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Determinants of pro-environmental behaviour: bioethanol fuel purchasing in Vietnam

A thesis
submitted in partial fulfilment
of the requirements for the Degree of
Master of Applied Science (Environmental Management)

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Lincoln University
by
Han Hoang

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Encouraging consumption of renewable energy, including biofuels, for transport is one way to reduce greenhouse gas emissions. In the past two decades in Vietnam remarkable economic growth has resulted in a significant increase in traditional energy consumption, leading to a substantial rise in greenhouse gas emissions. In response, the Vietnamese government has developed various strategies, including the launch of a bioethanol fuel, E5, in December 2014. Remarkably, two months after its introduction, E5 sales were equal to about 11% of total petrol consumption, which is higher than ethanol's shares in the gasoline markets of the USA (10%) and Europe (4.5%) in 2011 and 2013 respectively, even though bioethanol had been on the market a considerably longer time in those countries. This research identifies factors that affect E5 purchasing through applying a modified version of Triandis' Theory of Interpersonal Behaviour (TIB). Apart from considering influence on E5 purchasing behaviour of the original TIB's constructs including Intention, Habit and Facilitating Conditions, the applied framework investigates impacts of respondents' Environmental Knowledge about E5 relevant issues and their perceived power to overcome barriers to buying E5, which have proved strong predictive abilities in previous studies.

An Internet survey collected data on Vietnamese consumers' perspectives and experiences of E5 consumption. A total of 159 responses were collected within the final phase of data collection, denoting approximately 35% of response rate of the Internet-based mode.

The research findings indicate that Habit is the strongest determinant of both Intention to buy E5 and actual E5 purchase. The overwhelming influence of Habit implied that changing the habit of using conventional petrol is probably the most efficient approach to encourage E5 consumption. Intention and Facilitating Conditions are the two other significant antecedents of E5 purchasing Behaviour. E5

purchasing Intention is influenced by Attitude towards purchase of this product and Social Factors, along with Habit. The present research reveals that Environmental Knowledge did not affect E5 purchasing Behaviour. Barriers to E5 consumption, including availability of E5 stations, E5 price and cooperation of petrol attendants, were a significant but weak predictor of E5 actual use, implying that policies addressing these barriers might still be helpful but their contributions would likely be limited. The present study confirms the adequacy of the modified TIB in explaining E5 purchasing behaviour, which has not previously been used to predict biofuel consumption behaviour in particular, and pro-environmental behaviours in general. The modified TIB, however, is not capable of explaining how the habit of using traditional petrol can be changed and how E5 purchasing habit can be formed. This issue should be addressed in future research in order to identify possible interventions to encourage consumption of the more environmentally friendly petrol.

Keywords: Biofuel purchasing, Theory of Interpersonal Behaviour, Pro-environmental behaviour.

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Chapter 1

Introduction and Background

1.1 Introduction and problem statement

Climate change and the development of solutions to respond to this phenomenon have become a mutual concern of both developed and developing countries. Greenhouse gas (GHG) emissions are recognised as being the main cause of changes in weather patterns (Solomon, 2007), and much effort is being made internationally to reduce GHG emissions. Initiatives to move towards a 'low carbon economy' or 'low carbon society' have accordingly evolved and quickly become a development trend worldwide. The term 'low carbon society' was first introduced in the report *Our Energy Future* by the UK Department of Technology and Industry (2003) as a development model aiming at lower energy consumption and reduced GHG emissions. Encouraging supply and consumption of renewable energy, including biofuels for transport, was emphasized as one of the main approaches to achieve a low carbon economy (UK Department of Trade and Industry, 2003). Comparing the same amount of consumption, biofuels cause less GHG emissions than do fossil fuels (IEA, 2011a). The International Energy Agency (IEA) (2011a), in their report on the World Energy Outlook, indicated that, even though there is still a controversial debate on the sustainability of biofuels with respect to their threat to food security, biofuels are still a promising low-carbon energy option to replace high-carbon discharging fossil fuels. In fact, consumption of biofuels has already increased recently in many countries (IEA, 2011a).

