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Application of the extended theory of planned behavior to understand individual's energy saving behavior in workplaces



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ABSTRACT

Individual's energy saving behavior in workplaces is crucial to reduce energy consumption and carbon emissions. The main idea of this research is to explore the determinants of individual's energy saving behavior in workplaces. An extended theory of planned behavior (TPB) has been used as the theoretical research framework. The extension was implemented by adding two new variables: descriptive norm and personal moral norm. Data were collected using questionnaire survey method and analyzed with the help of structural equation modeling (SEM). The results indicate that individual's attitude towards energy saving, perceived behavior control, descriptive norm and personal moral norm positively affect individual's energy saving intention in workplaces, while the effect of subjective norm is insignificant. Descriptive norm is the most powerful variable to predict individual's energy saving intention. Moreover, the results also verify the usefulness of the extended TPB model, as it has increased the explanatory power of the original TPB model (from 22.6% to 34.9%). Based on the results, implications for improving individual's energy saving intention in workplaces and suggestions for further research are discussed.

1. Introduction

Carbon emissions caused by energy consumption have become a major source of total emissions and have attracted worldwide attention (Yang et al., 2016). Promoting energy-efficient technology, improving energy use efficiency and motivating individuals to save energy in their daily lives are effective ways to reduce energy consumption. However, promoting energy-efficient technology and improving energy use efficiency are not sufficient to reduce energy consumption due to the 'rebound effect'¹. Therefore, motivating individuals to save energy and performing energy saving behavior may potentially make a great contribution to reduce energy consumption.

Currently, individual's energy saving behavior has already become a hot research topic. The extant research on energy saving at the individual level, such as Banfi et al. (2008), Webb et al. (2013), Wang et al. (2014), Frederiks et al. (2015), Du et al. (2017) and Pothitou et al. (2017), mainly focuses on household's energy saving and aims to explore the willingness and determinants of household's energy saving behavior. Most of the researches indicate that households are willing to reduce energy consumption and save energy in their daily lives. Socio-demographics variables, energy saving awareness, social norm and

some situational factors significantly influence household's energy saving behavior.

To the best of our knowledge, little research has addressed the topic of individual's energy saving behavior in workplaces. In fact, individuals spend about 60–70% of their time in workplaces every week. Accordingly, it can be known that individual's willingness to save energy in workplaces is crucial to reduce energy consumption and carbon emissions. In addition, it is worth noting that energy saving in households differs from energy saving in workplaces. For individuals, energy consumption in households needs to pay, while energy consumption in workplaces is almost free of charge. To a large extent, energy in workplaces can be regarded as public goods. This attribute makes energy more easily wasted in workplaces than households. Hence, individual's energy saving behavior in workplaces is an important theoretical issue and needs to call for more research to obtain a better understanding of what factors affect individual's willingness to save energy in workplaces and thus to narrow the research gap. In this research, we try to address this shortfall.

To explore the factors influencing individual's energy saving behavior in workplaces, we build a theoretical model based on theory of planned behavior (TPB). There are three mainly variables namely

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¹ Rebound effect refers to an increase in energy use efficiency by 1% will cause a reduction in energy consumption that is far below 1% or, sometimes, it can even cause an increase in energy consumption (Georges et al., 2017).

attitude, subjective norm and perceived behavior control in TPB. Several scholars, such as Abrahamse and Steg (2009), Sigurdardottir et al. (2013), Yue et al. (2013), Chen and Tung (2014), Botetzagias et al. (2015) and Yadav and Pathak (2016) have used TPB theory to explore individual's pro-environmental behavior, such as green purchasing behavior, household's energy saving behavior and other sustainable consumption behavior in an individual setting. Meanwhile, several researchers, such as Greaves et al. (2013) and Norton et al. (2015) have also used TPB to explore individual's pro-environmental behavior in a workplace setting. Thus, it is appropriate to select TPB as the basic theoretical framework in this research to understand individual's energy saving behavior in workplaces.

Despite the usefulness of TPB, it exists two shortcomings in predicting individual's pro-environmental behavior. One is that TPB is a self-interest theory and all the variables included in TPB are rational predictors (Bertoldo and Castro, 2016). In fact, just as Toft et al. (2014) noted that pro-environmental behavior is influenced not only by self-interest motives but also pro-social motives. Norm activation model (NAM), which proposed by Schwartz (1977), pointed out that an individual behaves in a pro-social way because that he feels a moral norm to do so. Considering individual's energy saving behavior in workplaces is also belonging to pro-social behavior, this research attempts to add personal moral norm into TPB to deal with the limitations. Another shortcoming is that TPB reduces the effects of social norm. According to Ajzen (1991), social norm can be divided into two aspects: subjective norm and descriptive norm. In TPB, social norm is often seen as subjective norm. However, the effect of subjective norm on individual's behavior intention is relatively limited in TPB and thus reduces the explanatory power of the social norm (Zhang et al., 2014). To respond to these concerns, this research tries to add descriptive norm into TPB.

