

Recent times have been marked by growing environmental challenges, including global warming, energy security, and resource scarcity, resulting in mounting pressures to minimize the human ecological footprint by shifting to more sustainable production and consumption (Kotler, 2011, Scott and Weaver, 2018, Žabkar et al., 2018). Given persistent campaigns to raise awareness about critical issues pertaining to environmental sustainability, the eco-friendliness of products has become an increasingly important factor in consumers' purchase decisions (Giebelhausen et al., 2016, Luchs et al., 2010). Indeed, recent academic research has provided empirical evidence that consumers are concerned about the environmental consequences of their purchases. For example, a majority (71%) of the US consumers reported that they included environmental considerations in their shopping decisions and have expressed the desire to better understand environmental issues (Walker, 2013). Furthermore, a National Geographic (2014) study showed that one in two consumers in the 18 countries studied (both emerging and developed nations) consider themselves as "environmentalists", claiming that they minimize waste, save energy, and choose eco-friendly products in their purchases.

In response, firms have accelerated their efforts to transform eco-friendly ideas into new and "greener" processes, technologies, and products/services (Katsikeas, Leonidou and Zeriti, 2016). However, despite a modicum of progress toward the goal of more sustainable development, current efforts fall far short of addressing the myriad pressing environmental challenges (OECD, 2009, United Nations, 2013). For example, the report of Baldé et al. (2017) reveals that more than 52 million metric tons (Mt) of electronic waste, mainly small electronic devices, will be disposed of

worldwide by 2021, compared with the 40 million Mt generated in 2014. Due to the ongoing trend of electrifying nonelectrical equipment, shorter replacement cycles, and low recycling rates, the substantial rise of electronic waste poses disproportionately more serious problems than other waste substances, such as food and textiles (Hoornweg and Bhada-Tata, 2012).

Given these foreboding realities, a big challenge for firms concerns optimizing growth potential whilst reducing its negative environmental impact (European Commission, 2012). A promising answer to the question – which should be at the heart of government policies and industry practices – is the eco-innovation concept in which new products have both innovative and eco-friendly features. Being innovative and environmentally sustainable unleashes a new potential for economic benefits and competitive advantages across many businesses and industries (Varadarajan, 2015) and renders innovations less vulnerable to the threat of obsolescence (Majid and Russell, 2015), but firms need further guidance on how to proceed in terms of both developing new products and reaching target consumers.

This dissertation focuses on eco-innovative products developed based on one of the most advanced technologies, i.e., *Internet-of-things* (IoT) due to their increasing popularity and considerable impact in many spheres of life and society in recent years (Ng and Wakenshaw, 2017). Despite their enormous economic benefits and advantages, the pervasiveness of IoT-based devices and networks on a large scale accelerates the rapid growth of electronic waste, resource and energy consumption, and greenhouse emissions. The negative impact on the natural environment is contradictory to the potential social and environmental benefits that IoT adoption purports to offer. To cope with the growing ecological challenges and mounting pressures to reduce humanity's ecological footprint, the idealized vision of IoT inevitably includes its potential to bolster economic *and* environmental sustainability to improve the well-being of humankind (Maksimovic, 2017).

This vision could be more fully realized by introducing the eco-innovation concept into IoT technologies, such that new products offer both "smart" functions and eco-friendly benefits.

### 1.2. Rationale of the study

As with all innovations, eco-innovation faces a high rate of technology failure (Chan and Ip, 2010). Indeed, 46% of all resources allocated to new product development in U.S. firms are spent on products that failed to reach broad commercialization (Cooper, Edgett and Kleinschmidt, 2001). Moreover, estimates of new product failures among consumer packaged goods (fast-moving goods) approach 75% (Schneider and Hall, 2011) and 72% of new products do not meet profitability goals (Carmichael, 2014). While new product failure statistics do not provide a complete picture of the reasons why so many new products fail in the market, existing research attributes this phenomenon to ***inappropriate product designs*** (Celhay and Trinquecoste, 2015), ***insufficient levels of consumer demand*** (Hauser, Tellis and Griffin, 2006, Heidenreich, Spieth and Petschnig, 2017), and ***failure to commercialize global innovations in different market types and cultures*** (Evanschitzky et al., 2012). This dissertation addresses these issues in the context of the eco-innovation introduction.

*First*, with regard to new product designs, although it is widely acknowledged that an eco-innovation orientation is an inevitable reality for a firm's sustainable growth and differentiation, the best approaches to "greening" new product designs have not well understood by neither academics nor practitioners (Unruh and Ettenson, 2010). In the academic world, scholars have long studied product innovation adoption and eco-friendly products as separate domains. On the one hand, product innovation research has focused on the development of innovative technology, designs, and features (e.g., Celhay and Trinquecoste, 2015, Chitturi, Raghunathan and Mahajan, 2008, Radford and Bloch, 2011) rather than explicitly examining eco-innovation, where the innovative attributes

are directly associated with eco-friendly benefits in new product designs. On the other hand, most recent studies on eco-friendly products focus on examining how consumers respond to the introduction of sustainability attributes in conventional consumer goods—for example, shampoos in Luchs et al. (2010) or mattresses in Gershoff and Frels (2014). In short, the connection between innovative product designs and eco-friendly attributes remains understudied, although it is recognized as a pressing challenge by practitioners in today's marketplace (Katsikeas et al., 2016, Varadarajan, 2015).

From a managerial perspective, firms have faced challenges relevant to their new eco-friendly product development strategy, including making strategic investments in specific areas of research and development, manufacturing/outsourcing, as well as marketing decisions about brand extensions and product positioning (Katsikeas et al., 2016). In addition, eco-innovations are "normally not self-enforcing" in their diffusion due to their long take-off phase (Zhang, Gensler and Garcia, 2011, p. 155). The complexity of adoption dynamics and diffusion processes suggests that most endeavours to build and introduce sustainable innovations might fall short of their goals (Janssen et al., 2006).

The emerging research stream on eco-innovation has theoretically and empirically explored *why* and *how* companies/organizations respond to ecological issues by adopting resource-constrained product development (Sharma and Iyer, 2012), eco-design practices (Zhu, Sarkis and Lai, 2012), sustainable innovation orientation (Varadarajan, 2015), and new eco-friendly product development (Katsikeas et al., 2016). However, far too little attention has been paid to investigate *whether*, *how*, and *under what conditions* consumers respond positively to the introduction of eco-innovation in comparison with their conventional alternatives. A lack of empirical evidence on consumers responses to eco-innovation requires immediate attention due to the often-disappointing adoption

levels of sustainable products relative to firms' considerable investments in integrating consumers' environmental concerns into their new product development and marketing strategies (Heidenreich et al., 2017). This unanswered question provides the impetus for the current research project to focus on key new product design aspects, namely (1) trade-offs between innovative features and eco-friendly benefits, (2) types of eco-innovative attributes, and (3) detachability of eco-innovative attributes.

*Second*, the success of eco-innovation in the marketplace depends on how effectively firms target the consumers who are most likely to be interested in learning about and adopting a new product concept (Hoffman, Kopalle and Novak, 2010). Diffusion of Innovations Theory describes the dynamics of the innovation diffusion process through a population by articulating five distinct innovation adopter categories and phases: innovators, early adopters, early majority, late majority, and laggards (Rogers, 2003). A significant body of the innovation literature suggests that consumer innovativeness (CI), as an individual's desire or willingness to take the risk of adopting new products, underlies the difference in adoption speed between innovators (early adopters) and imitators (e.g., Im, Bayus and Mason, 2003, Manning, Bearden and Madden, 1995).

Despite significant progress to date, two major limitations in the current research on CI warrant further consideration. First, despite the complex adoption dynamics and diffusion processes of eco-innovations (Janssen et al., 2006, Wiedmann et al., 2011), only few research efforts have shed light on the relationship between CI and consumers' adoption of eco-innovative offerings. Second, and more importantly, the limited empirical research on this topic only investigates CI as an innate general trait, including such concepts as "need for stimulation" (Jansson, 2011) and "need for uniqueness" (Heidenreich et al., 2017), rather than focusing on a domain-specific level of abstraction in the CI conceptualization. It has been argued that the domain-

specific level of abstraction of CI is more powerful in predicting innovation adoption behaviours than global innovativeness (Hoffmann and Soyez, 2010, Klink and Athaide, 2010). It is thus crucial to understand the nature of domain-specific consumer innovativeness (DSI) in the context of eco-innovations and its effects on consumers' product beliefs and adoption intentions.

*Third*, eco-innovation has been increasingly manufactured and consumed across national borders. While recent eco-innovations (e.g., electric cars or smart energy-efficient TV) have been dominantly invented and developed in industrialized countries, the demands for these new offerings are expected to surge worldwide (European Commission, 2012, OECD, 2009). For instance, registrations of electric cars hit a new record in 2016, with over 750 thousand sales worldwide and are predicted to reach 40-70 million electric cars on the road by 2025 (International Energy Agency, 2017). The worldwide adoption of eco-innovation allows smart specialization of some regions/countries (Boons et al., 2013). For instance, Europe and Japan are responsible for developing a large proportion of new eco-friendly technologies whereas China and South America dominate the supply of eco-innovation components in the global market. As a result, consumers may be presented with a variety of eco-innovations which could be designed in one country but manufactured in other countries (United Nations Development Programme, 2016). Although global outsourcing can be financially profitable, it is questionable *whether* consumers respond the products manufactured in different countries in the same way, especially in the case of the incongruence between country of manufacture (COM) and product attributes in eco-innovative product designs (Bloemer, Brijs and Kasper, 2009, Hamzaoui and Merunka, 2006).

On the one hand, it has been acknowledged that COM is an increasingly important and most widely investigated component of country-of-origin (COO) (Allman et al., 2016,

Fetscherin and Toncar, 2010, Garrett et al., 2017, Hustvedt, Carroll and Bernard, 2013). Despite a wealth of research on COM in the current literature, the conceptualization of COM image has not taken environmental aspects into consideration whereas there is ample evidence that countries vary considerably in terms of their ecological images and sustainability profiles (e.g., Dekhili and Achabou, 2015, RobecoSAM, 2017). More importantly, several studies have revealed that the COM cue facilitates consumers to avoid buying products from negative COM ecological stereotypes, especially when consumer's knowledge and experience with eco-friendly products are limited (Manrai et al., 1997, Reuber and Fischer, 2011). Furthermore, international marketing scholars (e.g., Auger et al., 2010) posit that consumers might trade-off environmental product attributes with other extrinsic cues (e.g., COM) in their product choices. Therefore, it is important to understand *whether* and *how* the effects of the sustainability aspect of COM can become a more epigrammatic style of purchase decision making involving COM cue and eco-friendly attributes of innovations.

On the other hand, sustainable consumption research reports mixed results on the effects of new eco-friendly products on consumer responses (Heidenreich et al., 2017, Lin and Chang, 2012, Luchs et al., 2010, Olson, 2013). While some evidence shows that consumers positively respond to sustainable offerings (e.g., Hartmann and Apaolaza-Ibáñez, 2012, Haws, Winterich and Naylor, 2014, Kronrod, Grinstein and Wathieu, 2012, Majid and Russell, 2015), other scholars (Luchs et al., 2010, Newman, Gorlin and Dhar, 2014) argue that sustainability may not always be a valuable asset of a firm, especially in some situations, sustainable products have potential negative effects on consumer preferences. Such mixed findings suggest not only that the link between eco-innovative product designs and consumer responses is complex but also that the inclusion of environmental benefits into new product designs may not enhance

performance under all circumstances. Efforts to explain these mixed findings have led to the emerging stream on identifying the conditioning factors of this relationship such as *attribute strength* (Luchs et al., 2010), *attribute salience and centrality* (Gershoff and Frels, 2014), and *attribute trade-offs* (Olson, 2013) and situational variables: *consumption context* (Van der Wal, Van Horen and Grinstein, 2016) and *temporal distance* (Pujari, Wright and Peattie, 2003). However, insights into *whether* and *how* intrinsic (i.e., product eco-friendly features) interacts with extrinsic (i.e., ecological COM) to create the impact of eco-innovative product designs on consumer responses remain scarce.

The increasing number of eco-innovation and recurrent instances of greenwashing have led to higher consumer skepticism of eco-friendly products in general, and of eco-innovation in particular due to its newness and high-tech nature (Leonidou and Skarmeas, 2017). This problem is even exacerbated at the international level when eco-innovation is associated with multi-nation affiliations, pointing to a need for further theoretical and empirical studies on consumers' responses to eco-innovation based on processing two types of product-information cues: product attributes (*intrinsic*) and ecological COM (*extrinsic*). From theoretical viewpoints, this absence of research on the critical role of ecological COM (ECOM) in the eco-innovation development and marketing strategy limits our understandings of *whether* and *how* consumers' product evaluation and purchase intention toward eco-innovation might be shaped by ecological aspects of COMs and eco-friendly product attributes (i.e., product eco-friendliness - PECO) in innovative product designs. From the managerial perspective, empirical evidence on this topic is needed, as managers are increasingly challenged to make strategic decisions in which types of eco-innovation should be developed and where they should be manufactured and launched. Extending this line of research, this present study uniquely investigate *whether* and *how*

consumers' product quality perceptions and purchase likelihood depend on the *ecological match* in eco-innovative product designs – that is, whether the ecological image of COMs (unfavourable *vs.* favourable) is matched with PECO (low *vs.* high) and consumer traits (i.e., need for cognition - NFC).

### 1.3. Research objectives

The overall purpose of the dissertation is to investigate how key product-design factors and consumer-related variables affect consumer responses to eco-innovation across product categories and across national markets. The dissertation focuses on three main research objectives:

1. *What product-design aspects lead consumers to respond positively to eco-innovation? Or what design factors contribute to the success of the eco-innovation introduction?*

During the past decades, a plethora of environmental sustainability issues have been incorporated into new product development and innovation (Iyer and Reczek, 2017, Lim, 2017). However, scant attention has been devoted to investigating *whether* different approaches to integrating eco-friendly attributes in innovative product designs triggers different psychological and behavioural responses in consumers' adoption processes. The lack of empirical work on this front limits our understanding of the preferred design options in terms of trade-offs between innovative features and eco-friendly benefits, types of sustainability issues, and detachability level of eco-innovative attributes should be emphasized in the eco-innovation development.

We contend that there are situations in which product innovativeness can either complement or constrain eco-friendly benefits, in the latter case to such an extent that consumers may be reluctant to adopt sustainable innovations due to the trade-offs between innovative performance and environmental benefits. We also propose that other design aspects (i.e., types and detachability of eco-innovative attributes) serve as important stimulating factors influencing consumers' responses to

such new product offerings. Therefore, this dissertation aims to shine new light on the mechanisms that explain consumers' responses to eco-innovative product designs in terms of three key design aspects: *(1)* trade-offs between innovative attributes and eco-friendly benefits, *(2)* types of eco-innovative attributes, and *(3)* detachability of eco-innovative attributes across different product categories. Drawing from the Bloch (1995) model of consumer responses to product form, this dissertation develops a conceptual framework that suggests eco-innovative product designs affect consumers' psychological and behavioural responses.

2. *Which segments of consumers are likely to respond more positively to different types of eco-innovation?*

Previous studies have attempted to identify and characterize eco-friendly consumers based on an array of demographic (i.e., age, gender, and income) and psychographic variables (i.e., environmental concerns and GREEN values) as potential indicators of ecologically conscious behaviours (Brough et al., 2016, Haws et al., 2014, Lin and Chang, 2012). Considering the complex and high-tech nature of eco-innovation, it is logical to investigate the role of consumer innovativeness (CI) as an important market segment criterion to identify early adopters and the majority of people in their adoption speed of eco-innovative offerings. In order to market an eco-innovation in and beyond niches, future efforts are needed to examine the role of CI in the sustainable innovation domain (i.e., eco-friendly consumer innovativeness –ECI) in determining how consumers make trade-offs between the ecological dimension of new products and other purchase criteria (e.g., innovativeness, performance, and durability).

Recent theorists argue that consumer choice of eco-friendly products is often based on a multi-attribute evaluation process associated with perceived trade-offs among complementary (vs. conflicting) product attributes (Rokka and Uusitalo, 2008). By adopting the consumer value

framework, Papista and Krystallis (2013) propose that consumers engage in trade-offs among gains (i.e., economic, social value, hedonic value, and altruistic) and losses (i.e., price, effort, time, and performance) when making purchase decisions for eco-friendly products. The bulk of empirical evidence (e.g., Webb, Mohr and Harris, 2008) confirms that consumers' beliefs about the trade-offs between environmental practices and product quality significantly affect their socially responsible consumption behaviours (i.e., buying eco-friendly products, recycling, and avoidance and use reduction). However, prior work has not yet examined *whether* and *how* ECI interact perceived trade-offs between eco-friendly benefits and functional performance to determine consumer responses to eco-innovation. Given the trade-off nature of eco-innovative product designs, this study aims to shed light on the nature of ECI and its interaction effects with perceived trade-offs in eco-innovative product designs on consumers' product evaluation and adoption intention.

3. *How consumer responses to eco-innovation might vary on the basis of the ecological match between ECOM and PECO in the globalized marketplace*?

The dissertation is the first to investigate the ecological COM cue usage in the sustainable innovation context and provide empirical evidence on the mechanism underlying its interaction effects with eco-innovative product attributes (i.e, PECO) and individual differences (i.e., NFC) on consumer responses. Based on Social Schema Congruity Theory of Mandler (1982) and the Elaboration Likelihood Model of Petty and Cacioppo (1986), we contend that consumers' evaluations of eco-innovation hinge not just on the ECOM cue but also on the extent to which an ECOM is associated with PECO levels across product categories, national markets, and consumer segments. Two experiments provide support for this basic assertion and evidence for the underlying process to underlie it. Specifically, we demonstrate that consumers react more

positively when there is an ecological match between ECOM and PECO in cases of publicly consumed products and in the emerging market. Conversely, the incongruence between ECOM cue and PECO elicits more favourable responses for privately consumed products and in the industrialized market. Finally, we locate this interaction in the greater ecological match with low NFC consumers compare with high NFC consumers across two national markets. When the ecological match satisfies consumer's needs for cognitive/rational thinking tasks when purchasing new products, it allows more fluently new product-related information processing, and importantly, more positive responses to eco-innovation.

### 1.4. Main findings and contributions

The dissertation makes three primary contributions to existing knowledge about eco-innovation development.

*First*, the dissertation provides rigorous answers about the extent to which the introduction of eco-innovative product designs significantly affects consumers' psychological and behavioural responses across various product categories—particularly high-tech products (based on IoT technologies). The central implication of this dissertation for innovation research and practice is that eco-innovative product designs create value by rendering technologies that are both state-of-the-art and eco-friendly. Therefore, the introduction of eco-innovative product designs should be given strategic importance.

The dissertation responds to repeated calls from marketing scholars (Kotler, 2011, Varadarajan, 2015, Žabkar et al., 2018) to explore the processes and mechanisms that can be employed to explain consumers' responses to eco-innovative product designs. Our findings offer boundary conditions under which the inclusion of eco-friendly attributes in innovative product designs can have beneficial or detrimental effects on consumer responses. The findings support the

premise that including eco-friendly attributes in innovative product designs does not uniformly trigger either negative or positive consumer responses. The dissertation also provides empirical evidence indicating that the integration of different types of environmental benefits in innovative product designs elicits different psychological and behavioural responses from consumers. In doing so, we offer useful guidelines on the best approaches to "greening" new product designs

Specifically, drawing on the sustainability and innovation literature streams, along with exploratory interviews with managers and consumers, we investigate the role of three main eco-innovative product design factors in stimulating consumers' positive perceptions and adoption intentions across various product categories: (1) trade-offs between innovative and eco-friendly attributes, (2) types of eco-friendly attributes, and (3) the detachability and attribute importance of eco-friendly features. Although these factors have been introduced in the innovation literature, their importance has been overlooked in the context of the eco-innovation introduction. Our study provides a better understanding of how firms' decisions about these three important design aspects of innovative product design can affect consumers' psychological and behavioural responses in a favourable way.

*Second*, the dissertation proposes a new conceptualization of CI at a domain-specific level of abstraction by adapting the DSI concept of Goldsmith and Hofacker (1991) to the realm of sustainable innovation consumption, so called eco-friendly consumer innovativeness (ECI). To further validate the ECI scale, we demonstrate that ECI predicts consumers' perceptions and adoption intention across different types of eco-innovation. More specifically, we contribute by specifying the unique mechanism through which ECI affects consumers' psychological and behavioural responses. We suggest that consumers with stronger ECI increase adoption intention towards eco-innovation through more favourable evaluations of the environmental aspect of an innovation. Furthermore,

because of the way ECI interacts with perceived trade-offs between environmental benefits and product effectiveness, our analysis provides new insights into the complex dynamics linking consumers' traits to their product beliefs and behavioural intention in the context of sustainable innovation.

*Third,* the dissertation advances our understanding of consumer responses to eco-innovation by creating a nuanced picture of how ECOM interacts with PECO to shape consumers' product beliefs and purchase intention. By doing so, this research goes beyond the dominance of the overall COM effects and the COM – product fit on consumers' product beliefs and purchase decisions in the international marketing literature (Hsieh, Pan and Setiono, 2004, Koschate-Fischer, Diamantopoulos and Oldenkotte, 2012, Lu et al., 2016) to establish the impact of the ECOM-and-PECO-contingent nature across product categories and national markets.

By responding to the recent literature calls (e.g., Allman et al., 2016) for exploring the role of individual characteristics (i.e., NFC) in the schema-based product evaluation, we provide evidence for the underlying mechanism, implicating the match between ECOM, PECO, and NFC as a driver of consumer responses to eco-innovation. This research, therefore, contributes to the more recent strand of the eco-innovation research, which aimed to uncover the cognitive mechanism underlying consumer response to eco-innovation (Dekhili and Achabou, 2015, Heidenreich et al., 2017, Wiedmann et al., 2011). And more specifically, our study broadens the extant understanding of the schema (in)congruence in the context of eco-innovation introduction by exploring the interactive roles of ECOM, PECO, and NFC that are particularly germane to consumer judgements and purchase likelihood towards eco-innovation based on cross-product evaluation and cross-national validation. The results provide companies with a useful guideline

for global outsourcing/manufacture strategies and localizing international marketing approaches in the eco-innovation launch.

### 1.5. Outline of the dissertation

This dissertation consists of seven chapters. Chapter *One*, the Introduction, highlights the importance and rationale of the study associated with research objectives and its potential values for prospective audiences. Chapter *Two* offers the general overview of the Stimuli-Organism-Response (S-O-R) Framework and comprehensive discussions into its components in the context of sustainable innovation. Chapter *Two* also synthesizes relevant research in the multiple disciplines: new product designs, sustainability, and consumer behaviours, which serves as a strong foundation for the conceptual framework development. Chapter *Three* develops the general conceptual framework and focuses the conceptualization of the main constructs in the research model. Chapter *Four* conveys the hypothesized relationships among these main constructs in five studies in accordance with the three research questions of the dissertation. This is followed by explanations for research methodology selection together with a clear and detailed of experimental designs for each study in Chapter *Five*. Chapter *Six* represents quantitative results and analyses of data collected from the online experiments in the five studies. In Chapter *Seven*, a general discussion of research findings in conjunction with previous studies, theoretical contributions, and managerial implications are presented. Finally, the dissertation concludes with a summary of key findings of this dissertation, limitations, and useful suggestions for future research.

# CHAPTER TWO

# LITERATURE REVIEW

# CHAPTER TWO

# LITERATURE REVIEW

## 2.1. Stimuli-Organism-Response (S-O-R) Framework

Existing literature on new product designs draws its theoretical foundations from the Stimuli-Organism-Response (S-O-R) framework proposed by Mehrabian and Russell (1974) and the Bloch's (1995) conceptual model. These models present and explain how physical forms or design cues of a new product affect consumers' psychological and behavioural responses (Rindova and Petkova, 2007, Widdows, 1991). Over the last decade, the models have been extensively employed in product design research to address the question of how firms can influence consumers' internal states and external responses through design choices they make about the product form (Bloch, Brunel and Arnold, 2003, Creusen and Schoormans, 2005, Veryzer and Hutchinson, 1998).

The S-O-R paradigm was first introduced by Mehrabian and Russell (1974), who postulate that the stimuli of a particular environment (S) impact consumers' behavioural responses (R) via three primary emotional responses (O) of arousal, pleasure, and dominance. The environmental psychology suggests that managers need to control the environmental cues of their offerings in order to provoke emotional and behavioural responses of consumers in a favourable way (Vieira, 2013). Following this further, in the context of new product development, Bloch (1995) proposes the more comprehensive framework describing how new product forms elicit consumers responses with a focus on the moderating roles of situational factors and consumer characteristics. More specifically, Bloch (1995) posits that a new product form, in terms of its exterior appearance, triggers a variety of consumers' cognitive and affective responses, and consequently affects their preferences, intentions, and product choice. All these relationships are likely moderated by individual differences and situational factors, reflecting potentially important causes of the

variations of consumer reactions to new product designs. The validity and generalizability of these models have been supported by numerous empirical evidence across different product categories such as wine (Celhay and Trinquecoste, 2015), mobile phones and home appliances (Creusen and Schoormans, 2005) and automobiles (Landwehr, Wentzel and Herrmann, 2013).

Despite numerous studies on new product designs, the conflicting empirical findings and arguments on the hypothesized relationships in the S-O-R framework and the Bloch's (1995) model in the existing literature could not offer a conclusive and detailed understanding of the relational mechanisms and boundary conditions of the effects of new product designs on consumer responses (Vieira, 2013). Furthermore, although the S-O-R and the Bloch's (1995) model offer rich insights into how consumers respond to new product design cues, Noble and Kumar (2010) argue that the conceptualization and operationalization of "product form" remain largely unexplored and unexplained in an consistent way in the current literature. Altogether, these gaps have been considered as a "black box" in the innovative research, causing doubts in the models' generalization capacity and challenges while preventing scholarship and practical advancement in the design field, especially for really new offerings such as eco-innovation enabled by IoT technologies.

This research extends and complements the S-O-R and the Bloch's (1995) model in the context of eco-innovations by considering an insightful array of unique elements of eco-innovative product designs and by expanding the understanding of boundary conditions of the links between these design choices and consumer responses. Particularly, this study focuses on the stimuli, i.e., eco-innovation, embracing both innovative and eco-friendly attributes in new product designs. Due to the complex and constrained design process to ensure both innovative features and eco-friendly benefits, the research and development (R&D) process of an eco-innovation must take into account

both functional performance and environmental concerns. In addition, it is vital that an eco-innovative product design should also satisfy the other constraints in the manufacturing and consumption processes (e.g., production, cost, regulatory and legal constraints). Beyond the Bloch's (1995) relatively broad approach to defining product form, this study focuses on particular elements of eco-innovative product designs such as trade-offs between innovative features and environmental benefits, types of eco-innovative attributes, and detachability of eco-innovative attributes.

Overall, this study provides a comprehensive view of the full complexities of the effects of design elements and detailed consumer outcomes (both internal states and responses) associated with their boundary conditions. Moreover, this research investigates a much wider range of consumer responses, including both cognitive responses (i.e., product beliefs – innovativeness and eco-friendliness, perceived product quality); affective responses (i.e., product preference). Different facets of consumers' approach-avoidance responses are also studied in terms of adoption intention, willingness to pay, product choice, and estimated consumption levels.

### 2.2. Stimuli: Eco-innovative product designs

#### *2.2.1. Conceptualization and operationalization of eco-innovative product designs*

Much attention has recently been paid to challenges related to incorporating environmental sustainability issues into marketing strategies (e.g., Leonidou, Katsikeas and Morgan, 2013), new business models (e.g., Esslinger, 2011), and public policy (e.g., Nielsen, Reisch and Thøgersen, 2016). A growing stream of this research field has focused on the integration of ecologically conscious initiatives into new product development and innovation design (e.g., Fussler and James, 1996, Goodman, Korsunova and Halme, 2017, Johansson and Magnusson, 1998, Machiba, 2010, Tsai and Liao, 2017, Varadarajan, 2015). While advanced technologies and skilful industrial designs

facilitate the rapid development of innovative products, this changing landscape also requires a faster pace of product upgrading, triggers shorter replacement cycles, and creates a greater fear of obsolescence, ultimately leading to negative consequences for the environment (Calcott and Walls, 2005). Guiltinan (2009) identifies two aspects of new product development that drive these environmental issues: the frequent introduction of replacement products and the recyclability of new products. These two aspects exacerbate environmental problems if firms only emphasize producing and marketing innovations without any focus on sustainability.

The eco-innovation concept, which incorporates both innovative and eco-friendly attributes in a new product design, reflects a proactive orientation toward positive sustainability in product design rather the reactive elimination of environmentally problematic features (Pujari, 2006). Halila and Rundquist (2011) refer to eco-innovation as either new products, process, and practices or modifications to existing ones that aim to reduce or avoid environmental harm. Taking a broader and more practical approach, the European Commission (2012, p. 2) defines eco-innovation as "all forms of innovation—technological and non-technological—that create business opportunities and benefit the environment by preventing or reducing their impact, or by optimizing the use of resources." Building on the extant innovation and sustainability literature, Varadarajan (2015) concludes that while a variety of definitions of eco-innovation have been suggested, the literature contains no widely accepted and broadly sound conceptualization as well as robust operationalization of eco-innovation, especially with regard to the consumer market. This inhibits the comparability and generalizability of findings across product categories and industries. The current work examines the design of eco-innovation from the consumer perspective and defines an eco-innovative product design "as a firm's new product design that is perceived by consumers to be *innovative* and *eco-friendly* based on their evaluation of product attributes." In particular, this study focuses on eco-friendly IoT as underlying

technologies allowing both smart functions and eco-friendly benefits of eco-innovations, which are regarded as highly innovative products in the market. The study thus departs from the majority of past research investigating the determinants of innovation adoption, which has concentrated solely on the innovative aspect or exterior appearance of a new product design.

### *2.2.2. Eco-friendly Internet-of-things as a research context*

In the recent years, the widespread adoption of connected objects implies the considerable increase in environmental-related issues such as enormous energy consumption for the diverse task performance. The forecasted worldwide energy consumption of IoT-based devices dramatically rises with an annual growth rate of 20% and reaches estimated 46 terawatt hours (TWh) in 2025, which is equal to the entire annual electricity consumption of Portugal in 2012 (Friedli et al., 2016). Furthermore, the entry of billions of "smart" devices requires "resource-intensive" in manufacturing, distributing, implementing, and discarding in the next decade (Weber, 2015). All these facts raise the questions of designing IoT based products for reducing energy consumption as well as reusing and recycling electronic devices. In this context, the introduction of the concept "Eco-friendly IoT" or "Green IoT", with a goal of creating a sustainable smart world, has been an inevitable trend in the future of the IoT development.

Gapchup et al. (2017) define eco-friendly IoT as a smart information system, encompassing the two main aspects. The first dimension focuses on the design and production of "energy efficient computing devices, communications protocols, and networking architectures" for optimizing power consumption and maximizing bandwidth utilization. The second aspect refers to the utilization and disposal of IoT to minimize carbon emissions and improve energy efficiency (p.2142). Similarly, Shaikh, Zeadally and Exposito (2017) emphasize the energy-efficient procedures (hardware or software) adopted by eco-friendly IoT in order to optimize its greenhouse

footprint. The environmental impact during the lifecycle of IoT-based products, from design, production, utilization, to finally post-use disposal/recycling, should be minimized (even close to zero) and much lower than the current IoT technologies (Shaikh et al., 2017). These definitions of eco-friendly IoT are consistent with the concept of eco-innovation as discussed in the previous section.

The numerous applications of eco-friendly IoT could be foreseen in many industries such as industrial automation, smart home, smart healthcare, and smart grid with various supporting technologies such as RFID, sensor networks, cellular networks, or machine-to-machine communications (Gapchup et al., 2017). Pursuing this further, Maksimovic (2017) asserts that eco-friendly IoT could improve the quality of life through environmental protection and ultimately create smarter, safer, and more sustainable living environment. Undoubtedly, the development of eco-friendly IoT for interconnecting our physical world via green networks would become a focal point of attention of not only academic researchers but also industry practitioners and individual citizens (Maló, 2013).

The introduction of eco-friendly IoT, as sustainable innovations, where new products have both smart features and eco-friendly benefits, could potentially reduce consumer's innovation resistance and reluctance to adopt eco-friendly products. At one level, eco-friendly IoT is expected to help a firm to attract eco-conscious consumers, gain loyalty among eco-conscious consumers, and enhance its reputation among a broader cross-section of the public. At another level, in a market environment characterized by increasing number of product categories and growing sustainability awareness, consumers are likely to be limited to brands that are rated high on specific sustainability attributes (Varadarajan, 2015).

To sum up, eco-friendly IoT is an inevitable approach to ensure the vision of IoT in achieving environmental sustainability and improving human well–being. From the marketing perspective, eco-friendly IoT as sustainable innovations potentially brings up new opportunities to accelerate the adoption of IoT based products/services while effectively dealing with growing ecological challenges. The aim of this study is to shine new light on the introduction of eco-friendly IoT as the promising path for companies to tap into the new market of eco-conscious consumers as well as ensure their sustainable development in the modern business world.

### *2.2.3. Defining components of eco-innovative product designs*

The definition above emphasizes two key elements in need of deeper investigation in the design and development of eco-innovation, namely innovative attributes and eco-friendly attributes. In terms of the innovative dimension of product design, Mugge and Dahl (2013) define a product innovation as "*a good (or service) introduced to the market that is either new or significantly improved with respect to its attributes*" (p.3). To measure innovative product attributes, from the consumer perspective, Rogers (2003) introduces the concept "perceived innovation attributes" as potential adopters' perceptions and evaluations of product innovations, which significantly affect their adoption decisions.

Much of current literature on product innovations highlights that innovative product attributes play an important role in defining and classifying different types of innovation. In the existing literature, there are different taxonomies to categorize product innovations on the basis of the innovativeness levels of product attributes. The most common approaches in the field of design include exploratory and exploitative innovation (Kraft and Bausch, 2016); incremental, more innovative, and radical innovation (Holahan, Sullivan and Markham, 2014); market breakthrough and technological breakthrough innovation (Zhou, Yim and Tse, 2005). It has been suggested that

the innovativeness level of product attributes could result in a minor or large deviation from consumers' mental schemas as well as their purchase decisions (Mugge and Dahl, 2013, Rindova and Petkova, 2007).

The second element, eco-friendly attributes, as a subset of ethical attributes, refer to any product features that aim to enhance environmental protection. In the current literature, eco-friendly attributes comprise a variety of environmental protection solutions such as recycling (e.g., Giebelhausen et al., 2016), carbon emission reduction (e.g., Heidenreich et al., 2017), renewables (e.g., Claudy, Peterson and O'Driscoll, 2013), energy saving (e.g., Tangari and Smith, 2012), and natural or locally supplied ingredients (e.g., Bodur, Gao and Grohmann, 2014). In more systematic ways, a number of studies have reported three main approaches to classifying eco-friendly attributes. First, Irwin and Naylor (2009) refer to eco-friendly attributes as "protected" or "scared" values that consumers are not willing to exclude from their purchase decisions (p.235). Second, Bodur, Tofighi and Grohmann (2016) posit that eco-friendly attributes are either *product-related* (directly affecting product performance and quality, e.g., natural ingredients) or *symbolic* (indirectly addressing environmental issues, e.g., cause-related marketing). Finally, in the context of sustainable innovations, Varadarajan (2015) categorizes the sustainability-related benefits of an innovation into two main groups: *physical differentiation attributes* (resource use efficiency, elimination, or substitution during the production stage) and *experienced differentiation attributes* (resource use efficiency, elimination, or substitution during the product usage stage). The most recent study of Iyer and Reczek (2017) emphasizes the importance of understanding the two approaches: *mitigating* (i.e., reducing resource consumption) and *creating* (i.e., introducing alternative fuels and energy resources or pro-environmental values).

According to innovation researchers (e.g., Fussler and James, 1996, Hellström, 2007, Johansson and Magnusson, 1998), the scope of eco-innovation is strictly limited to really new products or new technologies. Conversely, other scholars (e.g., Fuller and Ottman, 2004, Huber, 2008, Varadarajan, 2015) argue that regardless of innovation types, a defining component of an eco-innovation design is positive ecological attributes that have purposely been designed-in (embedded) in the new product development process. Following the second paradigm, this research contends that the success of an eco-innovative product design mainly depends on how consumers understand and value the ecological benefits of eco-innovation drawn from their product attributes. The focus of this study, therefore, is to explore how to improve consumers' confidence in innovations positioned as "sustainable", which remains unanswered and in need of deeper attention due to negative effects of conventional marketing techniques such as "greenwashing" (Luchs, Brower and Chitturi, 2012).

### 2.3. Consumers' organism and responses to eco-innovative product designs

Over the last two decades, a large and growing body of literature has investigated sustainable consumption across a wide range of product/service categories and national markets. Our extensive review of the current literature reveals that most studies on this topic focus on conventional fast-moving consumer products in both Western (e.g., U.S., Germany, and Norway) and Asian contexts (e.g., China or Korea). Large-scale surveys and experiments have traditionally been used to examine the relationships between eco-friendly offerings and consumer responses such as attitudes and preferences, purchase intention, recycling behaviour, or willingness to pay. In this area, prior work has introduced a variety of mediators and moderators, offering in-depth understandings into the relational mechanisms and boundary conditions of the effects of sustainable products on consumer perceptions and behaviours (see Table 1). Nonetheless, recent studies

provide mixed and contradictory results, triggering an on-going debate about the underlying mechanism of the impact of eco-friendly product attributes on consumer responses.

In the first research stream, recent evidence shows that consumers positively respond to sustainable offerings (e.g., Hartmann and Apaolaza-Ibáñez, 2012, Haws et al., 2014, Kronrod et al., 2012, Majid and Russell, 2015). More precisely, the meta-analysis of Tully and Winer (2014) reveals that a majority of respondents are willing to pay a positive premium for ethical products which benefit humans (e.g., labour practices) and the natural environment across a wide range of product categories. Most recently, Lim (2017) asserts that consumers have incorporated social, environmental, and ethical concerns into their preferences and responsibilities enacted through the acquisition and consumption of sustainable products/services.

Notwithstanding with these propositions, some scholars (e.g., Carrington, Neville and Whitwell, 2010, Carrington, Neville and Whitwell, 2014) argue that the introduction of new eco-friendly products may be risky as consumers' explicit attitude and ethical intention rarely translate into actual ethical consumption behaviour. This view is supported by the global survey of United Nations Environment Programme (2005), which reveals that the significant gap 40/4 between consumers' stated attitudes (40% said they were willing to buy sustainable products) and their actual purchasing behaviours (only 4% actually bought sustainable products). As a result, it is questionable what would be the return on investing in the integration of environmental concerns into a firm's new product development as well as marketing strategies.