In the past two decades, Vietnam has experienced a remarkable growth that has allowed the country to transform from a low-income into a middle-income nation (Mishra & Tuan Dinh, 2012). However, economic development in Vietnam has resulted in a significant increase in fossil fuel consumption, leading to a substantial rise in GHG emissions. According to the 2010 national GHG inventory, the total amount of GHG emissions that year was 246.8 million tonnes of CO₂ equivalent (tCO₂e), which was 137.76% higher than that in 1994 (MONRE, 2014). The energy sector was the largest emission contributor (accounting for 53.05%), of which emissions from transportation accounted for 25.6% (MONRE, 2014). Unless a new pattern of energy consumption is developed, Vietnam will soon become an energy-importing country, with a high level of GHG emissions per capita (Socialist Republic of Vietnam, 2012).

To deal with this unsustainable trend, the Vietnamese government (hereinafter referred to as the government) has made great effort into putting the country on the track toward a low carbon economy. A wide range of activities has been implemented. In 2004, the Prime Minister approved the

Strategic Orientation for Sustainable Development in Vietnam (Vietnam Agenda 21), demonstrating national targets in harmonizing socio-economic development and environmental protection as well as mitigating climate change (Socialist Republic of Vietnam, 2004). Of these targets, changing fuel consumption from traditional petrol to clean fuels is considered a top priority. Policies on clean and renewable energy were developed further when the government issued the National Target Programme on Energy Efficiency and Conservation in 2006, approving pilot programmes of biofuel use (Socialist Republic of Vietnam, 2006). One year later, a scheme to develop biofuels by 2015 and to provide vision towards 2025, was published, which sets the production targets of biofuel products, namely E5 and B5, and specifies main tasks to achieve these objectives. Accordingly, E5 was first launched onto the market in December 1st, 2014 in seven provinces. E5 has been sold nationwide since December 1st, 2015 (Ministry of Trade and Industry MOIT, 2014). The price of E5 has fluctuated since it came onto the market, but it is generally cheaper than regular fuel (MOIT, 2014).

According to Vietnam National Petroleum Group (Petrolimex), as of January 2015, E5 sales were about 11% of total petrol consumption. This number is higher than ethanol fuel's share in the gasoline market of US (10%) and Europe (4.5%) in 2011 and 2013, respectively (European Biofuels Technology Platform, 2015; U.S. Energy Information Administration (EIA), 2012), even though these products were launched much earlier in those countries than in Vietnam.

Despite the potential contributions of biofuels to mitigation of climate change worldwide, there are limited studies investigating factors that either encourage or discourage consumption of the product. To the best of my knowledge, since E5 has just come onto the market, no research has yet addressed antecedents of E5 purchasing behaviour in Vietnam.

1.2 Overview of E5 – bioethanol fuel

Biofuels are a recent category of renewable energy for transportation. They are liquid fuels that are produced directly or indirectly from organic materials including plant materials and animal waste (IEA, 2011b). Biofuels are developed for the purpose of reducing international dependence on oil and contributing to the decarbonisation of the transport sector (IEA, 2011b; Kondili & Kaldellis, 2007). Biofuels are used as an alternative or supplementary energy source for internal combustion engines through blending it with conventional petrol (ITRC, 2011). Biofuels are regarded as an approach to shift to low carbon fuels with 'minimal changes to vehicle stocks and distribution infrastructure' (IEA, 2011b, p. 7). According to IEA, biofuels was first produced at the end of the 19th century. Bioethanol is a type of biofuels. Biofuel production drastically decreased due to a drop in fossil fuel prices in the 1940s, before it climbed up again in the mid-1970s when ethanol production commenced from sugarcane in Brazil and corn in USA.

Biofuels are regarded as environmentally friendly products because they absorb CO₂ from the atmosphere when their raw material grows, and blending them into traditional petrol diminishes carbon intensity of the fuel, which then leads to a lower concentration of CO₂ in emissions of vehicles consuming the blend (IEA, 2011a). Biofuels are expected to account for 27% of total transportation fuel by 2050, leading to approximately 2.1 Gigatonnes of CO₂ emission reduction per annum if they are produced sustainably¹ (IEA, 2011a). Nonetheless, there are wide-ranging debates concerning the potential threats posed by biofuels. Fletcher et al. (2011) and Fargione et al. (2009) stated that, biofuels are possible threats to food security, deforestation, biodiversity loss and a 'biofuel carbon debt'². In the scope of the current research, these controversies however are not explored. Rather than seeking an answer on whether the contributions and threats of biofuels really exist, the research investigates only their influences on Vietnamese people's choice of fuel.

