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## Linking Chinese cultural values and the adoption of electric vehicles: The mediating role of ethical evaluation

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### ABSTRACT

Electric vehicles (EVs) have been regarded as one of the most prominent green technologies, touted to help reduce global energy consumption and carbon emissions. China advocates the development of EVs to address the increasing challenges of climate change, urban air pollution and energy security, but consumers' enthusiasm for adopting EVs remains low. In this paper, we present a concept model that hypothesizes Chinese cultural values as a key to understanding Chinese consumers' intention to adopt EVs. Based on a nationwide online survey in China, this study explores Chinese consumers' attitudes toward two types of EVs—battery electric vehicles and plug-in hybrid electric vehicles—by identifying the influence of the human–nature relationship, long-term orientation, face consciousness, and risk attitude, as well as the mediating effect of deontological ethical evaluation in decision-making. The results suggest that public policy and social marketing efforts should pay more attention to the role of cultural values when promoting environmentally sustainable technologies, and importantly, that the promotion efforts should differ for different cultural elements and products with different levels of innovativeness.

### 1. Introduction

Automobility is amongst the most important causes of energy consumption worldwide (Urry, 2004). Petrol and diesel usage in transportation contributes about one-sixth of global greenhouse gas emissions and the majority of urban air pollution (Fenger, 1999). Therefore, electric vehicles (EVs), which emit considerably lower levels of CO<sub>2</sub> than petrol cars, have been regarded as one of the most promising green technologies, which could help reduce global carbon emissions and energy consumption (Kley et al., 2011; Sang and Bekhet, 2015).

As part of its national sustainable development strategy, the Chinese government chose EVs, including plug-in hybrid electric vehicles (PHEVs) and battery electric vehicles (BEVs), to address the increasing challenges of climate change, urban air pollution and energy security (Gong et al., 2013). China aimed to produce 2 million units of EVs annually and sell, cumulatively, 500,000 units by 2015 and 5 million units by 2020 (The State Council of P.R.C., 2012). Despite the potentials for EVs to contribute substantial environmental benefit and receive strong government support (considering purchase subsidy, infrastructure promotion, and research and development) (Zhang et al., 2017), Chinese consumers have been hesitant to adopt EVs. The pilot EV commercialization program initiated in early 2009 only achieved an average of 26% of its goal across 25 cities by October 2011 (Gong et al., 2013). In 2013, only 17,600 EVs were sold in China, the majority of which were buses and utility trucks, accounting for less than 0.1% of annual vehicle

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sales (Wan et al., 2015). The Chinese government then implemented a wide range of incentive policies to further promote the market of EVs (Ministry of Finance et al., 2013, 2014; The State Council of P.R.C., 2014a), which helped drive an increase in the market share to 0.3% and 1.3% in 2014 and 2015 respectively. By the end of 2015, however, China was still failing to achieve the intended sale target (China Association of Automobile Manufacturers, 2015, 2016).

To achieve the desired environmental benefits of EVs, it is crucial to understand key antecedents that can influence consumers' willingness or unwillingness to adopt EVs and the related influencing mechanism. Existing research on EV adoption has focused on the influences of product-related factors (such as purchase and running costs, vehicle performance and emission level), service factors (such as charging infrastructure), policy factors (such as government incentives and regulations), as well as individual factors (such as environmental awareness and technology awareness) (Cherubini et al., 2015; Potoglou and Kanaroglou, 2008; Rezvani et al., 2015). Surprisingly, there is limited knowledge about the role of cultural values in consumers' decision-making processes when considering whether to purchase an EV (Lane and Potter, 2007).

Drawing on the “value-attitude-behavior” framework (Homer and Kahle, 1988) and the theory of planned behavior (Ajzen and Madden, 1986), we investigate the cultural antecedents of EV adoption corresponding to three key attributes of EVs: environmental friendliness, symbolism, and innovative attributes. The environmental benefits of EVs are the main motivation behind the Chinese government's promotion of EVs. However, the symbolic attributes of EVs may also bestow owners with desirable pro-environmental and prosocial identity markers (Griskevicius et al., 2010). Moreover, EVs are innovative and will require major transition of the current socio-technical system of mobility (Tyfield, 2014), so consumers tend to perceive them as cars for tomorrow (Graham-Rowe et al., 2012).