**Table 1** Selected studies of the existing research on sustainable consumption

| Study | Sample | Methods | Products /Services | Variables | | | | Main findings |
|---|---|---|---|---|---|---|---|---|
| | | | | Independent Var. | Mediators | Moderators | Dependent Var. | |
| Alwitt and Pitts (1996) | 210 female consumers with children under age 3 in USA | Email survey | Disposable diapers | General environmental concern (GEC) | - Environmentally relevant attitudes (EATT)<br>- Importance of the product's environmentally related characteristics | | Purchase intentions towards | • General environmental concern has only an *indirect* effect on purchase intentions for environmentally relevant products<br>• This effect is mediated by environmentally relevant attitudes. |
| Irwin and Spira (1997) | Undergraduate students in USA | Lab experiments | Automobiles An orthogonal array | Eco-friendly attributes (performance, CO level, recycled content, or a combination of these) | Emotionality (or morality) | - Emotional involvement<br>- Familiarity with the attributes | - Willingness to pay<br>- Likelihood of purchase<br>- Perceived environmentally friendliness | • The specific type of eco-friendly attribute (recycled content) has a *negative* impact on consumer responses<br>• Recycled content *did not show a strong embedding effect* on the consumers' perception of environmental friendliness |
| Pujari et al. (2003) | Undergraduate students in USA | Lab experiments | Light bulbs | Temporal distance (proximal – 1 month vs. distal– 3 years) | | - Consumer elaboration on potential outcomes<br>- Retail shelf shopping context/Ad-based context<br>- Construal level | - Product choice<br>- Attitudes toward products<br>- Perception of purchase timing | • Consumers lower in elaboration *more likely to choose* an energy efficient product when perceived distance is proximal versus distal. |
| Cornelissen et al. (2008) | Undergraduate students in Spain | Lab experiments | Cookies, paper towels, energy efficient light bulbs, and detergents | Frequency/ Commonity of eco- behaviour | - Self-perception<br>- Moral obligation | | - Diagnosticity ratings of environmental behaviours product choice<br>- Attitudes towards ecological behaviour | • The cueing of common ecological behaviours leads participants to choose environmentally friendly products with *greater* frequency, and even to use scrap paper *more efficiently*<br>• Cueing people with common environmental behaviours affects their pro-environmental self-perception *more strongly* than does cueing with uncommon environmental behaviours. |
| Luchs et al. (2010) | Undergraduate students and | Lab and field experiments | Shampoos, laundry detergent, | Perceived ethicality | | - Gentleness/ Strength-related attributes | Consumer preference for ethical products | • Consumers associate *higher* product ethicality with gentleness-related attributes and *lower* product |

| Study | Sample | Methods | Products /Services | Variables | | | | Main findings |
|---|---|---|---|---|---|---|---|---|
| | | | | Independent Var. | Mediators | Moderators | Dependent Var. | |
| | consumers in USA | | automobile tires, and liquid hand sanitizers | | | - Importance of the ethical attributes<br>- Explicit cues about product strength. | | ethicality with strength-related attributes.<br>• The positive effect of product sustainability on consumer preferences *is reduced* when strength-related attributes are valued, therefore, sometimes even resulting in *preferences for less sustainable product alternatives*. Conversely, when gentleness-related attributes are valued, sustainability enhances preference.<br>• The potential negative impact of sustainability on product preferences can be attenuated using explicit cues about product strength. |
| Wiedmann et al. (2011) | 480 consumers in Germany | Online survey | Cars | Financial, Performance, Physical, Time, Social, Psychological risks | | - Car Involvement<br>- Ecological awareness | Innovation resistance to natural gas vehicles (NGVs) | • Financial, performance (technological), time, social, and psychological risk *positively* affect consumers' innovation resistance to NGVs |
| Zhang et al. (2011) | 7000 consumers in USA | Database | Alternative Fuel Vehicles | Technology Push<br>Regulatory Push<br>Market Pull | | | Diffusion of Eco-Innovations | • Technology push can be an important mechanism for speeding the diffusion of AFVs.<br>• Market pull, that is, word of mouth, also has a *positive* impact on the diffusion of AFVs and *increases* the social good by decreasing the preference for fuel-inefficient vehicles as well as *higher* willingness to pay for AFVs<br>• Governmental push leads to a *decrease* in the social good (air pollution improvement) because market share for fuel-inefficient vehicles increases |

| Study | Sample | Methods | Products /Services | Variables | | | | Main findings |
|---|---|---|---|---|---|---|---|---|
| | | | | Independent Var. | Mediators | Moderators | Dependent Var. | |
| Griskevicius, Tybur and Van den Bergh (2010) | Undergraduate students in Mexico | Lab experiments | Cars, household cleaners, dishwashers backpacks, batteries, and table lamps | Prosocial status | | Consumption situation (private vs public)<br><br>Price | Attractiveness of green products | • Activating status motives *encourage* people to choose green products over more luxurious non-green products.<br>• Altruism signals one's willingness and ability to incur costs for others' benefit, status motives *increased* desire for green products when shopping in public (but not private) and when green products cost more (but not less) than non-green products. |
| Hartmann and Apaolaza-Ibáñez (2012) | 762 consumers in Spain | Field Experiment | A fictitious green energy brand | - Environmental concerns<br>- Perceptions about green energy brand's utilitarian environmental benefits<br>- Warm glow | Attitude toward the brand | Expectation of self-expressive benefits Nature experiences | Purchase intention | • Only self-expressive benefits do neither affect participants' attitudes toward the experimental brand nor their purchase intentions.<br>• Utilitarian benefits of green products have *positive* effects on purchase intention<br>• Nature experience evoked by advertising has the *strongest influence* on brand attitude, but no effect on purchase intention. |
| Kronrod et al. (2012) | Undergraduate students and consumers | Lab and online experiment | Water/soap | Assertive Language | Perceived Issue Importance | | Compliance | • Consumers who perceived the environmental issues as less important were *more* affected by a non-assertive message than an assertive message and are *more* willing to comply with the message |
| Lin and Chang (2012) | Consumers in USA | Field experiments | Hand sanitizer | Types of products | Perceptions of a green product's effectiveness | Environmental consciousness<br><br>Providing information | Amount of a green product usage | • Consumers use *more* of a green product in comparison with its conventional counterpart to accomplish a given task.<br>• Consumers who are more environmentally conscious *overuse* a green product, while less environmentally conscious consumers do not display this usage pattern.<br>• This phenomenon seems to be driven by consumers' perception of a product's effectiveness. |

| Study | Sample | Methods | Products /Services | Variables | | | | Main findings |
|---|---|---|---|---|---|---|---|---|
| | | | | Independent Var. | Mediators | Moderators | Dependent Var. | |
| Catlin and Wang (2012) | Undergraduate students and consumers in USA | Lab and field experiments | Papers and paper towels | Presence of recycling options | | | Consumption levels | • The availability of a recycling option can actually *increase* resource usage of products for which the consumer faces no direct cost to consume (e.g., office paper and bathroom paper towels). |
| Luchs et al. (2012) | Undergraduate students and consumers | Field and online experiments | Shoes and phones | - Trade-off between sustainability and functional performance<br>- Aesthetic design | Anticipatory emotions (guilt, confidence, distress) | - Sustainability importance<br>- Goal/threshold | Choice likelihood for products with superior sustainability | • Consumers tend to choose the product with superior functional performance over the product with superior sustainability characteristics, due to feelings of distress, until a minimum threshold of functional performance is achieved.<br>• Choice given this trade-off depends upon sustainability that, in turn, is mediated by consumers' feelings of confidence and guilt.<br>• The effective use of product aesthetic design can *improve* the relative choice likelihood of sustainable products. |
| Cho et al. (2013) | 726 consumers in South Korea and USA | Field survey | General products | - Cultural Orientation<br>- Horizontal Individualism<br>- Vertical Individualism<br>- Horizontal - Collectivism<br>- Vertical Collectivism<br>- Confucian Collectivism | Perceived Consumer Effectiveness (PCE)<br><br>Environmental Attitude | | Environmental Commitment | • Horizontal collectivism and vertical individualism are important influencers of PCE<br>• PCE *positively* affects environmental attitude which results in pro-environmental commitment manifested in specific behavioural intentions.<br>• PCE *did not directly* impact environmental commitment, but rather impacted it through the influence on environmental attitude. |
| Gleim et al. (2013) | Nearly 1000 consumers in USA | Critical incident (CIT) survey<br>Email survey<br>Experiment | Shower cleaner | - Social norms<br>- Willingness to comply with social norms<br>- Personal norms<br>- Price, quality, expertise, trust, availability, | - Perceived consumer effectiveness | Numbers of information cues | Satisfaction<br><br>Purchase intentions | • Price is a *significant barrier*, but that expertise also appears to be a significant impediment to the consumption of green products.<br>• Consumers experienced poor product quality with a previous purchase and thus were *reluctant* to purchase green again |

| Study | Sample | Methods | Products /Services | Variables | | | | Main findings |
|---|---|---|---|---|---|---|---|---|
| | | | | Independent Var. | Mediators | Moderators | Dependent Var. | |
| | | | | apathy, brand loyalty, miscellaneous<br>- Verbal information<br>- Presentation of information about attributes | | | | • Simple verbal information generated *higher* purchase intentions than equivalent numerical information<br>• Number and form of informational cues that educate consumers about green products overcome purchase barriers. |
| Grimmer and Bingham (2013) | 754 consumers in Australia | Field experiment | Mobile phones | Company environmental performance (PEP) | | - Environmental involvement (EI)<br>- Relative price | Purchase intention | • Consumers with high EI report *greater* purchase intention for high PEP companies and the reverse for low PEP companies,<br>• Participants are *more likely* to favour a high PEP company when the relative price of a product is *low* versus high, irrespective of their level of EI. |
| Kidwell, Farmer and Hardesty (2013) | Undergraduate students and households in USA | Lab and longitudinal experiments | Recycling | Appeal type<br>Fluency | | Political Ideology | - Target sustainable behaviour<br>- Spillover effects (other green behaviours) | • Conservatives are shown to have heightened intentions to recycle when exposed to a binding moral appeal, while liberals are shown to have heightened intentions to recycle when exposed to an individualizing appeal.<br>• Appeals congruent with underlying moral foundations significantly influences actual recycling behaviour for both liberals and conservatives<br>• Fluency positively affects intentions to recycle as well as have spillover effects on acquisition and usage intentions. |

| Study | Sample | Methods | Products /Services | Variables | | | | Main findings |
|---|---|---|---|---|---|---|---|---|
| | | | | Independent Var. | Mediators | Moderators | Dependent Var. | |
| Ko, Hwang and Kim (2013) | 389 female consumers in South Korea | Field survey | General products | Consumer awareness of green marketing | Corporate image: social responsibility, product image, and corporate reputation | | Purchase intentions | • Green marketing has a *direct effect* on the social responsibility and product image.<br>• Social responsibility plays an important role as mediator in the effect of green marketing on product or corporate reputation.<br>• Product image and corporate reputation have a *direct effect* on purchase intentions, whereas social responsibility has an *indirect* effect on purchase intentions |
| Olson (2013) | 134 consumers in Norway | Online survey | Hybrid, diesel, and gasoline powertrains for cars; LED, LCD, and plasma screens for TVs | Trade-offs (Implicitly and Explicitly) | | - Price expectation<br>- Attribute importance | - Preferences for the greenest attribute levels and products<br>- Purchase intention | • Strong preferences for green products are found when trade-offs are *not apparent*, but preference shifts significantly to *less* green compromise alternatives when the *actual* attribute trade-offs are considered.<br>• A green product offering some compensatory advantage on a conventional attribute attracts consumers, while only "dark green" consumers are willing to pay the price to go green when the product offers few compensatory qualities. |
| Peloza, White and Jingzhi (2013a) | Undergraduate students and consumers | Lab and field experiments | Juice, coffee, tea, crackers | - Self-Accountability<br>- Awareness of discrepancy between actual and ought selves | Anticipated guilt | - Explicit guilt appeal/guilt appeal<br>- Presence of others | Preference for products promoted using ethical appeals | • Situational factors that heighten consumers' self-accountability lead *to increased* preferences for products promoted through their ethical attributes.<br>• The subtle activation of self-accountability leads to *more positive* reactions to ethical appeals than explicit guilt appeals.<br>• When accountability is heightened, consumers respond more favourably to an ethical appeal than to a traditional self-benefit appeal.<br>• When consumers do not feel a heightened sense of self-accountability, *no* preference for |

| Study | Sample | Methods | Products /Services | Variables | | | | Main findings |
|---|---|---|---|---|---|---|---|---|
| | | | | Independent Var. | Mediators | Moderators | Dependent Var. | |
| | | | | | | | | products positioned through ethical versus self-benefit appeals was observed |
| White and Simpson (2013) | Undergraduate students and consumers | Lab and field experiments | Grass cycling<br>Disposal of grass<br>Waste in the garbage<br>Composting | - Individual and Collective levels of self<br>- Descriptive norm, injunctive norm appeals, the benefit appeals | Self-focused thoughts | Perceived ambiguity<br>Autonomy | Sustainable intentions and behaviours | • When the collective level of self is activated, injunctive and descriptive normative appeals are *most effective*, whereas benefit appeals are *less effective* in encouraging sustainable behaviours.<br>• When the individual level of self is activated, self-benefit and descriptive appeals are particularly effective.<br>• The positive effects of descriptive appeals for the individual self are related to the informational benefits that such appeals can provide. |
| Haws et al. (2014) | Undergraduate students and consumers | Field surveys | Bags<br>Detergents<br>Cleaners<br>Dresses<br>Shirts | Green consumption values | - Non-environmental product attribute evaluations | Consumer susceptibility to interpersonal influence | - Relative preference<br>- Willingness to pay<br>- Likelihood to buy | • Stronger green consumption values *increase* preference for environmentally friendly products through more favourable evaluations of the environmental attributes |
| Kalamas, Cleveland and Laroche (2014) | 263 consumers in Canada | Field survey | General products | External- external environmental locus of control: powerful-others or chance/fate | | | Pro-environmental behaviours | • Consumers ascribing environmental responsibility to powerful-others *engage* in pro-environmental behaviours; whereas those attributing environmental change to chance/fate typically *do not*. |
| Lee et al. (2014) | 416 consumers in Korean | Field survey | General products | Altruistic value | - Perceived consumer effectiveness (PCE)<br>- Environmental concern | | - Green purchase behaviour<br>- Good citizenship behaviour<br>- Environmental activist behaviour | • Altruistic value has *no* direct influence on behaviour, but has an i*ndirect* impact through PCE and environmental concerns.<br>• PCE and environmental concern are positively related to citizenship behaviour and purchase behaviour.<br>• Activist behaviour is explained by PCE |

| Study | Sample | Methods | Products /Services | Variables | | | | Main findings |
|---|---|---|---|---|---|---|---|---|
| | | | | Independent Var. | Mediators | Moderators | Dependent Var. | |
| Matthes, Wonneberger and Schmuck (2014) | 484 consumers in USA | Online experiment | Ecological laundry detergent | - Functional ads<br>- Emotional ads<br>- Combined ads | Ad attitude | - Environmental concerns<br>- Green purchase behaviour<br>- Attitude towards green products | Brand attitude | • Green purchase behaviour and green product attitudes exert the strongest *moderating effects* on brand attitude, but not for environmental concern.<br>• Emotional appeals significantly affect consumers' brand attitudes.<br>• The combined ad has the *greatest impact* on brand attitudes. |
| Newman et al. (2014) | Consumers in USA | Online experiments | A dish soap and a drain cleaner<br>Household cleaner<br>Ice cream | Unintended/ intended green enhancement | - Perceived quality<br>- Liking<br>- Resource reallocation | - Type of socially beneficial enhancement (inherent vs. separate) design | Purchase intention | • Consumers are *less* likely to purchase a green product when they perceive that the company intentionally made the product better for the environment compared to when the same environmental benefit occurred as an unintended side effect.<br>• When the benefit is separate from the product, consumers evaluate the product *more favourably* when the benefit is intended (vs. unintended) |
| Olsen, Slotegraaf and Chandukala (2014) | Consumers in USA | Database Primary data (survey-based experiment) | Five FMCG industries (household products, food, beverages, and personal care) | - Competitive trend in green new products<br>- Prior green new product introductions | Green new product introduction | - Product type (Virtue/Vice)<br>- Message framing (quantity and Valence)<br>- Source credibility (Environmental legitimacy and brand longevity) | Changes in brand attitude | • Green new product introductions can indeed *improve* brand attitude<br>• Brand and category's positioning *positively* affects the introduction of green new products.<br>• Quantity of green messages, the product type, and their source credibility influence the extent to which green new products change brand attitude. |
| Gershoff and Frels (2014) | Consumers in USA | Online experiments | Mattress<br>Panini and Waffle maker<br>CPU<br>PM monitor | Product categories | Perceived centrality of a green component | Dependency Importance based on personal evaluation | Perceived greenness | • If a central attribute offers a green benefit, the product is perceived as *more* environmentally friendly compared with when a peripheral attribute provides an identical environmental benefit<br>• The mediating role of perceived centrality either through *categorization* of the product or through *integration* in the product design. |

| Study | Sample | Methods | Products /Services | Variables | | | | Main findings |
|---|---|---|---|---|---|---|---|---|
| | | | | Independent Var. | Mediators | Moderators | Dependent Var. | |
| Leary et al. (2014) | 460 consumers in USA | Online survey | General products | Environmental concern | Perceived marketplace influence (PMI) | | Sustainable consumption behaviour: recycling, energy efficiency behaviour, Eco-conscious buying behaviour | • Attributions about a firm's motivation exert *insignificant* effects on perceived greenness<br>• PMI plays an important role in mediating the relationship between environmental concerns and sustainable consumption behaviours. |
| Karmarkar and Bollinger (2015) | Households in USA | Observations and Experiments | Shopping bags Organic products | Bring their own bags for grocery shopping | Priming and licensing | - Dependents' Influence<br>- Salience of additional costs | - Purchase organic items<br>- Purchase more indulgent products | • Bringing one's own bags positively impacts purchases of indulgent items<br>• The increased likelihood of purchasing organic when bringing a bag is indeed reduced by larger price premiums<br>• For both organic and indulgent purchases, the bags' effects are also attenuated by the salience of costs. |
| Xie, Bagozzi and Grønhaug (2015) | 210 consumers in Norway | Online experiment | Offshore industry | - Environmental Irresponsibility/ Environmental responsibility | - Contempt<br>- Anger<br>- Disgust | - Social justice values<br>- Empathy<br>- Moral identity<br>- Relational self<br>- Collective self<br>- Empathy | *Consumer responses*<br>- Negative WOM<br>- Complaining<br>- Boycotting<br><br>*Consumer responses*<br>- Positive WOM<br>- Resistance to negative information<br>- Identification<br>- investment | • For corporate non-green actions, individual difference characteristics (social justice values, empathy, moral identity, self-concept) *moderate* the elicitation of negative moral emotions (contempt, anger, disgust), which, in turn, lead to consumer negative responses (negative word of mouth, complaint behaviours, boycotting).<br>• For corporate green actions, empathy *moderates* elicitation of positive emotions on gratitude, which, in turn, influences consumer positive responses (positive word of mouth, resistance to negative information, identification with the company, investment). |

| Study | Sample | Methods | Products /Services | Variables | | | | Main findings |
|---|---|---|---|---|---|---|---|---|
| | | | | Independent Var. | Mediators | Moderators | Dependent Var. | |
| Majid and Russell (2015) | Consumers in USA | Database | Cars | - Green technology<br>- New green brands/Green brand extensions<br>- The introduction of an improved technology | | | Value retention | • Hybrid (i.e., green) vehicles *lose value faster* than their non-hybrid counterparts.<br>• Pure green brands (such as the Prius), whose ability to express greenness is more salient, *lose value at a slower* rate than green brand extensions.<br>• Pure green brands are also *less vulnerable* to the threat of obsolescence from technological innovations |
| Minton, Kahle and Kim (2015) | 388 consumers in USA and Korea | Online survey | Eco-Friendly Purchase and Disposal behaviours<br>Indirect sustainable behaviours<br>Low-carbon diet behaviours | Religious affiliation (Eastern, Western, and Atheists) | | Religiosity self-defining behaviours | Participation in sustainable behaviours (e.g., purchasing green cleaning supplies, recycling, purchasing organic foods). | • Consumers who are more religious are *more likely* to participate in sustainable behaviours<br>• In contrast to Christians and Atheists, highly religious Buddhists more likely participate in sustainable behaviours. |
| Wu et al. (2015) | 305 consumers in Taiwan | Field survey | Electric vehicles | - Image<br>- Risk<br>- Value<br>- Perceived usefulness | | | Purchase intention | • Image has a *positive effe*ct on value and purchase intention<br>• Risk has a *negative effect* on purchase intention<br>• Perceived usefulness and value have *a positive effect* on purchase intention |
| Yang et al. (2015) | Undergraduate students in China | Lab experiments | Natural drinks<br>Cars | Abstract appeal/concrete appeal | | - Other-Benefit Association/Self-Benefit Association<br>- Public self-awareness<br>- A collective/ individual level of self | Purchase intention | • Abstract (concrete) appeal is *more effective* in generating green purchase intentions than concrete (abstract) appeal in situations where the benefit association of green products is other (self).<br>• Public self-awareness and identity salience moderate the effect of appeal type and benefit association on green purchase intentions. |

| Study | Sample | Methods | Products /Services | Variables | | | | Main findings |
|---|---|---|---|---|---|---|---|---|
| | | | | Independent Var. | Mediators | Moderators | Dependent Var. | |
| Cohen, Lobel and Perakis (2015) | | Database | General products | Government subsidies<br>Company strategy<br>Customer demand | | | Green technology adoption | • Consumer surplus depends on the trade-off between lower prices and the possibility of underserving customers with high valuations.<br>• Policy makers ignore demand uncertainty when designing consumer subsidies, they can significantly miss the desired adoption target level. |
| Zane, Irwin and Reczek (2015) | Undergraduate students and consumers in USA | Lab experiments | Jeans backpacks | Wilfully ignorant consumers | - Denigration of ethical others<br>- Negative social comparison<br>- Decreased feelings of anger regarding the underlying ethical issue. | A second chance | Ethical behaviour<br>Ignore ethical product information | • Wilfully ignorant consumers *negatively* judge ethical others. The denigration arises from the self-threat inherent in negative social comparison with others who acted ethically instead of choosing not to do so.<br>• Denigration becomes less strong if wilfully ignorant consumers have a second opportunity to act ethically after initially ignoring the ethical product information and also significantly weakens if initially ignoring the ethical attribute is seen as justifiable. |
| Van der Wal et al. (2016) | 410 consumers in Netherlands | Observations and Experiments | Shopping bags<br>Organic products | Prosocial status | | Consumption situation (private vs public)<br>Price | Attractiveness of green products | • Shoppers of a high-status sustainable grocery chain display sustainable shopping *more* by using branded shopping bags than shoppers of a lower-status chain.<br>• High-status "green" shoppers are *more likely* to buy new bags rather than bring their own. This wasteful behaviour for purpose of displaying status has obvious negative environmental consequences. |

| Study | Sample | Methods | Products /Services | Variables | | | | Main findings |
|---|---|---|---|---|---|---|---|---|
| | | | | Independent Var. | Mediators | Moderators | Dependent Var. | |
| Bodur et al. (2016) | Undergraduate students and consumers in USA | Lab and field experiments | Chips and juices | Ethical Attributes | Quality Perceptions | - Price Importance of ethical attributes<br>- Brand reputation<br>- Resource synergy beliefs | Brand evaluation | • Private Label Brands (PLB) benefit from offering ethical attributes in the context of higher-priced PLBs or higher retailer reputation.<br>• Low priced PLBs and those associated with low retail reputation benefited from *not* offering an ethical attribute.<br>• The positive effect of ethical attributes on consumer evaluations of high-priced PLBs and PLBs associated with lower retail reputation was mediated by consumers' quality perceptions.<br>• Consumers with negative resource synergy beliefs evaluated PLBs with ethical attributes and associated with a low reputation retailer particularly *unfavourably*. |
| Trudel, Argo and Meng (2016) | Undergraduate students and consumers in USA | Lab and online experiments | Recycling | Identity-Linked Products | | - Strength of connection<br>- National/social identity social identity valence: positive vs. negative | Consumer Recycling behaviour | • When an everyday product is linked to a consumer's identity, it is *less likely* to be trashed and more likely to be recycled.<br>• The tendency to recycle an identity-linked product *increases* with the strength and positivity of the connection between the consumer and product (or brand). |
| Kazeminia, Hultman and Mostaghel (2016) | 2000 Swedish citizens | Online survey | Ecotourism | - Affective attitude<br>-Environmental beliefs<br>- Materialism | | Ecotourism interest | Willingness to pay for sustainable offerings | • While attitude and environmental beliefs relate positively to willingness to pay premium (WTPP) for ecotourism, materialistic values exert a *negative* effect.<br>• Greater ecotourism interest amplifies the influence of affective attitude and materialistic values on WTPP while simultaneously attenuating the effect of environmental beliefs |

| Study | Sample | Methods | Products /Services | Variables | | | | Main findings |
|---|---|---|---|---|---|---|---|---|
| | | | | Independent Var. | Mediators | Moderators | Dependent Var. | |
| Giebelhausen et al. (2016) | Consumers in Japan | Survey and field experiments | Fast casual restaurant hotels | Green program participation | Warm glow | Types of Incentives | Satisfaction | • People are *more satisfied* with a service experience when they choose to participate in the provider's voluntary green program—an effect mediated by the "warm glow" of participation.<br>• The downside, however, is that this same mechanism *decreases satisfaction* among people who choose not to participate.<br>• Incentivizing the program paradoxically *increases satisfaction* for those who do not participate but decreases satisfaction among those who do.<br>• Compared with no incentive, an "other-benefiting" incentive *increases* warm glow and satisfaction for green program participants but decreases them among nonparticipants. Mixed incentive bundles *maximiz*e warm glow and satisfaction for both groups |
| Gonçalves, Lourenço and Silva (2016) | 197 consumers in Portugal | Mail survey | Biological products | - Functional value<br>- Social value<br>- Emotional value<br>- Conditional value<br>- Epistemic value | | | Green buying behaviour | • Functional value is almost always necessary but is *not sufficient* by itself for predicting green buying. However, three "causal recipes" formed with the functional value are sufficient, namely emotional, conditional and social values<br>• In contrast, the absence of the functional value *is a sufficient condition for not green buying* |

| Study | Sample | Methods | Products /Services | Variables | | | | Main findings |
|---|---|---|---|---|---|---|---|---|
| | | | | Independent Var. | Mediators | Moderators | Dependent Var. | |
| Brough et al. (2016) | Undergraduate students and consumers in USA and China | Field and online experiment | A plastic bag, lamp, backpack, and batteries household drain cleaner, | - Green behaviour<br>- Gender identity: masculine and feminine | | Self-affirmation branding: conventional vs. masculine | - Implicit attitudes toward the perceived gender-affiliation<br>- Perceived greenness of products<br>- Preference for green products<br>- Likelihood to donate to green organizations | • Consumers who engage in green behaviours are stereotyped by others as more feminine and even perceive themselves as more feminine.<br>• Men's willingness to engage in green behaviours can be influenced by threatening or affirming their masculinity as well as by using masculine rather than conventional green branding. |
| Moon et al. (2016) | 784 undergraduate students in USA and Australia | Survey experiments | New high-tech biofuel | Individual traits:<br>-Environmental consciousness<br>- Prosocial<br>- Openness to experience<br>- Vertical Individualism<br><br>Retailer choice attributes:<br>- Location convenience<br>- Payment convenience<br>- Price<br>- Servciescape Cleanliness<br><br>Message Framing:<br>- Negative<br>- Positive<br>- Hybrid framing | | | Consumers' adoption of innovative sustainable products | • A negatively framed educational message highlighting the negative impact of gasoline (versus biofuels) is *most effective* in leveraging the social desirability of product adoption against its economic disadvantages.<br>• Consumer traits *positively* associated with the adoption of bio-butanol are environmental consciousness, prosocial behaviour, and openness to new experiences, whereas vertical individualism discourages such adoption<br>• Retailer choice attributes of location and payment convenience *facilitate* adoption, while retailer choice attributes based on price and servicescape cleanliness *discourage* such adoption. |
| Kwon, Englis and Mann (2016) | 768 consumers in USA | Online quasi-experiment | Many products | Third-party ratings | | - Environmental concern<br>- Prior brand loyalty | - Perceived brand greenness<br>- Perceived validity of green-brown rating information | • Environmental concern does not affect the validity of third-party green–brown ratings<br>• The impact of the ratings on brand greenness perception was greater |

| Study | Sample | Methods | Products /Services | Variables | | | | Main findings |
|---|---|---|---|---|---|---|---|---|
| | | | | Independent Var. | Mediators | Moderators | Dependent Var. | |
| | | | | | | | | among consumers with high (vs. low) environmental concern.<br>• Consumers who are loyal to a brand are *more likely* to accept the validity of the brand's green rating than that of its brown rating. |
| Sun and Trudel (2017) | Undergraduate students | Lab experiments | Plastic cups Recycling Packaging Materials Gift Wrapping with Paper | Recycling | | The amount of packaging materials recycled or trashed | Amount of consumption | • The positive emotions associated with recycling can overpower the negative emotions associated with wasting.<br>• Consumers could use a larger amount of resource when recycling is an option and more strikingly, this amount could go beyond the point at which their marginal consumption utility becomes zero. |
| Li, Moul and Zhang (2017) | Consumers in China | Database | Automobiles | Higher air pollution | | City's income level | Sales of fuel inefficient vehicles | • Air pollution levels *negatively* affect the sales of fuel-inefficient cars on average. This relationship, though, is U-shaped over the observed air pollution levels, in that fuel inefficient car purchases rise with air pollution beyond some threshold.<br>• City's income level is a significant factor in this non-monotonic relationship, in the sense that consumers of higher-income cities are less likely to suffer this reversal. |
| Wang, Krishna and McFerran (2017) | Consumers in China | A quasi experiment and field experiment | Hotel services Toothbrush Plates Cups Bottles | Perceptions of a firm's greenness | Reactance | Firm-price-image visible-firm-effort, firm-request | Consumer conservation-behaviour | • Consumers' conservation behaviour is affected by the extent to which consumers perceive the firm as being green.<br>• Firm requests to consumers to save resources can create consumer reactance and can backfire when firms themselves do not engage in visible costly environmental efforts.<br>• Such reactance is more likely for firms with a high price image. |

| Study | Sample | Methods | Products /Services | Variables | | | | Main findings |
|---|---|---|---|---|---|---|---|---|
| | | | | Independent Var. | Mediators | Moderators | Dependent Var. | |
| Han, Seo and Ko (2017) | 24 consumers in Korea | Focus groups and Observation | Fashion products | Awareness and knowledge about sustainable fashion | | | Sustainable fashion consumption (SFPC) | • Fashion consumers' limited awareness and knowledge about sustainable fashion products may promote *negative sentiments* toward SFPC.<br>• The negative sentiments can be reduced by staging personalized experiences.<br>• Developing and staging consumer-cantered experiences help balance the psychological imbalance occurring in the attitude– behaviours gap between sustainability concerns and SFPC |
| Peyer et al. (2017) | 1458 consumers in Germany | Online survey | Consumer durable goods | Voluntary simplifiers | | | - Buying ecological products<br>- Buying fair-trade products.<br>- Boycott activities<br>- Impulsive buying.<br>-Consciousness for sustainable consumption. | • Voluntary simplifiers buy *more green* products, exhibit a *greater* environmental and economic sustainability consciousness and share *more universalistic* values compared to four other uncovered segments, namely well-off consumers, over-consumption consumers, less well-off consumers and poor consumers. |
| Sharma and Jha (2017) | 526 consumers in India | Online and offline survey | General products | Personal values - Holistic Values - Indian values | | - Environmental attitude<br>- Perceived Consumer effectiveness | 17 environment-friendly behaviours such as buying organic products, recycling, energy saving | • Personal, holistic, and Indian value dimensions drive sustainable consumption practices.<br>• Environmental attitude is more likely to moderate the relationship for internally oriented values than externally oriented values. |
| Heidenreich et al. (2017) | 1105 consumers in Germany | Online survey | Alternative fuel vehicles | Consumer innovativeness: - Hedonist innovativeness<br>- Social innovativeness | | External Policies: adequate infrastructure, external support, external communication | Adopt eco-friendly innovations | • AFV adoption relates *positively* to consumer innovativeness and that this effect can be intensified by providing external policies such as infrastructure, incentives, and communication policies |

Most importantly, recent evidence suggests that sustainability may not always be a valuable asset of a firm, and under some circumstances, sustainable products have potential negative effects on consumer preferences (Luchs et al., 2010, Newman et al., 2014). One plausible explanation for this argument is that even consumers want environmentally-minded products, they consider the functional performance of a product in the first place and then its environmental advantage (Evamy, 1990). In other words, since consumers might not be willing to trade off the 'standard' product performance, such as convenience or durability, against environmental benefits in their purchase criteria, eco-friendly products must also perform competitively in the key non-environmental attributes (Ewing and Sarigöllü, 2000, Peattie and Ratnayaka, 1992). Moreover, eco-friendly attributes are often associated with indirect and other-benefits rather than direct and self-benefits (e.g., pollution reduction as opposed to superior performance or value implications) (Bodur et al., 2016). Consequently, despite high social desirability of eco-friendly products, consumers are reluctant to buy these products as they believe eco-friendly products often cost more, have lower quality, and experience greater uncertainty regarding product performance compared to their counterparts (Chang, 2011, Lin and Chang, 2012). Hence, eco-friendly products are believed to be less effective and less desire under some situations (Griskevicius, Cant and Vugt, 2012, Luchs et al., 2010).

Drawing from the Stimuli-Organism-Response (S-O-R) framework and the Bloch's (1995) conceptual model, a theoretical organizing framework is developed based on an extensive review of the current literature on sustainable consumption and eco-friendly products (See Figure 1). The framework demonstrates how eco-friendly attributes in product designs affect consumers' psychological and behavioural responses across various product categories. Furthermore, the framework offers a clear and functional structure that allows a unified overview of all product-related and individual consumer-related variables examined by numerous studies in the sustainability research. All identified relevant factors were hypothesized to influence one or several dimensions of sustainability consumption.

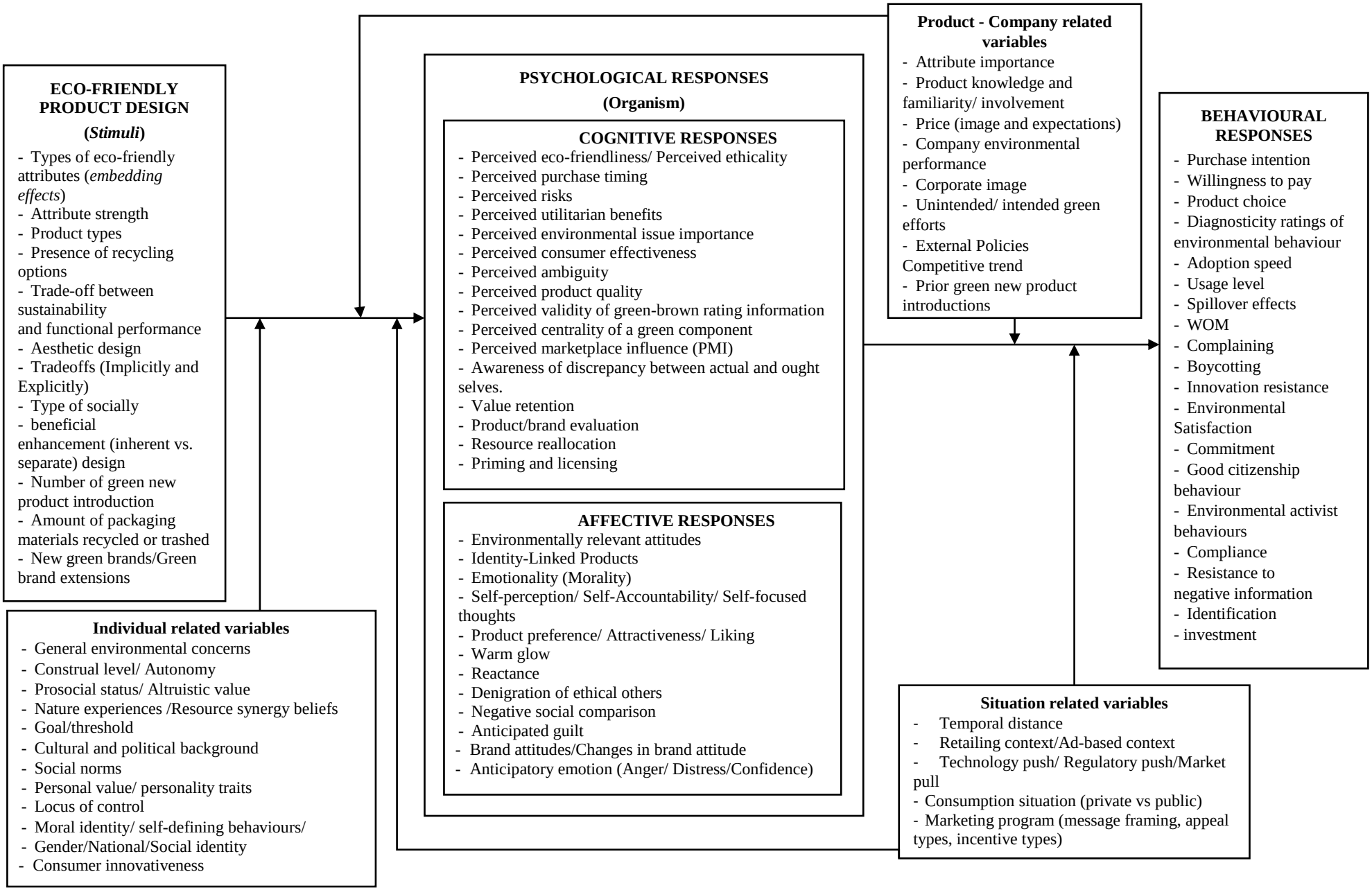


**Figure 1** A theoretical organizing framework of sustainable consumption

The inconsistent and weak associations between the introduction of eco-friendly products and consumer responses under some situations reported across previous studies suggest that further investigations of eco-innovative product designs and the boundary conditions under which its effects on consumer responses are strengthened or weakened is good topic for future research. The present research effort contributes to this research stream by examining *whether, how* and *under which conditions* the introduction of eco-innovation is considered as a promising way to shift consumers' perceptions and responses to eco-friendly products in a more favourable way. In other words, by making suitable product design choices and appropriate marketing strategies, eco-innovation could be an effective means to encourage consumption of relatively more sustainable products by ensuring both their innovative product performance and eco-friendly benefits.

### 2.4. Summary

Eco-innovation is increasingly recognized as a key trend in new product development and marketing practices of firms around the world (Katsikeas et al., 2016). A primary concern of developing eco-innovations is to examine the extent to which the integration of eco-friendly benefits into innovative product designs could lead to more positive responses from consumers. Innovation research to date has focused primarily on the relationship between product innovativeness and consumer responses. However, far too little attention has been paid to investigating the new concept of eco-innovative product designs, where both innovative and eco-friendly features are incorporated. In this chapter, the extensive review of the existing literature set up the theoretical background for this study based on in-depth discussions about what has been done in each dimension in the S-O-R framework. Most importantly, the chapter highlighted the important gaps in the literature, which have been repeatedly called for further research on the topic of eco-innovation. Following this further, Chapter Three and Four will present the conceptual framework and develop relevant hypotheses for testing in the next phases.

# CHAPTER THREE

# CONCEPTUAL FRAMEWORK

# CHAPTER THREE

# CONCEPTUAL FRAMEWORK

## 3.1. The conceptual framework

Based on the extant literature review and comprehensive discussion on eco-innovation in the previous chapter, the present research aims to address the shortcomings in the existing literature by providing an integrated conceptual framework for understanding the effects of eco-innovative product design cues on consumer responses and the boundary conditions of these effects (see Figure 2). More specifically, this research includes five main studies for testing the conceptual framework across product categories and national markets.

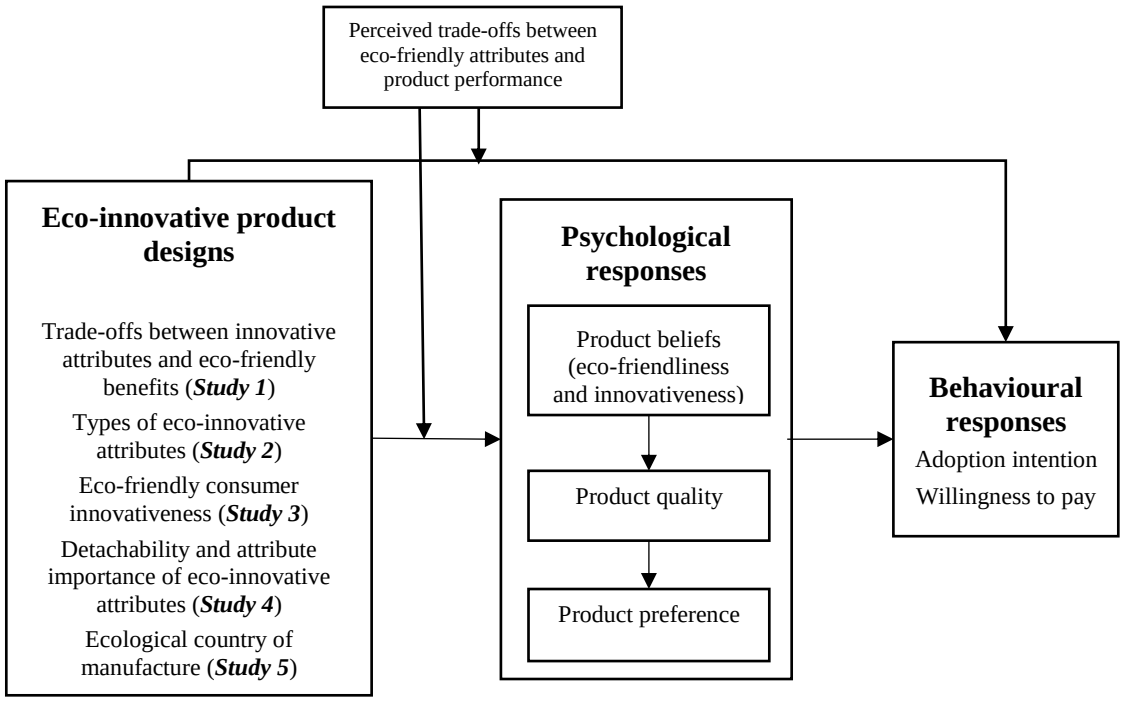


**Figure 2** The conceptual framework

**Study 1** aims to investigate the roles of attribute trade-offs in eco-innovative product designs (i.e. *objective* trade-offs) and perceived eco-friendly product effectiveness (i.e. *subjective* trade-offs) in product evaluation and adoption intention. **Study 2** focuses on different types of eco-innovative

attributes in a new product design, which might result in different product evaluations and behavioural responses. The objectives of **Study 3** are to replicate and confirm the primary results of Study 2 in another product category and to explore the underlying mechanism of the effects of ECI on consumer responses across different types of eco-innovations. In **Study 4**, the effects of detachability (importance to the functioning of a product) of eco-innovative features on consumers' responses are examined in comparison with attribute weighting (the importance consumers attach to certain attributes). Finally, **Study 5** attempts to shed light on how international firms might accelerate or hinder the adoption of eco-innovations by selecting the appropriate combination of ECOM and PECO levels across product categories, national markets, and consumer segments.

### 3.2. The conceptualization of main constructs in the conceptual model

#### *3.2.1. Product-related variables*

##### *3.2.1.1. Trade-offs between innovative features and eco-friendly benefits*

In the current literature, it could be argued that consumers' choices of eco-friendly products often involve trade-offs between environmental benefits and other important attributes, such as functional performance, aesthetic design, price, and safety (Luchs et al., 2012, Olsen et al., 2014). Such trade-offs have been used to explain the intention–behaviour gap, where pro-environmental consumers do not necessarily follow through on their beliefs (i.e., they do not "walk the talk") despite their high level of concern for environmental issues and ethical consumption intentions (Bamberg, 2003, Carrington et al., 2014). This gap implies that consumers are less likely to replace "browner" products with "greener" alternatives when they are forced to make compromises on certain product features (Kollmuss and Agyeman, 2002, Pujari, 2006, Pujari et al., 2003). Few studies (Luchs et al., 2012, Olson, 2013) have attempted to examine the effect of attribute trade-offs as an explanation for the often-disappointing levels of eco-friendly product consumption. However, to the best of our knowledge, no

study has focused on the moderating roles of trade-offs between innovative features and environmental benefits in the context of eco-innovation introduction. A better understanding of this is vital, particularly when eco-innovative products are considered the inevitable trend in today's marketplace (Katsikeas et al., 2016, Varadarajan, 2015). This study considers two main contrasts in attribute trade-offs: (1) *innovative technology that offers no eco-friendly advantages or creates a negative impact on the environment* (e.g., intelligent infotainment system requiring higher energy consumption) and (2) *innovative technology that results in eco-friendly benefits* (e.g., solar engines using renewable energy). Given the uncertainty in adoption and the value–action gap of sustainable consumption, it is crucial to understand how the trade-offs between innovative features and eco-friendly benefits affect consumer responses in the context of eco-innovations.

#### *3.2.1.2. Types of eco-friendly attributes in eco-innovative product designs*

Following previous studies on the eco-innovation classification, along with the interviews with managers and consumers, we contend that there are three key types of eco-friendly attributes that can be integrated into new product development and marketing activities: (1) resource use reduction/efficiency features, (2) resource use elimination features, and (3) resource use substitution features. We discuss each in turn.