E5 is a type of bioethanol fuels created through blending biofuels into traditional petrol (MOIT, 2014). E-number stands for the percentage of bioethanol in the mixture by volume. Accordingly, E5 has 5% of bioethanol and 95% of regular petrol. In Vietnam, bioethanol is mainly produced from dried sliced cassava (MOIT, 2014), which is one of the four main crops in this country (H. Nguyen, Schoenau, Nguyen, Van Rees, & Boehm, 2002).

According to Ministry of Industry and Trade of Vietnam (MOIT), E5 started to be developed in Vietnam following the approval by the Prime Minister Decision No. 177/2007/QD-TTg on November 20th, 2007 of the scheme to develop biofuels by 2015. E5 was first launched onto the market on December 1st, 2014 in seven provinces, namely Hanoi, Ho Chi Minh City, Hai Phong, Da Nang, Can Tho, Quang Ngai and Ba Ria-Vung Tau. E5 has been sold nationwide since December 1st, 2015.

Currently, there are seven ethanol manufacturers and three providers of E5 in Vietnam. These providers include Vietnam National Petroleum Group (Petrolimex), Vietnam National Oil and Gas Group (PetroVietnam) and One-Member Limited-Liability Oil & Gas Company of Ho Chi Minh City (Saigon Petro).

1.3 Research objectives and questions

This research aims to examine the E5 purchasing behaviour of Vietnamese people. It also attempts to identify factors that drive people's decisions on using or not using the bioethanol fuel. For these purposes, it addresses the following two research questions:

¹ This figure is based on a comparison with emissions of the similar amount of fossil fuel consumed (IEA, 2011a)

² Biofuel carbon debt refers to the situation when the CO₂ discharged level due to conversion of rainforests, grassland and so on to fuel-crop land exceeds the GHG reductions provided by replacing traditional petrol with biofuels (Fargione et al., 2009).

- What is the consumers' E5 purchasing behaviour in Vietnam?;
- Which factors determine Vietnamese E5 purchasing behaviour?

The two research questions are detailed into twelve research hypotheses, which are presented in Chapter 3 of this thesis.

1.4 Significance of the research

Since it is the first study addressing E5 consumption in Vietnam, the present research contributes to better understanding of determinants influencing behaviour of Vietnamese people in purchasing a biofuel, E5. Because pro-environmental behaviours are complex (McKenzie-Mohr, Nemiroff, Beers, & Desmarais, 1995; Steg & Vlek, 2009), this study assesses a wide range of factors to investigate E5 purchasing behaviour. However incorporating all potential determinants of E5 purchase is not feasible within the scope of the research. Notwithstanding that there are still contributions of the research to the contemporary body of knowledge through examining several chosen variables, which are able to cover the main characteristics of the given behaviour. Moreover, the present study reveals a theoretical framework that is suitable to evaluate E5 purchasing behaviour, which can be helpful for future research targeting this act.

To reduce the national GHG emission, the Vietnamese government has employed a wide array of policies and strategies to promote environmentally friendly products in Vietnam. While investigating the factors that most influence E5 purchase, the research findings also support the identification of solutions and channels that are probably the most effective for encouraging the use of this fuel, assisting policy makers in their effort to diminish the GHG emissions in Vietnam.

1.5 Structure of the thesis

This thesis comprises of five chapters including this introduction. The remainder of the thesis is structured as follows. Chapter 2 presents the theoretical framework employed to investigate E5 purchasing behaviour and the development of hypotheses to answer the two research questions. In order to do so, it reviews literature on models for behaviour examination and selects the most suitable framework based on characteristics of the targeted behaviour.

Chapter 3 outlines the research methodology and design to collect the necessary data. It discusses pros and cons of potential methods of survey distribution as well as identifies sample size. This chapter also provides the strategy of data analysis, including measurement of variables in the theoretical framework.