Taking these viewpoints into account, this research extends TPB by adding two variables, namely descriptive norm and personal moral norm, and investigates how these variables influence individual's energy saving behavior in workplaces. To the best of our knowledge, this is the first time to incorporate these two variables together into TPB to understand individual's energy saving behavior in workplace settings. The main goals of this research are to explore whether these variables significantly influence individual's energy saving behavior in workplaces, to illustrate which variables are more powerful in influencing individual's energy saving behavior in workplaces, and to test whether the two additional variables increase the explanatory power of the TPB model. This research has several contributions to the current literature. Firstly, this research examines the influencing factors of individual's energy saving behavior in workplaces and further enriches and expands individual's energy saving behavior research. Secondly, this research extends TPB by adding two variables and examines the combined effects of these variables. Finally, this research confirms the usefulness of the extended TPB model in pro-social and pro-environmental behavior research area.

The rest of this research is organized as follows. In Section 2, we deal with the literature review and propose the conceptual framework and hypotheses. In Section 3, we focus on data and the research method. Data analysis and the results are shown in Section 4. In Section 5, we discuss the results and implications. In Section 6, we conclude the research and address the research limitations.

2. Theoretical background and research hypotheses

2.1. Theory of planned behavior

TPB was first proposed by Ajzen (1991) and now it is the most popular theory to study individual's behavior in a wide range of fields, especially pro-environmental behavior. According to this theory, individual's behavior intention is decided by attitude towards this behavior, subjective norm and perceived behavior control. Attitude refers to individual's feelings (negative or positive) to perform a specific

behavior. Subjective norm refers to individual's perceived social pressure from others who are important to him that thinks he should or should not perform the behavior. Perceived behavior control refers to the perceived ease or difficulty of conducting the behavior.

Attitude is the first important variable to affect individual's behavior intention in TPB theory. The more individual holds positive attitude towards the behavior, the more likely he will intend to conduct this behavior. Several studies, such as Webb et al. (2013), Hori et al. (2013), Wang et al. (2016) and Yadav and Pathak (2016) have noted the importance of attitude in predicting individual's pro-environmental behavior in various contexts such as household's energy saving behavior, green products purchasing behavior, and green vehicles adoption behavior. Similarity, in the context of energy saving behavior, it can be speculated that if individual considers the energy saving behavior in workplaces is significant, valuable and beneficial to reduce carbon emissions, he will hold positive attitude and likely to form intention to save energy. Thus, it is hypothesized that:

Hypothesis 1. Attitude towards energy saving positively affects individual's intention to save energy in workplaces.

Subjective norm is the second important variable to affect individual's behavior intention. Individual tends to comply with the expectations or viewpoints of some important people. In other words, individual's behavior intention might be based on the approval or disapproval of some people that are important to an individual (Chen and Tung, 2014). The higher subjective norm individual perceived, the more likely to perform a behavior. This is also suitable for energy saving behavior in workplace settings. If individual realizes that most workmates think he should save energy in workplaces, he will perceive pressures and intend to save energy. Thus, it is hypothesized that:

Hypothesis 2. Subjective norm positively affects individual's intention to save energy in workplaces.

Perceived behavior control is another important variable to affect individual's behavior intention. Some factors such as opportunity, resource, time, knowledge and skills may not be under the control of individuals and thus influence their intention to conduct a particular behavior. If individuals have a higher degree of control over themselves, they will have stronger intention to perform a particular behavior. This phenomenon can be extended to energy saving behavior in workplace settings. If individuals feel easy and have relevant knowledge and skills to save energy in workplaces, they will more likely to form intention to save energy. Thus, it is hypothesized that:

Hypothesis 3. Perceived behavior control positively affects individual's intention to save energy in workplaces.

2.2. Inclusion of additional variables in the TPB

The TPB model was extended by adding two additional variables, personal moral norm and descriptive norm in this research. Personal moral norm refers to an individual conducts a particular behavior based on his moral responsibility or obligation. Descriptive norm refers to individual's decision to perform a certain behavior or not depends on what the majority of people actually do in a given situation (Graham-Rowe et al., 2015; Jun and Arendt, 2016). Several researchers have confirmed the usefulness of extending TPB by adding these two variables in pro-environmental research area. For example, Kaiser and Scheuthle (2003) noted that the addition of personal moral norm into TPB significantly improved the model explanatory power and personal moral norm has a significant effect on individual's intention to conduct environmentally friendly behavior. Wang et al. (2016) incorporated personal moral norm into TPB to predict green vehicles adoption intention and found that the personal moral norm has a significant effect on adoption intention. Manning (2009) conducted a meta-analytical study and noted that the addition of descriptive norm improved the

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