*Resource use reduction or efficiency innovations.* The development of these innovations aims to improve productivity and efficiency in the use of resource inputs in the manufacturing and consumption processes of the eco-innovation (European Commission, 2013, Varadarajan, 2015). In other words, natural resources should be processed and consumed in a more efficient and sustainable way over the whole life cycle of the product (Schandl, 2011). This type of eco-innovation is often designed to minimize energy use and maximize carbon reduction. For example, smart metering provides real-time energy consumption feedback to consumers and can generate a sustained reduction in energy consumption of

5%–10% (HM Treasury, 2005). Another example is the smart Nebia shower system, which reduces water consumption by 70% without affecting people's shower experience (Mitchell, 2015).

*Resource use elimination innovations*. The goal of this eco-innovation type is to eliminate the use of natural resources or harmful ingredients as an input for manufacturing and consumption processes while maintaining the same levels of product functionality and performance (Malhotra, 2016). According to Varadarajan (2015, p. 8), there are three approaches to developing resource use elimination innovations: (1) excluding ecologically harmful ingredients, (2) excluding filler ingredients from a product, and (3) excluding the need to use a complementary product. The possibility of eliminating potentially hazardous materials largely depends on the availability of safer alternatives that ideally perform at least the same or even better functions. A recent example is the Quanthor cell phone, which is based on Fibonacci sequence technology to eliminate the emission of electromagnetic radiation. The innovative XO Laptop for children containing no hazardous materials is also a good illustration of this type of eco-innovation.

*Resource use substitution innovations*. Resource use substitution innovations are developed by substituting (1) non-renewable resources with renewable resources, (2) ecologically harmful non-renewable resources with less/non harmful non-renewable resources, (3) less abundant non-renewable resources (subject to the substitution not having a negative impact on the overall sustainability profile of the product) with more abundant non-renewable resources, or (4) mined raw materials with above-ground ones (Varadarajan, 2015, p. 8). This type of eco-innovations is considered as the key to reduce costs and raise the efficiency, performance, and deployment levels of renewable energy usage (e.g., solar, wind, modern biomass, hydro, geothermal) on a regional, sectional, and global scale (Saygin et al., 2015). A good example of this type of innovation is the Immortus car (by EVX Ventures in Melbourne), which is powered by solar energy captured by photovoltaic paneling along the vehicle's exterior (Mitchell, 2015). Another example is Trinity, an innovative portable micro wind turbine from Janulus, which generates power at low wind speeds for charging small devices and even electronic cars.

*3.2.1.3. Detachability and importance of eco-friendly attributes: core versus peripheral*

A large body of the innovation literature has recognized innovation locus as an important parameter in a new product design issue, whereby managers need to decide about developing new features either as an integral part (a core locus design) or as a detachable accessory (a peripheral locus design) (Gatignon et al., 2002, Kim, Kumar and Kumar, 2012, Yoo, Henfridsson and Lyytinen, 2010). However, extant research has not explicitly examined the distinction between the two innovation loci (i.e., core versus peripheral components), especially in the context of eco-innovative product designs (Ma, Gill and Jiang, 2015). New product eco-designs require managers to decide whether eco-innovative attributes will be either situated in the periphery of the product or built into the core of its innovation system. For example, in the case of the new battery electric technology in the automobile industry, while Nissan built this new eco-friendly functionality in the "core" of its new cars models (e.g., Nissan Leaf), Toyota offered the same eco-innovative feature peripherally as a plug-in hybrid electric vehicle (e.g., Toyota Pirus). Understanding the role of eco-innovation locus (i.e., core versus peripheral) is important not only for new eco-friendly product development, but also for consumer adoption decisions (Ma et al., 2015).

There are two approaches to defining the two types of innovation loci. On the one hand, Gatignon et al. (2002) refer to core innovative features as "either more tightly connected to or more interdependent with other subsystems," while peripheral features are "weakly coupled to or are less interdependent with other subsystems" (p.1106). On the other hand, Ma et al. (2015) distinguish cores and peripherals based on two key characteristics: optionality (where components are not necessary for the functioning of the base product) and detachability (where components can be physically separated from the base product). The concept of peripheral components proposed by Ma et al. (2015) is analogous to the ideas of independent add-ons or a supplemental set of features in new product designs (Bertini, Ofek and Ariely, 2008, Meyer, Zhao and Han, 2008, Noseworthy, Wang and Islam, 2012). Innovation

researchers (e.g., Ma et al., 2015) argue that adding a really new feature as a detachable component results in higher adoption intentions than positioning that same feature in the core in the context of incrementally new innovations. Contrary to this notion, other scholars (e.g., Gershoff and Frels, 2014, Sloman, Love and Ahn, 1998) indicate that given the identical functional benefits, modifying central (vs. peripheral) features has a greater impact on consumer perceptions and overall product evaluation. These inconsistencies in empirical findings suggest the need to identify factors that enhance or inhibit the impact of detachability of new features on consumer responses, especially in the context of eco-innovations.

*3.2.1.4. General COM and ecological country of manufacture*

**A review on general COM**

Given the rapid globalization and the emergence of international value chains with multinational production locations, firms now have more control in searching for better places to manufacture their products by taking advantages of lower labour/material costs and tax rates in other countries (Coskun and Burnaz, 2016). This leads to the dominance of the hybrid or bi-national products, which are designed and branded in one nation but manufactured or assembled in another (Hamzaoui Essoussi and Merunka, 2007, Ulgado and Lee, 1993). Phau and Prendergast (2000) posit that the growing occurrence of bi-national products might cause potential dissonance for consumers when facing the conflicting views about products with multi-country affiliations. The proliferation of hybrid products in the globalized marketplace coupled with the increasing criticism on a single cue approach in many COO studies highlights the needs of decomposing the COO concept into specific dimensions.

In this context, a burgeoning body of the literature has adopted a multi-cue approach based on the decomposition of the traditional COO concept as a multidimensional construct rather than

only general effect (Lu et al., 2016, Pharr, 2005, Ulgado and Lee, 1993). There are two main approaches in the multi-cue COO studies that consumers are commonly exposed to: one where only brand origin (BO) and COM are provided (Hamzaoui Essoussi and Merunka, 2007, Hui and Zhou, 2003) and another where both intrinsic (physical) product attributes and COO (including BO and COM) are available (Bloemer et al., 2009, Ulgado and Lee, 1993). The former approach with two components (BO and COM) is by far more popular in the COO literature (Chao, 1993, Hui and Zhou, 2003, Insch and McBride, 2004, Johnson, Tian and Lee, 2016). While BO could be invoked through brand names, COM is factual information of the location where the final production stage occurs, manifested in the "*Made-in*" label. More specifically, Samiee (1994) refers to COM as the final point of manufacture or assembly of a product, which could be the same as BO and might vary over time and space.

While consensus exists with respect to the main effect of the general COO concept on consumers' evaluation of binational products across various settings (Carvalho, Samu and Sivaramakrishnan, 2011, Hamzaoui Essoussi and Merunka, 2007), the relative importance of COM has been a controversial and disputed subject (Samiee, 2010, Zeugner-Roth and Diamantopoulos, 2010). To date, previous research has reported inconsistent and contradictory findings into the critical relevance of COM across various product types and development levels of countries studied (See Table 2).

**Table 2** Selected studies on country of manufacture (COM) in the international marketing

| Author(s) | Sample | Product category(ies) | Brand names | Measurement and Position of COM in the research model | Moderating variable(s) | Outcomes/ Dependent variable(s) | Key findings |
|---|---|---|---|---|---|---|---|
| **The current study** | Study 1: 211 American consumers<br>Study 2: 192 Indian consumers and 204 American consumers | Eco-innovative products: Driverless cars, Connected TV, and Innovative smartphones | Fictitious corporation and brand names | Ecological COM (manipulated by name of the countries) – Independent and moderating variable<br>Perceived ecological COM – Moderating variable | Product eco-friendliness level (low vs. high)<br>Product categories (private vs. public)<br>Market conditions (Emerging vs. Developed market)<br>Need for cognition (-) | Eco-innovative product evaluation<br>Product preferences<br>Purchase intention | Ecological COM has main *positive* effects on product quality, product preferences, and purchase intention across product categories and national markets.<br>The incongruence between ecological COM and PECO significantly triggers more positive consumer responses for private products in the developed country while there should be a match between these two factors to create more favourable responses in the case of public products in the emerging market.<br>While schema congruity between ecological COM and PECO has a significantly stronger effect on low NFC respondents than high NFCs in the emerging market, this same effect was not found in the developed market. |
| **Garrett et al. (2017)** | 270 young Korean adults | Fashion and electronic products | Fictitious corporation and brand names | COM (name of the countries) – Independent variable | Regulatory focus | Product evaluation<br>Purchase intention | COM has *no main effect* on product evaluation and purchase intention<br>Both promotion-focused and prevention-focused consumers consider COM in their product evaluations. |
| **Hsu, Chang and Yansritakul (2017)** | 305 university students in Taiwan | Green skincare products | No brand name mentioned | Perceived COM image (developing vs. developed countries) – Moderating effects | Price sensitivity | Purchase intention | COM and price sensitivity *positively* moderates the positive effects on the links between purchase intention and its antecedences (i.e., attitudes, subject norms, and perceived behavioural control) |
| **Cheah, Zainol and Phau (2016)** | Australia consumers | Luxury branded apparel | Well-known brands | COM (name of the countries of ingredient in terms of authenticity of raw materials , artisan | | Product evaluation | COM (in terms of sustainability/ethical considerations) *positively* impacts consumers' judgment of the branded product |

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|---|---|---|---|---|---|---|---|
| | | | | skills, and sustainable/ethical considerations) – Independent variable | | | |
| **Allman et al. (2016)** | 530 American consumers | Automotive | Well-known brands | COM (name of countries)- Independent variable and moderating variable | Brand concept (Functional vs. Prestige) (+) Vertical line extension (VLE) (downwards vs. upwards) (+) | Brand image evaluation | COM has *no main and moderating effect* in the case of functional brands with both upward and downward VLE<br>COM has a *negative* moderating effect in the case of prestige brands with only downward VLE |
| **Carvalho, Muralidharan and Bapuji (2015)** | 153 undergraduate students in US | Laptop batteries | Fictitious and well-known brand name | COM image – Independent variable and moderating variable | Reason for product defect (specified vs. unspecified) Brand familiarity (-) | Attribution of blame to the brand company | In the unfamiliar brand, COM has a *negative* impact on the attribution of blame, *no effect* in the familiar brand<br>COM *negatively* moderates on the relationship between reason of product defect and attribution of blame |
| **Dekhili and Achabou (2015)** | Study 1: 106 French consumers<br>Study 2: 145 French consumers | Eco-friendly products: Washing up liquids, TV | Fictitious and well-known brand names | Ecological COM (name of countries)- Independent variable | Confidence in the eco-certification Confidence in the product's COM | Evaluation of the eco-labelled product | The availability of a COM cue with unfavourable ecological image *negatively* influences the product's evaluation, especially when there is no information about the brand. This effect is moderated by the level of confidence towards the product's COM |
| **Hustvedt et al. (2013)** | 255 American consumers | Wool blend sweaters | Fictitious corporation and brand names | COM (name of the countries) – Independent variable | Consumer ethnocentric tendency (CET) | Willingness to pay | COM has a *positive* impact on willingness to pay in the cases of highly ethnocentric consumers, but *no effect* in the cases of low CET consumers |

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|---|---|---|---|---|---|---|---|
| **Wilcox, Roggeveen and Grewal (2011)** | Study 1: 216 undergraduate students<br>Study 3: 157 undergraduate students<br>Study 4: 64 real consumers | Experiential products: chocolate, a gift card, and wine | Fictitious corporation and brand names | COM (name of the countries) – Independent variable | Information order | Product evaluation<br>Purchase intent | When favourable (unfavourable) product information was presented before sampling, it *increased (decreased*) evaluations, but when it was presented after sampling it decreased (increased) evaluations.<br>COM had a significant *negative effect* on purchase intent |
| **Diamantopoulos, Schlegelmilch and Palihawadana (2011)** | 300 UK consumers | Refrigerators | No brand name mentioned | Perceived COM image – Independent variable | | Product specific country image<br>Brand image<br>Purchase intention | COM image has *positive* effects on the product-specific country image, brand image, and purchase intention |
| **Hamzaoui-Essoussi, Merunka and Bartikowski (2011)** | 376 Tunisian consumers | Cars and TV | Well-known brands | COM micro and macro image – Independent variables | | Brand quality | COM macro has a *positive* impact on brand quality<br>COM micro has *no* effect on brand quality |
| **Fetscherin and Toncar (2010)** | 190 American students | Cars | No brand name mentioned | COM (name of the countries) – Independent variables | | Brand personality perception | COM have a *positive* effect on brand personality perception |
| **Sim Ong, Kitchen and Shiuan Chew (2010)** | 426 Malaysian consumers | Air-conditioners | Well-known brands | COM (name of the countries) – Independent variable | | Perceived value | COM has a *positive* impact on perceived value |
| **Zbib et al. (2010)** | 326 Lebanese consumers | Potato chips | No brand name mentioned | COM (name of the countries) – Independent variable | | Product evaluation<br>Purchase intention | COM has *no impact* on product evaluation and purchase intention |
| **Auger et al. (2010)** | 904 consumers from Germany, Spain, Turkey, USA, India, and South Korea | Shoes and AA batteries – focusing on social attributes | No brand name mentioned | COM (name of the countries) – Independent variable | | Product choice | Social attributes are generally more influential in developed than in emerging economies,<br>The importance of social attributes holds across high and low involvement products<br>Social attributes can influence product choice even when other intangible attributes (e.g., COM information) are included in the design. |

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|---|---|---|---|---|---|---|---|
| **Hamzaoui Essoussi and Merunka (2007)** | 389 Tunisian consumers in a field survey | Cars and TV | Well-known brands | COM image and COM/product fit Congruity of brand and COM – Independent variables | | Perceived product quality Brand image | COM has a *positive* impact on perceived product quality Perceived product quality mediates the relationship between COM and brand image COM/product fit has a *positive* impact on perceived product quality Congruity brand/COM has a *positive* impact on brand image |
| **Hamzaoui and Merunka (2006)** | 389 Tunisian consumers | Cars and TV | No brand name mentioned | COM image and COM image/ product fit – Independent variables | | Product quality | COM image and COM image/product fit have a *positive* impact on product quality |
| **Phau and Suntornnond (2006)** | 371 Australian consumers | Beers | Both well-know and fictitious brands | COM (name of the countries) – Independent variable | Brand familiarity | Product quality Value Acceptability | COM has *positive* effects on product quality, value, and acceptability. These effects are stronger for familiar brands than for unfamiliar brands |
| **Maheswaran and Chen (2006)** | Study 1: 210 students Study 2: 181 students | A new digital camera | No brand name mentioned | COM (name of the countries) – Independent variable | Emotion: sad vs. anger Description: superior vs. inferior Agency control: situation vs. human Argument strength: strong vs. weak | Product evaluation Cognitive responses | COM *positively* influenced evaluations only in the angry (vs. sad) condition where human (vs. situation) control was high. COM, termed "nation equity," includes both performance and emotional components. |
| **Hsieh et al. (2004)** | 2828 car buyers in 20 markets | Cars | No brand name mentioned | COM image – Independent variable | | Actual purchase | COM image has a *positive* impact on actual purchase |
| **Insch and McBride (2004)** | 375 US consumers and 583 Mexican consumers | Television, athletic shoes and mountain bike | No brand name mentioned | COM of parts/components COA (Country of assembly) – Independent variables | | Design quality Manufacturing quality Other quality Overall product quality | COM and COA has a *positive* impact on assembly quality, part quality, manufacturing quality, and overall quality |

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| **Hui and Zhou (2003)** | 192 undergraduate students | Electronic products | Well-known brands | (In)congruence between CBO and COM – Independent variable | Brand equity (-) | Product beliefs<br>Attitudes for brands | Congruence between CBO and COM has *no effect* on product beliefs and brand attitude<br>Incongruence between CBO and COM has a *negative impact* on product beliefs and brand attitude and this effect is *stronger* for low equity brand than high equity brand. |
| **Thakor and Lavack (2003)** | 125 undergraduate students | Motorcycles and stereo systems | Well-known brands | COM (country of component source) - Independent variable | | Product Quality | COM has *no effect* on product quality |
| **Gürhan-Canli and Maheswaran (2000b)** | Study 1: 125 students<br>Study 2: 101 students | New electronic products | Fictitious corporation and brand names | COM (name of the countries) – Independent variable | Information type: condensed, dispersed, or no-information<br>Processing goal | Cognitive responses<br>Product evaluations and beliefs | COM has a significant *positive* effect on product evaluations under low motivation, or when the processing goal is to evaluate COM. Under such conditions, relevant evidence about the COM provided by dispersed information is likely to affect product evaluation. |
| **Kim and Thorndike Pysarchik (2000)** | 281 US students | Cameras and sweaters | Well-known brands | COM (name of the countries) – Independent variable | | Product quality | COM has *no effect* on product quality |
| **Knight (1999)** | 87 US students | Microwave ovens and dishes | Well-known brands | COM (name of the countries) – Independent variable | | Purchase preferences<br>Willingness to pay | COM has a *stronger impact* on purchase preferences than COB<br>COM has a *positive* impact on in the cases of the COM and COB fit |
| **Okechuku and Onyemah (1999)** | 1721 Nigerian consumers | Cars and televisions | Well-known brand name | COM (name of countries)- Independent variable | | Consumer preference<br>Purchase intention | COM has the *strongest positive* effect on consumer preference and purchase intention in comparison with the brand name, price, reliability, and safety |
| **Ulgado and Lee (1998)** | 361 US students | TV set and t-shirts | No brand name mentioned | COM (name of the countries) – Independent variable | Product attribute information (-) | Product evaluations<br>Purchase intention | COM had a *positive* impact on product evaluations and purchase intention<br>When product attribute information is available, COM has *no impact* on purchase intention |
| **Lee and Ulgado (1996)** | 93 US students | TV and athletic shoes | Well-known brands | COM (name of the countries) – Independent variable | | Brand evaluation | COM has *no effect* on brand evaluation |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Elliott and Cameron (1994)** | 401 Australian consumers in a field survey | Computers, cars, tires, dishwashers, shoes, and jam | No brand name mentioned | COM (name of the countries) – Independent variable | | Product quality<br>Product preferences | COM has a *positive* impact on perceived product quality and product preferences |
| **Usunier (1994)** | 442 French consumers | VCR and microwave ovens | Well-known brands | COM (name of the countries) – Independent variable | | | Social status has *no effect* on COM image |
| **Maheswaran (1994)** | Study 1: 119 students<br>Study 2: 135 students<br>Study 3: 60 students | New personal computer<br>A stereo system | No brand name mentioned | COM (name of the countries) – Independent variable | Consumer expertise<br>Attribute strength | Product evaluation | When attribute information is unambiguous, COM has positive effect on product evaluation for novices while no significant impact for experts<br>Experts use COM to selectively process and recall attribute information while novices used it to differentially interpret attribute information. |
| **Du Preez, Diamantopoulos and Schlegelmilch (1994)** | 73 French consumers, 63 Korean consumers, and 140 Spanish consumers | Cars – focusing on eco-friendly attributes | No brand name mentioned | Relative importance of COM | | Purchase intent | A considerably higher proportion of Korean respondents attach importance to COM than do European respondents.<br>Much greater preference for green attributes in the Korean sample than those of the other countries |
| **Ulgado and Lee (1993)** | 188 students | TV and athletic shoes | Well-known brands | COM (name of the countries) – Independent variable | | Product evaluation | COM has a *positive* impact on product evaluation |
| **Hong and Wyer (1989)** | 128 students | A personal computer (PC) and a video cassette recorder (VCR) | No brand name mentioned | COM (name of the countries) – Independent variable | | Overall product evaluation<br>Recall of information<br>Attribute ratings | COM has a *positive* impact on consumers' interest in the product and consequently leads them to think more extensively about product information and its evaluative implications. |
| **White and Cundiff (1978)** | 480 industrial buyers in a field survey | Industrial lift truck, a metal working machine tool, and a dictation system | No brand name mentioned | COM (name of the countries) – Independent variable | | Perceived product quality | COM has a *positive* impact on perceived product quality |

On the first research stream, the last decade has witnessed a growing number of criticisms proclaiming the irrelevant role of COM in the international marketing literature (Nebenzahl, Jaffe and Lampert, 1997, Peterson and Jolibert, 1995, Pharr, 2005, Phau and Chao, 2008, Samiee, 2010, Samiee, Shimp and Sharma, 2005). Empirical evidence has shown that consumers do not often care about "*Made-in*" label on products (Samiee, 1994, Thakor and Katsanis, 1997), thus COM no longer affects consumers' product beliefs and purchase likelihood (Hustvedt et al., 2013, Kim and Thorndike Pysarchik, 2000, Lee and Ulgado, 1996).

The essence of the criticism is that COM can vary over time as global firms have increasingly manufactured its products in various locations, moved their production facilities from one country to another to leverage cost advantages (e.g., cheaper labour and material costs or lower tax rates), or decided to use international outsourcing and delocalization (Hamzaoui and Merunka, 2006). As a result, COM could be associated with multiple country affiliations, providing a weaker association with and a limited meaning to the product/brand evaluation (Hamzaoui-Essoussi et al., 2011). Notably, Usunier (2011) argues as marketers often put more emphasis on brand names in their advertisements, when clearly displayed, BO performs better in activating origin recognition than COM. As a result, consumers largely rely on BO to evaluate a product and do not necessarily try to find a "*Made-in*" label. As a good example, even when Toyota and Honda have attempted to "naturalized" status in the US by emphasizing the COM image of their US factories, consumers still consider them as Japanese cars, their "default" origin (Hamzaoui-Essoussi et al., 2011). In short, it seems that COM becomes less relevant the BO in the consumer purchase process.

Conversely, the second research stream asserts that COM acts an important signal of product quality and brand image (Insch and McBride, 2004, Thakor and Lavack, 2003), and also

influences perceived value (Sim Ong et al., 2010), product preferences (Hui and Zhou, 2003), purchase intention (Diamantopoulos et al., 2011), willingness to pay (Hustvedt et al., 2013), and actual purchase (Hsieh et al., 2004). In general, prior studies in this research stream have revealed that COM is a more diagnostic cue to evaluate products than BO, especially for unfamiliar brands (Tse and Lee, 1993), technically complex products (Wall, Liefeld and Heslop, 1991), and new brand extensions (Allman et al., 2016). The COM effects on product evaluation and purchase likelihood could be explained by the country's economic, technological and industrialized level, signalling its general or product-specific manufacturing expertise and competencies (Wu and Fu, 2007). As a result, despite general tendency to favour domestic products, consumers still rate products manufactured in industrialized countries to have better quality than those from emerging markets (Thakor and Katsanis, 1997). For example, companies leverage the favourable image of European countries among U.S. consumers by emphasizing favourable COM cue (Made in Europe) in their promotional campaigns (e.g., Mercedes-Benz C-Class made in Germany). Given the strong effects of consumer animosity on consumer responses to hybrid products, multinational enterprises have put an emphasis on multiple country affiliations (especially favourable COMs) for different product attributes to minimize these effects (Funk et al., 2010, Riefler and Diamantopoulos, 2007).

Furthermore, empirical evidence has revealed that many consumers either do not know/remember BO of a specific product (even well-known brands) or do not take it into consideration in their purchase decisions (Balabanis and Diamantopoulos, 2011, Liefeld, 2004, Samiee et al., 2005). In absence of BO knowledge, consumers need other forms of origin (i.e., factual information about COM) for making choices between alternatives (Usunier, 2011). Thus, we contend that consumers' responses to new products (i.e., eco-innovation) would be expected to be influenced – either directly or indirectly – by the COM consideration. Specifically, COM not

only acts as an important cue for product evaluation but also a key criterion in their purchase decisions, especially when BO familiarity/knowledge is absent (i.e., for unfamiliar brands or really new products).

**Ecological COM**

In the context of eco-innovation introduction, eco-friendly attributes, as defining components, are regarded as "credence" qualities which could not be identifiable and evaluable easily prior to purchase (Nelson, 1970). As average consumers have neither technical expertise/knowledge nor strong needs to perform the costly inspection to evaluate PECO (Darby and Karni, 1973), they tend to use other extrinsic cues (e.g., COM) to assess environmental allegations from the COM image and consequently make an inference about PECO (Manrai et al., 1997). Despite the diverse and extant conceptualizations and associated measurement scales of COM (Zeugner-Roth and Diamantopoulos, 2010), very few studies explicitly take environmentally related dimensions of COM image into consideration (Dekhili and Achabou, 2015). While the growing evidence strongly suggests that consumers respond more positively new products from the countries with positive sustainable reputation (Cheah et al., 2016, Funk et al., 2010, Hsu et al., 2017, Koschate-Fischer et al., 2012). This gap leaves researchers with a little guidance on how to best conceptualize and operationalize ecological COO/COM in empirical efforts (Chan, 2000, Pugh and Fletcher, 2002). The increasing ecological awareness of consumers worldwide and internationalization of eco-firms highlight the urgency of giving a higher research priority to the relevant role of COM in forming consumers' perceptions and intention to adopt eco-innovative products.

Although there is a consensus about the COM image-product evaluation link for both exist existing and new products in the market, the specific aspect (i.e. the ecological dimension) of COM and its respective influences on consumer responses to eco-innovations warrant more exploration

(Dekhili and Achabou, 2015). First, the effects of overall/generalized COM might be different from those of domain-specific COM as consumers tend to associate a country with specific domains (Hamzaoui Essoussi and Merunka, 2007). Moreover, even when the overall country image is negative, consumers might have a positive domain-specific image of COM, which could then be transferred to new products associated with the same country (Agarwal and Sikri, 1996, Coskun and Burnaz, 2016, Heslop, Lu and Cray, 2008). Thus, it is important to further investigate into the domain-specific dimension of COM image (i.e., sustainability development) and its interaction effects with PECO on consumer responses to eco-innovation.

In accordance with more recent conceptualizations of the logical connection (fit) or the perceptual distance between a country and a product (Roth and Romeo, 1992), we therefore adopt a more domain-specific approach of the COM image, suggested by Nebenzahl, Jaffe and Usunier (2003) and Papadopoulos and Heslop (2003) to focus on a specific dimension (i.e., the sustainable reputation or ecological image) of the country. In this sense, the ecological image of a country refers to *the extent to which consumers perceive the country's sensitivity to environmental problems through its history in sustainable development, legislation, and current actions to protect the earth* (Dekhili and Achabou, 2015). The objective of our study is to explore how individuals cognitively process their internally organized and categorized concepts about ecological product-country associations (i.e., ECOM - PECO) in the case of eco-innovation launch in the market. In other words, our research model employs the concept "*ecological COM*", which is considered to be better suited than other general (non-product related) information of a country in examining consumers' responses at the specific product level (i.e., eco-innovative product category) (O'Shaughnessy and O'Shaughnessy, 2000).

### *3.2.2. Consumer-related variables*

#### *3.2.2.1. Eco-friendly consumer innovativeness*

The consumer innovativeness (CI) concept was first introduced in the early 1970s by Rogers and Shoemaker (1971) as "the degree to which an individual is relatively early in adopting an innovation than other members of his system." This definition, which focuses on the actual time of adoption, has initiated a lasting debate on the conceptualization and measurement of CI in the marketing field (Midgley and Dowling, 1978). Since its introduction, CI has become an important concept in innovation and marketing communications research (Goldsmith, Freiden and Eastman, 1995, Heidenreich and Kraemer, 2016).

During the early phases of CI's conceptual development, it was regarded as actual adoption behaviour within a particular product category or across several categories (Summers, 1972, Venkatraman and Price, 1990). In the late 1970s, the academic and intellectual debate was extended to focus on conceptualizing and operationalizing CI at a higher level of abstraction. Specifically, several researchers developed a cross-sectional measurement of CI, which offers a deeper and more abstract understanding of CI as a cognitive style (Kirton, 1976) and as an individual personality trait (e.g., innate innovativeness [see Midgley and Dowling (1978)] or inherent innovativeness [see Hirschman (1980)]).

Since the 1990s, rationalizing the CI concept in a specific domain has become more attractive to marketing researchers, providing a pragmatic approach for the vast majority of academic research to focus on (Goldsmith and Hofacker, 1991). Over the last decade, CI has continued to garner significant attention (Bartels and Reinders, 2011, Heidenreich et al., 2017, Vandecasteele and Geuens, 2010). Specifically, the past decade has witnessed the development of the CI conceptualization at three different levels of abstraction: general personality trait innovativeness, domain-specific innovativeness, and actualized innovativeness. These diverse classifications and operationalizations of CI (see Figure

3) aggravate the findings' comparability and generalizability as well as prevent cumulative knowledge development and disciplinary maturity.

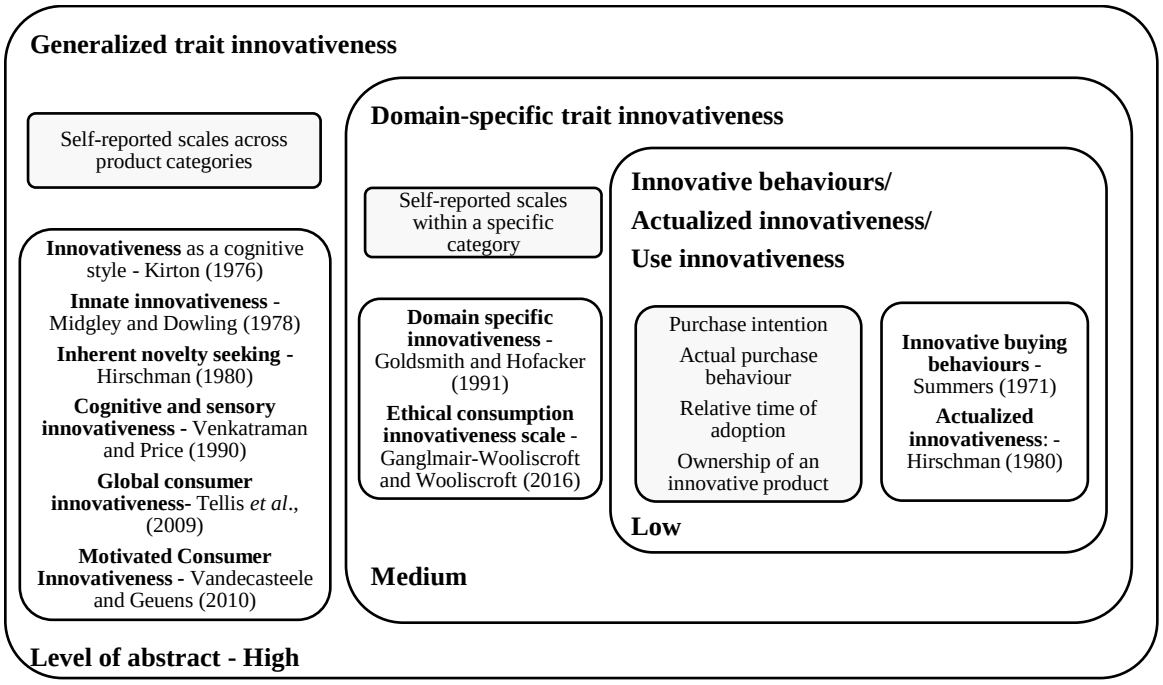


**Figure 3** Conceptualizations of consumer innovativeness used within the marketing field

In several pivotal publications, researchers have argued that the intermediate level of abstraction of CI (i.e., DSI) is more effective in predicting innovation adoption behaviours than global innovativeness, which represents as high level of abstraction (e.g., Goldsmith et al., 1995, Hoffmann and Soyez, 2010, Klink and Athaide, 2010). The first DSI scale proposed by Goldsmith and Hofacker (1991) has been empirically tested and shows good validity, favourable psychometric properties, and a high correlation with actual adoption behaviours across various settings (Goldsmith et al., 1995, Roehrich, 2004). Furthermore, Bartels and Reinders (2011) posit that DSI is the most popular approach to measuring CI in the existing literature. Following prior work, we focus on DSI in the specific domain of eco-innovative products (i.e. ECI) and investigate its impact on consumers' perceptions and adoption behaviours.

Inspired by Goldsmith and Hofacker (1991), we thus define ECI as *the consumer's tendency to be knowledgeable about and adopt innovative products and services that are beneficial to the natural environment*. In other words, ECI is nested within the DSI concept with respect to the sustainable innovation product category. We believe that the uptake of eco-innovation—that is, when consumers pay more attention to environmental aspects of an innovation, overlook the perceived trade-offs between eco-friendly benefits and product effectiveness, and ultimately adopt eco-innovative offerings—is a sign of ECI in the context of sustainable innovation consumption.

To develop our ECI scale, we modified the original DSI scale of Goldsmith and Hofacker (1991) and the ethical consumption innovativeness scale of Ganglmair-Wooliscroft and Wooliscroft (2016) in the context of eco-innovation. To ensure conceptual compatibility and meaningful equivalence, we invited two experienced marketing scholars and eight doctoral candidates (37.50% men, $M_{age}$ = 30.05, SD = 4.66) to review our scale by evaluating the representation of each item based on our definition of ECI on a five-point Likert scale (1 = "does not fit at all"; 5 = "good fit"). Based on data analysis from this pretest, we finalized the structure and the content of the ECI scale with a five-item self-reported scale to measure ECI within the specific domain of environmental interests ($M_{\text{Fit score}} \geq 3$), while eliminating the item "I will buy a new [product name] even if I have not heard of it before" due to its low fit ($M_{\text{Fit score}} < 3$) (see Table 3).

**Table 3** The original DSI and ECI and the modified scale of eco-friendly consumer innovativeness

| **Domain-specific innovativeness (DSI)** Goldsmith and Hofacker (1991) and Goldsmith et al. (1995) | **Ethical consumption innovativeness (ETCI)** Ganglmair-Wooliscroft and Wooliscroft (2016) | **Eco-friendly consumer innovativeness (ECI)** The current study |
|---|---|---|
| 1. In general, I am among the last in my circle of friends to buy a new [product name] when it appears. (**r**)<br>2. If I heard that a new [product name] was available in the store, I would be interested enough to buy it.<br>3. Compared to my friends, I own a few [product name]. (**r**)<br>4. In general, I am the last in my circle of friends to know the names/ information of the latest [product name]. (**r**)<br>5. I will buy a new [product name] even if I have not heard of it before<br>6. I know the names of new [product name] before other people do. | 1. In general, I am among the first in my circle of friends to undertake an ethical consumption behavior.<br>2. If I hear about a new ethical consumption issue, I am interested to find out more.<br>3. Compared to my friends, I make a lot of consumption choices on an ethical basis.<br>4. In general, I am the first in my circle of friends to know about ethical consumption issues.<br>5. I know about ethical consumption issues before other people do. | 1. In general, I am among the first in my circle of friends to adopt eco-innovative products.<br>2. If I hear about new ideas/ products on environmental issues, I am interested to find out more.<br>3. Compared to my friends, I make a lot of consumption choices that are good for the environment.<br>4. In general, I am the first in my circle of friends to know about eco-friendly consumption issues.<br>5. I know about environmental issues before other people do. |

*3.2.2.2. Consumer perceptions of trade-offs between eco-friendly attributes and product performance*

The Diffusion of Innovation Theory suggests that consumers are likely to adopt an innovation that offers superior characteristics relative to the current alternative, which allows faster and more widespread adoption in the market (Rogers, 2003). Although this proposition has been extensively supported in innovation research across a variety of contexts (Im et al., 2003, Ostlund, 1974, Venkatesh et al., 2003), the theory neglects the impact of negatively correlated attributes in new product designs, particularly eco-innovations, where innovative attributes are either compromises or complementary to eco-friendly benefits. Therefore, in this study, we adopt the multi-attribute utility models proposed by Newman (1977) for eco-innovative product designs, where innovative and eco-friendly attributes are either positively or negatively correlated. Following this theory, prior work (e.g., Luchs et al., 2012, Olson, 2013) has posited that average consumers prefer eco-friendly attributes when there are no trade-offs but select less eco-friendly "compromise" products when

trade-offs exist. Under these conditions, attribute trade-offs can make a difference in their psychological and behavioural responses to the new offerings.

As consumers become increasingly concerned about ethical issues, and environmental problems in particular, they are paying more attention to eco-friendly attributes in their purchase decisions (Giebelhausen et al., 2016, Luchs et al., 2010). Nonetheless, prior work offers considerable evidence that consumers do not actually buy eco-friendly products even though they might be environmentally mindful (Carrington et al., 2014). This intention–behaviour gap can be partially explained by a lack of cognitive dissonance resulting from the trade-offs one must make between product attributes and eco-friendly benefits in product designs (Olson, 2013).

### 3.3. Summary

The main purpose of this chapter is to provide a critical analysis of relevant previous studies on the conceptualization of the main constructs in the existing literature to develop a strong theoretical foundation for this study. The author summarized and discussed key conclusions of prior work on the crucial roles of key product-related variables and consumer-related factors in the eco-innovation diffusion process. Next, Chapter Four developed the specific hypothesized relationships among these variables in the conceptual framework in the five studies.

# CHAPTER FOUR

# RESEARCH HYPOTHESES

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## 4.1. Study 1: Effects of the trade-offs between innovative features and eco-friendly benefits on consumer responses to eco-innovation

In this study, we differentiate the main effect of the manipulated trade-offs between trade-offs between innovative attributes and eco-friendly benefits in eco-innovative product designs (i.e., *object* attribute trade-offs) and the moderating effects of consumers' general belief about trade-offs between eco-friendly attributes and overall product performance (i.e., *subjective* attribute trade-offs). We define perceived eco-friendly product innovativeness as *the degree to which a person infers that the inclusion of eco-friendliness in a product design influences the overall effectiveness of the product* (Lin and Chang, 2012).

When it is impossible to "have it all" in on product offering, consumers might select a compromise alternative with average scores on all product attributes to avoid the poor scores on specific attributes, which happens commonly in the cases of most eco-friendly products (Newman, 1977, Olson, 2013). However, based on the regulatory focus theory, Luchs et al. (2012) argue that consumers would choose the product with superior sustainability if a satisfactory threshold level of functional performance is achieved. Consumer choice between a product with superior functional performance and one with superior sustainability features is mediated by consumers' feelings of distress, guilt, and confidence (Luchs et al., 2012). In line with prior work, in the case of eco-innovations, we expect that when there are no trade-offs between innovative features and eco-friendly benefits, consumers are more likely to choose eco-innovative products. On the contrary, consumers might be reluctant to adopt eco-innovations when innovative and eco-friendly features are developed as separate and conflicting product attributes.

***H1.*** Consumers have (*a*) stronger product preferences, (*b*) stronger adoption intention, and (*c*) higher willingness to pay for eco-innovative products when they perceive *no trade-offs* between innovative attributes and eco-friendly benefits than when perceive the trade-offs.

We also predict that the higher levels of product effectiveness that consumers infer about eco-friendly products in general, the less they are concerned about trade-offs in eco-innovative product designs and ultimately respond more positively to such offerings. In other words, when consumers believe the products are less effective if eco-friendly attributes are included, they pay more attention to attribute trade-offs in the eco-innovative product design. This, in turn, reduces the likelihood of adopting the eco-innovation as well as new product usage as a result of the perceived low level of eco-friendly product effectiveness (Lin and Chang, 2012, Olson, 2013).

In accordance with these propositions, we propose that perceived eco-friendly product effectiveness negatively moderates the impact of trade-offs between eco-friendly and innovative attributes on consumer responses. That is, the more (vs. less) effective consumers consider eco-friendly products in general to be, the weaker (vs. stronger) is the impact of the trade-offs between eco-friendly and innovative attributes on consumer product preferences. In other words, when consumers perceive high (vs. low) levels of effectiveness of general eco-friendly products, they tend to be less (vs. more) concerned about the trade-offs between eco-friendly and innovative attributes, thus leading to a higher (vs. lower) product preferences. Formally, we offer the following hypotheses:

***H2.*** Perceived eco-friendly product effectiveness *negatively* moderates the relationships between the attribute trade-offs (between innovative features and eco-friendly benefits) and consumers' product preferences, such that the relationship is *weaker* when consumers perceive *higher* eco-friendly product effectiveness and *stronger* when they perceive *lower* eco-friendly product effectiveness.

### 4.2. Study 2: Effects of types of eco-friendly attributes in eco-innovative product designs on consumer responses to eco-innovation

Our main hypothesis is that consumers might respond differently to different types of eco-friendly attributes, as consumers tend to form categorizations, evaluations, and expectations of eco-innovation based on prior product knowledge and experience (Moreau, Lehmann and Markman, 2001a, Moreau, Markman and Lehmann, 2001b). We base our main hypothesis on categorization theories (i.e., the categorization-based knowledge transfer for new products and the fuzzy set theory). The categorization theory postulates that "individuals naturally categorize and spontaneously name objects" according to the richness (number of attributes) and distinctiveness (differentiating attributes) of product categories (Sujan and Dekleva, 1987, p. 372). In the case of really new products, Moreau et al. (2001b) argue that consumers face the challenge of using cues from multiple categories to understand the innovation and develop their new product expectations and preference. As a result, consumers are likely to categorize a new product into the category that is first cued, and then use this category label to make inferences about the product and purchase decisions.

Other researchers have adopted the "fuzzy set" theory to investigate product categories as sets without clear boundaries that separate category members from non-members (e.g., Ahmad and Richard, 2014, Viswanathan and Childers, 1999). In a fuzzy set, the category membership of a product depends on the degree to which it possesses a particular attribute or a set of attributes. Drawing on this theory, Viswanathan and Childers (1999) suggest that consumers evaluate the gradedness of category membership at the level of individual attributes, which are then combined to reach overall measures of category membership gradedness for a whole product. Applying these theories in the context of eco-innovation, in which both innovative and eco-friendly attributes are included in a new product design, we focus on the distinctiveness aspect of the categorization approach, in which knowledge is transferred

from multiple categories (innovativeness and eco-friendliness) to formulate a new representation of an eco-innovation and form their expectations and preferences.