Chapter 4 presents results of the present research. They include the response rate of the final phase of data collection, i.e. distribution of the final questionnaire, which is followed by descriptive statistics of the sample, outcomes of the evaluation of measurement and structural models, as well as empirical results regarding the research hypotheses.

Chapter 5 summarises and discusses the main findings from the empirical results provided in the previous chapter. It sets out contributions of the present research and its implication for practice and future study. This chapter also emphasises limitations of the research, which will be associated with several cautions for generalisation of the research findings, before setting out the final conclusion.

Chapter 2

Theoretical framework and Hypothesis development

This chapter provides a review of literature about theoretical frameworks to investigate a certain behaviour and the development of research hypotheses. For the purpose, it first identifies criteria to select a suitable theoretical model for investigating E5 purchasing behaviour. Based on these criteria, three models are chosen for further evaluation, in which advantages and disadvantages of each model are drawn out before the final choice of the conceptual framework is made. The second part of the chapter presents hypotheses that will be tested in order to answer the research questions.

2.1 Theories to investigate and predict behaviours

2.1.1 Criteria of theory selection

Many theories and models have been developed to investigate human behaviours. Darnton (2008), in his report on behaviour change models, identified more than 60 social-psychological theories of a wide array of behaviours. Concentrating more on purchasing or consuming behaviours, Jackson (2005) reviewed 22 theories to explain and predict human actions. According to Jackson (2005), whilst theories or models are diverse, they have two main roles. One role is to provide 'heuristic understanding' to explore and conceptualise a given behaviour (Jackson, 2005, p. vi). In this role, models are used to address a wide range of factors motivating behaviours. The resulting complexity can create difficulties for data collection when these models are applied to explain a specific behaviour (Prager, 2012). The other use of models is empirical testing of the strength of identified causal relationships between behaviours and their determinants, and also identification of potential for behaviour changes (Jackson, 2005). Models playing this role are often simplified. A good conceptual framework is able to achieve a balance between 'parsimony and explanatory completeness' (Jackson, 2005, p. vi).

If potential negative environmental consequences of biofuel productions are properly addressed, biofuels are considered green products (Turner, Plevin, O'Hare, & Farrell, 2007). Accordingly, purchasing biofuels can be defined as a green-consumption behaviour (Pagiaslis & Krontalis, 2014). This behaviour, in the first place, is still a consumption activity. Therefore, price and quality of the product are of concern for fuel purchasing, as Ali, Khan, Ahmed, and Shahzad (2011) showed in their research on green purchase behaviour in Pakistan. On the other hand, buying an environmentally friendly product can also be an ethical action; thus, it can be motivated by morality (Hopfenbeck, 1992). Moreover, as purchasing fuel is a regular activity, changing from regular petrol to biofuels can be hindered by the influence of habit (Bamberg & Schmidt, 2003). In short, while investigating

bioethanol fuel consumption, conscious control to maximize consumers' utility, moral motives and habit can be all expected to be determinants of the action.

Based on the aforementioned characteristics of both behaviour models and the given behaviour, the criteria used to select a theoretical framework to explain and predict E5 purchase were:

- *Suitability for the research objective*: The selected model should be able to respond to the research questions. It needs to cover major determinants of the specific pro-environmental behaviour (bioethanol fuel purchasing), which is also a regular consumption activity.
- *Predictive power*: it is important that the selected model has strong explanatory and/or predictive ability. This ability can be illustrated through the strength of causality between its factors, which needs to be proved through empirical testing. Accordingly, the selected model should have been applied by significant numbers of previous applications so that its predictive ability can be verified.
- *Ability to operationalize/practicality*: the chosen model must be practical in terms of data collection and analysis as well as interpretation in a limited timeframe. In other words, parsimony is also a desired characteristic (Jackson, 2005).

According to the criteria, three models were considered: Theory of Planned Behaviour (TPB) (Ajzen, 1985), Norm Activation Model (NAM) (Schwartz, 1977) and Theory of Interpersonal Behaviour (TIB) (Triandis, 1977). The following section introduces and analyses advantages and disadvantages of these three models before selecting one model as the theoretical framework of the present research based on the selection criteria mentioned above.