We identify four factors that could largely correlate Chinese social and cultural values with consumer attitudes to EVs. First, the “human–nature relationship” and “long–term orientation” (LTO), values originating from Taoism and Confucianism respectively in Chinese culture, may influence consumer perceptions on the environmental attribute of EVs. Further, “face consciousness,” an important aspect of Chinese culture, may elucidate the importance of symbolism associated with EVs. In addition to these three Chinese cultural values, we included “risk attitude” as another potential factor in EV adoption, that is, the impact of uncertainty on consumers' intention to adopt innovative technology.

In spite of the potentially important influence of cultural values on consumer behavior, prior studies suggest that effects of cultural values are usually indirect and take effect via specific mediating processes (e.g., Chan and Lau, 2000; Chan, 2001; McCarty and Shrum, 1994). The existing literature argues that when cultural values affect the ethical evaluation of sustainable consumption, consumers are more likely to link their beliefs with behavioral intention (Lu et al., 2015); however, few studies have examined the influence of culture on consumption sustainability via ethical evaluation (e.g. Yin et al., in press). Drawing on marketing ethics theory, which applies ethical decision-making to marketing contexts (Hunt and Vitell, 1986, 1993), we further probe the mediating mechanism of deontological ethical evaluation—that is, an individual's evaluation of the inherent rightness versus wrongness of a behavior (Hunt and Vitell, 1986, 1993)—in the influence of cultural elements on consumers' intention to adopt EVs.

Investigation of mediating mechanisms may have important implications for understanding the influential effects of cultural factors on environment-related consumption. Different types of EVs have different effects on energy savings and emission reduction (Zhou et al., 2013)—BEVs are driven by a battery recharged from the electricity supply while PHEVs can be driven by an internal combustion engine or an electric motor with a short all-electric range (Graham-Rowe et al., 2012; Schuitema et al., 2013). Therefore, by using mediation analysis, we examined the direct only effects (i.e., no mediation), indirect only effects (i.e., full mediation), or both direct and indirect effects (i.e., partial mediation) of various cultural factors. In particular, the mediation analysis for the effects of environmental factors on explaining the adoption intention of each type of EV may inform the design of more effective environmental policies and social marketing campaigns to promote the adoption of EVs.

In the remaining parts of this paper, we first review the literature of EV adoption and present research hypotheses. Then we introduce the research method and discuss our analyses of the measurement model, structural equation model, and mediation test. Finally, we discuss the theoretical and policy implications of the results and reflect on the potential limitations of the study.

## 2. Literature review and research hypotheses

Understanding consumer attitudes toward EVs is essential for market development. The adoption of EVs must not only overcome technological obstacles, but also address social, cultural and ethical challenges relating to consumers' attitudes to achieve widespread adoption (Heffner et al., 2007). As researchers argue, instrumental attributes may not be as important as assumed for the adoption of sustainable or environmentally friendly innovations; instead, other less-examined environmental, symbolic, or innovative aspects may be more important to consumers (Noppers et al., 2014). Thus, consumers' acceptance of sustainable innovations such as EVs may be influenced by values, emotions, lifestyle, and social networks, as well as other non-technical factors.

Given that values often translate into behaviors, it is a matter of great importance to understand whether and how values may predict consumers' sustainability-related attitudes and behaviors (Haws et al., 2014). Referring to the “value-attitude-behavior” framework proposed by Homer and Kahle (1988) and the theory of planned behavior (Ajzen and Madden, 1986), our theoretical model summarizes the hypothesized relationships among key constructs (see Fig. 1). The theory of planned behavior attempts to explain the causal link between values, beliefs, attitudes and behavior, and proposes that when facing a behavioral choice, individuals will consider the alternatives and assess their consequences based on their beliefs and values (Ajzen, 1991). Thus, beliefs influence intention to act, assuming that behavioral intention is a strong indicator of actual choice. Similarly, the “value-attitude-behavior” framework stresses the importance of personal values and norms, including social value systems and ethical evaluation, in predicting consumer behavior. Homer and Kahle (1988) argue that studies on personal values and consumer behavior tend to focus

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