In the sustainability literature, numerous studies have provided a deeper understanding of consumer psychology with a focus on both mitigating negative impacts of consumption and creating/promoting pro-environmental values and behaviours across a wide range of product/service categories and national markets (Iyer and Reczek, 2017). Specifically, eco-friendly attributes can affect consumers' overall brand attitudes and evaluations (e.g., Bodur et al., 2016, Olsen et al., 2014), purchase intention (e.g., Alwitt and Pitts, 1996, Gleim et al., 2013, Gonçalves et al., 2016, Hartmann and Apaolaza-Ibáñez, 2012, Karmarkar and Bollinger, 2015, Newman et al., 2014, Peyer et al., 2017, Wu et al., 2015, Yang et al., 2015), willingness to pay (e.g., Haws et al., 2014, Irwin and Spira, 1997, Kazeminia et al., 2016), product preferences (Cornelissen et al., 2008, Griskevicius et al., 2010, Han et al., 2017, Peloza, White and Shang, 2013b, Zhang et al., 2011), satisfaction (e.g., Giebelhausen et al., 2016), and adoption intention (e.g., Moon et al., 2016).

Our extensive review of the current literature reveals mixed and contradictory results, triggering an ongoing debate about the mechanism underlying the impact of eco-friendly product attributes on consumer responses. The current major streams of sustainability research directly identify specific boundary conditions under which the inclusion of eco-friendly attributes can either enhance or diminish consumers' product evaluation and behavioural intention, such as *attribute strength* (Luchs et al., 2010), *attribute centrality* (Gershoff and Frels, 2014), or *firm intentionality* (Newman et al., 2014). However, prior studies in these research streams have examined specific types of eco-friendly attributes in conventional products in a separate manner (see Appendix A). Thus, it remains unknown whether consumers respond differently to different eco-friendly attribute types incorporated in innovative product designs.

We extend this research stream by exploring which types of eco-friendly benefits integrated in new product designs should be emphasized to encourage consumers to adopt eco-innovation across the consumption contexts. We contend that categorization-based transfer, triggered by offering consumers different eco-friendly attributes in eco-innovation, leads to different products' category membership (i.e., types of eco-innovations). Depending on purchase situations and product knowledge, consumers may assign different weights to different types of new eco-friendly attributes (Moreau et al., 2001a). Once the categorization and evaluation process of the eco-innovation's category membership gradedness occurs, consumers then use the cues and assign weight of the respective category to make inductive inferences about product quality. These inferences influence consumers' preferences, adoption intention, and willingness to pay for eco-innovations. Thus, we put forward the following hypotheses:

***H3***. Different types of eco-friendly attributes (i.e., resource use reduction, elimination, and substitution features) yield significant differences in consumers' *(a)* product quality perceptions, *(b)* preferences, *(c)* adoption intentions, and *(d)* willingness to pay with respect to eco-innovative product designs.

### 4.3. Study 3: Effects of eco-friendly consumer innovativeness on consumer responses across different types of eco-innovation

Based on cognitive identity theory, Grewal, Mehta and Kardes (2004) posit that because social identity facilitates the acceptance of an individual in a social group to which they are emotionally attached, the individual is more likely to adopt an innovation in a specific domain to demonstrate their in-group belongingness. Prior research has revealed the strong predictive power of DSI for consumers' product beliefs and their adoption behaviours across various settings and product categories (Goldsmith, d'Hauteville and Flynn, 1998, Goldsmith et al., 1995, Hofstetter et al., 2013, Mowen,

2004). Yet, until now, neither an empirically nor a theoretically grounded framework has been offered to explain the mechanism underlying the effect of the DSI on consumer responses in the domain of sustainable innovation consumption. We propose that ECI—representing an individual's innovativeness in the specific domain of interest regarding environmental protection and mindfulness—might lead consumers to have positive responses to new sustainable products (Gatignon and Robertson, 1985, Hirschman, 1980).

To further validate the new ECI scale developed in this study, we examine how ECI affects consumers' responses to eco-innovation not only to provide evidence of predictive validity of ECI but also for practical implications. For example, marketers could identify and target specific types of consumers who may be more likely to buy certain eco-innovations with appropriate marketing messages. Accordingly, we propose that because an eco-innovation may help consumers high in ECI express their willingness and desire to try new products with positive environmental attributes, these consumers put more emphasis on the eco-friendly aspects of the innovation. This, in turn, results in higher perceived product eco-friendliness and ultimately stronger adoption intention toward an eco-innovation. In other words, we aim to test both direct and indirect effects of ECI on adoption intention through perceived product eco-friendliness across different types of eco-innovation. Formally, we test the following two hypotheses:

***H4a.*** ECI is positively related to perceived product eco-friendliness.

***H4b.*** Perceived product eco-friendliness mediates the positive effect of ECI on adoption intentions.

In addition, when purchasing eco-friendly products, consumers often face trade-offs between environmental benefits and other important attributes, such as functional performance, aesthetic design, price, and safety (Luchs et al., 2012, Olsen et al., 2014). Such trade-offs can have a negative impact on consumers' perceptions and actual adoption, regardless of their concerns about environmental issues

(Bamberg, 2003, Carrington et al., 2014, Olson, 2013). Therefore, we examine the role of these perceived trade-offs in explaining the effects of ECI on adoption intention. From a managerial perspective, a better understanding of this mechanism will enable marketers to design appropriate marketing messages that target early adopters by focusing on information about perceived trade-offs in eco-innovation product designs.

To the best of our knowledge, no empirical research has not yet explored the moderating effect of the trade-offs between eco-friendly benefits and overall product effectiveness in the context of eco-innovation. First, we argue that consumers' perception of these trade-offs weakens the relationship between perceived product eco-friendliness and adoption intentions. Specifically, when consumers hold stronger (vs. weaker) perceptions of trade-offs, they will be more (vs. less) reluctant to adopt an eco-innovation with higher (vs. lower) perceived product eco-friendliness. Second, drawing on the costly signalling theory, we propose that when high-ECI consumers are aware that environmental benefits of a product may compromise overall product effectiveness, they are more likely to adopt an eco-innovation for the desirable status it signals. Costly signalling theory suggests that consumers will consider engaging in activities that are increasingly costly (in terms of resources, energy, risk, or time) as a way to signal their ability and willingness to incur certain inconveniences for a given cause and to compete for status (Zahavi and Zahavi, 1999). In other words, a person can gain status if he or she is willing and able to sacrifice certain resources for others (Cole and Chaikin, 1990). Applying this theory in the sustainable consumption context, Griskevicius et al. (2012) posit that green marketing efforts should make consumers who engage in self-sacrificing behaviours feel comfortable and easy to be socially visible, thus drawing attention to their status and their sacrifice as a way to encourage the voluntary adoption of more sustainable practices.

Through eco-innovation adoption, high-ECI consumers effectively convey to their peers that they are willing to incur costs (i.e., they will sacrifice product convenience or effectiveness for

environmental benefits), thereby increasing their relative status. ECI enables consumers to overcome past negative experiences with eco-friendly products and motivates them to embrace the trade-offs between eco-friendly benefits and product effectiveness as a means to signal their own inherent innovativeness (Heidenreich, Kraemer and Handrich, 2016). Conversely, low-ECI consumers are not willing (or at least more reluctant) to make trade-offs between eco-friendly benefits and other attributes (e.g., product functionality). Low-ECI consumers may be less susceptible to the benefits of sustainable innovations and more sensitive to trade-offs between eco-friendly benefits and product effectiveness due to an inherent hesitation to take certain risks (Klink and Athaide, 2010). In summary, we expect different moderating roles of perceived trade-offs not only on the relationship between perceived eco-friendliness and adoption intentions but also on the link between ECI and adoption intentions.

***H5a.*** Perceived trade-offs between environmental benefits and product effectiveness *negatively* moderate the positive effect of perceived eco-friendliness on adoption intention.

***H5b.*** Perceived trade-offs between environmental benefits and product effectiveness *positively* moderate the positive effect of ECI on adoption intention.

### 4.4. Study 4: Effects of detachability and importance of eco-friendly attributes: core versus peripheral on consumer responses to eco-innovation

In this study, we investigate an eco-innovation (based on IoT technologies) as a really new innovation, which causes marketing and technological discontinuities at both macro and micro levels (Garcia and Calantone, 2002, Hellström, 2007, Varadarajan, 2015). Innovation researchers (e.g., Ma et al., 2015) highlight that situating really new features in a peripheral (vs. core) locus positively impact consumer adoption intentions. This advantage for the peripheral (vs. core) locus in a really new product design stems from four main aspects. *First*, the detachability of really new features could result in higher schema congruity with base product category knowledge structure as the core product

functionality is not likely to be affected by really new features. *Second*, as really new features are often associated with higher performance risks, placing these features in a peripheral (vs. core) locus could reduce consumers' perception of risks. *Third*, from incongruity resolution, it is easier for consumers to understand and accept really new innovations when it is integrated as peripheral components. *Finally*, the detachability of really new features allows higher perceived usage flexibility with more control for consumers. Therefore, we expect that the detachability of eco-friendly attributes in eco-innovative product designs will significantly influence consumer responses, meaning that placing eco-friendly attributes in a peripheral locus offers an advantage over integrating it into the core. Thus:

> ***H6***. Detachability of eco-friendly attributes in eco-innovative product designs is positively related to (*a)* product quality perceptions, (*b*) preferences, and (*c*) adoption intentions with respect to eco-innovative product designs

We also contend that the effect of locus of eco-friendly attributes on consumer adoption intention will play out differently depending on attribute importance. This is because new eco-friendly features, which are optional and/or detachable from the base innovation, can vary in their importance to a consumer's product evaluation and ultimately product adoption. For example, when consumers make decisions about buying a car, they might consider an auto air filtration system, an optional or detachable component, as one of the most important criteria in their product evaluation. Placing greater importance on detachable (or supplemental and add-on) features may be common in mature product categories in which most of the core features are identical among manufacturers (Gershoff and Frels, 2014). Furthermore, to generalize the findings on detachability of eco-friendly attributes in eco-innovative product designs, it is crucial to distinguish the effect of attribute importance in consumers' evaluations and decisions from the effects of its detachability (its importance in the functioning of the product). In summary, we hypothesize the following:

***H7.*** The effect of attribute detachability and attribute importance will affect independently, rather than interactively, consumers' perceptions of (*a*) overall product quality, (*b*) product preference, and (*c*) intention to adopt the new product.

## 4.5. Study 5: The interactive roles of ecological country-of-manufacture, eco-friendly attributes, and need for cognition

### *4.5.1. Social schema theory and schema-based product evaluation process*

Social schema theory posits that individuals categorize and organize knowledge of a concept in memory-based structures called schemas, including the concept's attributes and relationships among them (Fiske and Taylor, 1991). This theory also suggests that schematic knowledge and structures are continuously updated with new data; hence, the simpler and more organized the attributes become, the more extreme evaluation is based on the fit with the existing schemas (Fiske and Taylor, 2013). The level of fit or balanced relationships between new information and existing schema/categories determines the formation and changes in attitude toward an object (Fiske and Taylor, 2013). Specifically, schema congruity occurs when new information can be easily organized into the existing schemas while schema-incongruence exists due to the difficult integration of new information into existing knowledge structures. Therefore, the level of the schema (in)congruity is determined by the degree of fit (or lack thereof) between product representative (i.e., product attributes) and the activated schema (i.e., a product category or a country) (Meyers-Levy and Tybout, 1989, Peracchio and Tybout, 1996). Drawing on these notions, we argue that social schema theory is an appropriate theory linking product-level and country-level beliefs.

According to Chao (2001), a country schema may be invoked by COM information, which, in turn, elicits consumers' curiosity to form their initial set of perceptual judgments about specific

product attributes associated with that country. In the case of unfamiliar brands or really new products with limited BO information, marketers choose to put more emphasis on country-specific information that is congruent with the desired brand in order to create favourable beliefs and attitudes about the new products (Keller, 1993). For example, considering a favourable country such as Japan for its advanced technologies, a Japanese camera manufacturer promotes its new product on the basis of the latest Japanese technologies and components. This presumably results in stronger and more favourable brand associations as Japan may mean "high innovativeness" to many consumers.

The notion of fit or balance has been extensively investigated in the COO literature to highlight the detrimental impact of incongruence between BO and COM on perceived product quality, consumer attitudes, and purchase decisions (Hamzaoui Essoussi and Merunka, 2007, Hui and Zhou, 2003, Johnson et al., 2016, Knight, 1999). A typical example is a German car manufactured in South Africa, perceived as incongruent, could cause negative consumers' responses. The COO literature has also noted the importance of continuous matching elaboration among BO, COM, and product attributes since each of these elements affects product beliefs and attitude toward a brand with varying strengths (Carvalho et al., 2011, Chao, 1993, Horsky, Nelson and Posavac, 2004, Maheswaran, 1994). COO (including COM), as intangible and extrinsic information, not only exerts a direct influence on product evaluation but also stimulates consumers' interest in assessing tangible and intrinsic product attributes (Hong and Wyer, 1989, Olson and Jacoby, 1972). However, it is questionable if the intangible COM effect overrides the impact of product attributes as tangible cues, especially in the case of unfamiliar brands or really new products.

To the best of our knowledge, there has been no research to date which examines the notion of fit or consistency between ECOM and specific product attributes (i.e., eco-innovative

attributes). More importantly, no study has investigated the (in)congruence in the context of eco-innovation introduction where products are unfamiliar and really new to consumers in the foreign markets. According to Balabanis and Diamantopoulos (2008), where facing an unfamiliar brand or a really new product, consumers attempt to transfer their knowledge about COM to infer or predict product's unknown attributes (e.g., innovativeness, eco-friendliness, or product quality). Consumers may review different information cues independently and then integrate them by deciding how much weight each attribute should be assigned in the product evaluation and purchase process (Hastak and Hong, 1991).

We expect ECOM cues (in terms of a country's sustainability reputation) provide a starting point for managers to elicit higher consumer motivation to evaluate eco-friendly product attributes and ultimate more positive consumer responses to eco-innovations in the globalized marketplace. We examine for which combinations of ECOM and PECO, it is beneficial (vs. detrimental) to communicate the country-related information and eco-friendly product attributes to consumers when launching eco-innovative products across different product categories, national markets, and consumer segments. We contend that beyond just the ECOM effect itself, the connection between the ecological image of a country and product attributes (i.e., eco-innovative features) will influence consumers' perceptions of product quality and their subsequent purchase decisions.

#### *4.5.2. Schema (in)congruence between ecological COM and product eco-friendliness (PECO)*

The fit or consistency between COM image and intrinsic product attributes is determined based on consumers' perception of capacity and competence of a COM in manufacturing a product in a/several specific product category(ies) (Hamzaoui Essoussi and Merunka, 2007). The COO literature has denoted consumers' country preference bias for specific products where some countries are more favourable over others in manufacturing one or several product categories (e.g.,

German cars, French wines, Swiss watches, or Belgium chocolates) (Ulgado and Lee, 1998). In other words, consumers are presumably substantively different in their attitudes towards foreign products based on their product category-country associations (Pappu, Quester and Cooksey, 2006). Such preference bias and pre-existing attitudes toward products/brands from a specific country are derived from either their prior experience with products from the same country or the country's stereotypical image (Jaffe and Nebenzahl, 2001). Several studies have also revealed that perceived reputation or country stereotype of COM could be used as a substitute for a more objective assessment of a product, which, in turn, affects consumers' perceptions and behaviours, even in the absence of intention (Diamantopoulos et al., 2017, Herz and Diamantopoulos, 2013, Papadopoulos and Heslop, 2003).

Following the theory of schema congruity (Mandler, 1982), in this study, schema congruity is defined as an *ecological match* between the schema activated (i.e., a favourable ecological country) and the target product attribute (i.e., an eco-friendly feature). Schema incongruity refers to an *ecological mismatch* where a target attribute (i.e., an eco-friendly feature) is not expected to be a part of the activated schema (i.e., an unfavourable ecological country). Arguably, although schema congruity elicits favourable consumer judgments due to the ease of comprehension and categorization, schema incongruity potentially create tension for a more detailed information processing and even more positive product evaluations (Lee and Schumann, 2004). For example, prior studies (e.g., Meyers-Levy and Tybout, 1989) highlight the incongruity effect in creating more favourable product judgements with higher affective intensity than schema congruity, especially in the case of new product introduction.

Conversely, with another approach, international marketing scholars explain the schema (in)congruity (i.e., between product attributes and COM) from the irradiation perspective, which emphasizes subjective interconnections of consumer evaluations of related objects/properties

(Diamantopoulos et al., 2011). Accordingly, an image of COM could serve as a signal to draw inferences about unobservable attributes (e.g., product quality), which, in turn, affects consumers' purchase decisions. This implies that the strength of eco-friendly product attributes is partly attributable to the ECOM (Maheswaran, 1994). This notion is in line with other international marketing studies (e.g., Hamzaoui Essoussi and Merunka, 2007, Park, Milberg and Lawson, 1991), which posit that positive country associations might be transferred to the product evaluations if the product category is logically related to COM. Therefore, it is expected that the schema congruity could potentially evoke more positive responses to eco-innovation if these new products are manufactured in a favourable ecological country. When ECOM cues are presented along with intrinsic product attributes in a congruent way (e.g., an electronic car made in Germany), consumers would evaluate the new product with higher PECO from their knowledge about German cars and its sustainable reputation. Conversely, consumers might avoid the eco-innovative offerings with the incongruity between ECOM and PECO (e.g., an electronic car made in South Africa).

Such inconclusive findings in the current COM literature lead us to evaluate the relationship between schema (in)congruence and consumer responses to identify its conditioning factors in the sustainable innovation domain. Specifically, we focus on examining the moderating roles of certain key situational factors, namely product types (publicly vs. privately consumed products), market types (emerging vs. developed markets), as well as consumer trait (i.e., NFC).

#### *4.5.3. Moderating effect of product categories (publicly consumed vs. privately consumed)*

In line with previous research (Hamzaoui Essoussi and Merunka, 2007, Moldovan, Steinhart and Ofen, 2015, Weaver et al., 2015), we define publicly consumed products are those that are highly visible and known to other people rather than only the owner on a daily basis (e.g.,

cars, smartphones). On the contrary, privately consumed products are those that could be hidden from public views and only known or seen by the owner in everyday situations (e.g., TVs, vacuum cleaners, pyjamas). The categorization of individual products into these two types of products depends on the degree to which their consumption process is socially visible to other people (Kulviwat, Bruner and Al-Shuridah, 2009).

The literature suggests that observability of product consumption (public vs. private) could mitigate the effects of the (in)congruence between ECOM and PECO on consumer responses through three routes. *First*, consumers are under higher pressure when making decisions to buy publicly consumed products due to a higher need for enhancing their symbols of individuality or social identity and in-group conformity (Batra, Homer and Kahle, 2001, Bourne, 1957). The congruence between intrinsic (i.e., eco-friendly attributes) and extrinsic (i.e., ECOM) product information reduce consumer tension in buying publicly consumed products by facilitating the information processing and easing the communication of desired public appearance to other people (Hamzaoui Essoussi and Merunka, 2007).

*Second*, when a product is consumed or used in the presence of others (it is publicly consumed), it is associated with social cues for signalling status (Griskevicius et al., 2010) and consequently higher levels of social risk (Solomon, 1996). Thus, consumers are more sensitive to their self-image when purchasing and using socially visible products in daily situations, resulting in a greater effect of the congruence on product evaluations than privately consumed products (Graeff, 1996).

*Third*, consumers could learn about publicly consumed products through observation and simply buy these products to conform with others under certain conditions (Schmidt and Spreng, 1996) whereas they acquire knowledge about privately consumed products from external sources (e.g., magazines, newspapers) or word-of-mouth from their community network (Moldovan et al.,

2015). Hence, we contend that the congruence between ECOM and PECO of an eco-innovation consumed in public places enables consumers to evaluate this new product via observation in an easy and transparent manner. In contrast, for eco-innovative products consumed in a private setting, consumers' product experience is more subjective and more influence by extreme positive or negative ratings (i.e., incongruent product information) (You, Vadakkepatt and Joshi, 2015). In short, we expect the congruence between ECOM and PECO elicits higher perceived product quality and increases purchase likelihood for publicly consumed products than privately consumed products. Formally:

***H8***. Congruence between ECOM and PECO triggers (*a*) higher product quality and (*b*) stronger purchase intention for publicly consumed products than for privately consumed products.

#### *4.5.4. Moderating effect of national contexts (emerging vs. developed)*

Prior work suggests that cultural dimensions exert a significant influence on a wide range of consumer responses such as self-concepts, product beliefs, attitudes, purchase intention, brand choice, consumption symbols (e.g., Aaker, Benet-Martinez and Garolera, 2001, De Mooij, 2015, Markus and Kitayama, 1991). However, only a few studies have examined whether the effects of the (in)congruence among product information cues (intrinsic and extrinsic) on consumer responses vary across countries and/or cultures. For examples, Gürhan-Canli and Maheswaran (2000a) compare among Japanese and U.S. consumers' product evaluation when products were described in terms of their COM cue and product attributes. The results indicate that there are cultural variations in the way consumers process product-related information. However, these studies focus on comparing consumers' product evaluations across the developed markets. In emerging markets, when consumers are often unfamiliar with product attributes and benefits (Batra, 1997) and the product information is less available or less reliable (Erdem, Swait and Valenzuela, 2006) associated with unbranded product

competition (Sheth, 2011), they may believe that products made in developed markets have superior quality than their domestic products (Wang and Yang, 2008). Nevertheless, when both intrinsic (i.e., product attributes) and extrinsic (i.e., COM) product information are available, it could result in the schema (in)congruence in the information processing and more difficulties in the buying decision-making process. Therefore, it is questionable whether and how consumers in such markets infer product quality and make their purchase decisions when the schema (in)congruence occurs, especially in the cases of really new products.

We expect that the effects of the (in)congruence between ECOM and PECO are moderated by national contexts due to their significant differences in terms of consumers' prior experience, market conditions, and cultural dimensions of emerging and developed countries. *First*, as unbranded products and services have accounted for nearly 60% of consumption in emerging markets, many consumers in these markets may not have much experience with world-class-quality products (Sheth, 2011). Therefore, in emerging markets, consumers make inferences about product quality and their purchase decisions based on the COO/COM image (the halo effect) while making abstraction of product-related cues into the country image (the summary effect) (Sharma, 2011). On the other hand, consumers in the developed markets (e.g., the UK or the USA) may be familiar with branded and high-quality products, thus they might want to focus on a broader range of attributes and exploit higher perceived fit of product attributes and COM (Story, 2005). Therefore, we expect that the incongruence between ECOM and PECO creates more difficulties for consumers in emerging countries to infer product quality and make purchase decisions than those in mature markets.

*Second*, regarding cultural dimensions, uncertainty avoidance and power distance are most clearly related to the schema (in)congruence effects on consumer responses to eco-innovation. Consumers from emerging countries with high-uncertainty-avoidance and high-power-distance

cultures are less willing to take risks, less tolerant to ambiguity while being more hierarchic in their interpersonal relationships and decision-making process (Hofstede, 2001). As a result, consumers in these markets tend to be reluctant to buy new products when they perceive the incongruence among product-related cues (i.e., ECOM and PECO). Furthermore, buying and consuming high-tech innovations from other countries could be considered as means to show material achievement, communicate desired status, and create a good impression on others in emerging markets (Cleveland, Laroche and Papadopoulos, 2009, Kulviwat et al., 2009). Due to a higher need for the symbolic acquisition and social distinction communication (i.e., prestige and wealth) in vertical relationships between social classes in emerging markets (Hofstede, 2001), making purchase decisions for eco-innovative products could be associated with high levels of social risks (Solomon, 1996). This, in turn, leads to the stronger impact of the schema (in)congruence on consumers' responses to eco-innovation in high-uncertainty-avoidance and high-power-distance cultures than low-uncertainty-avoidance and low-power-distance cultures.

The cultural distinction in terms of collectivism/individualism is a more complex phenomenon in regard to its possible relationship with the distinct influences of schema (in)congruence on consumer responses. Prior studies indicate that consumers in collectivist cultures tend to engage in more information search, assign more value to congruent products that enhance belongingness to the group, and pay more attention to group norms (i.e., interpersonal information or word-of-mouth) than those in individualist cultures (Money, Gilly and Graham, 1998, Song et al., 2018). On the other hand, consumers in individualistic countries have a tendency to search for more variety (Erdem et al., 2006) and less concern about developing social relationships with products as well as others' consumption experiences (Song et al., 2018). This results in a dampening of the incongruence effects for collectivists while these effects are strengthened for individualists. In other words, we expect the role

of congruence effects in enhancing quality perceptions and purchase intention for consumers in collectivist societies is more pronounced than in individualist countries. Thus:

***H9***. Congruence between ECOM and PECO triggers (*a*) higher product quality and (*b*) stronger purchase intention in emerging markets than in developed markets.

### *4.5.5. Moderating effect of need for cognition*

Need for cognition (NFC), as *an individual's tendency to engage in and enjoy effortful and systematic thinking tasks*, has been appeared to be one of the key determinants of personal involvement in the elaborative information processing (Cacioppo and Petty, 1982, Haugtvedt, Petty and Cacioppo, 1992, Smarandescu, Rose and Wedell, 2013, White and Willness, 2009). In the field of advertising research, it has been widely acknowledged that there are significant differences in individuals' motivation to process information across different levels of NFC (Cheema, 2008, Choi, Taylor and Lee, 2017, Inman, Peter and Raghubir, 1997). Specifically, consumers with a high NFC are more likely to evaluate a wider set of product attributes to make their purchase decisions whereas low NFC counterparts put more emphasis on peripheral cues of marketing messages (i.e., source attractiveness or source expertise) (Zhang and Buda, 1999).

In the context of the innovation diffusion, NFC is found to be positively associated with individual innovation behaviours (Hoffmann and Soyez, 2010, Venkatraman and Price, 1990) and variety seeking (Chien-Huang and Hung-Chou, 2012). High NFC consumers are inherently motivated to search for, gather, and analyze new information with a willingness to invest more cognitive resources for information processing than those with low NFC (Cacioppo and Petty, 1982). Specifically, they are intrinsically happy when facing complex and analytical tasks (Haugtvedt et al., 1992). On the other hand, people with low NFC tend to avoid effortful cognitive activities and rely on peripheral cues to minimize the considerable elaboration needed (Cacioppo et al., 1996).

Despite its important role in explaining consumer behaviour, the role of NFC, as a personal tendency of and intrinsic enjoyment derived from engaging in effortful information processing, remained largely unnoticed in the mainstream COO/COM research (Allman et al., 2016). We go beyond the direct impact of the scheme (in)congruity (between ECOM and PECO) to investigate *when* schema (in)congruity triggers more positive consumer responses and *how* schema (in)congruity is successfully resolved with a focus on the moderating role of NFC. Our basic assumption is that high and low NFC individuals would differ not only in the way they process external information but also in the way they deal with schema (in)congruity between new information and their memory-based schemas. Specifically, we believe individual differences in their likelihood to desire and savour effortful cognitive activities could be a fundamental variable determining the effects of congruence between ECOM and PECO on individual responses to eco-innovation. Our reasoning revolves around social psychological theories (i.e., Social judgement theory and Elaboration Likelihood Model) on the role of NFC in consumer perception and attitude formation via four main arguments.

*First*, people high in NFC tend to involve and enjoy complex and uncertain situations, which triggers consumers' curiosity and logical thinking to generate more task-relevant thoughts as well as draw new information from different cues from the environment (Cacioppo et al., 1996). As NFC is a key driver of consumer involvement (derived from the Elaboration Likelihood Model; Petty and Wegener (1998)), it is reasonable to expect that the schema (in)congruence between ECOM and PECO does not "matter" in evaluation and attitude formation for high NFC consumers with high involvement in the detailed information process. This is because high-NFC consumers are believed to scrutinize intrinsic product attributes rather than merely rely on the COM-product attribute congruence for rational product evaluations (Zhang and Buda, 1999).

Conversely, for low NFC individuals, the congruence between message structure and consumers' personal value (i.e., self-construal) are more persuasive and accessible (e.g., Aaker, 2000, Han and Shavitt, 1994, Polyorat, Alden and Alden, 2005). Furthermore, low NFC (i.e., low consumer involvement) in cognitive information processing could result in higher likelihood to reject a new product (i.e., new eco-friendly attributes) that is perceived as incongruent with their the latitude of acceptance (i.e., negative ECOM), as predicted by the social judgment theory (Sherif and Hovland, 1961).

*Second*, in the pursuit of comprehension, people with a high NFC have better capability to connect new and existing schemas in order to obtain new knowledge and solve complex problems, especially in the case of diverse and conflicting information available (Nair and Ramnarayan, 2000). It could be argued that high NFCs are more sensitive to the difficulty of making an accurate judgement and more aware of the asymmetry between their opinions/exiting knowledge and product information, resulting in higher scepticism towards the inaccuracy of their judgment than low NFCs (Hansen, Samuelsen and Sallis, 2013). As a result, high NFCs are better in resolving the schema incongruence within their cognitive schema network, leading more positive responses to eco-innovation in cases of schema incongruence than low NFCs.

*Third*, individuals with a high NFC are more likely to take into consideration more aspects of the problem in a deeper cognitive elaboration process, so that they could understand it thoroughly and generate arguments supporting their opinions (Shestowsky, Wegener and Fabrigar, 1998). High NFCs are motivated to follow the central route to persuasion, involving careful and effortful processing of product-relevant information (Cacioppo, Petty and Feng Kao, 1984). Conversely, low NFC consumers try to avoid cognitively challenging tasks by considering peripheral cues (e.g., contextual information) where fewer efforts are needed (Cacioppo et al., 1996). In other words, low NFC consumers might consider the schema congruence as a peripheral

cue to make their judgement and subsequent purchase decisions. Therefore, it is expected that if an eco-innovation is from a country perceived as eco-friendly, the schema congruence will be more persuasive for low NFC consumers than high NFCs, and consequently more positive attitudinal and conative responses.

*Finally*, after the cognitive elaboration, people with high NFC tend to be more confident and persistent in forming their attitudes and making decisions toward their goals (Cacioppo et al., 1986, Verplanken, 1991). Haugtvedt and Petty (1992) assert that high NFC consumers are reported to be more resistant to the counter-attitudinal impact while being more consistent between intentions and behaviours. In addition, schemas (i.e., ECOM and PECO) are developed not only from consumers' prior experience but also from interactions with new information from external sources (e.g., newspapers, TV, or Internet) to function as a diagnostic cue for consumer decisions (Hansen et al., 2013). Since high NFC consumers intrinsically enjoy such cognitive tasks, we suggest that the diagnosticity of eco-friendly product attributes will be more important whereas the effects of schema congruence will be lower for those with high NFC. Conversely, low NFC individuals are more likely to react more positively if eco-friendly attributes described in product descriptions are highly congruent with consumers' beliefs about ECOM. Therefore, the schema congruence effects should be much more salient for low NFCs than for high NFCs. Therefore, we expect:

> ***H10***. A three-way interaction among NFC, ECOM, and PECO predicts (*a*) consumers' perception of product quality and (*b*) intention to buy eco-innovation, such that low-NFC consumers have higher perceived product quality and stronger purchase intentions when there is the congruence between ECOM and PECO. Among high-NFC consumers, the incongruence between ECOM and PECO triggers more positive responses in terms of product quality and purchase intentions.

### 4.6. Summary

The main objectives of this chapter are to summary and synthesize empirical evidence pertaining to the key product-related variables and consumer-related factors, which have been identified in Chapter Three, to generate research hypotheses in each study. This is considered as a fundamentally theoretical ground to justify the choice of research methodology as well as to structure the experiments and statistical analyses in the next steps. Based on the research questions and practical considerations, Chapter Five includes the detailed descriptions of experimental designs with the specific procedures and techniques to collect and analyse empirical data for each study.

# CHAPTER FIVE

# METHODOLOGY

# CHAPTER FIVE

# METHODOLOGY

## 5.1. Research design

### *5.1.1. Justification for the use of online experiment method*

According to Miller (2005), the experimental approach has been extensively used in consumer behaviour research as a powerful way to examine cause-and-effect relationships with a deliberately narrow focus, and therefore more definite results than other research methods such as observations or surveys. In other words, experimental consumer research has been conducted not only to develop/test a new theory and to exhibit a new phenomenon but more importantly understand the causal process underlying a phenomenon and establish its boundary conditions (Morales, Amir and Lee, 2017). By setting up a direct comparison among various treatments of interests, experiment designs could engender strong confidence in the robustness and trustworthiness of causal findings (Bryman and Bell, 2011).

The primary research objective of this dissertation is to examine how consumers respond to different aspects of eco-innovation product designs across product categories, national markets, and consumer segments. Our main interests, therefore, are to compare and contrast consumers' responses in different conditions (i.e., different levels of each new product design factor) to make strong inferences about the nature of differences in consumer psychological and behavioural responses. To answer three main research questions, this dissertation employed the experimental approach by deliberately manipulating the independent variables (i.e., product-related factors) and then observing the consequential changes in the dependent variables (i.e., consumers' product beliefs, product preferences, adoption intentions, willingness to pay, and estimated consumption levels) while controlling for exogenous variables. With this approach, we hold all other variables constant to make sure any changes in the dependent variables must be caused by manipulations of the independent

variables. Moreover, we employed online experiments as an alternative to lab experiments as they can reach representative consumer samples across national borders (Deutskens et al., 2004) while helping to control for response style bias in cross-national research (Fischer, Völckner and Sattler, 2010). In short, online experimental designs enable the rigorous process of hypothesis testing about various types of consumer responses to eco-innovation and rule out alternative explanations of the underlying mechanisms while controlling extraneous variables across product categories and across national markets.

### *5.1.2. Justification for the choice of the product categories studied*

In all the experiments, automobiles, shoes, connected vacuum cleaners, TV sets, and smartphones were chosen as the product categories studied because they are familiar to our participant population, amenable to the incorporation of eco-friendly attributes, and compatible with a variety of experimental methods. These product categories are also considered as the leading areas of the IoT applications in the recent years (Accenture, 2015, Borgia, 2014, Samsung, 2016). Moreover, eco-friendly attributes have increasingly been found in brand descriptions of many automobile manufacturers (e.g., the Toyota Prius Two Eco), well-known shoe companies (e.g., Adidas X Parley shoes, made from recycled ocean plastic), top home appliance manufacturers (e.g., Samsung Cyclone Force with its ultra-low-power bagless cylinder technology and Samsung QLED TVs with a LED screen being free of mercury, a toxic metal), and innovative smartphone companies (e.g., Fairphone 2, with a 10 out of 10 reparability score).

In addition, these product categories are often characterized by highly innovative product designs and their product lifecycles have been shortened due to rapidly technological changes (Mahadevan, 2015). Finally, purchase decisions for these product categories are characterized by a high level of involvement and rational decision criteria, suggesting a strong need for cognitive information processing with regard to product attributes (Ratchford, 1987). These contexts are likely

to provide relevant and fertile grounds for theoretical research as well as practical managerial implications.

Because IoT-based products are designed as *dynamic service platforms* with high flexibility and heterogeneity in consumption, there are more opportunities to differentiate these products, moving competition away from price alone (Ng et al., 2015). In this sense, it can be argued that the price component is no longer the most substantial hindrance to adopting several types of IoT-enabled products. Indeed, according to Accenture (2015), consumers are more likely to pay more for smart in-house devices that offer safety (e.g., a smart smoke alarm, a smart security system) or novelty (e.g., smart cars, smart shoes).

Instead of actual selling prices, we focused on consumers' willingness to pay (WTP), defined as the minimum price at which or below the consumer will purchase the new product, as an important construction of price response functions (Völckner, 2008) to provide guidance for implementing suitable pricing instruments for eco-innovative products. To avoid a potentially biasing impact of pricing information on respondents' answers for WTP, we did not present actual selling prices or signal price differential across conditions in our experiments. Finally, to control for the effects of brand name, we used fictitious brand names for all the products in all the conditions.

### 5.2. Study 1: Trade-offs between innovative features and eco-friendly benefits

The purpose of Study 1 is to explore whether the introduction of eco-innovation with two differing attribute trade-off contrasts influences global evaluations of innovativeness and eco-friendliness of the products, and ultimately impacts consumers' product preferences, adoption intention and willingness to pay (**H1a-H1c**). We also examine the moderating role of perceived eco-friendly product effectiveness on the relationship between attribute trade-offs and consumers preferences (**H2**). To accomplish this objective, we used three product categories: cars, shoes, and

smartphones. We propose that two differing trade-off contrasts significantly impact consumers' perceptions, preferences, adoption intention, and willingness to pay.

***Stimuli – Pre-test***

We randomly assigned 60 consumers from different countries (56.70% men; $M_{age}$ = 43.9, SD = 12.74) who were members of an online forum to one of the two differing trade-off contrasts (*trade-offs*: innovative technology offers no eco-friendly benefits; *no trade-offs*: innovative technology offers eco-friendly benefits) for all three product categories (see Appendix B). Participants were asked to rate the innovativeness and eco-friendliness of these products. Product eco-friendliness was measured using a three-item and seven-point Likert scale (e.g., This product deserves to be labelled eco-friendly) (Gershoff and Frels, 2014). The innovativeness manipulation was checked by having participants evaluate product innovativeness using a five-item and seven-point Likert scale from Goode, Dahl and Moreau (2013), anchored by the following labels: not new/very new, not innovative/very innovative, not original/very original, not unique/very unique, not creative/very creative (1 = Strongly disagree to 7 = Strongly agree).

We compared relative innovativeness and eco-friendliness between two conditions for each product. As we expected, participants considered the eco-innovations to be more eco-friendly in the no-trade-off condition than in the trade-off condition: cars (6.16 vs. 3.16; $t_{car}(58) = 8.22$, $p < .001$), shoes (5.71 vs. 3.18; $t_{shoes}(58) = 7.98$, $p < .001$); and smartphones (5.64 vs. 2.92; $t_{smartphones}(58) = 7.17$, $p < .001$) while they expressed the same level of product innovativeness all the three product categories: cars (5.67 vs. 5.15; $t_{car}(58) = 1.60$, *ns.*), shoes (6.32 vs. 5.77; $t_{shoes}(58) = 1.89$, *ns.*), and smartphones (5.21 vs. 4.46; $t_{smartphones}(58) = 1.65$, *ns.*). The results indicate the manipulations were appropriate to operationalize attribute trade-offs in eco-innovative product designs.

***Sample and design***

We recruited 305 consumers (47.9% men; $M_{age}$ = 42.15, SD = 13.80) through Amazon Mechanical Turk (MTurk) to complete an online study in exchange for nominal compensation (paid \$0.50 –\$1). Approximately 50% of the respondents had an annual household income of more than \$40,000 and a minimum of a bachelor degree. Participants were randomly assigned to a 2 trade-off contrasts (*trade-offs*: innovative technology offers no eco-friendly benefits; *no trade-offs*: innovative technology offers eco-friendly benefits) x 3 product categories (a car, a pair of shoes, and a smartphone) mixed design. Attribute trade-offs was measured as a between factor and product category was a within factor. The order of product categories was counterbalanced.

***Procedure and measures***

All participants read short descriptions of three innovative products (a car, a pair of shoes, and a smartphone), which were about to be launched in the local market. In all cases, participants were told that they were looking at products from an online store dedicated to cars, shoes, or smartphones and that they are considering purchasing a new car, shoes, or a smartphone. On the following page, participants were shown an advertisement with the same picture of a car, shoes, or smartphone and were given the respective product descriptions. Finally, participants responded to the dependent variable measures and demographic questions.

Unless otherwise noted, all items were evaluated on Likert-scale ranging from 1 to 7, with higher scores indicating endorsement. For each product, to measure the extent to which participants evaluated the car, shoes, or smartphone as innovative and eco-friendly, we assessed perceived product innovativeness with a five-item scale following Goode et al. (2013) ($\alpha_{car}$ = .95, $\alpha_{shoes}$ = .96, $\alpha_{smartphone}$ = .98) and perceived product eco-friendliness with a three-item scale following Gershoff and Frels (2014) ($\alpha_{car}$ = .98, $\alpha_{shoes}$ = .97, $\alpha_{smartphone}$ = .98). Participants then reported their relative preferences

with a four-item scale following Jhang, Grant and Campbell (2012) ($\alpha_{car}$ = .96, $\alpha_{shoes}$ = .97, $\alpha_{smartphone}$ = .98), adoption intention with a three-item scale following Hassan, Shiu and Shaw (2014) ($\alpha_{car}$ = .95, $\alpha_{shoes}$ = .95, $\alpha_{smartphone}$ = .96).

To measure consumers' WTP, in our instruction to respondents, we indicated that the selling price had not yet been fixed and the price would be determined by the company next month. Participants were informed that they could not affect the pricing decision of the company, however, they could maximize the amount of money they would be willing to pay for the product. If a participant's stated WTP was higher than or equal to (lower than) the selling price of the company, he/she could (could not) buy the product. Then, participants were asked to answer the open-ended question "How much would you be willing to pay?" (Measured in U.S. dollars). We assessed the explicitness of participants' beliefs in the effectiveness of eco-friendly products by eliciting their agreement with the following two *reversed* items (1) "There is no way to include eco-friendly attributes into products without sacrificing their effectiveness," and (2) "Products with eco-friendly attributes are rarely effective" (Lin and Chang, 2012) (α = .77).

### 5.3. Study 2: Types of eco-friendly attributes in eco-innovative product designs

In Study 1, the results indicated that under the no-trade-off condition, respondents rated the eco-innovations higher on eco-friendliness and innovativeness. They also reported higher product preferences, stronger adoption intentions, and a higher WTP value than in the trade-off condition. However, in the product descriptions of Study 1, we investigate types of eco-friendly attributes in a separate manner across the conditions. Therefore, it is questionable whether consumers would respond differentially to different types of eco-innovations. In other words, we argue that including different types of eco-friendly attributes in an eco-innovation might result in different product evaluations and behavioural responses (**H3a-H3d**).

***Stimuli - Pre-test***

We conducted two separate pre-tests with marketing students who did not participate in the main studies. In the first pre-test, we recruited 44 postgraduate students (35% men, $M_{age}$ = 21.59, SD = 1.82) with adequate eco-friendly product knowledge and experience ($M$ = 4.40, SD = 0.86), as measured on a seven-point Likert scale adapted from Gershoff and Frels (2014) ($\alpha$ = 0.70). The students received the definitions of different types of eco-innovation and were asked to classify a list of the ten most popular innovative and eco-friendly features of vacuums and smartphones into four categories: (1) innovative features, (2) resource use reduction features, (3) resource use elimination features, (4) and resource use substitution features, with an optional answer of "I don't know." To control for any assumptions participants might make about the types of eco-friendly features, we used the words "reduce," "eliminate," and "substitute" in the descriptions of resource use reduction, resource use elimination, and resource use substitution features, respectively.