2.1.2 Review of the chosen models

Theory of Planned Behaviour (TPB)

Overview

The TPB is one of the most popular theories for predicting behaviours (Chao, 2012; Kollmuss & Agyeman, 2002; Ravis & Sheeran, 2003). Ajzen (1985) introduced the model in 1985 as an enhancement to the Theory of Reasoned Action (Fishbein & Ajzen, 1975). In brief, the TPB indicates that whether people will perform an environmentally friendly behaviour is led by their intention to undertake it. The intention is influenced by (i) Attitude, which involves beliefs about possible consequences of the given behaviour (Behavioural Beliefs), (ii) Subjective Norms, indicating normative expectations of other people who are important to them such as parents, partners and so on (Normative Beliefs), and (iii) Perceived Behavioural Control (PBC), which considers needed resources and potential obstacles to undertaking the behaviour (Control Beliefs). PBC can either influence a given behaviour directly, or influence it indirectly through behavioural intention (Ajzen, 1985, 1991). As Ajzen (1991) stated, the

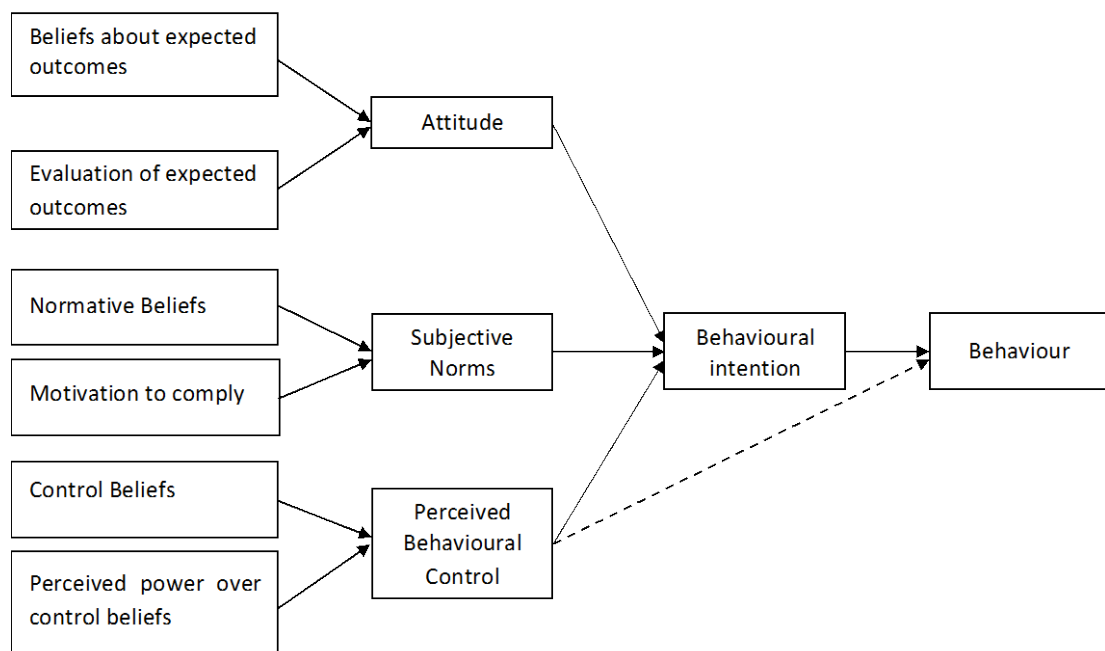
TPB emphasises the significance of benefit and cost arguments and investigates people as utility maximizing actors, who will select the behaviour bringing them the most positive consequences among possible options.

Application

Even though the TPB was not specifically designed for scrutinizing environmental behaviours, it is the most frequently applied model in this area (Joshi & Rahman, 2015), especially for recycling behaviour (e.g. Cheung, Chan, & Wong, 1999; Kelly, Mason, Leiss, & Ganesh, 2006; Rise, Thompson, & Verplanken, 2003) and green purchasing behaviour. With regard to the field of green consumption, the TPB was applied to explain bus use behaviour of university students (Heath & Gifford, 2002), private car consumption behaviour (Abrahamse, Steg, Gifford, & Vlek, 2009; Bamberg & Schmidt, 2003), intention to buy organic food (Arvola et al., 2008; Smith & Paladino, 2010; Tarkiainen & Sundqvist, 2005), as well as intention and behaviour of purchasing sustainable products (Ha & Janda, 2012; Kumar, 2012; Nguyen & Ho, 2014; Paul, Modi, & Patel, 2016).