We selected the features that the majority (i.e., 55% or more) of participants classified as being typical for each specific type. The majority of respondents categorized "remotely controlled by a smartphone app" (81%) and "home automation" (89%) as innovative features. Most of the respondents (95% and 66%, respectively) classified "50% less energy consumption" and "a 10/10 reparability score" as resource use reduction features. "Canisters" and "eliminating radiation emission" were classified as resource use elimination features by 81% and 75% of the respondents, respectively. Finally, "solar vacuum tube" and "solar phone charger" were classified as resource use substitution features by 68% and 59% of respondents, respectively.

In the second pre-test, we asked a different pool of marketing students ($n$ = 30, 43.3% men, $M_{age}$ = 21.87, SD = 1.20) to evaluate the eco-friendliness of the selected features from the first pre-test on a seven-point Likert scale (1 = "not at all"; 7 = "extremely"). We also measured eco-friendly product

knowledge and experience with the same scale adapted from Gershoff and Frels (2014) ($\alpha$ = 0.79). Participants displayed adequate knowledge about eco-friendly products ($M$ = 4.05, SD = 1.26). We then conducted one-sample *t*-tests to compare each attribute with respect to the scale midpoint of four. In line with the first pre-test, respondents rated the eco-friendly attributes as significantly higher than the scale midpoint value: resource use efficiency ($t_{vacuum}(29) = 5.64$, $p < 0.001$; $t_{phone}(29) = 5.76$, $p < 0.001$), resource use elimination ($t_{vacuum}(29) = 5.71$, $p < 0.001$; $t_{phone}(29) = 6.42$, $p < 0.001$), and resource use substitution ($t_{vacuum}(29) = 5.01$, $p < 0.001$; $t_{phone}(29) = 7.05$, $p < 0.001$). However, the innovation attributes were not rated significantly higher than the scale midpoint ($p > 0.30$). Based on the results of the pretests, we created four manipulations for each product category (see Appendix C).

***Sample and design***

One hundred thirty-one consumers (42% men; $M_{age}$ = 43.47, SD = 12.93) were recruited through Amazon Mechanical Turk (MTurk) to complete an online study in exchange for nominal compensation (paid \$0.50 –\$1). The sample was biased toward the upper end of the income brackets, with over 60% of respondents reporting medium (\$50,000–\$74,999), high (\$75,000–\$100,000), and very high (>\$100,000) annual incomes. The majority of respondents (86.30%) had a minimum of a bachelor's degree. Participants were randomly assigned to one of four versions of a survey and were roughly evenly distributed across the conditions. We used a four between-subjects design, including a *control* condition and three eco-friendly attribute types in eco-innovative product designs (i.e., types of eco-innovations): resource use efficiency, resource use elimination, and resource use substitution versions of a connected vacuum cleaner.

***Procedure and measures***

All participants were given a short description of a connected vacuum cleaner. They were then told that the description was from an online store dedicated to connected vacuum cleaners and that they

were considering purchasing one. On the following page, all participants were randomly assigned to one condition and were given an advertisement with the same picture of a connected vacuum cleaner and its respective descriptions according to the conditions. Finally, participants responded to the dependent variable measures and demographic questions.

To measure the extent to which participants evaluated the connected vacuum cleaner as innovative and eco-friendly, we employed the same measurement scales for perceived product innovativeness, perceived eco-friendliness, product preferences, adoption intentions, and willingness to pay as in Study 1. We also measured product quality with a single item based on a seven-point Likert scale: "How do you rate the quality of the product?" (1 star = "Extremely bad"; 7 stars = "Extremely good").

### 5.4. Study 3: Eco-friendly consumer innovativeness

The objective of Study 3 is to replicate and confirm the primary results that consumers respond differently to different types of eco-innovations—in the context of a publicly consumed product category, innovative smartphones. We also examine the underlying mechanism of the effects of ECI on consumer responses and test whether this mechanism varies across different types of eco-innovations (**H4 - H5**).

#### *Sample and design*

The usable sample for Study 3 consisted of 222 consumers (39% men; $M_{age}$= 42.18, SD=12.88) that were recruited through MTurk to complete an online study in exchange for nominal compensation (paid $0.50 –$1). Their annual incomes were distributed across low ($25,000–$50,000; 34.90%), medium ($50,000–$74,999; 27.22%), high ($75,000–$100,000; 20.71%), and very high (>$100,000; 10.65%) income brackets. More than 80% of the respondents had at least a bachelor's degree. Participants were randomly assigned to one of four versions of a survey and were roughly

evenly distributed across the conditions. We used a four between-subjects design that included four conditions: (1) control, (2) resource use efficiency, (3) resource use elimination, and (4) resource use substitution versions of an innovative smartphone (see Appendix C).

***Procedure and measures***

All participants received a short description of an innovative smartphone in the market. They were told that it was from an online store dedicated to smartphones and that they were considering purchasing one. On the following page, all participants were randomly assigned to one condition and were given an advertisement with the same picture of an innovative smartphone and its respective product description according to the condition. Finally, participants responded to the dependent variable measures and demographic questions.

We employed the same measurement scales for perceived product innovativeness, perceived eco-friendliness, product quality, product preferences, adoption intentions, and willingness to pay as in Study 1. Finally, we asked participants to predict what their consumption level (measured in hours) would be if they bought this product. We measured ECI with five items ($\alpha$ = 0.94) based on a seven-point Likert scale (1= "Strongly disagree"; 7 = "Strongly agree") (see Table 3). We assessed the explicitness of participants' beliefs in the trade-offs between environmental benefits and product effectiveness by eliciting their agreement with the following two items: (1) "There is no way to include eco-friendly attributes into eco-innovative products without sacrificing their effectiveness," and (2) "Eco-innovations with eco-friendly attributes are rarely effective" (Lin and Chang, 2012) ($\alpha$ = 0.82).

### 5.5. Study 4: Detachability and Importance of Eco-friendly Attributes: Core Versus Peripheral

The primary objective of Study 4 is to demonstrate the effect of detachability (the importance of an attribute to the functioning of the product) of eco-friendly features on consumers' responses

(product evaluations, preferences, adoption intentions) (**H6**). We also examine whether this effect is distinct from attribute weighting (the importance consumers attach to certain attributes when making their choices) (**H7**). In Study 4, we use innovative automobiles as the base category to show that the advantage of the peripheral locus of eco-friendly attributes in eco-innovative product designs is contingent on it being detachable from the base product, which might be distinct from the effect of attribute importance.

***Sample and design***

We recruited 291 consumers in the U.S. market (39.90% men; $M_{age}$ = 41.08, SD = 13.16) through MTurk to complete an online study in exchange for nominal compensation (paid \$0.50 –\$1). More than 60% of the respondents had an annual household income of more than \$40,000 and a minimum of a bachelor degree. Participants were randomly assigned to a 3 (detachability/locus: core-non-optional vs. core-optional vs. peripheral) × 2 (attribute importance in consumer choice: high vs. low) between-subjects design.

The stimulus in all conditions was an autopilot technology (i.e., driverless cars) with the option of electric battery chargers. We selected driverless cars as the base eco-innovative product category due to their relevance to U.S. consumers and electric battery chargers as a new eco-friendly attribute. It has been predicted that in the next ten years, there will be a widespread adoption of driverless cars (Garret, 2017), and a complementary electric energy system is available in many innovative car models in the U.S. market (Solar Energy USA, 2017). The product descriptions of each condition were described in Appendix D**.**

***Procedure and measures***

At the beginning of the survey, all participants learned about the fictitious driverless car brand. They were told that the innovative car model would be introduced within the next month with a new

eco-friendly attribute, namely, an electric battery charger, thus enabling the alternative electric driving mode. In all conditions, participants were told that they were looking at the car description that appeared on the website of the car manufacturer and that they were considering purchasing a new car. On the following page, participants were assigned into one condition and shown an advertisement with the same picture of an innovative car with the respective product descriptions. Finally, participants responded to the dependent variable measures and demographic questions.

We employed the same measurement scales for perceived product innovativeness, perceived eco-friendliness, product quality, product preferences, and adoption intentions as in Study 1. To enforce and check the manipulation of detachability, we asked participants to respond to a single seven-point Likert scale item, developed in accordance with the definition from Ma et al. (2015): "The electric battery charger could be physically separated from the car without affecting its functioning." We checked the manipulation of attribute importance in consumer adoption decisions by asking participants to answer three questions about the eco-friendly attribute: (1) "How important is the electric battery charger for your evaluation of and decision for or against the innovative car model?" (2) "To what extent is the electric battery charger a feature that you would consider in your evaluation of and decision for or against the innovative car model?" (3) "How relevant or irrelevant is the electric battery charger in your choice of a car model?" (Gershoff and Frels, 2014) ($\alpha$ = .80). Finally, as a control, we measured consumers' objective knowledge about cars, adapting a five-item and seven-point scale from Sambandam and Lord (1995) ($\alpha$ = .89).

### 5.6. Study 5: The Interactive Roles of Ecological Country-Of-Manufacture, Eco-Friendly Attributes, and Need for Cognition

We present two empirical studies to test and provide support for the interactive effects of ECOM and PECO on consumers' responses to eco-innovation across product categories, national

markets, and consumer segments. Experiment 1 examines *which* combinations of ECOM and PECO elicit positive consumer responses to eco-innovation across two product categories, namely connected TVs and driverless cars (**H8**). In Experiment 2, we provide further evidence of *whether* the way ECOM interacts with PECO to exert an influence on consumer responses varies across two national markets (emerging vs. developed markets) (**H9**). Experiment 2 also offers insights into the underlying mechanism of the effects of the schema (in)congruence on consumers' product beliefs and purchase intentions with NFC acting as a moderator. (**H10**).

***Stimuli - Pre-test***

*Product categories*. We selected product categories based on the five criteria: *(a)* the product categories are different in their consumption contexts, *(b)* there is the dominance of hybrid or bi-national products, which are designed and branded in one nation but manufactured or assembled in another, in the product categories, *(c)* the product categories are commonly used by consumers in general, *(d)* eco-innovation based on advanced technologies (i.e., IoT technologies) has been increasingly developed in the product categories, *(e)* companies often have freedom to change their COMs of the product categories over time.

A number of product categories with bi-nationalities were initially considered, including TV sets, automobiles, smartphones, light bulbs, and bicycles. We conducted a pretest with 44 consumers (56.4% men; $M_{age}$ = 30.25, SD = 10.51) at a major French city to investigate the familiarity of eco-innovations in these product categories. The results revealed that majority of the respondents (overly 70%) were mostly aware of the introduction of connected TVs, eco-smartphones, and driverless cars. Therefore, these three product categories were selected for main studies; specifically, connected TVs – a private product consumed inside houses while driverless

cars and eco-smartphones – a symbolic product expressing the owners' status (Hamzaoui Essoussi and Merunka, 2007).

*Favourable versus unfavourable ECOMs*. Another pre-test was conducted with 60 real consumers from an online forum (43.30% men; $M_{age}$ = 31.69, SD = 4.99). Respondents expressed the relatively high importance of COM in their purchase decisions for each product ($M_{TV}$ =4.56; $M_{car}$=4.93, $M_{smartphone}$=4.11) on a one-item and seven-point scale (1= not at all, and 7= extremely important). Participants were then asked to evaluate the ecological image/sustainable reputation of the ten popular manufacturing countries in each product category on a one-item and 100-point scale (1= extremely low, and 100= extremely high).

For TVs, Japan (M= 74.50) and South Africa (M= 31.93) were reported to be the most and least favourable ECOMs, respectively. Generally speaking, Japan is famous for its state-of-art technologies and environmental protection solutions for manufacturing TVs whereas South Africa is believed to use environmentally-unfriendly materials to compensate for low prices. For cars, France (M= 63.45) and India (M= 34.43) were identified as countries with the most/least favourable COMs in terms of eco-friendliness. This aligns with recent reports showing that France is named as one of the greenest countries for making and driving electric cars whereas India is perceived as producing lower-green cars (Sedghi, 2013). For eco-smartphones, South Korea (M= 78.53) and Slovakia (M= 25.17) were regarded as favourable/unfavourable ECOMs. Apart from the ecological aspects, all the selected countries present clear and homogeneous images for respondents based on the levels of their economic conditions and technological development, as well as distinct levels of perceived capacity to manufacture TVs, cars and smartphones.

*Eco-friendly attributes*. To control the effects of brand name and price, we used the same fictitious brand name and fixed prices across conditions. For each product category, we identified a list of ten new eco-friendly product attributes from various international manufacturers of the

same compact five-seat vehicle, TV, and smartphone categories based on the diverse sources such as advertisements, brochures, relevant magazines, and Consumer Reports. Average attribute functionality values and eco-friendliness scores of these attributes were calculated and reviewed by two independent professional marketers and one product designer on validity and correspondence to reality. We selected two attributes with equal functionality values but vary significantly in terms of their eco-friendliness. Based on the data analysis of the pre-test, we created the manipulations for each product category in cooperation with a professional advertiser (See Appendix E).

***Experiment 1***

The purpose of Experiment 1 is to explore which the combinations of ECOM and PECO are more likely to elicit positive consumer responses to eco-innovation across two product categories, namely connected TV and driverless cars (**H8**). In other words, we empirically compare consumers' product beliefs and purchase intention at different levels of the schema (in)congruence in order to identify the best/worst global outsourcing and international marketing communication strategies for eco-innovative products. We propose that the congruence between ECOM and PECO is the best scenario for manufacturing eco-innovation in the publicly consumed product category, whereas the incongruence triggers more positive consumer responses to eco-innovation consumed in private places.

*Sample and design*

We recruited 215 consumers (44.2% men; $M_{age}$ = 40.88, SD = 12.46) through Amazon Mechanical Turk (MTurk) to complete an online study in exchange for nominal compensation (paid \$0.50 –\$1). Approximately 56.8% of the respondents had an annual household income of more than \$50,000 and 87% of them held a minimum of a bachelor degree. Participants were

randomly assigned to a 2 (product type: publicly consumed products – driverless cars *vs.* privately consumed products – connected TVs) × 2 (product eco-friendliness levels: low *vs.* high) × 2 (ecological COM: unfavourable *vs.* favourable) between-subjects experiment design.

*Procedure and measures*

At the beginning of the experiment, participants were given an excerpt from a consumer magazine that described the sustainable development of different countries in the cars/TVs industry around the world. In this excerpt, Japan and France are ranked as the most eco-friendly countries whereas South African and India are regarded as one of the most polluted countries with low sustainable development. After that, all participants read one short description of an innovative product (a connected TV or a driverless car). Participants were told that they were looking at new product advertisements from online stores dedicated to cars or TVs and that they were considering purchasing a new car or a TV. On the following page, participants were shown an advertisement with the same picture of a car or a TV and given the respective short product descriptions (See Appendix E). Finally, participants responded to the dependent variable measures and demographic questions.

We controlled for consumer interest in the product category as an alternative determinant of consumers' quality perception and purchase intentions. For example, in the driverless car condition, participants indicated their agreement with the following statement: "Overall, I am very interested in driverless cars" (a seven-point Likert scale: 1= strongly disagree, and 7= strongly agree). There were no significant differences between publicly consumed and privately consumed products ($p$ >.50). Consumer responses to eco-innovation were assessed via perceived product quality (consumers' ratings of product quality, from 1 star= very bad to 7 stars=very good) and purchase intentions (a three-item and seven-point Likert scale; Hassan et al. (2014)). Moreover, the following

variables were included as control variables: product category knowledge (Sambandam and Lord, 1995), general country image (Roth and Romeo, 1992), perceived importance of COM (Herz and Diamantopoulos, 2017), familiarity with COM (Bloemer et al., 2009), experience with COM, openness to new culture, economic threats from foreign countries, and patriotism (Sharma, Shimp and Shin, 1994), and demographics (gender, age, education, and income). We tested the degree to which respondents perceived COMs as favourable or unfavourable in terms of their sustainable development in producing specific product categories on a two-item and seven-point scale (i.e., *[Product name] made in [country name] are superior in terms of eco-friendliness* and *[Product name] made in [country name] have a good reputation in eco-friendliness*, 1 = strongly disagree, and 7 = strongly agree). Finally, perceived product eco-friendliness and general ECOM (Chan, 2000) were asked for manipulation check purposes (see Appendix F).

***Experiment 2***

In Experiment 1, we have established that the incongruence between ECOM and PECO could lead to more positive evaluations and greater intention to buy in the case of privately consumed products while the congruent stimuli are more favourable for a publicly consumed product category. However, in Experiment 1, as we only focus on consumers from an industrialized country (the United States), it is still a question whether consumers from different national markets would respond differentially to different combinations of ECOM and PECO. Experiment 2 seeks an answer to this question by examining whether the effects of the schema (in)congruence on consumer responses to eco-innovation vary significantly across national markets in a different product category, an eco-smartphone (**H9**).

Moreover, Experiment 2 also aims to discover how the schema (in)congruence is likely to be processed by different types of consumers (low *vs.* high NFC) across national contexts. We

argue that consumers who are higher in NFC tend to engage more in the elaborative processing of product-related information; hence, they have more positive reactions to the schema incongruence than those with lower NFC. Our hypothesis suggests that NFC could serve as a boundary condition allowing for elaboration upon the schema (in)congruence, which leads to more positive consumer responses to eco-innovation (**H10**).

In this study, we selected India and the USA as the research contexts for two reasons. *First*, these countries are different in terms of economic strength (emerging vs. developed; United Nations (2014)) and cultural dimensions (collectivism/ individualism, power distance, and uncertainty avoidance; Hofstede (2003); see Figure 4); thus, these countries represented differing positions on the economic situation and cultural continuum, enabling valuable comparison and enhancing the generalizability of the results (Swoboda and Hirschmann, 2016). *Second*, both India and USA are facing serious environmental problems; specifically, USA is one of the top ten nations produce the most $CO_2$ per capita and India is considered one of the world's most polluted countries (Smith, 2017). Therefore, the introduction of eco-innovation in these countries is promising to tackle the current ecological issues.

*Sample and design*

We recruited 396 consumers (44.1 % men; $M_{age}$ = 34.67, SD = 10.74) through MTurk to complete an online study in exchange for nominal compensation (paid \$0.50 –\$1). More than 68% of the respondents had an annual household income of more than \$40,000 and 71% of them held a minimum of a bachelor degree. In each national sample, participants were randomly assigned to one of four versions of an online survey and were roughly evenly distributed across the conditions. The study utilized a 2 (market conditions: emerging vs. developed countries) × 2 (product eco-

friendliness: low vs. high) × 2 (ECOM: unfavourable vs. favourable) between-subjects experimental design.

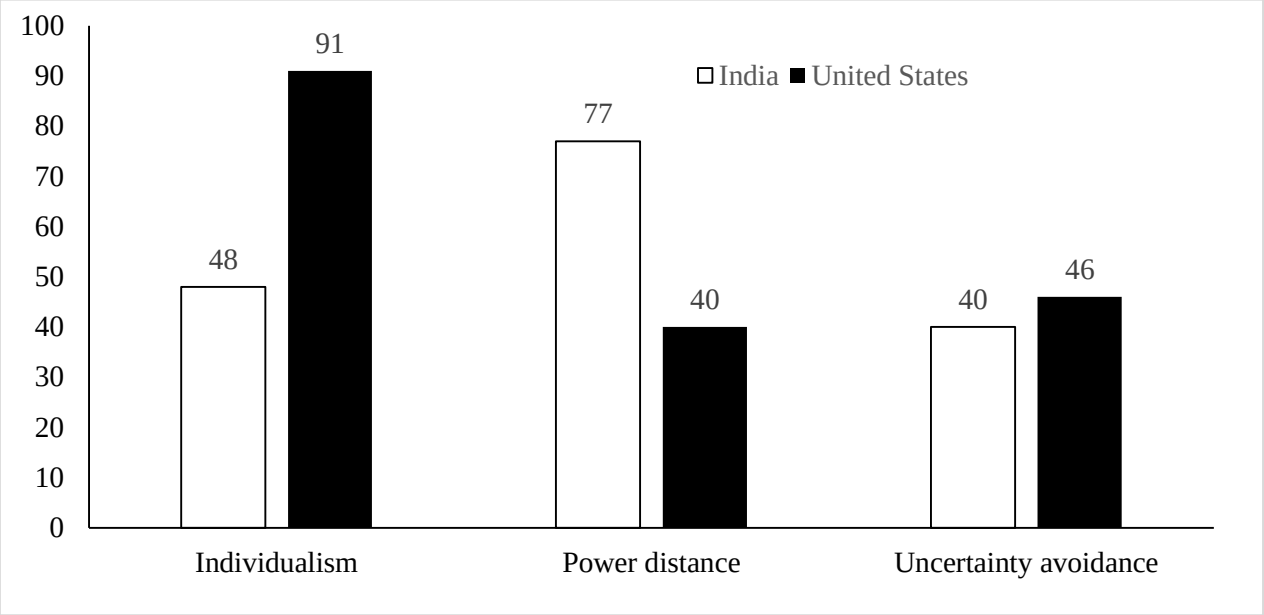


**Figure 4** Cultural distinction in terms of collectivism/ individualism, power distance, and uncertainty avoidance between India and the United States.

*Procedure and measures*

At the beginning of the experiment, participants were given an excerpt from a consumer magazine that described the sustainable development of different countries in the mobile phone industry around the world. In this excerpt, South Korea is ranked as the top five eco-friendly countries whereas Slovakia is regarded as one of the most polluted countries with low sustainable development. Then, participants were told that they were looking at the advertisement of a new eco-smartphone from an online store and that they are considering purchasing a new smartphone in near future. On the following page, all participants were randomly assigned one condition and given an advertisement with the same picture of a smartphone and respective product descriptions

(See Appendix E). Finally, participants responded to the dependent variable measures and demographic questions.

We employed the same measurement scales for PECO, product quality, and purchase intention, general and product-specific ecological country image as in Experiment 1. Furthermore, we measured NFC with the items adapted from the study of Cacioppo et al. (1984) based on a seven-point "extremely disagree/extremely agree" scale ($\alpha = .95$). Moreover, similar to Study 1, the following variables were included as control variables: product category knowledge, general country image, perceived importance of COM, familiarity with COM, experience with COM, openness to new culture, economic threats from foreign countries, and patriotism, and demographics (gender, age, education, and income). Finally, perceived product eco-friendliness and general ECOM were also asked for manipulation check purposes (see Appendix F).

### 5.7. Summary

This chapter presented all discussions and analyses of the selected techniques and procedures of the online experimental research designs. Using a scenario-based experimental approach is pertinent to addressing the research questions and achieving the research objectives of this dissertation. The chapter also described how the stimuli were developed, the actual data collection procedure, and variable measurement in each study of the dissertation.

# CHAPTER SIX

# RESULTS

# CHAPTER SIX

# RESULTS

## 6.1. Study 1: Trade-offs between innovative features and eco-friendly benefits

### *Results*

*Manipulation check.* We used a single-item seven-point semantic differential scale to test whether consumers recognized the trade-offs between innovative and eco-friendly attributes in the manipulations (1 = "not at all trade-offs," to 7 = "extremely trade-offs"). The results show that participants in the trade-off condition reported significantly higher scores for the trade-off scale than those in the no-trade-off condition across the three product categories: innovative car ($M_{car}$ = 5.78 vs. 4.96, $t_{car}(303) = 5.21$, $p < .001$), innovative shoes ($M_{shoes}$ = 6.01 vs. 5.61, $t_{shoes}(303) = 2.60$, $p < .05$), and innovative smartphones ($M_{smartphone}$ = 5.69 vs. 4.20, $t_{smartphones}(303) = 8.45$, $p < .001$). Thus, the between-subjects manipulation of the trade-off versus no-trade-off eco-innovative product design was successful. We also included a scale to measure social desirability bias (Strahan and Gerbasi, 1972) and found no significant correlations ($p > .05$) between social desirability bias and any of the subjective construct measures in our study. Thus, there is no evidence that social desirability bias affected our findings.

*Product eco-friendliness evaluation.* As we expected, participants in the no-trade-off condition perceived the product to be better for the environment than those in the trade-off condition across the three product categories: cars ($M_{car}$ = 6.03 vs. 3.27, $t_{car}(303) = 17.97$, $p < .001$), shoes ($M_{shoes}$ = 5.48 vs. 3.36, $t_{shoes}(303) = 12.63$, $p <. 001$), and smartphones ($M_{smartphone}$ = 5.43 vs. 2.93, $t_{smartphones}(303) = 14.01$, $p <.001$).

*Product innovativeness evaluation*. The independent sample *t*-tests reveal significant differences in perceived product innovativeness between no trade-off and trade-off conditions for the

innovative car ($M$ = 5.76 vs. 4.71, $t(303) = 7.16$ $p < .001$), the innovative shoes ($M$ = 6.00 vs. 5.64, $t(303) = 2.45$ $p < .05$), and the innovative smartphones (M = 5.70 vs. 4.06, $t(303) = 9.57$, $p < .001$). A significant contrast indicated that participants expressed higher perceived product innovativeness in the case of no trade-offs in an eco-innovative product design than in the trade-off condition across all the product categories. Therefore, we argue that innovative features that have no trade-offs with environmental benefits are considered more innovative than those that compromise eco-friendly aspects.

*Consumer preferences and adoption intentions*. As we predicted, trade-offs between innovative features and eco-friendly benefits had a significant effect on consumers' preferences and intention to adopt an eco-innovation. The independent *t*-tests in Table 4 reveal that consumers are more likely to prefer and adopt eco-innovative products that do not have trade-offs between innovative and eco-friendly attributes across the three product categories. Specifically, participants expressed higher preferences and adoption intentions when they acknowledged that there were no trade-offs between innovative features and eco-friendly benefits in innovative product designs, regardless of the product category, in support of **H1a** and **H1b**.

**Table 4** Differences between two trade-off contrasts in eco-innovative product designs across product categories

| **Product categories** | **Perceived product innovativeness** | | **Consumer preferences** | | **Adoption intention** | | **Willingness to pay** | |
|---|---|---|---|---|---|---|---|---|
| | Mean (No trade-offs vs. Trade-offs) | t-value | Mean (No trade-offs vs. Trade-offs) | t-value | Mean (No trade-offs vs. Trade-offs) | t-value | Mean (No trade-offs vs. Trade-offs) | t-value |
| Cars | 5.76 vs. 4.71 | $7.16^{***}$ | 6.05 vs. 4.37 | $11.17^{***}$ | 4.65 vs. 3.13 | $7.58^{***}$ | 34,634 vs. 20,720 | $2.35^{*}$ |
| Shoes | 6.00 vs. 5.64 | $2.45^{*}$ | 5.63 vs. 5.00 | $3.70^{***}$ | 4.67 vs. 4.07 | $2.81^{**}$ | 87.08 vs. 74.22 | $2.80^{**}$ |
| Smart-phones | 5.70 vs. 4.06 | $9.56^{***}$ | 5.81 vs. 3.63 | $12.05^{***}$ | 5.07 vs. 3.07 | $9.50^{***}$ | 308.23 vs. 178.71 | $5.53^{***}$ |

*Note*: $^{***}p < .001$; $^{**}p < .01$; $^{*}p < .05$

*Willingness to pay (WTP).* There were several zeros or refusals, in which participants entered the number 0 as their value for the predicted WTP for innovative cars, shoes, and smartphones. Specifically, a small fraction of participants (3.2%, 3.9%, and 7.1%) gave at least one zero WTP score for innovative cars, shoes and smartphones, respectively. According to Irwin and Spira (1997), respondents would not pay anything for environmental benefits when they find the trade-off to be unreasonable or offensive and the value for the eco-friendly attribute too high. Therefore, respondents were reluctant to put a price on it, which leads to the distinction between actual zero values/refusals and their correspondence with mean positive values. Based on these arguments, we eliminated zero or refusal responses from the WTP data. Next, we conducted independent *t*-tests to compare means of the positive WTP values in two conditions for each product category. The results reveal a significant effect of trade-offs between innovative and eco-friendly attributes on WTP across three product categories. Specifically, consumers are willing to pay more for the eco-innovative products when there are no trade-offs than for innovative products that compromise on environmental benefits, in support of **H1c**.

*Moderated mediation test.* We then tested the specific predicted pathway (attribute trade-offs → consumer product preferences → adoption intention) and the moderating role of perceived eco-friendly product effectiveness using the moderated mediation model. We dummy-coded the two conditions as –1 = trade-offs and 1 = no trade-offs. A bootstrapping analysis with 5,000 samples (Preacher and Hayes, 2008) was performed to test the full moderated mediation model (Model 7) using PROCESS macro. We then entered the measures of consumer product preferences as a mediator and perceived eco-friendly product effectiveness as a moderator of the effect of trade-offs in eco-innovative product designs on consumers' adoption intention. We ran separate moderated mediation analyses for each of the product categories.

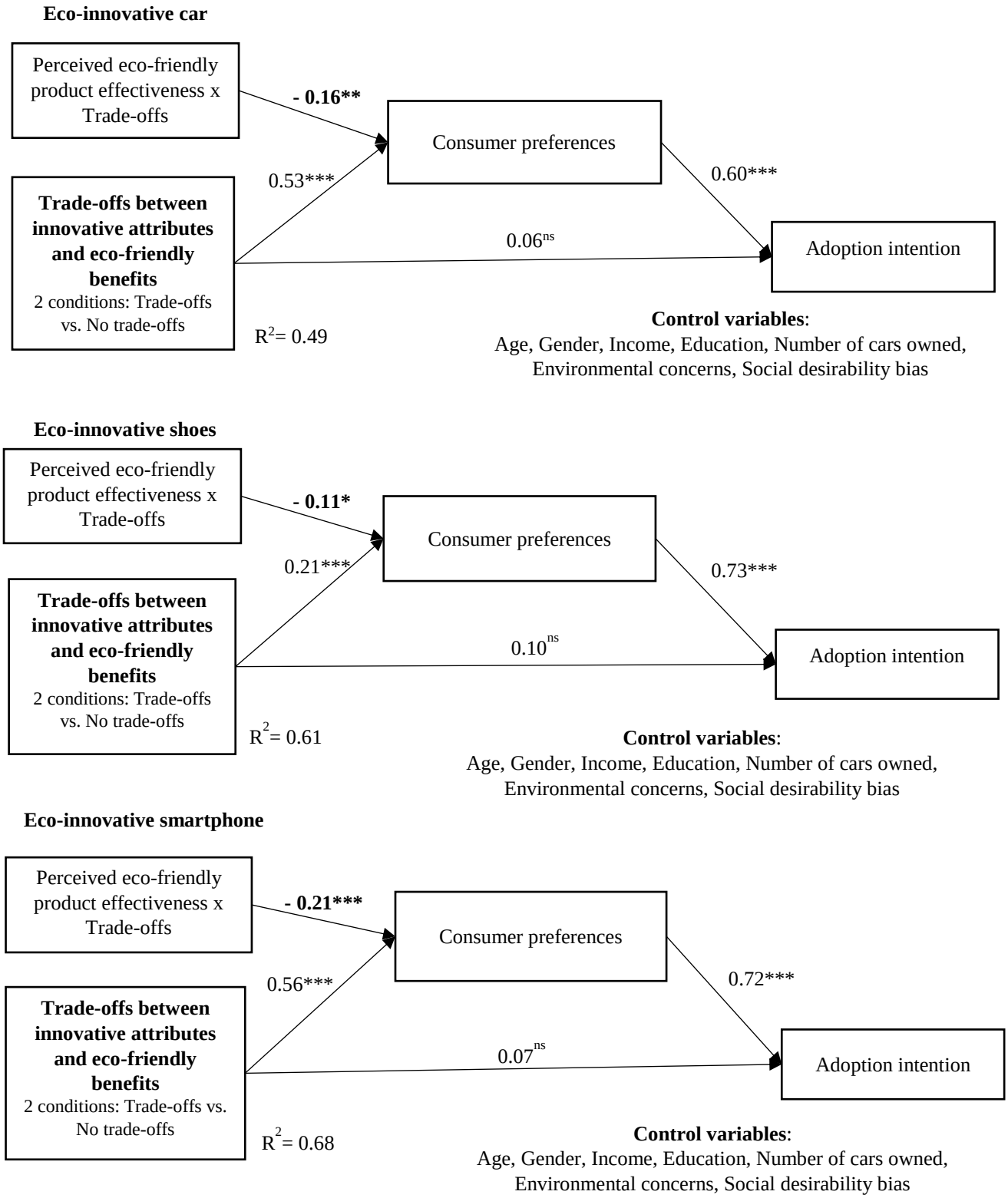


**Figure 5** The moderated mediation model

*Note*: $^{***}p$ <.001; $^{**}p$ <.01; $^{*}p$ <.05; ns: non-significant

Using Model 7, the 95% confidence interval (CI) for the index of moderated mediation did not include zero for the innovative car (B = -.09, 95% CI = [-.15, -.03]), the innovative shoes (B = -.08, 95% CI = [-.17, -.01]), and the innovative smartphone (B = -.15, 95% CI = [-.21, -.07]). The results reveal the significant indirect effects of attributes trade-offs on adoption intention via consumer product preferences for the innovative car (B = .32, SE = .04, 95% CI = [.25, .40]), the innovative shoes (B = .16, SE = .04, 95% CI = [.08, .23]), and the innovative smartphone (B = .41, SE = .04, 95% CI = [.33, .45]). The direct effect of trade-offs between innovative and eco-friendly attributes on adoption intentions after controlling the path through consumers' product preferences was no longer significant across the product categories (see Figure 5).

Consistent with **H2**, the results confirmed the moderating role of perceived eco-friendly product effectiveness on the relationship between attribute trade-offs and consumers' product preferences across the three product categories. The results indicated that the effect of the trade-offs in eco-innovative design was *weaker* when the respondents expressed *higher* perceptions of eco-friendly product effectiveness and *stronger* when they perceived *lower* eco-friendly product effectiveness. More specifically, the moderating effect of perceived eco-friendly product effectiveness on the link between trade-offs and consumer preferences were significant for the three products: the innovative car (B = -.16, SE =.05, 95% CI = [-.25, - .06]), the innovative shoes (B = -.11, SE = .06, 95% CI = [-.22, -.01]), and the innovative smartphone (B= -.21, SE = .05, 95% CI = [-.29, -.12]) (see Figure 6).

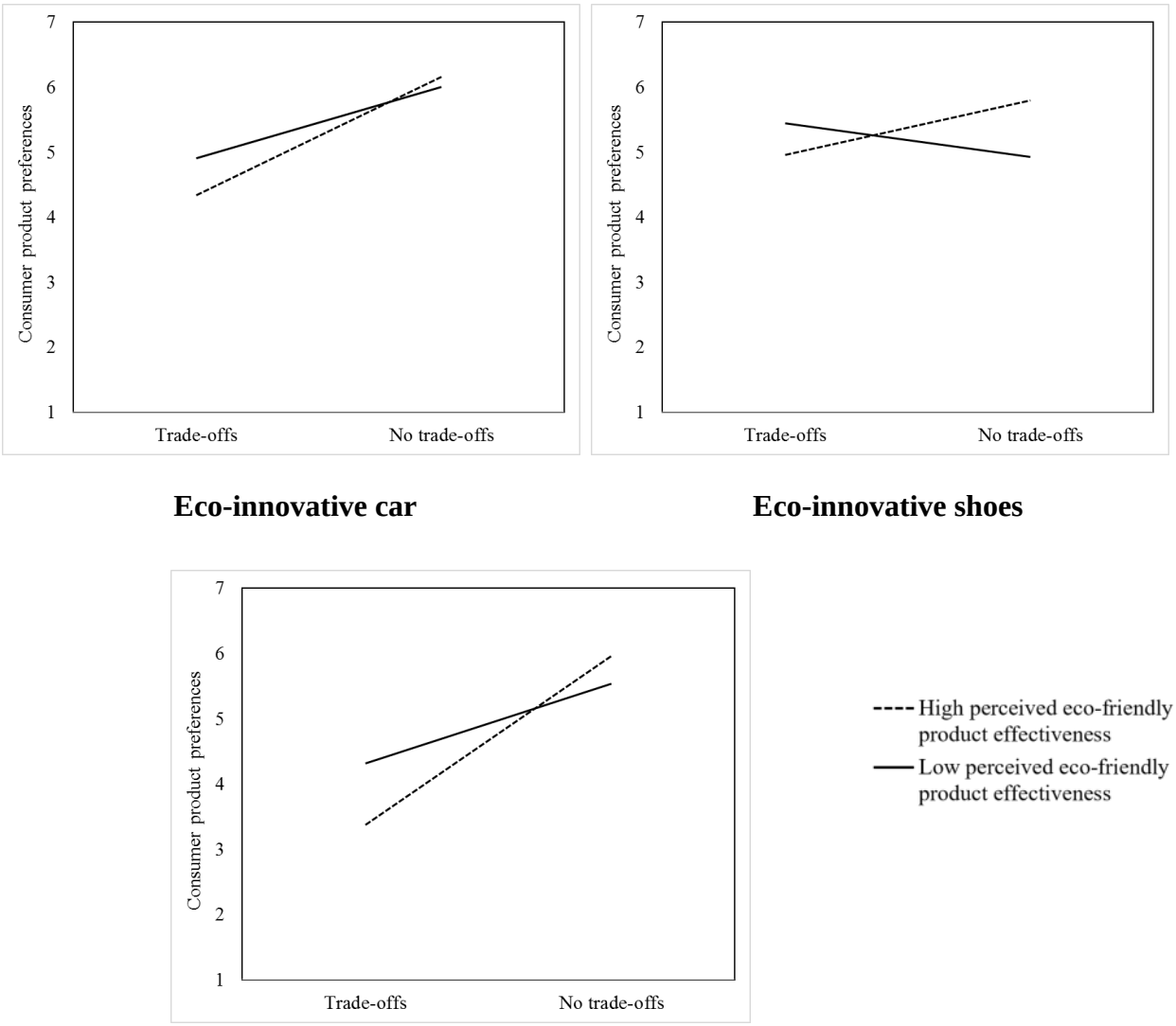


**Figure 6** The moderating effect of perceived eco-friendly product effectiveness on the relationship between attribute trade-offs and consumer product preferences across three product categories

***Discussion***

Study 1 confirms our proposal that trade-offs between innovative features and eco-friendly benefits in eco-innovative product designs lead consumers to respond to the offerings in different ways. We held constant one innovative attribute and one eco-friendly attribute while manipulating additional innovative attributes designed as either complementary or compensatory with regard to the

environmental benefits. The results are consistent with the predictions outlined in the literature review. Specifically, consumers have more positive product beliefs in terms of its eco-friendliness and innovativeness, higher product preferences, stronger adoption intentions, and higher willingness to pay when innovative attributes are complementary to eco-friendly attributes. In contrast, they are less likely to choose eco-innovations when the trade-offs are acknowledged. The trade-offs between innovative features and eco-friendly benefits influence consumers' adoption intentions, which is mediated by consumer product preferences, across the product categories. The last result confirms the moderating effect of perceived eco-friendly product effectiveness on the impact of the trade-offs in eco-innovative product designs on consumer product preferences. It appears that when consumers believe eco-friendly products to be highly effective in general, they less concern about attribute trade-offs, thus they tend to have a higher preference for the products and thus responded more positively to the offerings. However, when consumers perceived eco-friendly products to be ineffective, they pay more attention to attribute trade-offs and less prefer the products and respond more negatively to the eco-innovations. In Study 2, we further explore whether, under the no-trade-off condition, consumers respond differently to eco-innovations if different types of eco-friendly attributes are offered in new product designs.

### 6.2. Study 2: Types of eco-friendly attributes in eco-innovative product designs

#### *Results*

*Manipulation check.* Two separate analyses of variance (ANOVA) analyses demonstrated that the manipulations in terms of eco-friendliness and innovativeness were correctly operationalized. Participants evaluated the product as more eco-friendly in the resource use efficiency condition ($M$ = 4.79, SD = 1.07), the resource use elimination condition ($M$ = 5.83, SD = .88), and the resource use substitution condition ($M$ = 5.57, SD = 1.08) than in the control condition ($M$ = 4.13, SD = 1.16; $F$(3,

127) = 18.13, $p < .001$). Perceived product innovativeness scores were not significantly different among the four conditions ($F(3, 127) = 2.49$, *ns.*). Overall, we found that the product descriptions successfully manipulated participants' perceptions of the product's eco-friendliness and innovativeness.

*Consumer responses*. After the manipulation check, we eliminated the control condition ($n = 37$) from the dataset and focused on comparing the means of three types of eco-innovation. We conducted an ANOVA modelling consumer responses (product quality, product preferences, adoption intentions, and WTP) as a function of the eco-innovation-type conditions. In support of our hypotheses, we found significant effects of the eco-innovation-type conditions on consumer responses. In particular, we found evidence of a significant effect of eco-innovation types on product quality ($F(2, 91) = 7.07$, $p < .01$), preferences for eco-innovations ($F(2, 91) = 5.86$, $p < .01$), and adoption intentions ($F(2, 91) = 5.41$, $p < .01$), in support of **H3a, H3b,** and **H3c**, but no significant effect on WTP ($F(2, 91) = 1.25$, *ns.*), thus rejecting **H3d.**

**Table 5** Differences in consumer responses to types of eco-friendly features in eco-innovative product design in the context of a connected vacuum cleaner

| Types of eco-innovations | Product quality | | Product preferences | | Adoption intention | | Willingness to pay | |
|---|---|---|---|---|---|---|---|---|
| | ***M*** | **SD** | ***M*** | **SD** | ***M*** | **SD** | ***M*** | **SD** |
| Resource use efficiency innovation | $5.13_a$ | 1.01 | $5.52_a$ | 1.34 | $4.39_a$ | 1.54 | $192.39_a$ | 112.35 |
| Resource use elimination innovation | $6.03_b$ | 0.91 | $6.33_b$ | 0.76 | $5.45_b$ | 1.23 | $227.74_a$ | 114.36 |
| Resource use substitution innovation | $5.79_b$ | 1.06 | $6.17_b$ | 0.80 | $5.41_b$ | 1.58 | $189.03_a$ | 92.48 |

*Note*: Subscripts should be interpreted only within columns. Means with the same subscript are not significantly different from each other. Means with different subscripts are significantly different at $p < .05$.

These significant results suggest that participants responded differently to different types of eco-friendly benefits in an eco-innovative product design. Moreover, in paired comparisons, we found that consumers' responses were significantly different across each of the three eco-innovation-type conditions. As Table 5 shows, participants in the resource use elimination and resource use substitution

innovation conditions reported higher scores for product quality, product preference, and adoption intentions than those in the resource use efficiency condition.

***Discussion***

The results demonstrate that different types of eco-friendly attributes in an eco-innovative product design triggered significant differences in consumers' psychological and behavioural responses. It is evident that although participants responded more positively to resource use elimination and resource use substitution innovations, they were reluctant to pay more for these types of eco-innovation. The implications of these findings hold particular importance for managers, who must make decisions about what types of eco-friendly benefits should be included in eco-innovative product designs as well as decisions about brand extensions and product positioning in the context of privately consumed products such as vacuum cleaners.

### 6.3. Study 3: Eco-friendly consumer innovativeness

***Results***

*Manipulation check.* Participants in the control condition reported lower scores of product eco-friendliness ($M$ = 3.84, SD = 1.68; $F(3, 218) = 12.71$, $p < .001$) than those in the resource use efficiency condition ($M$ = 4.92, SD = 0.95), the resource use elimination condition ($M$ = 5.23, SD = 1.18), and the resource use substitution condition ($M$ = 4.65, SD = 1.05). Moreover, participants evaluated the product at the same level of innovativeness among the four conditions ($F(3, 218) = 2.09$, *ns.*). Therefore, the manipulation of eco-friendly attribute type and innovativeness was successful.

*Consumer responses.* After the manipulation check, we compared the means of three types of eco-friendly attributes in an eco-innovative product design by eliminating the control condition ($n$ = 53) from the dataset. The results of the ANOVA tests, using product quality, product preferences, adoption intentions, willingness to pay, and predicted consumption levels as dependent variables,

revealed that there were significant differences in consumers' responses among different types of eco-innovations, confirming the findings of Study 2.

More specifically, we found that different types of eco-innovations significantly affect product quality perceptions ($F(2, 166) = 3.98$, $p < .05$), adoption intentions ($F(2, 166) = 4.14$, $p < .05$), and predicted consumption level ($F(2, 166) = 5.00$, $p < .01$), in support of **H3a** and **H3c**. However, the results indicate that consumer preferences for eco-innovations ($F(2, 166) = .50$, *ns.*) and their willingness to pay ($F(2, 166) = .20$, *ns.*) were not significantly different among different types of eco-friendly attributes, thus rejecting **H3b** and **H3d**.

**Table 6** Differences in consumer responses to types of eco-friendly features in eco-innovative product design in the context of a smartphone

| **Types of eco-innovations** | **Product quality** | | **Preferences for eco-innovation** | | **Adoption intention** | | **Willingness to pay** | | **Predicted consumption levels** | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **M** | **SD** | **M** | **SD** | **M** | **SD** | **M** | **SD** | **M** | **SD** |
| Resource use efficient innovation | $5.37_a$ | 0.88 | $5.86_a$ | 0.94 | $5.01_a$ | 1.43 | $327.89_a$ | 202.06 | $4.35_a$ | 3.20 |
| Resource use elimination innovation | $5.84_b$ | 1.07 | $5.97_a$ | 1.06 | $5.57_b$ | 1.22 | $307.26_a$ | 176.69 | $6.41_b$ | 5.35 |
| Resource use substitution innovation | $5.78_b$ | 0.97 | $5.80_a$ | 0.83 | $4.90_a$ | 1.36 | $326.69_a$ | 206.97 | $4.35_a$ | 3.02 |

*Note*: Subscripts should be interpreted only within columns. Means with the same subscript are not significantly different from each other. Means with different subscripts are significantly different at $p < .05$.

Furthermore, in paired comparisons (see Table 6), we found that participants in the resource use elimination condition not only scored higher for product quality but also expressed stronger adoption intentions and higher level of estimated product consumption than those in the resource use substitution and resource use efficiency conditions. Consistent with the findings in Study 2, the results confirm that compared with other types of eco-innovation, resource use elimination is regarded as the more favourable option by creating more positive perceptions of product eco-friendliness and product quality, evoking stronger adoption likelihood, and even increasing higher predicted product consumption levels.

*Influence of eco-friendly consumer innovativeness (ECI) on perceived product eco-friendliness and adoption intention*. We conducted a mediated moderation analysis using Model 15 from PROCESS macro in SPSS for each eco-innovation type (Hayes, 2013). In the mediated moderation model, we entered ECI as the independent variable, perceived trade-offs as the moderator, perceived product eco-friendliness as the mediator, and adoption intentions as the dependent variable. We also controlled the effects of participants' demographic characteristics (age, gender, income, and prior product experience [measured by the number of smartphones owned]) in the analysis. Following the bootstrapping procedure recommended by Preacher and Hayes (2004), we applied 5,000 iterations to derive a 95% confidence interval for the indirect effect of ECI on adoption intentions through perceived product eco-friendliness. None of the control variables had significant effects on the dependent variables.

Examining the conditional indirect effects, we found that across the three types of eco-innovations, the 95% confidence interval excluded zero and *z*-values were significant (see Table 7), indicating a significant indirect effect of ECI on adoption intentions through perceived product eco-friendliness, in support of **H4a** and **H4b** across different types of eco-innovations. As Figure 7 shows, there was full mediation for the relationships of ECI and adoption intentions in the resource use elimination innovation and resource use substitution innovation conditions, while there was partial mediation in the case of the resource use efficiency innovation.

**Table 7** The indirect effect of ECI on adoption intention via perceived product eco-friendliness

| Types of eco-innovations | Indirect effect of ECI | Boot SE | Sobel test | 95% bias-corrected bootstrap CI |
|---|---|---|---|---|
| Resource use efficient innovation | 0.19 | 0.10 | 1.96* | [0.02, 0.41] |
| Resource use elimination innovation | 0.20 | 0.10 | 2.27* | [0.04, 0.45] |
| Resource use substitution innovation | 0.19 | 0.09 | 2.38* | [0.05, 0.43] |

*Notes*: * Significant at $p < .05$.

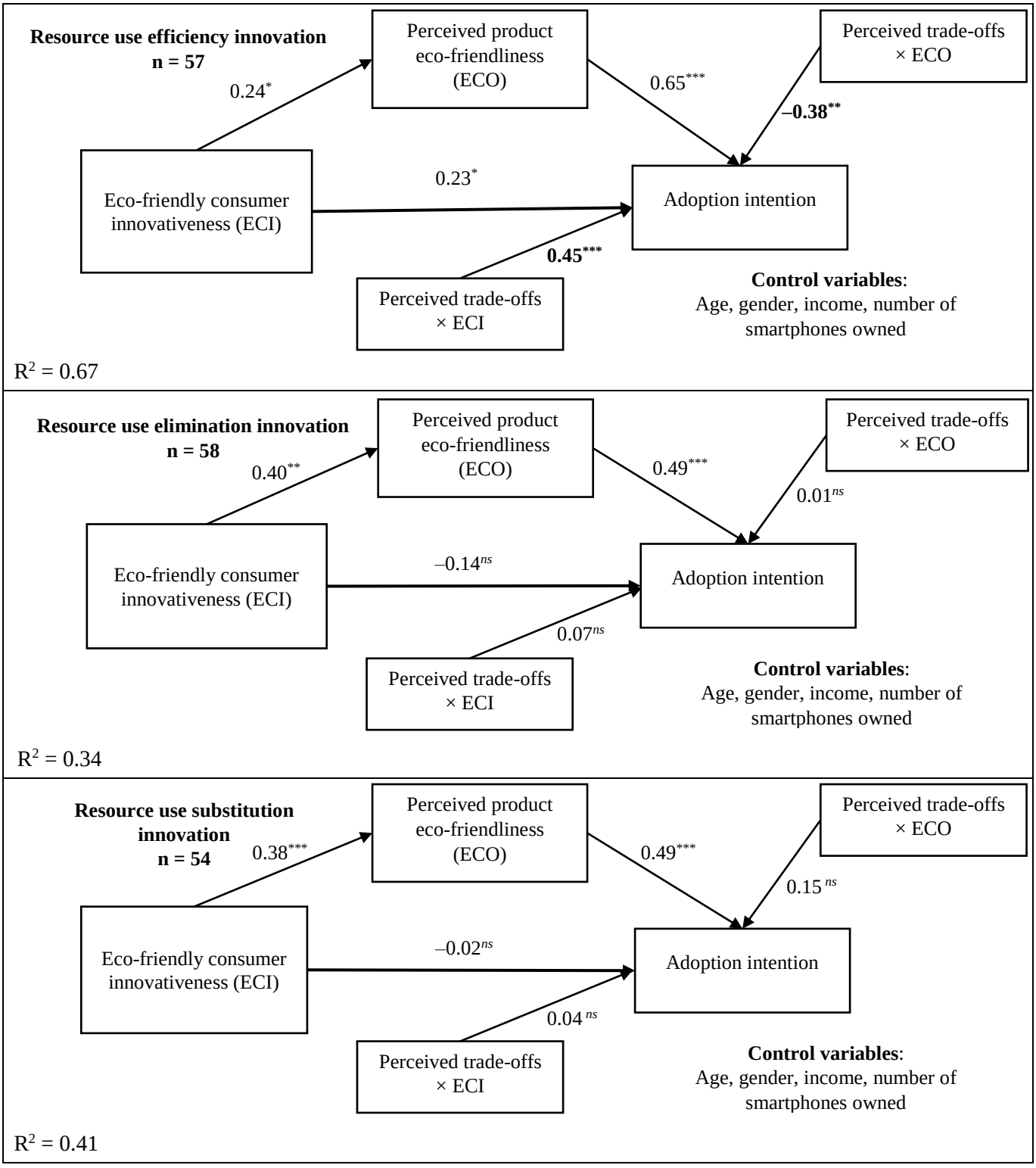


**Figure 7** The results for the mediated moderation analyses across different types of eco-innovations

*Note*: ***$p$ <.001; **$p$ <.01; *$p$ <.05; ns: non-significant

Regarding the moderating effects of perceived trade-offs between eco-friendly benefits and product effectiveness, the results indicate that perceived trade-offs significantly and negatively moderated the positive effects of perceived eco-friendliness on adoption intentions (interaction effect = –.38; 95% CI = [–.66, –.10]), in support of **H5a**, in the resource use efficiency condition. We also found a significant and positive moderating effect of perceived trade-offs on the link between ECI and adoption intentions (interaction effect = .45; 95% CI = [.21, .69]), in support of **H5b**, in the resource use efficiency condition (see Figure 8). However, we did not find any significant moderating effect of perceived trade-offs in the other two conditions.

A B

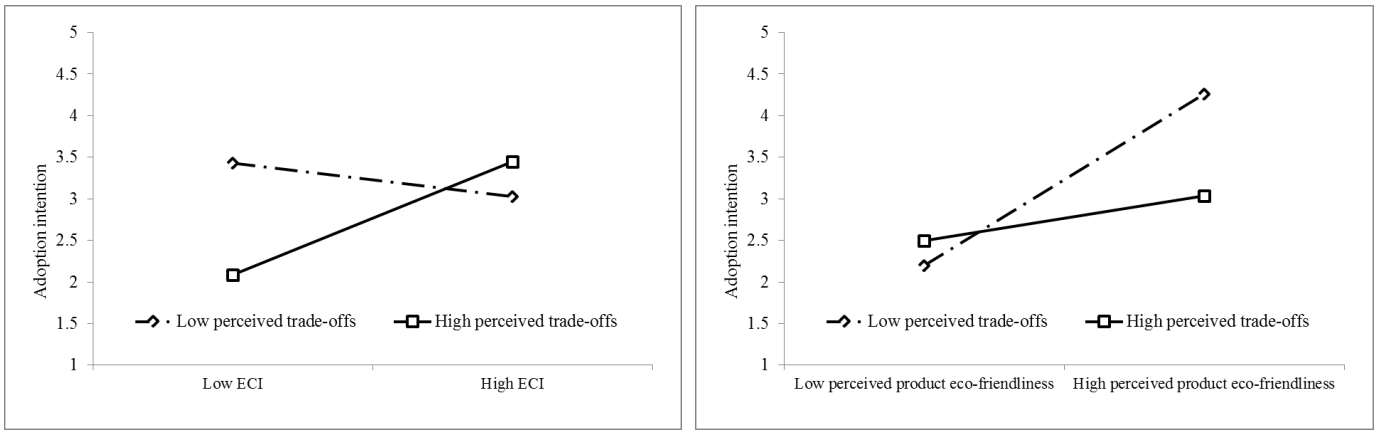


**Figure 8** The moderating effects of perceived trade-offs on the relationship between ECI and adoption intention (panel A) and on the relationship between perceived eco-friendliness and adoption intention (panel B) in the context of resource use efficiency innovations.

***Discussion***

Study 3 replicates key findings from Study 2 in a publicly consumed product context (an innovative smartphone) while exploring the underlying mechanism of the effect of ECI on adoption intentions across different types of eco-innovation. More specifically, Study 3 confirms that participants responded differently to different types of eco-friendly attributes included in an eco-innovative product

design. Resource use elimination innovations triggered the highest perceived quality, the strongest adoption intentions, and the highest level of estimated consumption, followed by resource use substitution and resource use efficiency innovations. The results support the generalizability of our findings in Study 2 across product categories.

The primary objective of Study 3, however, was to demonstrate how ECI affects adoption intentions across the different types of eco-innovation. The results reveal that stronger ECI enhanced consumers' perceptions of product eco-friendliness, which, in turn, affected their adoption intentions toward an eco-innovation. The indirect effect of ECI on adoption intentions was significant across three different types of eco-innovations. We found that the moderating effects of perceived trade-offs occurred only in the case of the resource use efficiency condition and not in the resource use elimination or the resource use substitution conditions. The pattern of the results underscores that trade-offs between eco-friendly attributes and product effectiveness play an important role in strengthening the impact of ECI while weakening the effect of product eco-friendliness on consumers' adoption intentions in the context of resource use efficiency innovations.

### 6.4. Study 4: Detachability and importance of eco-innovative attributes: core versus peripheral

#### *Results*

*Manipulation check.* We performed a one-way ANOVA and an independent *t*-test with perceived detachability and attribute importance as dependent factors. This analysis show that the condition manipulation was successful. As intended, participants in the core-non-optional condition found eco-innovative attributes to be less detachable ($M$ = 2.30, SD = 1.04) than those in the core-optional ($M$ = 2.38, SD = 1.14) and peripheral ($M$ = 2.88, SD = 1.53; $F(3,288) = 5.97$, $p < .01$) conditions. As we expected, participants perceived the eco-innovative attribute as more important for

their adoption decision when it was described as important ($M$ = 5.16, SD =1.02) than when it was not described as such ($M$ = 4.37, SD =1.45; $t(289) = 5.40$, $p < .001$).

*Consumer responses to eco-innovative product design.* We performed 3 (locus: core-non-optional vs. core-optional vs. peripheral) × 2 (attribute importance in consumer choice: high vs. low) ANOVA tests on perceived eco-friendliness, product quality, consumer preferences, and adoption intention. In all the tests, we controlled for age, gender, income, education, number of cars owned, and objective product knowledge.

*Perceived product eco-friendliness.* The ANOVA of perceived eco-friendliness showed a main effect of attribute importance ($F(1, 279) = 4.09$, $p < .05$) such that participants in the high importance condition reported higher perceived eco-friendliness than those in the low importance condition ($M_{high}$ = 5.28 vs. $M_{low}$ = 5.04). We found a main effect of detachability of the eco-innovative attribute ($F(2, 279) = 7.33$, $p < .01$), such that participants in the peripheral ($M_{peripheral}$ = 5.33) and core-optional conditions ($M_{core\text{-}optional}$ = 5.31) reported higher perceived eco-friendliness than those in the core-non-optional condition ($M_{core\text{-}non\text{-}optional}$ = 4.84). The interaction between detachability and attribute importance was not significant ($F(2, 279) = 2.01$, *ns.*). None of the control variables had main or interaction effects ($p > .20$).

*Product quality.* The ANOVA on product quality showed a main effect of attribute importance ($F(1, 279) = 4.73$, $p < .05$). Participants in the high importance condition perceived higher product quality ($M_{high}$ = 5.59) than those in the low importance condition ($M_{low}$ = 5.32). The main effect of detachability of the eco-innovative attribute was also significant ($M_{peripheral}$ = 5.58, $M_{core\text{-}optional}$ = 5.56 vs. $M_{core\text{-}non\text{-}optional}$ = 5.23; $F(2, 279) = 3.40$, $p < .05$), in support of **H6a**. The two-way interaction between detachability and attribute importance was not significant ($F(2, 279) = .40$, *ns.*). None of the control variables had main or interaction effects ($p > .10$).

*Consumer preferences toward eco-innovative cars*. The ANOVA on consumer preferences showed a main effect of attribute importance ($F(1, 279) = 6.73$, $p < .01$; $M_{high} = 5.70$ vs. $M_{low} = 5.36$). The results also indicated the significant main effect of detachability of the eco-innovative attribute ($F(2, 279) = 5.92$, $p < .01$). More specifically, participants in the peripheral ($M_{peripheral} = 5.70$) and core-optional ($M_{core\text{-}optional} = 5.67$) locus condition expressed higher product preferences than those in core-non-option condition ($M_{core\text{-}non\text{-}optional} = 5.21$), in support of **H6b**. The two-way interaction between detachability and attribute importance was not significant ($F(2, 279) = 0.80$, *ns.*). None of the control variables had main or interaction effects ($p > .10$).

*Adoption intention.* The ANOVA on adoption intention showed a main effect of age ($F(1, 279) = 6.47$, $p < .05$) and product knowledge ($F(1, 279) = 21.37$, $p < .001$), while other control variables had no significant impact on adoption intention. Detachability of the eco-innovative attribute had a main effect ($F(2, 279) = 4.24$, $p < .05$): participants reported a higher adoption intention when the eco-innovative attribute was detachable ($M_{peripheral} = 4.52$) and core-optional ($M_{core\text{-}optional} = 4.45$) than when it was core-non-optional ($M_{core\text{-}non\text{-}optional} = 3.87$). The main effect of attribute importance ($F(1, 279) = 1.47$, *ns.*) and the interaction between detachability and attribute importance ($F(1, 279) = 0.32$, *ns.*) was not significant. To assess the stability of our estimates, we also ran a detachability × attribute importance ANOVA, excluding age and product knowledge. The effect of detachability of the eco-friendly attribute on adoption intention remained unchanged ($F(2, 281) = 4.20$, $p < .05$), in support of **H6c**. Thus, the impact of detachability was robust regardless of the control for age and product knowledge.

For robustness, we performed follow-up analyses of simple effects, showing that detachability contributes to consumer responses beyond the influence of importance to the consumers. As an additional analysis, we removed the variable for manipulating attribute importance from the 3 × 2 ANOVA and instead included participants' self-reported ratings of the importance of the electric

battery charger as a covariate in the analysis. Even with perceived attribute importance included, the effect of detachability remained significant for perceived eco-friendliness ($F(2, 283)=5.81$, $p<.01$), product quality ($F(2, 283)= 3.15$, $p<.05$), consumer preferences ($F(2, 283)=4.46$, $p<.05$), and adoption intention ($F(2, 283)=3.25$, $p<.05$). We also performed separate one-way ANOVA tests to examine the effects of detachability on consumer responses for high vs. low attribute important conditions (see Table 8). Together, these results suggest that the effect of detachability is independent of that of attribute importance in consumer choice, in support of **H7 a, b, c**.

**Table 8** Follow-up analyses of detachability effects on consumer responses

| Paths | High attribute importance | Low attribute importance |
|---|---|---|
| Detachability → Perceived eco-friendliness | F(2, 143) = 1.75, $p$ =.18 | F(2, 142) = 6.24, $p$ =.00 |
| Detachability → Product quality | F(2, 143) = 2.44, $p$ =.09 | F(2, 142) = .97, $p$ =.38 |
| Detachability → Consumer preferences | F(2, 143) = 5.89, $p$ =.00 | F(2, 142) = 1.69, $p$ =.19 |
| Detachability → Adoption intention | F(2, 143) = 3.02, $p$ =.05 | F(2, 142) = 1.47, $p$ =.23 |

*Mediation analysis*. We next examined the mechanism underlying the effect of detachability on consumers' responses. We contend that perceived product eco-friendliness, product quality, and consumer preferences mediate the relationship between detachability of the eco-friendly attribute and adoption intention. Given the hypothesized relationships among the variables, we employed the serial multiple mediator model (Model 6) proposed by Hayes (2013), using the PROCESS macro in SPSS. In this model, we treated detachability of the eco-friendly attribute as the main independent variable while keeping age, gender, income, education, number of cars owned, product knowledge, and attribute importance as controls. Based on our theoretical model, we specified perceived eco-friendliness as the antecedent to product quality, which in turn was specified as the antecedents to consumer preferences and adoption intention.

Figure 9 presents the path parameter estimates and the 95% bootstrap CI estimates for the indirect effects based on a bootstrapping analysis with 5,000 samples (Preacher and Hayes, 2008).

The effect of detachability of the eco-friendly attribute on adoption intention was fully mediated by perceived eco-friendliness and product quality, as shown by the significant indirect effect of detachability on adoption intention through perceived eco-friendliness and product quality (B = .02; 95% CI = [.01, .04]). Likewise, the indirect effect of detachability on adoption intention through perceived eco-friendliness and consumer preferences was also significant (B =.03; 95% CI = [.01, .07]), suggesting the fully mediating roles of perceived eco-friendliness and consumer preferences. Finally, the sequential path from perceived eco-friendliness to product quality and then to consumer preferences was also significant (B = .02; 95% CI = [.01, .04]), suggesting that detachability affected adoption intention fully through perceived eco-friendliness, product quality, and consumer preferences.

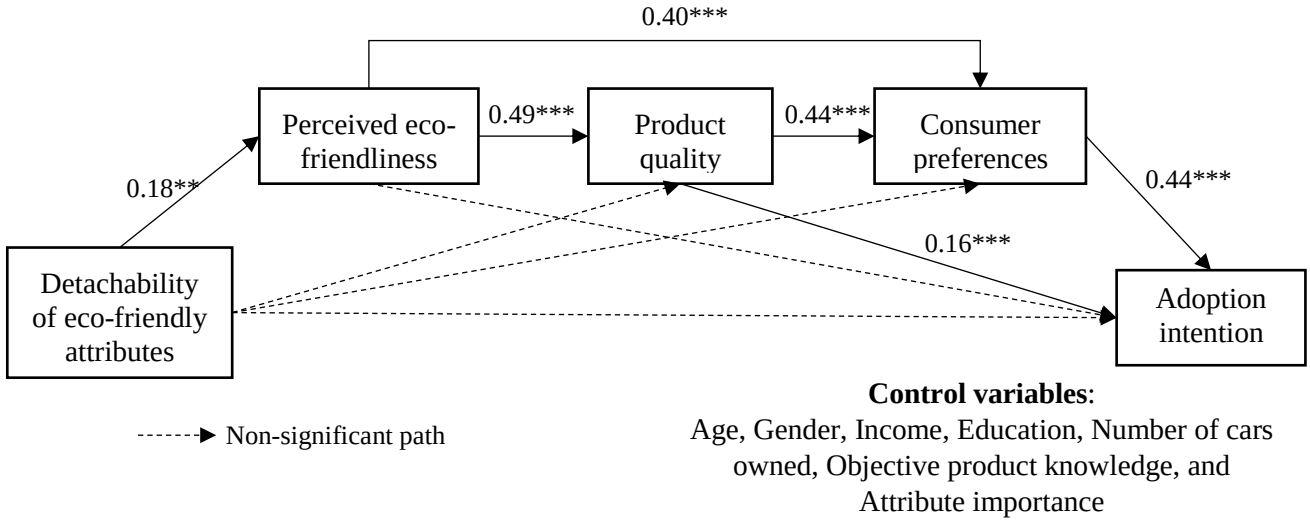


**Figure 9** The serial mediation model

*Note*: $^{***}p$ <.001; $^{**}p$ <.01

***Discussion***

Study 4 examines the effects of an eco-innovative attribute's detachability on consumer responses and tests whether the effect is independent of an eco-friendly attribute's importance in a

consumer's adoption decision. The empirical results support the positive impact of an eco-friendly attribute's detachability on consumers' perceptions of product eco-friendliness, product evaluation, preferences, and adoption intentions, in support of **H6**. The findings also confirm our hypothesis (**H7**) that the effect of detachability on consumer responses is independent of attribute importance. More specifically, including both manipulated and self-reported eco-friendly attribute importance in our analysis did not eliminate the effect of detachability on consumers' responses to an eco-innovation. We did not predict the observed unique effect of attribute importance on consumer response. One explanation may be that when consumers pay more intention to one eco-innovative attribute, they consider this attribute with higher environmental benefits, which leads to higher preferences toward the eco-innovation. Alternatively, attribute importance might signal levels of consumers' environmental concerns or different goals for eco-innovation, which could impact ad hoc categorization of the product.

More importantly, Study 4 provides useful insights into the mechanisms underlying the effect of detachability of an eco-friendly attribute. Notably, perceived eco-friendliness, product quality, and consumer preferences emerged as significant mediators. In other words, peripheral and core-optional (versus core-non-optional) locus enhanced consumers' understanding of the eco-friendly benefits of an eco-innovative product design, which led them to perceive higher product quality, be more attracted to the offering, and ultimately be more likely to adopt the innovation.

### 6.5. Study 5: The interactive roles of ecological country-of-manufacture, eco-friendly attributes, and need for cognition

#### *Experiment 1*

*Manipulation check*

*Product eco-friendliness*. We asked participants to rate on a single-item and seven-point Likert scale to express their evaluation of the eco-friendliness of the new products shown in the stimuli (1 star = very low, and 7 stars = very high). As anticipated, respondents' perception of PECO in the high eco-friendly condition (M = 6.04) was significantly higher than their evaluation of PECO in the low eco-friendly condition (M = 4.50, $t(213)=7.38$, $p < .001$).

*Ecological COM*. Participants rated France (M = 5.79) was perceived to be superior in terms of their sustainable reputation than India (M = 4.49, $t(103) = 5.85$, $p < .001$) in the car category and Japan (M = 5.41) was significantly better in environmental protection than South Africa (M = 4.27, $t(108) = 4.85$, $p < .001$) in the TV category. Overall, we found that the product descriptions successfully manipulated participants' perceptions of PECO and ECOM.

*Results*

We estimated two 2 × 2 × 2 full-factorial analysis of variance (ANOVA) tests with perceived product quality and purchase intentions as dependent variables. As expected, we found that ECOM and PECO had the statistically significant main effects on product quality and purchase intentions (See Table 9). Specifically, the series of t-tests reveal that respondents not only rated high eco-friendly products significantly higher in product quality ($M_{high} = 4.89$, $M_{low} = 4.48$; $t(213) = 2.22$, $p < .05$) but expressed marginally significant stronger intention to buy them ($M_{high} = 4.43$, $M_{low} = 3.99$; $t(213) = 1.86$, $p = .06$) than low eco-friendly innovations. Similarly, participants also responded significantly more positively to eco-innovations made in a favourable ECOM than an unfavourable ECOM in terms of product quality ($M_{Favourable} = 5.11$, $M_{unfavourable} = 4.27$; $t(213) = 4.76$, $p < .001$) and purchase intentions ($M_{Favourable} = 4.80$, $M_{unfavourable} = 3.64$; $t(213) = 5.07$, $p < .001$).

**Table 9** Analysis of variance results ANOVA (2 x 2 x 2 design) in Experiment 1

| Effects | df | Product quality | | Purchase intention | |
|---|---|---|---|---|---|
| | | F | $\eta^2$ | F | $\eta^2$ |
| Age | 1 | 0.01 | 0.00 | 5.11* | 0.03 |
| Gender | 1 | 0.04 | 0.00 | 0.74 | 0.00 |
| Income | 1 | 3.29+ | 0.02 | 1.73 | 0.01 |
| Education | 1 | 1.53 | 0.01 | 0.21 | 0.00 |
| Product category knowledge | 1 | 0.00 | 0.00 | 0.67 | 0.00 |
| Patriotism | 1 | 0.84 | 0.00 | 1.44 | 0.01 |
| Economic threats | 1 | 1.12 | 0.01 | 0.51 | 0.00 |
| Openness to new cultures | 1 | 0.03 | 0.00 | 2.00 | 0.01 |
| General country image | 1 | 30.16*** | 0.13 | 6.48* | 0.03 |
| **Product type (PRO)** | **1** | **3.64+** | **0.02** | **1.18** | **0.01** |
| **Ecological COM (ECOM)** | **1** | **9.83**** | **0.05** | **18.73***** | **0.09** |
| **Product eco-friendliness (PECO)** | **1** | **5.94*** | **0.03** | **4.83*** | **0.02** |
| **PRO x ECOM** | **1** | **0.04** | **0.00** | **0.42** | **0.00** |
| **PRO x PECO** | **1** | **3.53+** | **0.02** | **5.91*** | **0.03** |
| **ECOM x PECO** | **1** | **5.09*** | **0.03** | **8.47**** | **0.04** |
| **PRO x ECOM x PECO** | **1** | **6.81*** | **0.03** | **7.71*** | **0.04** |
| Residual | 198 | | | | |
| $R^2$ | | 0.38 | | 0.33 | |

` *Note*: ***$p < .001$; **$p < .01$; *$p < .05$ , +$p < .10$

Importantly, the three-way interaction among the three factors were statistically significant for product quality ($F(1, 198) = 6.81$, $p < .01$) and for purchase intention ($F(1, 198) = 7.71$, $p < .01$). This suggests that consumer responses to eco-innovation vary across different combinations of these factors. The results also highlight the importance of considering eco-innovative product designs associated with the manufacturing/outsourcing strategy for a particular product type. To examine **H8**, we probed the significant three-way interaction by conducting planned comparisons to contrast the four cells (i.e., congruence vs. incongruence between ECOM and PECO) for two product categories.

First, we split the data set on the basis of product category and then investigated the interaction effects of ECOM and PECO for each product category. **For the car category**, we found the main effects of both ECOM and PECO on consumer responses (i.e., product quality and

purchase intention, *p's* < .05) while the interaction effects of ECOM and PECO were not significant ($p > .10$). The results indicated that the main effects of ECOM on consumer responses are independent of those of PECO, suggesting the choice of using either ECOM or PECO to win consumers in the market. Companies could opt to manufacturing high eco-innovative cars (in either favourable or unfavourable ECOM) or producing innovative cars (either having low or high PECO) in a favourable ECOM to signal good product quality and accelerate higher adoption rates.

**For the TV category**, the main effect of ECOM was significant for purchase intentions ($F(1, 97) = 10.12$, $p < .01$) but only marginally significant on product quality ($F(1, 97) = 3.09$, $p = .08$). The main effects of PECO on consumer responses were not significant ($p > .10$). Moreover, the interaction effects of ECOM and PECO on product quality ($F(1, 97) = 9.47$, $p < .01$) and purchase intention ($F(1, 97) = 15.00$, $p < .001$) were significant. The results promoted the further investigation into the simple main effects of ECOM at each level of PECO. Manufacturing a low eco-innovation in a favourable ECOM elicited higher product quality ($t(52) = 4.66$, $p < .001$) and purchase intention ($t(52) = 6.33$, $p < .001$) than doing so in an unfavourable ECOM. Conversely, there were no significant differences in consumer responses (i.e., product quality and purchase intention) to high eco-innovative TVs made in Japan or South Africa ($p > .10$).

Additional analysis was performed by creating a new categorical variable, reflecting four combinations of PECO and ECOM to examine the general effects of schema (in)congruence on consumer responses within each category. We conducted planned comparisons to contrast the four cells (*Congruent unfavourable ECOM* [Low PECO-Unfavourable ECOM]; *Congruence favourable ECOM* [High PECO-Favourable ECOM]; *Incongruent unfavourable ECOM* [High PECO-Unfavourable ECOM]; *Incongruent favourable ECOM* [Low PECO-Favourable ECOM]) Figure 10 and 11 demonstrate the mean scores of two dependent variables (product quality and purchase intention) across conditions.

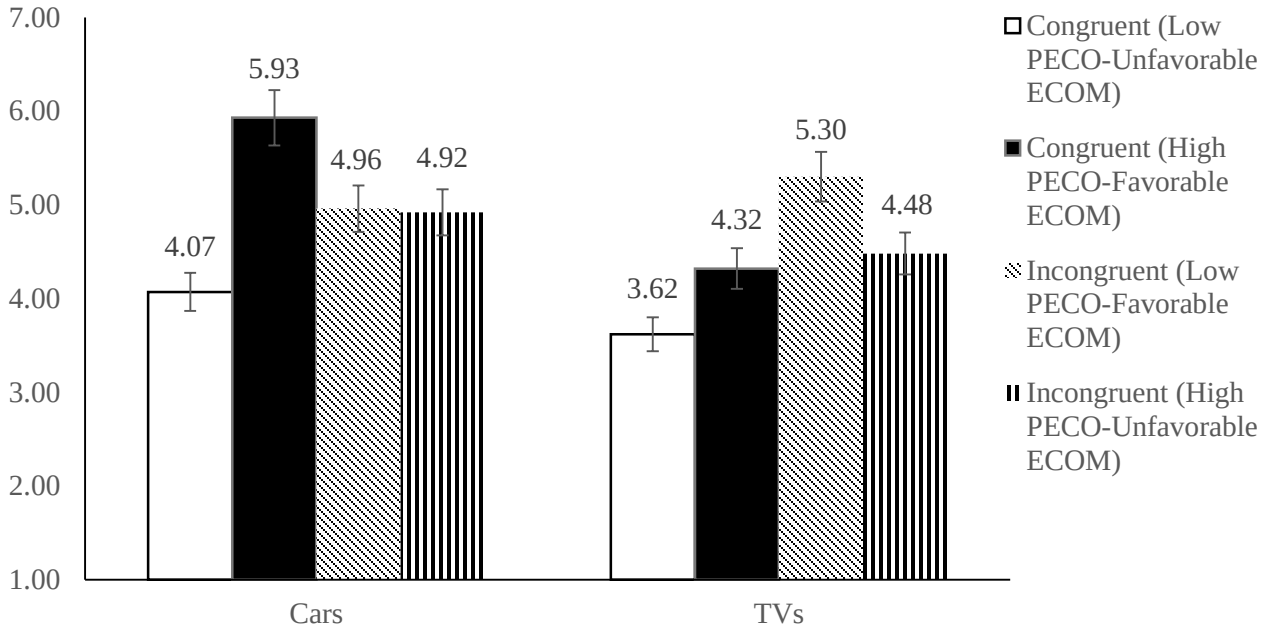


**Figure 10** Means for perceived product quality (Experiment 1)

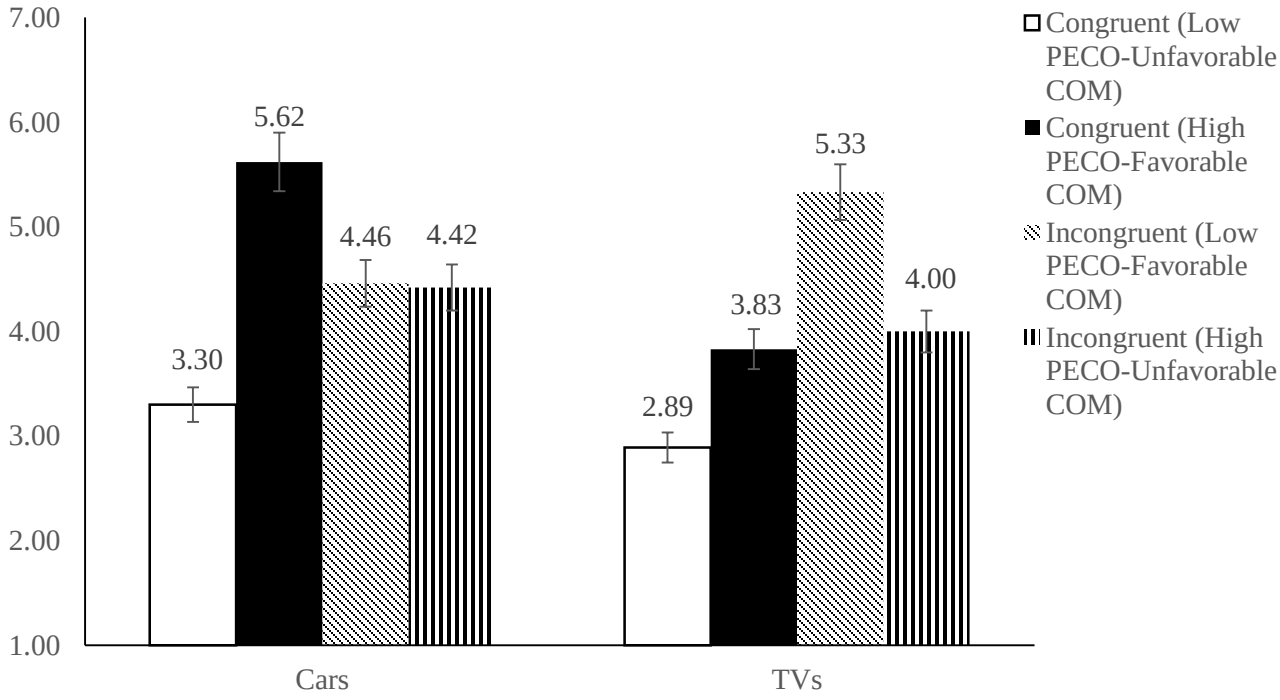


**Figure 11** Means for purchase intention (Experiment 1)

**For the car category**, while *congruent unfavourable ECOM* (i.e., Low PECO-Unfavourable ECOM) triggered the lowest product quality and purchase intentions, *congruent*

*favourable ECOM* (i.e., High PECO-Favourable ECOM) led to the most positive consumers' responses to eco-innovation than any other combinations (See Table 10). The results indicated that for publicly consumed products (e.g., cars), the congruence between ECOM and PECO positively affects consumer responses to eco-innovation. Conversely**, for the TV category**, the *incongruence favourable ECOM* (i.e., Low PECO-Favourable ECOM) significantly increase perceived product quality and purchase likelihood than the congruence cases (See Table 10). All together, these findings support **H8a, b**.

**Table 10** Tukey HSD post hoc test for dependent variables—perceived product quality and purchase intention for connected TVs and driverless cars.

| Product type | (In) congruence between PECO and ECOM (A) | (In) congruence between PECO and ECOM (B) | Product quality | | | Purchase intention | | |
|---|---|---|---|---|---|---|---|---|
| | | | Mean difference (A-B) | SD | *p* | Mean difference (A-B) | SD | *p* |
| Cars | Congruent Unfavourable ECOM | Congruent Favourable ECOM | -1.85 | 0.31 | 0.00 | -2.32 | 0.45 | 0.00 |
| | | Incongruent Unfavourable ECOM | -0.89 | 0.31 | 0.02 | -1.17 | 0.45 | 0.05 |
| | | Incongruent Favourable ECOM | -0.85 | 0.31 | 0.03 | -1.13 | 0.45 | 0.06 |
| | Congruent Favourable ECOM | Congruent Unfavourable ECOM | 1.85 | 0.31 | 0.00 | 2.32 | 0.45 | 0.00 |
| | | Incongruent Unfavourable ECOM | 0.96 | 0.31 | 0.01 | 1.15 | 0.45 | 0.06 |
| | | Incongruent Favourable ECOM | 1.00 | 0.31 | 0.01 | 1.19 | 0.45 | 0.05 |
| | Incongruent Unfavourable ECOM | Congruent Unfavourable ECOM | 0.89 | 0.31 | 0.02 | 1.17 | 0.45 | 0.05 |
| | | Congruent Favourable ECOM | -0.96 | 0.31 | 0.01 | -1.15 | 0.45 | 0.06 |
| | | Incongruent Favourable ECOM | 0.04 | 0.31 | 1.00 | 0.04 | 0.45 | 1.00 |
| | Incongruent Favourable ECOM | Congruent Favourable ECOM | 0.85 | 0.31 | 0.03 | 1.13 | 0.45 | 0.06 |
| | | Incongruent Unfavourable ECOM | -1.00 | 0.31 | 0.01 | -1.19 | 0.45 | 0.05 |
| | | Incongruent Favourable ECOM | -0.04 | 0.31 | 1.00 | -0.04 | 0.45 | 1.00 |
| TVs | Congruent Unfavourable ECOM | Congruent Favourable ECOM | -0.70 | 0.35 | 0.18 | -0.94 | 0.40 | 0.10 |
| | | Incongruent Unfavourable ECOM | -1.68 | 0.35 | 0.00 | -2.44 | 0.41 | 0.00 |
| | | Incongruent Favourable ECOM | -0.86 | 0.35 | 0.07 | -1.08 | 0.40 | 0.04 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Congruent Favourable ECOM | Congruent Unfavourable ECOM | 0.70 | 0.35 | 0.18 | 0.94 | 0.40 | 0.10 |
| | Incongruent Unfavourable ECOM | -0.97 | 0.35 | 0.03 | -1.50 | 0.40 | 0.00 |
| | Incongruent Favourable ECOM | -0.15 | 0.34 | 0.97 | -0.13 | 0.40 | 0.99 |
| Incongruent Unfavourable ECOM | Congruent Unfavourable ECOM | 1.68 | 0.35 | 0.00 | 2.44 | 0.41 | 0.00 |
| | Congruent Favourable ECOM | 0.97 | 0.35 | 0.03 | 1.50 | 0.40 | 0.00 |
| | Incongruent Favourable ECOM | 0.82 | 0.35 | 0.09 | 1.37 | 0.40 | 0.01 |
| Incongruent Favourable ECOM | Congruent Favourable ECOM | 0.86 | 0.35 | 0.07 | 1.08 | 0.40 | 0.04 |
| | Incongruent Unfavourable ECOM | 0.15 | 0.34 | 0.97 | -0.09 | 0.43 | 1.00 |
| | Incongruent Favourable ECOM | -0.82 | 0.35 | 0.09 | -1.09 | 0.43 | 0.06 |

*Discussion*

The results of Experiment 1 reveal that the effects of the schema (in)congruence between ECOM and PECO on consumer responses to eco-innovations depend on product type (publicly consumed *vs.* privately consumed products). We found that for publicly consumed products like cars, respondents tend to pay more attention to the schema congruence between the ecological aspect of a COM and PECO in their purchase decisions. Specifically, a highly eco-innovative product design manufactured in a favourable COM provokes the most positive consumers' reactions. Therefore, it could be the best outsourcing and international marketing approach for publicly consumed product categories.