The research of Heath and Gifford (2002) reveals that Attitude, Subjective Norms and PBC could explain over 70% of the variance in bus use intention, while Intention and PBC explained 53% of the variance of actual bus use. Abrahamse et al. (2009) and Bamberg and Schmidt (2003) also agreed that variables of the TPB well explained the behaviour toward private car utilization. In the study of Abrahamse et al. (2009), the explanatory power of the TPB variables was about 52%. Kumar (2012) and Nguyen and Ho (2014) also concluded that the factors of the TPB significantly influenced purchase behaviour toward green products.

Figure 2.1. Theory of Planned Behaviour (TPB) (Ajzen, 1991)



Pros and cons

Pros:

- The TPB is parsimonious, with a limited number of variables. This facilitates the process of data collection.
- The TPB has a wide range of applications and has strong predictive ability.

Cons:

- In spite of its popularity, shortcomings of the TPB have been disclosed in studies comparing it with other models. Abrahamse et al. (2009), Bamberg and Schmidt (2003), Jaccard and Davidson (1975) and Valois, Desharnais, and Godin (1988) indicated that the predictive ability of TPB is not as strong as that of the TIB, which will be introduced in the following section. This weakness was explained by either the absence of important determinant factors such as habit in car consumption behaviour, or how narrowly Subjective Norms are defined in the TPB (Bamberg & Schmidt, 2003). As a result, the TPB has been employed in an 'extended' form where other explaining factors were added to the original version (e.g. Conner, Warren, Close, & Sparks, 1999; Heath & Gifford, 2002; Loo, Yeow, & Eze, 2013).

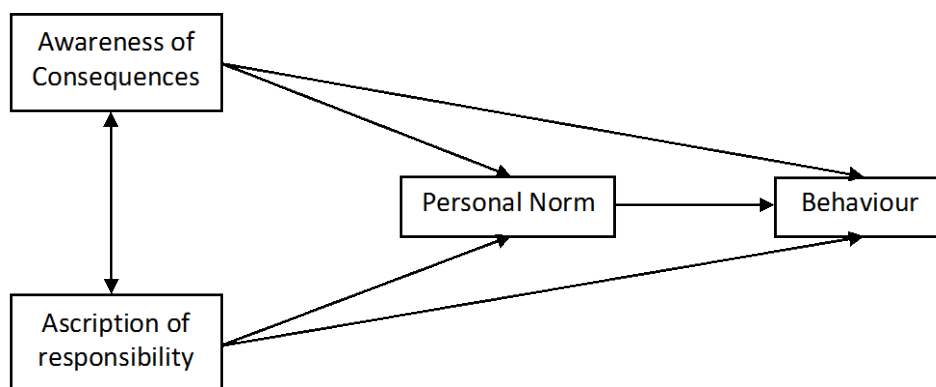
Norm Activation Model (NAM)

Overview

The Norm Activation Model introduced by Schwartz in 1977 aims to explain pro-social and altruistic behaviours (Schwartz, 1977). Contrary to Ajzen (1991), Schwartz argued that altruistic behaviours are only determined by Personal Norms rather than Intention, which are defined as people's feelings of moral obligation to undertake a given behaviour. Different from Subjective Norms of the TPB, Personal Norm is expectations stemming from the individuals' selves rather than others'. Personal Norms have two psychological antecedents, which are Awareness of Consequences and Ascription of Responsibility.

Awareness of Consequences illustrates the extent that people take into account negative impacts of their behaviours on welfare of others or other entity (for example, the environment) when making decisions. Ascription of Responsibility refers to feelings of accountability for consequences caused by their behaviours. While being direct antecedents of Personal Norms, Awareness of Consequences and Ascription of Responsibility also moderate the relationship between Personal Norms and Behaviour based on their strengths. More specifically, the connection between Personal Norms and Behaviour is more significant if people are aware of consequences of not undertaking the concerned behaviour and accept their responsibility for these consequences, and vice versa (Schwartz, 1977).