For products used in private settings, the incongruence between ECOM and PECO, particularly in the case of low eco-innovation made in a favourable ECOM, resulted in significantly more positive consumer responses than any of the other combinations of ECOM and PECO. Thus, this would be the best option for manufacturing low eco-friendly innovations in a favourable ECOM in this product category. However, there were no significant differences among consumer responses to high eco-friendly private products made in a favourable versus an unfavourable ECOM. Thus, manufacturing high eco-innovations in either country could be

advantageous for in-house product categories. The findings are consistent with the idea that consumers evaluate and make purchase decisions about publicly and privately consumed products differently. Specifically, they pay more attention to ECOM and its congruence with eco-friendly product attributes when assessing publicly consumed products to express their desired social status while consumers are more likely to be influenced by the incongruence in the case of privately consumed products.

***Experiment 2***

*Measurement equivalence*. To ensure the comparability of the variable measurements across two national groups, we followed the sequential process of assessing the invariance of the measurement models using the multi-group confirmatory factor analysis (CFA), as suggested by Steenkamp and Baumgartner (1998). First, we estimated the two-group models (including all the latent variables) to examine configural invariance; all other fit statistics provided evidence of good fit (root mean square error of approximation [RMSEA] = .05, Tucker–Lewis index [TLI] = .93, comparative fit index [CFI] = .94, and incremental fit index [IFI] = .94). Subsequently, we proceeded with the metric invariance assessment across the national samples and found full metric invariance across the two countries with satisfactory fit indices (RMSEA = .04, TLI = .93, CFI = .94, and IFI = .94). The result of the chi-square difference test was not significant ($\Delta\chi^2(21) = 32.60$, *ns.*). Therefore, reliable comparisons between the results from the Indian and the U.S. samples can be made.

*Manipulation check.*

*Product eco-friendliness*. As anticipated, consumers' perception of PECO towards the new products in the high eco-friendly condition (M = 5.43) was significantly higher than their evaluation of PECO in the low eco-friendly condition (M = 5.08, $t(394) = 2.33$, $p < .05$).

*Ecological COM*. We ran a *t*-test on the general ECOM image and found that respondents reported high scores on general ECOM in South Korea (M = 5.21) than those in Slovakia (M = 4.83; $t(394) = 3.26$, $p < .01$). Thus, we were successful in manipulating PECO and ECOM across two national markets.

*Results*

After controlling for the respondents' demographic profiles (age, gender, income, and education), their prior experience (number of smartphones owned), product category knowledge, and other country-related variables, the univariate ANOVA (2x2x2) results showed that only ECOM had the significant main effects on consumer's responses across two national markets (See Table 11). Specifically, the series of t-tests revealed that regardless PECO levels, respondents rated the innovations made in a favourable ECOM significantly higher in product quality ($M_{favourable} = 4.92$, $M_{unfavourable} = 4.50$; $t(394) = 3.22$, $p < .01$) and expressed higher purchase likelihood ($M_{favourable} = 4.94$, $M_{unfavourable} = 4.47$; $t(394) = 2.85$, $p < .01$). Conversely, there were no main effects of PECO on perceived product quality and purchase intentions ($p$'s > .10).

We found only the significant impact of the three-way interaction on product quality ($F(1, 378) = 12.17$, $p < .001$), but not on purchase intentions in both national markets, rejecting **H9b**. The results suggested that only the way respondents evaluated the quality of eco-innovation on the basis of ECOM and PECO varied significantly across two national markets. Furthermore, the lack of the main effect of PECO coupled with the significant three-way interaction on perceived product quality indicates that the PECO effect on product evaluation needs to be considered in association with ECOM and national contexts.

**Table 11** Analysis of variance results ANOVA (2 x 2 x 2 design) in Experiment 2

| Effects | df | Product quality | | Purchase intention | |
|---|---|---|---|---|---|
| | | F | $\eta^2$ | F | $\eta^2$ |
| Age | 1 | 0.95 | 0.00 | 2.10 | 0.01 |
| Gender | 1 | $3.92^{+}$ | 0.01 | 0.80 | 0.00 |
| Income | 1 | 0.09 | 0.00 | 0.19 | 0.00 |
| Education | 1 | $3.58^{+}$ | 0.01 | 0.16 | 0.00 |
| Prior experience [a] | 1 | 0.82 | 0.00 | 0.01 | 0.00 |
| Product category knowledge | 1 | $3.87^{+}$ | 0.01 | 1.78 | 0.00 |
| Openness to new cultures | 1 | 0.03 | 0.00 | 1.48 | 0.00 |
| Patriotism | 1 | 0.43 | 0.00 | 1.77 | 0.00 |
| Economic threats | 1 | 1.09 | 0.00 | 1.03 | 0.00 |
| General country image | 1 | $59.31^{***}$ | 0.14 | $57.30^{***}$ | 0.13 |
| **Country (CON)** | **1** | **1.17** | **0.00** | **$22.59^{***}$** | **0.06** |
| **Ecological COM (ECOM)** | **1** | **$6.52^{**}$** | **0.02** | **$4.66^{*}$** | **0.01** |
| **Product eco-friendliness (PECO)** | **1** | **0.16** | **0.00** | **0.02** | **0.00** |
| CON x ECOM | 1 | 0.09 | 0.00 | $4.78^{*}$ | 0.01 |
| CON x PECO | 1 | 1.59 | 0.00 | 0.38 | 0.00 |
| **ECOM x PECO** | **1** | **0.96** | **0.00** | **0.00** | **0.00** |
| **CON x ECOM x PECO** | **1** | **$12.17^{***}$** | **0.03** | **0.33** | **0.00** |
| Residual | 378 | | | | |
| $R^2$ | | 0.32 | | 0.42 | |

*Note*: $^{***}p < .001$; $^{**}p < .01$; $^{*}p < .05$ , $^{+}p < .10$; [a] measured by number of smartphones owned

To examine **H9a** in the two national markets, we probed the significant three-way interaction by splitting the data set on the basis of national context and then examined the simple interaction effect of ECOM and PECO on product quality within one national market. **In the Indian sample**, we found neither the significant main effects of ECOM and PECO nor their significant two-way interaction ($p$'s > .05). On the contrary, ECOM significantly affected perceived product quality ($F(1, 190) = 4.50$, $p < .05$) and its interaction effects with PECO was also significant ($F(1, 190) = 11.46$, $p < .01$) **in the U.S. sample**. The results promoted the further investigation into the simple main effect of ECOM on product quality at each level of PECO in this market. Manufacturing low eco-innovations in a favourable ECOM elicited higher product quality (M=4.84) than doing so in unfavourable ECOM (M=3.82, $t(99)= 3.34$, $p <.01$) in the US

sample. Conversely, there were no significant differences in perceived product quality to high eco-innovative smartphones made in South Korea and Slovakia (*p*'s > .10).

Additional analysis was performed by creating a new categorical variable, reflecting four combinations of ECOM and PECO to examine the general effects of schema (in)congruence on consumer responses within each category. We conducted planned comparisons to contrast the four cells (*Congruent unfavourable ECOM* [Low PECO-Unfavourable ECOM]; *Congruence favourable ECOM* [High PECO-Favourable ECOM]; *Incongruent unfavourable ECOM* [High PECO-Unfavourable ECOM]; *Incongruent favourable ECOM* [Low PECO-Favourable ECOM]) Figure 12 and 13 indicate the mean scores of product quality and purchase intentions across conditions in two national settings.

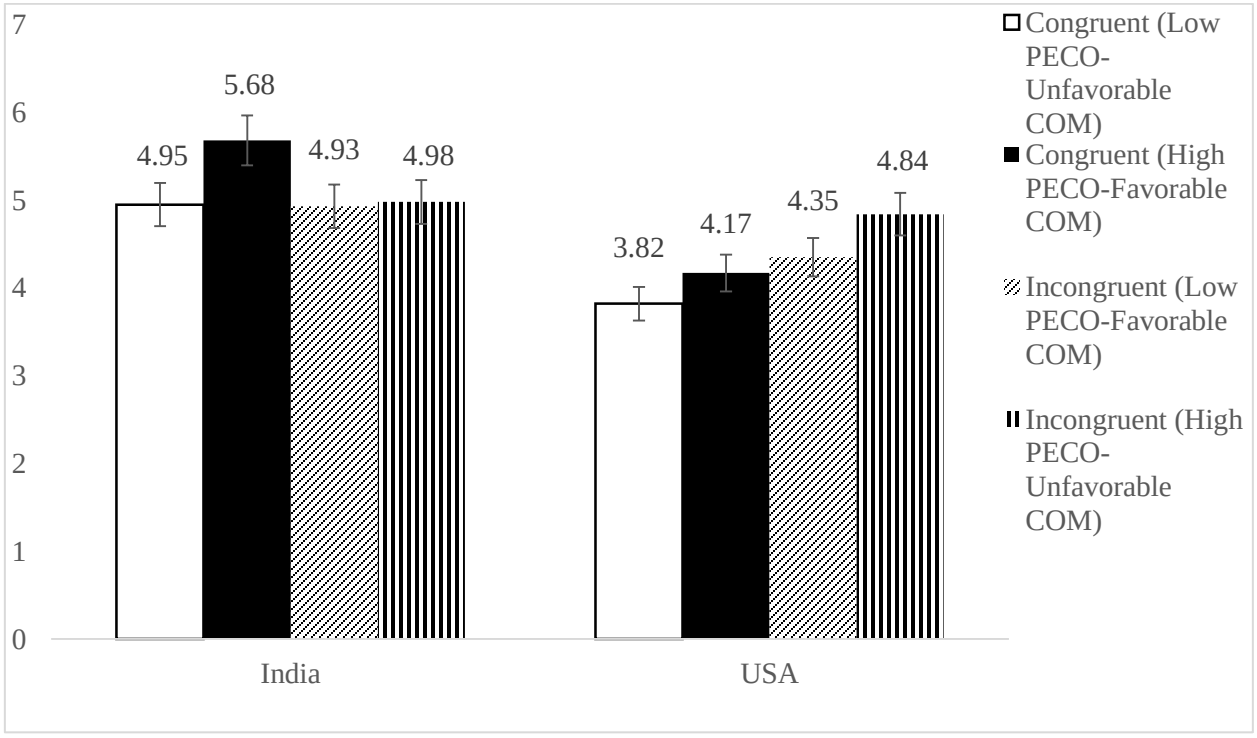


**Figure 12** Means for perceived product quality (Experiment 2)

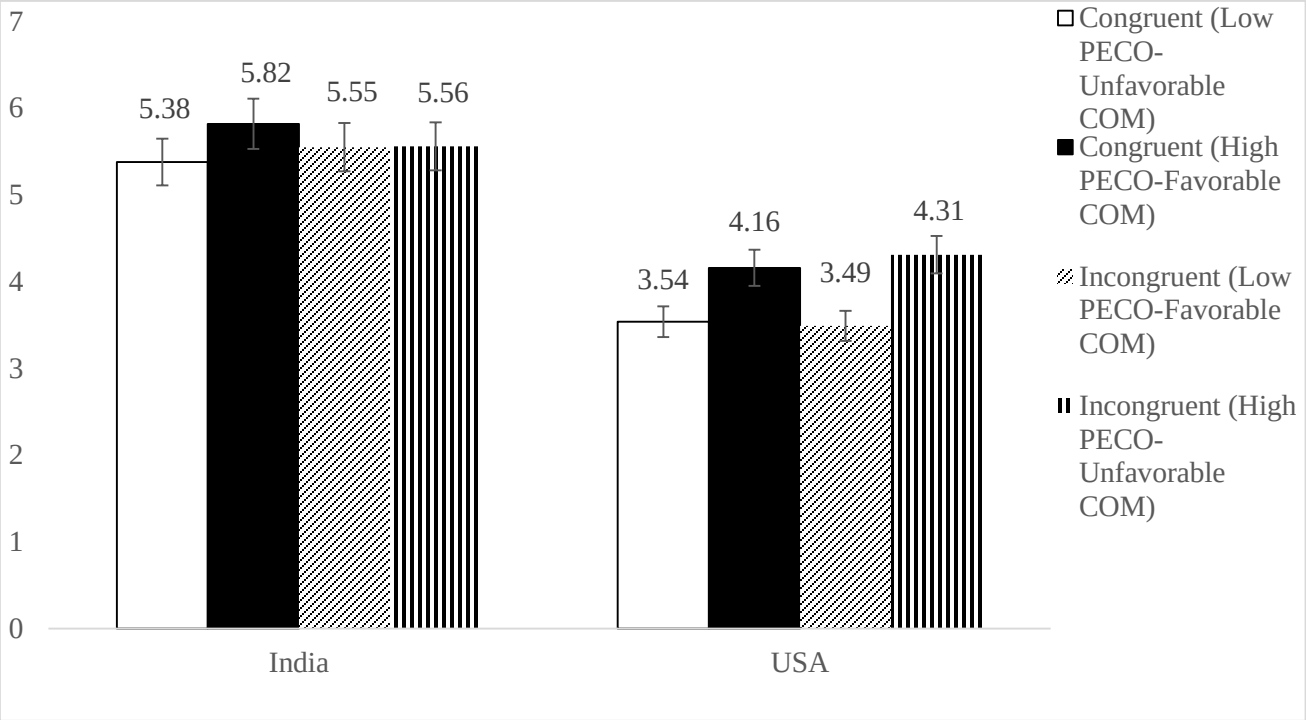


**Figure 13** Means for purchase intention (Experiment 2)

**In the Indian market**, *congruent favourable ECOM* (i.e., High PECO - Favourable ECOM) led to the most positive consumers' perception of product quality than any other combinations (See Table 12). The results indicated that even though participants in the emerging market did not express significantly higher purchase intention, they rated eco-innovation with the congruence between ECOM and PECO as higher quality products than the other alternatives. On the contrary, **in the US market**, the incongruence favourable ECOM (i.e., Low PECO - Favourable ECOM) significantly increase perceived product quality than the congruence cases (See Table 12). These findings support **H9a**.

**Table 12** Tukey HSD post hoc test for dependent variables—perceived product quality and purchase intention for connected TVs and driverless cars

| National markets | (In) congruence between PECO and ECOM (A) | (In) congruence between PECO and ECOM (B) | Product quality | | | Purchase intention | | |
|---|---|---|---|---|---|---|---|---|
| | | | Mean difference (A-B) | SD | *p* | Mean difference (A-B) | SD | *P* |
| India | Congruent Unfavourable ECOM | Congruent Favourable ECOM | -0.73 | 0.24 | 0.02 | -0.44 | 0.21 | 0.18 |
| | | Incongruent Unfavourable ECOM | 0.02 | 0.24 | 1.00 | -0.17 | 0.21 | 0.85 |
| | | Incongruent Favourable ECOM | -0.02 | 0.24 | 1.00 | -0.19 | 0.21 | 0.82 |
| | Congruent Favourable ECOM | Congruent Unfavourable ECOM | 0.73 | 0.24 | 0.02 | 0.44 | 0.21 | 0.18 |
| | | Incongruent Unfavourable ECOM | 0.75 | 0.24 | 0.01 | 0.26 | 0.21 | 0.61 |
| | | Incongruent Favourable ECOM | 0.71 | 0.24 | 0.02 | 0.25 | 0.21 | 0.65 |
| | Incongruent Unfavourable ECOM | Congruent Unfavourable ECOM | -0.02 | 0.24 | 1.00 | 0.17 | 0.21 | 0.85 |
| | | Congruent Favourable ECOM | -0.75 | 0.24 | 0.01 | -0.26 | 0.21 | 0.61 |
| | | Incongruent Favourable ECOM | -0.04 | 0.24 | 1.00 | -0.01 | 0.21 | 1.00 |
| | Incongruent Favourable ECOM | Congruent Favourable ECOM | 0.02 | 0.24 | 1.00 | 0.19 | 0.21 | 0.82 |
| | | Incongruent Unfavourable ECOM | -0.71 | 0.24 | 0.02 | -0.25 | 0.21 | 0.65 |
| | | Incongruent Favourable ECOM | 0.04 | 0.24 | 1.00 | 0.01 | 0.21 | 1.00 |
| USA | Congruent Unfavourable ECOM | Congruent Favourable ECOM | -0.35 | 0.24 | 0.47 | -0.61 | 0.33 | 0.26 |
| | | Incongruent Unfavourable ECOM | -0.53 | 0.24 | 0.13 | 0.06 | 0.33 | 1.00 |
| | | Incongruent Favourable ECOM | -1.02 | 0.24 | 0.00 | -0.76 | 0.33 | 0.10 |
| | Congruent Favourable ECOM | Congruent Unfavourable ECOM | 0.35 | 0.24 | 0.47 | 0.61 | 0.33 | 0.26 |
| | | Incongruent Unfavourable ECOM | -0.18 | 0.24 | 0.89 | 0.67 | 0.33 | 0.19 |
| | | Incongruent Favourable ECOM | -0.67 | 0.24 | 0.03 | -0.16 | 0.33 | 0.97 |
| | Incongruent Unfavourable ECOM | Congruent Unfavourable ECOM | 0.53 | 0.24 | 0.13 | -0.06 | 0.33 | 1.00 |
| | | Congruent Favourable ECOM | 0.18 | 0.24 | 0.89 | -0.67 | 0.33 | 0.19 |
| | | Incongruent Favourable ECOM | -0.49 | 0.24 | 0.18 | -0.82 | 0.33 | 0.07 |
| | Incongruent Favourable ECOM | Congruent Favourable ECOM | 1.02 | 0.24 | 0.00 | 0.76 | 0.33 | 0.10 |
| | | Incongruent Unfavourable ECOM | 0.67 | 0.24 | 0.03 | 0.16 | 0.33 | 0.97 |
| | | Incongruent Favourable ECOM | 0.49 | 0.24 | 0.18 | 0.82 | 0.33 | 0.07 |

*Moderating effects of NFC.* To determine whether NFC predicts variations in the impact of the schema (in)congruity on consumers' responses to eco-innovation, we conducted conditional mediated moderation analyses using PROCESS macro Model 3 with 5,000 bootstrapped resamples due to the presence of the two moderators (Hayes, 2013). The models regress each dependent variable (product quality and purchase intentions) on ECOM, PECO, and NFC, their two-way interactions and three-way interaction. We ran the two regression models in each national market separately (see Table 13). Both the models included respondents' demographic profiles (age, gender, income, education, and prior experience), social desirability bias, country-related consumption knowledge and experience, and openness to other cultures as covariates since previous research has demonstrated that these factors may influence consumers' perceptions and behavioural intentions in the COO/COM literature (e.g., Fetscherin and Toncar, 2010).

**Table 13** Unstandardized model coefficients

| **National markets** | **India** | | **USA** | |
|---|---|---|---|---|
| **Dependent variables** | **Product quality** | **Purchase intention** | **Product quality** | **Purchase intention** |
| Constant | -0.10 | 0.21*** | 0.07 | -0.17 |
| Product eco-friendliness (ECO) | 0.33*** | 0.22*** | 0.27*** | 0.21** |
| Ecological COM (ECOM) | 0.02 | 0.27*** | 0.22** | 0.14 |
| ECOM x ECO | 0.16 | 0.02 | -0.02 | -0.07 |
| NFC | -0.39** | -0.11 | -0.03 | -0.02 |
| ECOM x NFC | 0.43** | 0.23* | -0.02 | -0.01 |
| ECO x NFC | -0.27+ | 0.26** | -0.06 | 0.01 |
| **ECOM x ECO x NFC** | **0.13** | **-0.36**** | **-0.07*** | **-0.03** |
| Age | 0.02 | 0.14** | 0.02 | -0.10 |
| Income | -0.10 | -0.01 | -0.01 | 0.03 |
| Education | 0.07 | 0.00 | 0.10+ | -0.04 |
| Gender | 0.08 | 0.08* | 0.01 | -0.01 |
| Prior experience [a] | 0.06 | -0.04 | -0.06 | 0.04 |
| COM knowledge | 0.09 | 0.09 | 0.20* | 0.23* |
| Social desirability bias | 0.17* | 0.05 | 0.01 | -0.03 |
| Openness to new culture | 0.11 | 0.11 | 0.03 | 0.10 |
| General ECOM | 0.24* | 0.02 | 0.16* | 0.15+ |
| Product category knowledge | 0.03 | 0.12 | 0.01 | -0.06 |
| **$R^2$** | **0.47** | **0.51** | **0.51** | **0.37** |

*Note: *** $p \leq .001$. ** $p \leq .01$. * $p \leq .05$; + $p <.10$;* [a] measured by number of smartphones owned

The results of the regressions show that the three-way interaction between ECOM, PECO, and NFC was significant for purchase intentions ($b$ = -.36, $t$ = -3.15, $p$ < .01) in India and for product quality in the USA ($b$ = -.06, $t$ = -2.18, $p$ < .05). In order to test **H10**, we calculated the conditional effects of ECOM on consumers' responses at different levels of both moderators. We evaluated the conditional effects at – 1 and +1 standard deviation (SD) from the means for both NFC and PECO. The results of these analyses are depicted in Table 14. Our results reveal that, in the Indian market, for low NFC consumers, the effect of ECOM on purchase intentions was only significant for high eco-innovation ($b$ = .47, $t$ = 3.19, $p$ < .01). This means the more congruent between ECOM image and PECO, the more likely low NFC consumers are to buy high eco-innovative offerings in India. For the high NFC consumers, the effects of ECOM were significant for both high and low PECO levels. We performed the Fisher test recommended by Raghunathan, Rosenthal and Rubin (1996) and found a marginally significant difference between the regression coefficients (z = 1.65; $p$ =.09). This means the more incongruent between ECOM image and PECO, the more likely high NFC respondents will buy new products. Altogether, the results support **H10b** in the emerging market.

**Table 14** Conditional effects of ecological COM image on consumer responses in two national markets

| *Conditional effects of ecological COM image on purchase intention in India* | | | | | | |
|---|---|---|---|---|---|---|
| **Need for cognition** | **ECO** | **Effect size** | **SE** | **t** | **LLCI** | **ULCI** |
| Low (-1 SD) | Low (-1 SD) | -0.03 | 0.14 | -0.24 | -0.30 | 0.24 |
| Low (-1 SD) | High (+1 SD) | 0.47 | 0.15 | **3.19**$^{**}$ | 0.18 | 0.77 |
| High (+1 SD) | Low (-1 SD) | 0.12 | 0.12 | **4.74**$^{***}$ | 0.34 | 0.82 |
| High (+1 SD) | High (+1 SD) | 0.30 | 0.16 | **1.91**$^{+}$ | -0.01 | 0.62 |
| *Conditional effects of ecological COM image on product quality in the USA* | | | | | | |
| **Need for cognition** | **ECO** | **Effect size** | **SE** | **t** | **LLCI** | **ULCI** |
| Low (-1 SD) | Low (-1 SD) | 0.17 | 0.12 | 1.35 | -0.08 | 0.41 |
| Low (-1 SD) | High (+1 SD) | 0.30 | 0.11 | **2.67**$^{**}$ | 0.08 | 0.53 |
| High (+1 SD) | Low (-1 SD) | 0.35 | 0.10 | **3.41**$^{***}$ | 0.15 | 0.56 |
| High (+1 SD) | High (+1 SD) | 0.09 | 0.13 | 0.74 | -0.16 | 0.34 |

*Note: *** p ≤ .001. ** p ≤ .01. * p ≤ .05, + p <.10*

In the US market, for low NFC consumers, ECOM exerted a significant influence on perceived product quality only for high eco-innovative products ($b$ = .30, $t$ = 2.67, $p$ <.01). In the case of high NFC consumers, we found the significant impact of ECOM on product quality only for low eco-innovations. In other words, while the congruence between ECOM and PCEO made low NFC respondents perceive higher product quality, the mismatch between ECOM and ECOM encouraged high NFCs to engage in the in-depth product evaluation, which, in turn, resulted in higher perceived product quality in the US market. Altogether, **H10a** is accepted in the developed market.

*Discussion*

The findings from Experiment 2 demonstrate that a highly eco-innovative product associated with a favourable ECOM resulted in a significantly higher perceived product quality than the other combinations in the emerging market (i.e., India). However, there were no significant differences across the four cells, indicating the production of highly eco-innovative products in either country (with positive or negative sustainable reputation) could be advantageous in this market. On the other hand, in the developed markets (i.e., USA), there is evidence to suggest that, for many consumers, ECOM and PECO cues are considered as a driver of their product evaluations. More importantly, the highest perceived product quality means were results of a highly eco-innovative product manufactured in an unfavourable ECOM or a low eco-friendly innovation produced in a favourable ECOM. This pattern of the results confirms the positive effects of schema incongruity and implies that ECOM and PECO cues are diagnostic in the context of a developed market.

Furthermore, the mediated moderation tests reveal the striking differences in the moderating effect of NFC on the relationship between schema (in)congruity and consumer

responses to eco-innovation across two national markets. While the congruence between ECOM and PECO had a significantly stronger effect on purchase intentions on low NFC respondents than high NFCs in the emerging market, this same effect was found for another type of consumer responses (i.e., product quality) in the developed market. By incorporating NFC as a moderator, we confirmed our assertion that the impact of the convergence between ECOM and PECO could vary among different types of consumers and across different markets. These results, in conjunction with the overall findings of the study, suggest key theoretical contributions and managerial implications.

### 6.6. Summary

This chapter demonstrates major research findings and discussions based on the quantitative analyses of the experimental data collected in each study. The results provided empirical evidence supporting the hypothesized relationships, which were developed in Chapter Four. The key findings of this chapter are summarized in Table 15. Chapter Seven draws on these findings to discuss further and reach the conclusions on theoretical contributions and managerial implications of the dissertation.

**Table 15** Summary of the findings in the five studies

| Study | Hypothesized relationships | Research contexts | Results |
|---|---|---|---|
| 1 | ***H1.*** Consumers have (*a*) stronger product preferences, (*b*) stronger adoption intention, and (*c*) higher willingness to pay for eco-innovative products when they perceive *no trade-offs* between innovative attributes and eco-friendly benefits than when perceive the trade-offs. | - Driverless cars | - H1a, b, c supported |
| | | - Smart shoes | - H1a, b, c supported |
| | | - Smartphones | - H1a, b, c supported |
| | ***H2.*** Perceived eco-friendly product effectiveness *negatively* moderates the relationships between the attribute trade-offs (between innovative features and eco-friendly benefits) and consumers' product preferences, such that the relationship is *weaker* when consumers perceive *higher* eco-friendly product effectiveness and *stronger* when they perceive *lower* eco-friendly product effectiveness. | - Driverless cars | - H2 supported |
| | | - Smart shoes | - H2 supported |
| | | - Smartphones | - H2 supported |
| 2 | ***H3***. Different types of eco-friendly attributes (i.e., resource use reduction, elimination, and substitution features) yield | - Connected vacuums | - H3a, b, c supported and H3d rejected |

| Study | Hypothesized relationships | Research contexts | Results |
|---|---|---|---|
| | significant differences in consumers' *(a)* product quality perceptions, *(b)* preferences, *(c)* adoption intentions, and *(d)* willingness to pay with respect to eco-innovative product designs. | - Smartphones | - H3a, c supported and H3b, d rejected |
| 3 | ***H4a.*** ECI is positively related to perceived product eco-friendliness. | - Smartphones | - Supported for all three types of eco-innovations |
| | ***H4b.*** Perceived product eco-friendliness mediates the positive effect of ECI on adoption intentions. | - Smartphones | - Supported for all three types of eco-innovations |
| | ***H5a.*** Perceived trade-offs between environmental benefits and product effectiveness *negatively* moderate the positive effect of perceived eco-friendliness on adoption intention. | - Smartphones | - Supported for only resource use efficient innovations |
| | ***H5b.*** Perceived trade-offs between environmental benefits and product effectiveness *positively* moderate the positive effect of ECI on adoption intention. | - Smartphones | - Supported for only resource use efficient innovation |
| 4 | ***H6.*** Detachability of eco-friendly attributes in eco-innovative product designs is positively related to (*a)* product quality perceptions, (*b*) preferences, and (*c*) adoption intentions with respect to eco-innovative product designs. | - Driverless cars | - H6a, b, c supported |
| | ***H7.*** The effect of attribute detachability and attribute importance will affect independently, rather than interactively, consumers' perceptions of (*a*) overall product quality, (*b*) product preference, and (*c*) intention to adopt the new product. | - Driverless cars | - H7a, b, c supported |
| 5 | ***H8***. Congruence between ECOM and PECO triggers (*a*) higher product quality and (*b*) stronger purchase intention for publicly consumed products than for privately consumed products. | - Connected TVs<br>- Driverless cars | - H8a, b supported |
| | ***H9***. Congruence between ECOM and PECO triggers (*a*) higher product quality and (*b*) stronger purchase intention in emerging markets than in developed markets. | - An emerging market | - H9a supported, H9b rejected |
| | | - A developed market | - H9a supported, H9b rejected |
| | ***H10***. A three-way interaction among NFC, ECOM, and PECO predicts (*a*) consumers' perception of product quality and (*b*) intention to buy eco-innovation, such that low-NFC consumers have higher perceived product quality and stronger purchase intentions when there is the congruence between ECOM and PECO. Among high-NFC consumers, the incongruence between ECOM and PECO triggers more positive responses in terms of product quality and purchase intentions. | - An emerging market | - H10b supported, H10a rejected |
| | | - A developed market | - H10a supported and H10b rejected |

# CHAPTER SEVEN

# DISCUSSION, IMPLICATIONS, LIMITATIONS, AND FUTURE RESEARCH

# CHAPTER SEVEN

# DISCUSSION, IMPLICATIONS, LIMITATIONS, AND FUTURE RESEARCH

## 7.1. General discussion

The introduction of eco-innovative products—that is, the integration of sustainability-related attributes into new product offerings—is considered an effective way for companies to strategically align themselves with customers' increasing environmental concerns (Katsikeas et al., 2016). However, the best approaches to "greening" new product design to gain consumers' attention have remained largely under-researched in the current literature. The lack of such empirical investigation leads to uncertainties when making important decisions about developing eco-innovation product designs and limits our understanding of the underlying mechanisms that explain consumers' perceptions and reactions to such offerings.

How do consumers respond to an eco-innovative product design? No singular set of studies has yet provided a rigorous answer to this question, but the current study attempts to illuminate one tenable explanation: because an eco-innovation, as a really new product, consists of both innovative and eco-friendly attributes, it requires consumers to transfer information from the repository of their past experiences across multiple product categories (Moreau et al., 2001b). Consumers also need to process different types of information (both from *intrinsic* and *extrinsic* product-related cues) to update their schematic knowledge or create a new schema about eco-innovation, which, in turn, affects their expectations, preferences, and adoption intentions (Meyers-Levy and Tybout, 1989). To facilitate consumers' categorization and learning processes, it is crucial for marketers to understand and delineate appropriate information that emphasizes the distinctiveness (i.e., differentiating design cues) and its (in)congruence with extrinsic information (i.e., ECOM) across product categories, national markets, and consumer segments.

Our first hypothesis is that developing an eco-innovative product design without making the trade-offs between innovative functionality and environmental benefits enhances consumers' perceptions and adoption intentions, which is moderated by consumers' beliefs in the general effectiveness of eco-friendly products (**Study 1**). Furthermore, consumers respond differently to different types of eco-innovative attributes, suggesting the need for emphasizing different approaches to developing eco-innovations to ensure its success during the commercialization phase (**Study 2**). ECI motivates consumers to overcome attributes trade-offs in eco-product designs as a means to signal their own innovativeness and environmental concerns to others in a specific type of eco-innovations (**Study 3**). Furthermore, we argue that the detachability of an eco-innovative attribute is also an effective way to provoke positive consumer responses to eco-innovation (**Study 4**). We propose that this advantage of a peripheral and core-optional (versus core-non optional) locus of eco-friendly attributes ensues from three factors: (1) higher perceived product eco-friendliness, (2) higher product quality (eco-friendly benefits localized in one peripheral component), and (3) higher preferences toward eco-innovative offerings (no trade-offs with the core functions of the product). All these effects can be triggered only if the eco-friendly attribute is physically detachable without any effect on the essential functioning of the core product (Ma et al., 2015). Finally, as eco-innovations have been manufactured and launched around the world, it is important to understand the impact of COMs in terms of sustainable development and its interaction effects with PECO on consumer responses across product categories, national markets, and consumer segments (**Study 5**).

We empirically tested and verified our hypothesized relationships in five online experimental studies using the diverse stimuli from five different product categories, in which eco-innovations have been developed based on the latest technology, namely IoT. To the best of our knowledge, the present research is one of very few research attempts in introducing the consumer perspective into the eco-innovation literature, a facet which must be included in any new product design processes. This study

integrates the relevant theories such as Diffusion of Innovation Theory, categorization theories, Social Schema Congruity Theory and the Elaboration Likelihood Model into the conceptual framework to understand how consumers respond to the introduction of eco-innovation. The present research takes a more comprehensive view of key design factors and consumer-related factors which significantly influence the consumer decision-making process. Hopefully, this study will help introduce other researchers to this important area of eco-innovation research and spur their interest in further widening the body of knowledge known as sustainable consumption in the digital era.

## 7.2. Theoretical contributions and managerial implications

### *7.2.1. Theoretical contributions*

The present research contributes to the existing literature on eco-innovation in three important ways. *First*, the study broadens and deepens our understandings of how consumers respond to eco-innovation with regard to the key aspects of new product design. In the current literate, the research streams on innovation adoption and sustainable consumption have largely advanced in parallel, and relatively little is known about the interaction of these two factors in the eco-innovation product designs on consumer behaviour. On the other hand, the focal point of recent eco-innovation studies (e.g., Katsikeas et al., 2016, Varadarajan, 2015) has been on the importance of eco-innovation orientation and development with respect to firm performance. As relatively new in the market, eco-innovations tend to defy straightforward categorization (Moreau et al., 2001b). Thus, it is questionable how consumers transfer relevant knowledge from multiple sources to better comprehend them and react with the eco-innovation introduction in the market. It has been argued that a more thorough understanding of how consumers respond to such eco-innovative products is required (Heidenreich et al., 2017). Whereas most studies on the eco-innovation development have been centred on the organizational perspective, we extend this research area by focusing on the consumer perspective.

By responding to the repeated calls from marketing scholars (Gershoff and Frels, 2014, Kotler, 2011, Varadarajan, 2015), we contribute by focusing on the long-standing debate about uncertainty in eco-innovation adoption due to its long take-off phase and the value-action gap of sustainable consumption. Specifically, we offer a rigorous analysis of the extent to which the introduction of eco-innovative product designs affects consumer responses in a favourable way. We uncover the effects of trade-offs between innovative features and eco-friendly benefits on consumer responses and shine new light on the moderating role of consumer beliefs about eco-friendly product effectiveness in these relationships (**Study 1**). When consumers believe that eco-friendly products are not effective in general, they tend to pay more attention to the attribute trade-offs in an eco-innovative product design and are more reluctant to adopt this new offering.

Our results also show that the different types of eco-innovative attributes can trigger different consumer responses across different product categories (**Study 2** and **Study 3**). In Study 2 and Study 3, we focus on the distinctiveness of eco-innovation categories—that is, by differentiating the types of eco-friendly attributes included in eco-innovative product designs. In Study 2 with a connected vacuum cleaner employed as a research context, we find that participants expressed more positive perceptions of product eco-friendliness and product quality as well as stronger preferences and adoption intentions toward resource use elimination and resource use substitution innovations. However, they were not willing to pay a higher price for these types of eco-innovation. The findings could be explained by the fuzzy set theory, which posits that consumers assess gradedness of category membership at the attribute level and then combine across attributes for the overall gradedness score of a product (Viswanathan and Childers, 1999). Based on consumers' evaluation, resource use elimination and resource use substitution innovations possess higher gradedness of the eco-innovative product category via creating new alternative resources, which led to more positive consumer responses. Conversely, resource use reduction innovations, with a focus on the mitigation approach, have lower gradedeness of the eco-

innovative product category, which could decrease consumers' product evaluation and adoption intentions.

Study 3 confirms the findings of Study 2 in a publicly consumed product context (an innovative smartphone). Similarly, participants reported more positive responses to resource use elimination innovations than to the other types of eco-innovation. In the context of innovative smartphones, although respondents were still not willing to pay more for the resource use elimination innovation, they would adjust their sense of payment equity by increasing the predicted consumption levels for this type of eco-innovation. The results could be explained by the lay theory which indicates that consumers increase the use of eco-friendly products as they consider pro-environmental products as being less effective than traditional products (Lin and Chang, 2012, Luchs et al., 2010). We further suggest that the higher level of product eco-friendliness consumers perceive, the more they consume the product in comparison with other eco-friendly alternatives.

Moreover, we document consumers' associations between the detachability of an eco-innovative attribute with product eco-friendliness and overall product quality, which in turn affects their preferences and intention to adopt the eco-innovation (**Study 4**). Specifically, we provide insights into the process by which consumers evaluate eco-innovative product designs, with a focus on the detachability and the importance of an eco-innovative attribute. We show that the advantage of the eco-innovative attribute detachability arises from increased product eco-friendliness, enhanced perceived product quality, and higher consumer preferences for these new offerings.

Overall, in terms of key new product design aspects, the present research complements an emerging body of literature on the effect of including eco-friendly attributes into product designs (Gershoff and Frels, 2014, Luchs et al., 2012, Olson, 2013). These studies indicate that the product-related beliefs that consumers derive from sustainability attributes vary with attribute centrality and

attribute trade-offs with functional performance or conventional product features. Unlike previous studies, we show that consumers' perceptions, preferences, and adoption intentions triggered by eco-innovative product designs also vary significantly with the trade-offs between innovative features and eco-friendly benefits, types of eco-innovative attributes, and detachability of an eco-innovative attribute. Our findings provide support for the central roles of these aspects in greening innovative product designs as viable ways to gain consumers' attention and positive responses by managing the mechanisms that may affect consumers' psychological and behavioural responses.

*Second*, drawing on a trait-based approach, we take an initial step toward better understanding the concept of DSI in the sustainable innovation consumption domain by conceptualizing and operationalizing the concept of ECI in the case of eco-innovation adoption (**Study 3**). We note that our ECI concept and measurement focus on the overall patterns of consumers' tendency to adopt innovative ideas/products for environmental protection, rather than capturing varying motivations for general ethical consumption. We further validate the predictive ability of ECI on consumer responses to eco-innovation by highlighting its strong and positive effect on consumers' perception and adoption intentions across different types of eco-innovations. The results further substantiate the findings of prior researchers (e.g., Heidenreich et al., 2017, Jansson, 2011) who have posited that CI, a general and static trait, exerts a significant influence on the alternative fuel vehicle adoption. Importantly, the results provide additional evidence that a domain-specific conceptualization and operationalization of CI (i.e., ECI) may be superior to a global CI approach (i.e., CI as a general trait) in predicting and explaining how consumers respond to eco-innovations. Therefore, we suggest that our ECI scale is an important part of a broader individual difference factor that can help future researchers understand how consumer traits impact the sustainable innovation adoption.

To the best of our knowledge, this study is the first to uncover the underlying mechanism driving the effect of ECI on consumer adoption across different types of eco-innovation. Specifically, instead

of solely investigating the direct effect of ECI on adoption intentions, as previous studies have done (Goldsmith et al., 1998, Heidenreich et al., 2017), we provide further insights into how ECI affects adoption intentions by factoring in consumer perception of product eco-friendliness. In other words, when consumers have a strong tendency to adopt eco-innovative products as a means to support environmental protection, they tend to pay more attention to the eco-friendly aspects of the innovation, which results in higher perceived product eco-friendliness and ultimately stronger adoption intentions.

The results pertaining to the moderating roles of perceived trade-offs between environmental benefits and product effectiveness in the context of resource use efficiency innovations offer new insights for eco-innovation research. In particular, the findings demonstrate how perceived trade-offs strengthen the positive effects of ECI but weaken the impact of perceived product eco-friendliness on adoption intentions. On the one hand, our study confirms the findings of prior studies (Luchs et al., 2012, Olson, 2013) that have emphasized the negative effects of perceived trade-offs in consumers' decisions to buy eco-friendly products. In line with existing literature, we find that the higher the perceived trade-offs, the more reluctant consumers are to adopt an eco-innovation when they perceive the innovation to be eco-friendly. On the other hand, and perhaps more importantly, our findings uncover the positive moderating effect of perceived trade-offs on the link between ECI and adoption intentions. Because individuals with high ECI levels are more concerned about the eco-friendly dimension of an innovation, they are more likely to sacrifice product effectiveness for environmental benefits as a means to signal their own innovativeness, environmental concerns, and status relative to others. The more explicit they believe these trade-offs to be, the more they are willing to take greater risks in adopting an eco-innovation (Steenkamp and Baumgartner, 1992).

However, the moderating effects of perceived trade-offs were significant only in the context of resource use efficiency innovations. The pattern of results reveals that consumers tend to be more concerned about the trade-offs between environmental benefits and product effectiveness when there is

a reduction in a number of resource inputs in the innovation consumption process. Yet this evidence is tentative in nature; thus, more research is needed to explore the roles of perceived trade-offs in influencing consumers' adoption intentions in the contexts of resource use elimination innovations and resource use substitution innovations.

*Third*, the present research challenges the recent criticisms of the COM construct by providing additional evidence showing that COM (in terms of its ecological image) is still a relevant and important cue impacting consumers' responses to really new products (i.e., eco-innovation). By combining the tenets of Schema Congruity Theory of Mandler (1982) and the Elaboration Likelihood Model of Petty and Cacioppo (1986), we undertake a rigorous empirical investigation into the interactions between ECOM and PECO, reflecting varying levels of (in)congruence (**Study 5**). Our findings highlight the importance of (in)congruence of the ecological aspect in new product designs and focal ECOMs in the introduction of eco-innovation in the globalized marketplace and thus, illuminate tenable explanations for the inconsistency of the COM effects on consumer behaviour in the existing literature with three conditioning factors, namely product types, market conditions, and consumer traits.

The results of the two experiments in Study 5 suggest the significant variance of the interactive effects of ECOM and PECO across different product categories (Experiment 1) and across national markets and across consumer segments (Experiment 2). The findings of Experiment 1 indicate that consumption contexts, manipulated via two product categories (publicly vs. privately consumed products), contribute to the variance in consumers' product evaluations and intentions to buy eco-innovation due to the (in)congruence levels of ECOM and PECO. As predicted, we find that schema incongruity explains higher perceived product quality and stronger purchase likelihood toward private eco-innovative products which are consumed in the private/in-house contexts (e.g., TV sets). On the other hand, for the public eco-innovative products (e.g., cars) with higher social

signaling values, consumers tend to put more emphasis on the ecological match between ECOM and PECO.