Figure 2.2. Norm Activation Model (NAM) (Schwartz, 1977)



Application

The NAM was first applied to pro-social behaviours such as blood donation (Zuckerman & Reis, 1978). In the area of pro-environmental behaviours, it has been used to investigate behaviour of recycling (Vining & Ebreo, 1992), energy consumption (Black, Stern, & Elworth, 1985) and car use (Bamberg &

Schmidt, 2003). The explanatory power of the NAM in these studies was mixed. When combining Social Norms with the NAM, Vining and Ebreo (1992) concluded that the predictors could explain 38.2% of the variance in recycling behaviours. Bamberg & Schmidt (2003) showed weak explanatory power of morality toward private car use, with only 14% of the behavioural variance explained. van der Werff and Steg (2015) found explanatory ability of the NAM different among considered behaviours but generally weak. More specifically, the NAM could only explain 5%, 6%, 9% and 18% of the variance in the behaviour of water-saving showering, energy-saving driving, meat consumption and energy saving respectively. Likewise, Black et al. (1985) indicated that Personal Norms did not significantly affect expensive energy efficiency behaviours, while it could explain less than 10% of the variance of low-cost energy efficiency behaviours. The issue was explained by constraining factors such as funding availability, physical structure and so on, which reduced the ability of energy users to undertake desired pro-environmental behaviours.

Pros and cons

Pros

- The NAM is a simple model with few variables.

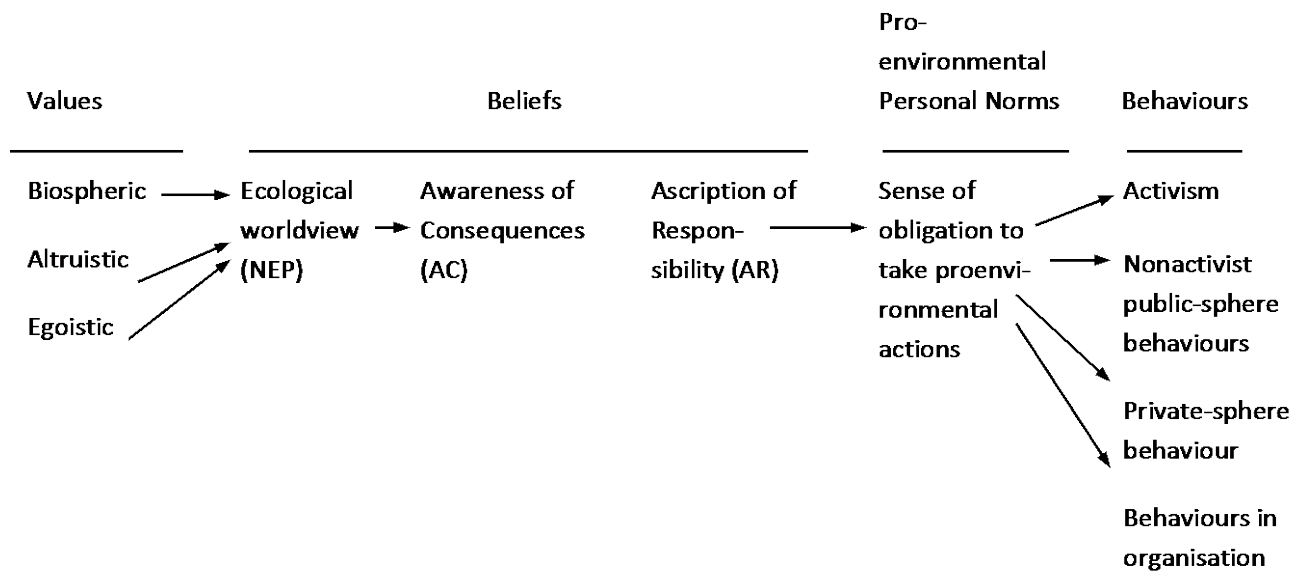
Cons

- The NAM narrows the explanation of behaviours to internal determinants only. Whilst this feature can be highly useful to understand volunteering activities, it seems less helpful in cases where the ability to undertake a given behaviour is strongly impeded by external factors such as budget constraints or requirements of relevant infrastructure. In these circumstances, predictive ability of the NAM is limited.
- Compared with the TPB, the NAM is less frequently applied (Bamberg & Schmidt, 2003).