The significant differences in our results between driverless cars and connected TV sets might be attributed to the level of consumer involvement when making purchase decisions for privately vs. publicly consumed products. In general, privately consumed products, commonly used in the house, represent lower risks, lower hedonic value, and lower social distinction than symbolic products (Hamzaoui Essoussi and Merunka, 2007, Li and Wyer Jr, 1994). On the contrary, the choice of publicly consumed products might require more cognitive thinking efforts due to symbolic meanings and status. In this context, consumers who particularly concern about publicly demonstrating their sustainable behaviours will be more likely to give greater importance to the ecological match between ECOM and PECO of the eco-innovative offerings. The results support the findings of Pappu, Quester and Cooksey (2007) which highlight that consumers are more sensitive to the country image when buying public products (e.g., cars) than private products (e.g., TV sets).

Experiment 2 shows the influence of the congruence between ECOM and PECO tend to be particularly strong in an emerging market such as India. One tenable explanation is that since interpersonal relationships are more important in emerging and collectivistic Asian countries, buying publicly consumed products (e.g., smartphones) is a means for the symbolic acquisition and communication of social distinction. In this context, the congruence between ECOM and PECO are highly valued to publicly display their sustainable consumption and desired ranking in society. These results are in line with previous studies (e.g., Batra et al., 2000), which posit that consumers in developing countries consider COO/COM as a product/brand's desirability for symbolic and status-enhancing reasons, apart from signalling the overall quality. Furthermore, consumers in emerging markets are less tolerant to the ecological mismatch in eco-innovative product designs due to their

limited prior experience with high-quality and branded products as well as high uncertainty avoidance tendency. Therefore, the schema congruence would be the best approach to accelerate consumer adoption of eco-innovation in emerging markets.

On the other hand, in the developed markets, the schema incongruence (i.e., low eco-innovation from a favourable ECOM and high eco-innovation in an unfavourable ECOM) trigger more positive consumers' responses to eco-innovation. In an individualistic culture that ranks low/moderate on the uncertainty avoidance dimension, such as the US, consumers tend to be more likely to take more risks to adopt innovative products, be more tolerant of different/incongruent ideas and more flexible in their decision-making process (Hofstede, 2003). Moreover, consumers in developed markets have a tendency to pay attention to a broader range of attributes and exploit higher perceived fit of product attributes and COM (Story, 2005). As individualistic consumers in developed markets have higher variety seeking (Erdem et al., 2006) and weaker social relationships with products (Song et al., 2018), they are more likely to accept the incongruence between ECOM and PECO and rate the eco-innovative offerings as high-quality products.

The current study is also the first to investigate how schema (in)congruity is processed and resolved across different types of consumers (segmented by their NFC levels) and the nature of their responses to eco-innovation. In cases of really new products, consumers often use multiple cues from their memory-based categories to understand, evaluate, and make purchase decisions (Moreau et al., 2001b). Therefore, both marketing theory and practices might benefit from a more nuanced understanding of how consumers deal with schema (in)congruence among different product-related information (both intrinsic and extrinsic) depending on dispositional individual differences. This research, therefore, also contributes to the schema (in)congruence literature by demonstrating that the interactive effects of ECOM and PECO may differ among certain consumers with different levels of NFC. Specifically, our results shed light on the psychological mechanism underlying the apparent

superiority of schema incongruity between ECOM and PECO among high-NFC consumers while emphasizing the positive effect of schema congruence on product beliefs and purchase intention among low NFCs.

Overall, although the moderators and mediators in our conceptual model have been studied separately in prior innovation and sustainable consumption research, this research is the first to unite these lines if inquiry and identify and explain their influences on consumer eco-innovation adoption across product categories, national markets, and consumer segments.

### *7.2.2. Managerial implications*

This study provides useful insights for product designers/managers and marketers. In the recent years, the negative effects of greenwashing in marketing (Delmas and Burbano, 2011) and the generally low perceived effectiveness of eco-friendly products (Luchs et al., 2010) cause significant discrepancies between consumers' intentions and actual behaviours in sustainable consumption. In many cases, pro-environmental consumers do not "walk their talk" and often feel reluctant to replace "browner" products with more eco-friendly alternatives (Bamberg, 2003, Carrington et al., 2014). All these challenges become more significant in the case of eco-innovations, where the concepts of innovativeness and eco-friendliness could either complement or conflict with each other.

Managers have been under increasing pressured to find effective approaches for encouraging sustainable consumption in general (Luchs et al., 2010, Olsen et al., 2014) and the uptake of eco-innovation in particular (Katsikeas et al., 2016). In practical terms, firms must make decisions about the best approaches for investing, capturing competitive advantage, and maximizing profits while satisfying consumers' needs and requirements. Our study offers useful insights for strategic research-and-development investment and decision-making processes for new products and, in particular, for selecting the best-suited approaches for developing eco-innovations and maximizing their success in

the commercialization phase. Because eco-innovative products can be plausibly categorized into multiple product categories, marketers have different options when developing and positioning these novel products.

*New eco-friendly product development and positioning.* **Study 1** supports the proposition that consumers are less likely to adopt eco-innovations when they are forced to compromise on other product features (Kollmuss and Agyeman, 2002, Pujari, 2006, Pujari et al., 2003). Our results suggest that companies should invest in innovative features that also offer environmental benefits in their new product development strategies, rather than focusing on developing a separate and conflicting set of attributes in an eco-innovative product design.

**Study 2** and **Study 3** offers useful guidelines for companies to direct their eco-friendly efforts to the specific types of eco-friendly attributes that are more likely to trigger positive responses from consumers, particularly when a company has investment options with similar environmental payoffs. Our results suggest that developing and positioning an eco-innovation as a resource use elimination innovation could evoke more positive consumer responses than resource use substitution innovations and resource use efficiency innovations. Specifically, firms should place greater emphasis on advanced technologies for eliminating the need to use a complementary product (e.g., Samsung CycloneForce, with its ultra-low-power bagless cylinder). They should also develop complementary product carryover innovations—for example, iPhone Qi-certified chargers, based on wireless technology and universal charging standards, can be used for all the latest versions of iPhones in cars, cafés, hotels, and furniture. Another possible approach is to invest in innovative materials to replace ecologically harmful components (e.g., the innovative XO Laptop for children, which contains no hazardous materials or new Samsung LED LCD TVs are free of mercury, a toxic metal). However, our results suggest that as consumers are generally not willing to pay more for resource use elimination innovations, the price for this type of eco-innovation should remain the same as that of other innovations.

**Study 4** highlights a viable way to overcome the challenges inherent to marketing eco-innovations as really new innovations, given that consumers are often uncertain about capturing the innovative features and environmental benefits of an innovation. Our findings suggest that managers working with eco-innovations can enhance consumer perceptions of product eco-friendliness and its overall quality by offering the eco-friendly attribute as a peripheral relative to the base product. As Ma et al. (2015) suggest, offering really new innovative features as peripherals is considered the most effective way to reduce risk and enhance the likelihood of trials. In this study, we suggest that eco-innovative attributes, developed as detachable components, not only facilitate the processing of the environmental benefits of the attribute but also prevent consumers from being forced to accept the presumed trade-off between the eco-friendly benefits and product performance. This, in turn, leads consumers to give higher overall product quality ratings, higher product preferences, and ultimately be more likely to adopt an eco-innovation.

*Segmentation*. Although previous researchers (e.g., Heidenreich et al., 2017) have argued that companies can target different types of consumer segments to accelerate the diffusion process, this study emphasizes that the "right" consumers must be addressed during the early phases of eco-innovation development to ensure its success in the market. Our findings suggest that consumers with differing degrees of ECI respond differently to eco-innovation, indicating that ECI may be used as an effective segmentation tool to identify and profile early adopters who have a strong tendency to try eco-friendly innovative ideas/products. In **Study 3**, we found that consumers high in ECI are more likely to infer higher product eco-friendliness and express stronger adoption intentions than low-ECI consumers. It is important to improve the segmentation of the early adopters with high ECI in the eco-innovation market with respect to specific types of eco-innovations so that marketers can distinctively address eco-friendly innovative consumers that best fit the potential user profile of their new products.

As **Study 5** indicates, NFC can serve as an important criterion to identify market segments with different (heterogeneous) response functions to the eco-innovation introduction. However, it is challenging to employ a psychological factor like NFC as a segmentation criterion as managers cannot easily identify whether a consumer is high or low in NFC. One possible option is to invite consumers to answer the screening questions related to their demographic profiles and a NFC scale by explaining the benefits that they could get such as better promotions or more personalized after-sales services. By obtaining knowledge about the customer's NFC through screening, firms can decide their outsourcing/manufacturing strategies and personalize their marketing messages. Whereas a low-NFC consumer might respond more positively to the schema congruence among product-related cues, a high NFC is more likely to enjoy the cognitive thinking process triggered by schema incongruence between ECOM and PECO. Thus, firms could diversify their outsourcing/manufacturing destinations and marketing message framing to match the perceptions and preferences of different market segments.

*Marketing communication customization*. Marketers can also choose how to communicate environmental benefits in eco-innovative product designs, and our research has several recommendations for these marketing efforts. **Study 1** highlights the notion of no trade-offs in eco-innovative product designs can make consumers respond to eco-innovations in more favourable ways. Thus, information about the complementary nature of innovative and eco-friendly attributes can help consumers avoid being forced to make trade-offs in their decision-making processes. **Study 2** provides recommendations about which types of eco-friendly benefits should be developed and communicated to consumers to trigger more positive consumer responses in the market.

The results of **Study 3** reveal that, for resource use efficiency innovations, making the trade-offs between environmental benefits and product effectiveness easily perceivable is key to harness the power of ECI to motivate consumers' adoption intentions. High-ECI consumers can then explicitly exhibit their choice to sacrifice some degree of functional performance for sustainability as a way to

signal their innovativeness and commitment to environmental protection. For example, to target high-ECI consumers, marketers of resource use efficiency innovations could explicitly communicate the trade-offs between environmental benefits and product effectiveness while emphasizing the product's superior innovativeness and eco-friendliness over traditional products. Conversely, when promoting eco-innovations to segments of the market that are not as strongly dedicated to innovative ideas for sustainability (i.e., the mass market), it is more important to find effective ways (e.g., Facebook groups, online forums, online review ratings) for early adopters to share their experiences with the late majority who normally have low ECI. However, in both cases, it is critical to reassure consumers that the new product meets a minimum acceptable threshold of functional performance (Luchs et al., 2012).

For resource use elimination and resource use substitution innovations, firms do not need to address the trade-offs in eco-innovative product designs but instead should focus on simply promoting the environmental benefits of these innovations to encourage consumers with high ECI to learn more about and adopt new product concepts. Marketers might visualize the unique features of these innovations for consumers while emphasizing the superiority of an innovation compared with existing products, especially in terms of the product's ecological impacts.

In **Study 4**, we also find that eco-innovative attributes that are important to the individual consumer can influence the consumer's perception of eco-friendliness and overall quality of the product. However, the detachability of an eco-innovative attribute still has an influence beyond the role of attribute importance. Therefore, as Study 4 suggests, marketing communication strategies could emphasize the detachable and the independent nature of eco-innovative attributes from the base innovations, thus enhancing perceived eco-friendliness and the overall product quality and inspiring greater consumer adoption intentions.

*International marketing strategies*. Due to the rapid changes in the business environment and the extensive globalization, firms have increasingly adopted the global approaches to producing and marketing their new products. Thus, *where* innovations should be produced and *how* they should be communicated to target audiences are important and challenging questions for managers to achieve rapid market penetration and positive brand values across national borders. Relatedly, the development and promotion of eco-innovation in the globalized marketplace can be expected as the main source of firms' competitive advantage.

This study demonstrates how ECOM affects consumers' responses to eco-innovation depends not just on ECOM itself (*where* the product is produced) but also on product attributes (*what* features the product has), product categories (*where* the product is consumed), and market conditions (*where* the product is launched). Managers in international firms should understand that although ECOM has significant effects on consumers' responses to eco-innovative offerings, the effects should be considered in relation with levels of PECO to leverage the positive impact of schema (in)congruence within a specific product category, a national market, and particular market segments.

For privately consumed products, firms can significantly trigger more positive consumer responses by manufacturing low eco-innovative offerings in a favourable ECOM. Furthermore, if companies in these product categories choose to product high eco-innovative products, they could opt to either country with positive or negative sustainable reputation as consumer responses remain the same regardless ecological favourableness of COMs. For publicly consumed product categories, consumers respond more positively if there is an ecological match between ECOM and PECO. Our results highlight that schema congruence in the case of publicly consumed products (e.g., cars) is needed to enable consumers to publicly display their sustainable behaviours to achieve the desired status in terms of pro-environmental consumption in the society.

The findings also provide distinct results for emerging and developed markets. If companies aim to launch eco-innovations in emerging markets, manufacturing highly eco-innovative offerings in a favourable ECOM would be more advantageous than doing it in an unfavourable ECOM or producing low innovative product versions. On the other hand, in developed markets, companies have more flexibility by taking advantage of the schema incongruence approach, namely low eco-friendly innovations in a favourable ECOM or high eco-friendly innovations in either positive or negative ECOMs. Pursuing a low eco-friendly product in an unfavourable ECOM is clearly the worst option in both national markets while the best option would be highly eco-friendly innovations in either positive or negative ECOMs.

Our findings consistently support the notion that the combination of ECOM and PECO should be considered in association with product categories (consumption contexts), national market settings, and consumer segments. We provide managerially relevant guidelines for decisions about manufacturing eco-innovative products based on location selection as well as international marketing communication strategies. Managers in global firms can actively manage the effects of the (in)congruence between ECOM and PECO levels on consumer responses by selecting appropriate manufacturing facility locations on the basis of PECO levels across product categories, national markets and consumer segments.

### 7.3. Limitations and avenues of the future research

The present research results should be interpreted in light of several limitations inherent in our research design that need to be addressed in future work. *First*, we examined the effects of key design aspects and consumer-related variables using a scenario-based experimental approach. The experimental approach across five product categories and two national markets enables us to test our hypotheses with some degree of generalizability. Nevertheless, previous studies argue that consumers' eagerness for new products varies substantially by nationality and product category (Lynn

and Gelb, 1996, Tellis, Yin and Bell, 2009). Future work could enhance the external validity of our findings by replicating this study across different high-tech product categories and other national markets. Further research is also required to study how consumers from different cultural backgrounds respond to different types of eco-innovations and whether product-related and cultural characteristics moderate the effects of ECI on adoption behaviours.

*Second*, we focus on manipulating key design aspects (i.e., trade-offs between innovative features and eco-friendly benefits, types of eco-innovative attributes, and detachability of eco-innovative attributes) while keeping other factors constant (e.g., price, aesthetic design). Prior researchers have underscored the important roles of price perceptions (Kuester et al., 2015) and aesthetic design (Luchs et al., 2012) in consumers' product evaluations and adoption timing. Including these factors in a research model would also be a worthwhile extension that could provide valuable insights into individual adoption behaviour toward eco-innovations.

*Third*, the current research focuses only on the situations in which one firm introduces an eco-innovation in the market. Because competitors can respond more rapidly to such innovations by offering similar products, consumers' reactions toward the pioneer's eco-innovation may change dramatically (Ma et al., 2015). Future research could provide deeper insights into the mechanisms that underlie the introduction of eco-innovative product design by considering these other market factors (e.g., market dynamism, competition in sustainability innovations, industrial environmental impact).

*Fourth*, because we examined the associations of eco-innovative product design aspects and consumers' responses using cross-sectional data, future research might conduct longitudinal examinations by measuring consumers' responses at different points in time for different versions of eco-innovative product designs. Such an approach could reveal the dynamics of causality between decisions about eco-innovative product designs and consumer responses.

*Fifth*, our study investigated the mechanisms underlying the role of three aspects (trade-offs between eco-friendly and innovative attributes, types, and detachability of eco-friendly attributes) of innovative product designs on consumer responses. Nonetheless, other important decisions in eco-innovative product designs should be taken into consideration, such as relative numbers of innovative and eco-friendly attributes, aesthetic designs, and acceptable within-attribute conflict levels. Examining the effects of these dimensions of eco-innovative product designs would be an intriguing research avenue.

*Sixth*, in our experimental research designs, we use fictitious brands for all product categories. The effects might be different if the eco-innovation is framed as an extension of a well-known brand (e.g., iPhone, Samsung). Therefore, further research might examine how brand reputation and brand longevity moderate the effects of ECI and perceived trade-offs on consumers' adoption behaviours. Future studies might also consider the consequences of our results for marketing communications for different types of eco-friendly innovative consumers. A targeted approach to determining which marketing messages best match the perceptions and preferences of certain eco-friendly innovative consumers may significantly increase communication effectiveness in the eco-innovation diffusion.

*Seventh*, we defined individual adoption as an intention to adopt an eco-innovation, willingness to pay and estimated product consumption levels. As many marketing scholars have stated (e.g., Carrington et al., 2010, Hassan et al., 2014), there is an intention–behaviour gap in a sustainable consumption context. Actual adoption behaviour (i.e., the first trial) and actual consumption (i.e., actual usage levels of eco-innovations) may be a better manifestation of the adoption decision because early adopters might have strong adoption intentions but feel reluctant to actually purchase the eco-innovation. Therefore, a promising direction for further research is to measure the actual adoption and postadoption usage of eco-innovation in a customer management context.

*Finally*, our study investigated the mechanisms underlying the moderating role of NFC as an individual difference factor in the relationship between schema (in)congruence and consumer responses. Nonetheless, other individual differences should be taken into consideration, such as consumer innovativeness, perceived GREEN values, or public awareness. Examining the moderating effects of these factors on the impact of the schema (in)congruence on consumer responses to eco-innovation would be an intriguing research avenue. Finally, research might consider examining the conditioning role of other situational variables (e.g., availability/scarcity of eco-innovation or temporal distance) in the context of the international eco-innovation launch.

### 7.4. Concluding comments and summary

A significant body of research has examined the frustrating gap in which consumers do not "walk their talk" in the sustainable consumption context (Carrington et al., 2010, Carrington et al., 2014). Especially in the case of eco-innovation, in which both innovative and eco-friendly attributes converge, marketing endeavours to introduce and promote such offerings are likely to underperform due to the complex adoption dynamics and diffusion processes (Janssen et al., 2006). Although there may be many alternative explanations for understanding this phenomenon in the current literature, the present research suggests potential directions for a firm's new product development and marketing strategies in terms of the four main aspects of eco-innovative product designs: (1) trade-offs between innovative and eco-friendly attributes, (2) types and (3) detachability of eco-innovative attributes, (4) the (in)congruence between PECO and ECOM, and two consumers' traits (1) ECI and (2) need for cognition. As one of the first research attempts to examine how consumers respond to eco-innovative product designs, we hope that the current work spurs further investigation into how to accelerate the adoption process of eco-innovation.

Eco-innovation is about more than simply new products; it is about the creation and diffusion of innovative manufacturing processes and consumption behaviours with a greater environmental

sustainability focus. Eco-innovation is also not just about supporting business development; it is vital to address pressing environmental challenges, such as pollution, climate change, resource scarcity, and dwindling biodiversity. The widespread uptake of eco-innovations could light the path to a better future in which innovations enable improved resource productivity and overall well-being for people in a cleaner and healthier living environment. However, there are no miracle technologies for a better future unless we find effective ways to tackle the challenges of sharing, implementing, and bringing to scale existing sustainable innovations.

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# APPENDICES

**Appendix A** Selected studies of the existing research on eco-friendly product attributes

| Study | Context | Product categories | Type of eco-friendly attributes studied | | | | Consumer behaviour aspects examined (dependent variable) | Major findings |
|---|---|---|---|---|---|---|---|---|
| | | | Resource use reduction (e.g., energy efficiency) | Resource use elimination (e.g., harmful chemical elimination) | Resource use substitution (e.g., renewable energy) | General claims (e.g., better for the environment) | | |
| Alwitt and Pitts (1996) | United States | Disposable diapers | | x | | | - Purchase intentions | • General environmental concern has only an *indirect* effect on purchase intentions for environmentally relevant products through environmentally relevant attitudes. |
| Irwin and Spira (1997) | United States | Automobiles An orthogonal array | x | x | | | - Willingness to pay<br>- Purchase intention<br>- Perceived eco-friendliness | • The specific type of eco-friendly attributes (i.e., recycled content) has a *negative* impact on consumer responses.<br>• Recycled content *did not show a strong embedding effect* on the consumers' perception of eco-friendliness. |
| Pujari et al. (2003) | United States | Light bulbs | x | | | | - Product choice<br>- Product preferences<br>- Perception of purchase timing | • Consumers lower in elaboration are more likely to choose an energy-efficient product when perceived distance is proximal versus distal. |
| Cornelissen et al. (2008) | Spain | Light bulbs, and detergents | x | x | | | - Product choice<br>- Attitudes towards<br>- Product preferences | • The cueing of common ecological behaviours leads participants to choose environmentally friendly products with *greater* frequency and even to use scrap paper *more efficiently.*<br>• Cueing people with common environmental behaviours affects their pro-environmental self-perception *more strongly* than cueing with uncommon environmental behaviours. |
| Luchs et al. (2010) | United States | Shampoos, detergent, automobile tires, and | | | | x | - Product preferences | • The positive effect of product sustainability on consumer preferences *is reduced* when strength-related attributes are valued, thus sometimes even resulting |

| Study | Context | Product categories | Type of eco-friendly attributes studied | | | | Consumer behaviour aspects examined (dependent variable) | Major findings |
|---|---|---|---|---|---|---|---|---|
| | | | Resource use reduction (e.g., energy efficiency) | Resource use elimination (e.g., harmful chemical elimination) | Resource use substitution (e.g., renewable energy) | General claims (e.g., better for the environment) | | |
| | | hand sanitizers | | | | | | in *preferences for less sustainable product alternatives*. |
| Wiedmann et al. (2011) | Germany | Natural gas vehicles (NGVs) | | | x | | - Resistance to NGVs | • Financial, performance (technological), time, social, and psychological risk *positively* affect consumers' innovation resistance to NGVs. |
| Zhang et al. (2011) | United States | Alternative fuel vehicles (AFVs) | | | x | | - Diffusion of eco-innovations | • Technology push can be an important mechanism for speeding the diffusion of AFVs.<br>• Market pull has a *positive* impact on the diffusion of AFVs and *increases* the social good as well as *higher* willingness to pay for AFVs.<br>• Governmental push leads to a *decrease* in the social good. |
| Griskevicius et al. (2010) | Mexico | Cars, household cleaners, dishwashers backpacks, batteries, and lamps | x | x | | | - Product preferences | • Activating status motives *encourage* people to choose green products over more luxurious non-green products.<br>• Status motives *increased* desire for green products when shopping in public and when green products cost more than non-green products. |
| Hartmann and Apaolaza-Ibáñez (2012) | Spain | A fictitious green energy brand | | | x | | - Brand attitude<br>- Purchase intention | • Utilitarian benefits of green products have *positive* effects on purchase intentions.<br>• Nature experience evoked by advertising has the *strongest influence* on brand attitude but no effect on purchase intention. |
| Lin and Chang (2012) | United States | Hand sanitizer | | x | | | - Product usage | • Consumers who are more environmentally conscious *overuse* a green product driven by perceptions of a product's effectiveness. |
| Luchs et al. (2012) | United States | Shoes and phones | | x | x | | - Product choice | • Consumers tend to choose the product with superior functional performance over |

| Study | Context | Product categories | Type of eco-friendly attributes studied | | | | Consumer behaviour aspects examined (dependent variable) | Major findings |
|---|---|---|---|---|---|---|---|---|
| | | | Resource use reduction (e.g., energy efficiency) | Resource use elimination (e.g., harmful chemical elimination) | Resource use substitution (e.g., renewable energy) | General claims (e.g., better for the environment) | | |
| | | | | | | | | the product with superior sustainability characteristics.<br>• The effective use of product aesthetic design can *improve* the relative choice likelihood of sustainable products. |
| Gleim et al. (2013) | United States | Shower cleaner | | x | | | - Satisfaction<br>- Purchase intentions | • Price is a *significant barrier*, but expertise also appears to be a significant impediment to the green product consumption.<br>• Consumers experienced poor product quality with a previous purchase and thus were *reluctant* to purchase a green product again.<br>• Number and form of informational cues that educate consumers about green products overcome purchase barriers. |
| Olson (2013) | Norway | Cars and televisions | x | | | | - Product preferences<br>- Purchase intention | • Strong preferences for green products are found when trade-offs are *not apparent*, but preferences shift significantly to *less* green alternatives when the *actual* attribute trade-offs are considered. |
| Peloza et al. (2013a) | United States | Juice, coffee, tea, crackers | | x | | | - Product preferences | • Situational factors that heighten consumers' self-accountability lead *to increased* preferences for products promoted through their ethical attributes.<br>• The subtle activation of self-accountability leads to *more positive* reactions to ethical appeals than explicit guilt appeals. |
| Haws et al. (2014) | United States | Bags, detergents dresses, shirts | | x | | | - Relative preference<br>- Willingness to pay<br>- Likelihood to buy | • Stronger green consumption values *increase* preference for environmentally friendly products through more favourable evaluations of the environmental attributes. |

| Study | Context | Product categories | Type of eco-friendly attributes studied | | | | Consumer behaviour aspects examined (dependent variable) | Major findings |
|---|---|---|---|---|---|---|---|---|
| | | | Resource use reduction (e.g., energy efficiency) | Resource use elimination (e.g., harmful chemical elimination) | Resource use substitution (e.g., renewable energy) | General claims (e.g., better for the environment) | | |
| Newman et al. (2014) | United States | A dish soap and household cleaner | | | | x | - Purchase intention | • Consumers are *less* likely to purchase a green product when they perceive that the company intentionally made the product better for the environment compared with when the same environmental benefit occurred as an unintended side effect. |
| Olsen et al. (2014) | United States | Household products, food, beverages, and personal care | | x | | | - Brand attitude | • New green product introductions can *improve* brand attitude.<br>• Brand and category's positioning *positively* affects the introduction of new green products. |
| Gershoff and Frels (2014) | United States | Mattress, panini and waffle maker, CPU, PM monitor | | x | | | - Perceived greenness | • If a central attribute offers a green benefit, the product is perceived as *more* environmentally friendly than when a peripheral attribute provides an identical environmental benefit. |
| Karmarkar and Bollinger (2015) | United States | Shopping bags, organic products | | x | | | - Purchase intention | • Bringing one's own bags positively affects the purchase of indulgent items.<br>• The increased likelihood of purchasing organic when bringing one's own bag is reduced by larger price premiums. |
| Majid and Russell (2015) | United States | Cars | | | x | | - Value retention | • Hybrid (i.e., green) vehicles *lose value faster* than their nonhybrid counterparts.<br>• Pure green brands (e.g., the Prius), whose ability to express greenness is more salient, *lose value at a slower* rate than green brand extensions.<br>• Pure green brands are also *less vulnerable* to the threat of obsolescence from technological innovations. |
| Wu et al. (2015) | Taiwan | Electric vehicles | | | x | | - Purchase intention | • Image has a *positive effe*ct on value and purchase intention.<br>• Risk has a *negative effect* on purchase. |

| Study | Context | Product categories | Type of eco-friendly attributes studied | | | | Consumer behaviour aspects examined (dependent variable) | Major findings |
|---|---|---|---|---|---|---|---|---|
| | | | Resource use reduction (e.g., energy efficiency) | Resource use elimination (e.g., harmful chemical elimination) | Resource use substitution (e.g., renewable energy) | General claims (e.g., better for the environment) | | |
| Yang et al. (2015) | China | Natural drinks<br>Cars | x | x | | | - Purchase intention | • Perceived usefulness and value have *a positive effect* on purchase intention.<br>• Abstract (concrete) appeal is *more effective* in generating green purchase intentions than concrete (abstract) appeal in situations where the benefit association of green products is other (self).<br>• Public self-awareness and identity salience moderate the effect of appeal type and benefit association on green purchase intentions. |
| Van der Wal et al. (2016) | Netherlands | Shopping bags<br>organic products | | x | | | - Product preference | • Shoppers of a high-status sustainable grocery chain display sustainable shopping *more* by using branded shopping bags than shoppers of a lower-status chain. |
| Bodur et al. (2016) | United States | Chips and juices | | x | | | - Brand evaluation | • The positive effect of ethical attributes on consumer evaluations of high-priced private label brands (PLBs) and PLBs associated with lower retail reputation was mediated by consumers' quality perceptions.<br>• Consumers with negative resource synergy beliefs evaluated PLBs with ethical attributes and associated with a low reputation retailer particularly *unfavorably*. |
| Gonçalves et al. (2016) | Portugal | Biological products | | x | | | - Purchase intention | • Functional value is almost always necessary but is *not sufficient* by itself for predicting green buying. In contrast, the absence of the functional value *is a sufficient condition for not green buying.* |

| Study | Context | Product categories | Type of eco-friendly attributes studied | | | | Consumer behaviour aspects examined (dependent variable) | Major findings |
|---|---|---|---|---|---|---|---|---|
| | | | Resource use reduction (e.g., energy efficiency) | Resource use elimination (e.g., harmful chemical elimination) | Resource use substitution (e.g., renewable energy) | General claims (e.g., better for the environment) | | |
| Moon et al. (2016) | United States and Australia | New high-tech biofuel | | | x | | - Adoption intention | • Consumer traits *positively* associated with the adoption of bio-butanol are environmental consciousness, prosocial behaviour, and openness to new experiences, whereas vertical individualism discourages such adoption. |
| Han et al. (2017) | Korean | Female clothes | | | | x | - Sustainable fashion consumption (SFPC) | • Fashion consumers' limited awareness and knowledge about sustainable fashion products may promote *negative sentiments* toward SFPC.<br>• Developing and staging consumer-centered experiences help balance the psychological attitude–behaviours gap between sustainability concerns and SFPC. |
| Peyer et al. (2017) | Germany | Consumer durable goods | | | | x | - Purchase intention<br>- Consciousness for sustainable consumption. | • Voluntary simplifiers buy *more green* products, exhibit a *greater* environmental and economic sustainability consciousness, and share *more universalistic* values. |
| Heidenreich et al. (2017) | Germany | Alternative fuel vehicles | | | x | | - Adoption intention | • AFV adoption relates *positively* to consumer innovativeness, and this effect can be intensified by providing external policies such as infrastructure, incentives, and communication policies. |
| This study | United States | IoT-based products (high-tech products) | x | x | x | | - Product quality<br>- Product preferences,<br>- Adoption intention,<br>- Willingness to pay<br>- Predicted level consumption | •Consumers tend to express more positive product beliefs, higher preferences, and stronger adoption intention toward resource use elimination innovations compared with the other types of eco-innovations across two product categories. |

**Appendix B** Car, shoes, and smartphone manipulations in Study 1

| Trade-off condition | No trade-off condition |
|---|---|
| **Driverless car A:**<br>**A NEW CAR FOR OUR DAILY LIFE** | **Driverless car B:**<br>**A NEW ECO-FRIENDLY CAR FOR OUR PLANET** |
| - Autopilot: Autonomous driving mode<br>- Climate Change / Air Quality: 22/10 (0 - greenest to 100 - most polluting)<br>- **Intelligent infotainment system with excellent performance, but requiring higher energy consumption** | - Autopilot: Autonomous driving mode<br>- Climate Change / Air Quality: 22/10 (0 - greenest to 100 - most polluting)<br>- **Full electric car with a new battery technology offering significantly decreased charging time and the ability to bend** |
| **Smart Shoes A:**<br>**NEW SHOES FOR AN ENJOYABLE RUN** | **Smart Shoes B**:<br>**ECO-FRIENDLY SHOES FOR A NEW LIFESTYLE** |
| - GPS enabled function<br>- A removable and replaceable footbed<br>- **An innovative sensor to measure real-time data of your running performance is made of *non-recyclable* and *non-biodegradable* materials** | - GPS enabled function<br>- A removable and replaceable footbed<br>- **An innovative sensor to measure real-time data of your running performance is made of *recyclable* and *biodegradable* materials** |
| **Smartphone A:**<br>**A NEW SMARTPHONE FOR OUR DAILY LIFE** | **Smartphone B**:<br>**A NEW ECO-FRIENDLY SMARTPHONE FOR A NEW LIFESTYLE** |
| - Home Automation<br>- Low radiation emission rates<br>- **Wireless charging offers great convenient, but might cause low efficient electric power and take more time to charge the smartphone** | - Home Automation<br>- Low radiation emission rates<br>- **100% of innovative materials are made from electric waste** |

**Appendix C** Connected vacuum cleaner and smartphone manipulations in Study 2 and 3

| | **Control condition** | **Resource use reduction innovation** | **Resource use elimination innovation** | **Resource use substitution innovation** |
|---|---|---|---|---|
| **Study 2** | **Connected vacuum cleaner A: A new vacuum for our daily life** | **Connected vacuum cleaner B: A new eco-friendly vacuum for our planet** | **Connected vacuum cleaner C: A new eco-friendly vacuum for our planet** | **Connected vacuum cleaner D: A new eco-friendly vacuum for our planet** |
| Innovative features | Remotely controlled by a smartphone app | Remotely controlled by a smartphone app | Remotely controlled by a smartphone app | Remotely controlled by a smartphone app |
| Eco-friendly attributes | | *50% less energy consumption* based on the compression technology | Vacuum cleaners with canisters whose contents can be directly emptied into a wastebasket, thus *eliminating the use of disposable bags* | Solar vacuum tube *enabling renewable energy substitute* |

| | | | | |
|---|---|---|---|---|
| **Study 3** | **Smartphone A: A new smartphone for an enjoyable life** | **Smartphone B: A new eco-friendly smartphone for a new lifestyle** | **Smartphone C: A new eco-friendly smartphone for a new lifestyle** | **Smartphone D: A new eco-friendly smartphone for a new lifestyle** |
| Innovative features | Home automation: connected to home applications | Home automation: connected to home applications | Home automation: connected to home applications | Home automation: connected to home applications |
| Eco-friendly attributes | | A 10/10 reparability score for all components to *reduce resource usage and electronic waste* | *Eliminating radiation emission* based on the new technology | Solar phone charger *enabling renewable energy substitute* |

**Appendix D** Driverless car manipulation in Study 4

| Importance of eco-friendly attributes | Detachability | | |
|---|---|---|---|
| | **Core non-optional** | **Core-optional** | **Peripheral** |
| | **Car A** | **Car B** | **Car C** |
| **High** | - Autopilot: Autonomous driving mode<br>- New electric battery technology is a key built-in feature of this car model<br>- Choose fully electronic cars instead of gasoline cars<br>- For you, the electric battery charger is one of the most important criteria when buying the car | - Autopilot: Autonomous driving mode<br>- New electric battery technology is a built-in feature within the car but is an additional OPTION to the conventional gasoline engine.<br>- Choose your driving energy: electricity or gasoline anytime on the road by using a switching button on the steering wheel<br>- For you, the electric battery charger is one of the most important criteria when buying the car | - Autopilot: Autonomous driving mode<br>- New electric battery technology is offered as a plug-in/optional accessory<br>- Choose your driving energy: electricity or gasoline by using a switching button on the steering wheel.<br>- You can choose to EXCLUDE the new electronic battery if you want.<br>- For you, the electric battery charger is one of the most important criteria when buying the car |
| | **Car D** | **Car E** | **Car F** |
| **Low** | - Autopilot: Autonomous driving mode<br>- New electric battery technology is a key built-in feature of this car model<br>- Choose fully electronic cars instead of gasoline cars<br>- For you, the electric battery charger is a **NOT** important criterion when buying the car | - Autopilot: Autonomous driving mode<br>- New electric battery technology is a built-in feature within the car but is an additional OPTION to the conventional gasoline engine.<br>- Choose your driving energy: electricity or gasoline anytime on the road by using a switching button on the steering wheel<br>- For you, the electric battery charger is a **NOT** important criterion when buying the car | - Autopilot: Autonomous driving mode<br>- New electric battery technology is offered as a plug-in/optional accessory<br>- Choose your driving energy: electricity or gasoline by using a switching button on the steering wheel.<br>- You can choose to EXCLUDE the new electronic battery if you want.<br>- For you, the electric battery charger is a **NOT** important criterion when buying the car. |

**Appendix E** Driverless car, connected TV, and smartphone manipulation in Study 5

| **Experiment 1: Connected TVs and driverless cars (n=215)** | | | |
|---|---|---|---|
| **Product type** | **Product eco-friendliness levels** | **ECOM** | **N** |
| **Connected TVs** | **High –**Annual electricity cost: 50$ | **Favourable** – Japan | 27 |
| | | **Unfavourable –** South Africa | 28 |
| | **Low –** Annual electricity cost: 250$ | **Favourable** – Japan | 27 |
| | | **Unfavourable –** South Africa | 28 |
| **Driverless cars** | **High –**Zero CO2 Emissions (0 g/km) | **Favourable –** France | 27 |
| | | **Unfavourable –** India | 26 |
| | **Low –** High CO2 Emissions (200 g/km) | **Favourable –** France | 26 |
| | | **Unfavourable –** India | 26 |
| **Experiment 2: Smartphones (n=396)** | | | |
| **Market conditions** | **Product eco-friendliness levels** | **ECOM** | **N** |
| **Emerging - India** | **High – Use of recycled plastics** (95% in charger case and in inner tray) | **Favourable** – South Korea | 49 |
| | | **Unfavourable –** Slovakia | 48 |
| | **Low - Use of recycled plastics** (5% in charger case and in inner tray) | **Favourable** – South Korea | 48 |
| | | **Unfavourable –** Slovakia | 47 |
| **Developed - USA** | **High - Use of recycled plastics** (95% in charger case and in inner tray) | **Favourable** – South Korea | 51 |
| | | **Unfavourable –** Slovakia | 51 |
| | **Low - Use of recycled plastics** (5% in charger case and in inner tray) | **Favourable** – South Korea | 51 |
| | | **Unfavourable –** Slovakia | 51 |

**Appendix F** Construct measurement in Study 5

| Construct | Items | Measurement (Source) |
|---|---|---|
| Perceived product quality | How do your rate the overall quality of this product? | Single 7-point item, anchored by "very low quality" [1 star] and "very high quality" [7 stars] |
| Purchase intention | To me, buying this product is…<br>1. Improbable/ Probable<br>2. Unlikely/Very likely<br>3. Impossible/Possible | Three-7-point semantic differentials (Hassan et al., 2014) |
| General ecological COM | 1. [Country name] is an environmentally friendly country<br>2. The [country name] government has been doing a lot to improve the ecological well-being of its country<br>3. [Country name] people are, in general, environmentally conscious | Three 7-point items, anchored by "strongly disagree" [1] and "strongly agree" [7], adapted from Chan (2000) |
| Needs for cognition | 1. I would prefer complex to simple problems.<br>2. I like to have the responsibility of handling a situation that requires a lot of thinking.<br>3. Thinking is not my idea of fun.<br>4. I would rather do something that requires little thought than something that is sure to challenge my thinking abilities<br>5. I try to anticipate and avoid situations where there is a likely chance I will have to think in-depth about something.<br>6. I find satisfaction in deliberating hard and for long hours.<br>7. I only think as hard as I have to.<br>8. I prefer to think about small, daily projects to long-term ones<br>9. I like tasks that require little thought once I've learned them<br>10.The idea of relying on thought to make my way to the top appeals to me.<br>11.I really enjoy a task that involves coming up with new solutions to problems.<br>12.Learning new ways to think doesn't excite me very much<br>13.I prefer my life to be filled with puzzles that I must solve.<br>14.The notion of thinking abstractly is appealing to me.<br>15.I would prefer a task that is intellectual, difficult, and important to one that is somewhat important but does not require much thought.<br>16.I feel relief rather than satisfaction after completing a task that required a lot of mental effort.<br>17.It's enough for me that something gets the job done; I don't care how or why it works | Eighteen 7-point items, anchored by "strongly disagree" [1] and "strongly agree" [7] (Cacioppo et al., 1996) |

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|---|---|---|
| | 18.I usually end up deliberating about issues even when they do not affect me personally. | |
| **Covariates/controls** | | |
| Product category interest | Overall, I am very interested in driverless cars/Connected TVs/Eco-smartphones | Single 7-point item, anchored by "strongly disagree" [1] and "strongly agree" [7] Adapted from Melnyk, Klein and Völckner (2012) |
| Product category knowledge | 1.Compared to the average person, I know a lot about [product name]<br>2.I like to work on [product name] myself<br>3.I don't understand very much of my [product name] workings<br>4.I know how an internal [product name] system works<br>5.My friends consider me an expert on [product name] | Five-item scale by "strongly disagree" [1] and "strongly agree" [7] adapted from Sambandam and Lord (1995) |
| General country image | How do you evaluate [country name] in terms of its…<br>1. Design<br>2. Workmanship<br>3. Prestige<br>4. Innovativeness | Four 7-point items, anchored by "very low" [1] and "very high" [7] (Roth and Romeo, 1992) |
| Perceived importance of COM | 1.A product's country of manufacture is important to me.<br>2.The country of manufacture has an impact on my evaluations.<br>3.Within this product category, a product's country of manufacture is important to me | Three 7-point items, anchored by "strongly disagree" [1] and "strongly agree" [7] (Herz and Diamantopoulos, 2017) |
| Familiarity with COM | I know the country very well | Single-item scale anchored by "strongly disagree" [1] and "strongly agree" [7] Adapted from Bloemer et al. (2009) |
| Experience with COM | Have you recently bought any products manufactured in [country name]? | Multiple-choice question: Yes/No/Never |
| Openness to new culture | 1. I would like to have opportunities to meet people from different countries<br>2. I am very interested in trying things from different countries | Two-item scale anchored by "strongly disagree" [1] and "strongly agree" [7] Adapted from Sharma et al. (1994) |
| **Manipulation check variables** | | |
| Perceived product eco-friendliness | How do you rate the product in terms of its product eco-friendliness? | Single 7-point item, anchored by "not at all eco-friendly" [1 star] and "very eco-friendly" [7 stars] |
| Product-specific ecological COM | 1. [Product name] made in [country name] are superior in terms of eco-friendliness<br>2. [Product name] made in [country name] have a good reputation in eco-friendliness | Two 7-point items, anchored by "strongly disagree" [1] and "strongly agree" [7] |