Drawing strongly on the NAM in combination with the New Ecological Paradigm or worldview (NEP) by Dunlap, Liere, and Kent (1978), in 1999, Paul Stern and his colleagues developed the Value-Belief-Norm theory (VBN) to explain pro-environmental behaviours (Stern, 2000; Stern, Dietz, Abel, Guagnano, & Kalof, 1999). The VBN consists of the NAM constructs (i.e. Awareness of Consequences, Ascription of Responsibility, and Personal Norm) and value constructs.

Figure 2.3 presents the VBN by Stern (2000). Similar to the NAM, the VBN has been criticised for being less effective when it was used to explain pro-environmental behaviours that are costly, time consuming or difficult to implement (Ibtissem, 2010). It can be explained by the fact that expensive or challenging behaviours are less connected to personal norms than less expensive and challenging ones (Steg, Dreijerink, & Abrahamse, 2005).

Figure 2.3. Value-Belief-Norm theory (VBN) (Stern et al., 1999)

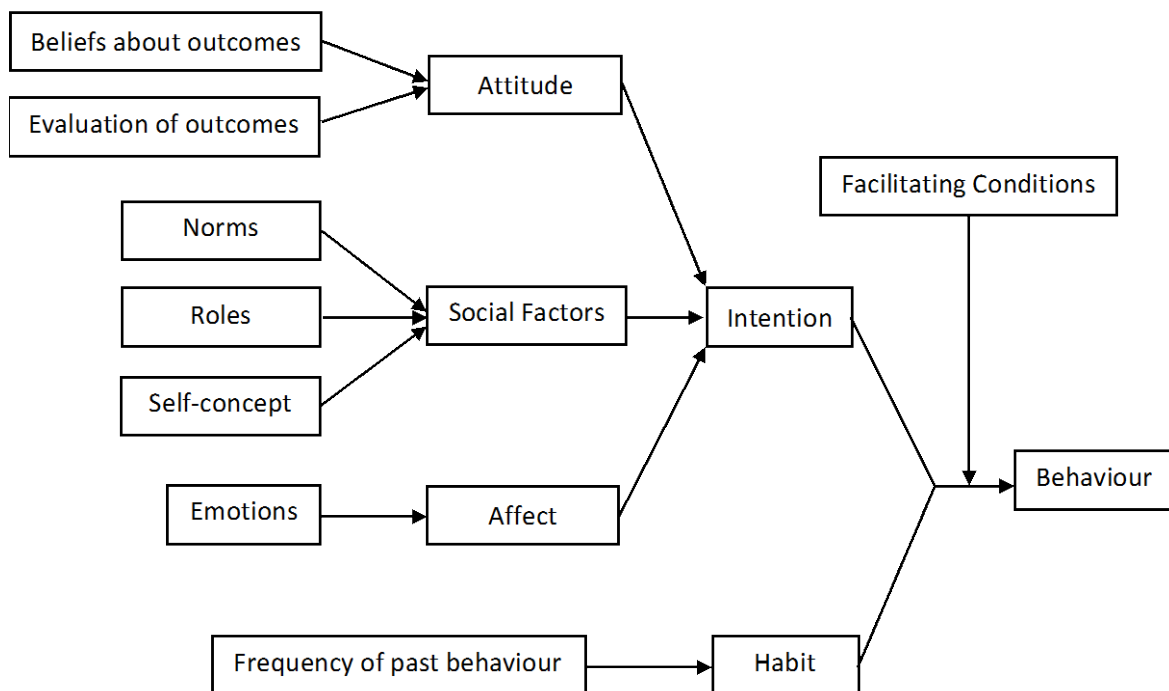


Theory of Interpersonal Behaviour (TIB)

Overview

The TIB was regarded as a general theory of social behaviour by its author, Harry Triandis, when he introduced it in 1977 (Triandis, 1977).

Figure 2.4. Theory of Interpersonal Behaviour (TIB) (Triandis, 1977)



The TIB is much more comprehensive than the TPB as it includes almost all of TPB's constructs plus additional variables including Habit, Facilitating Conditions and Affect. Both models consider Intention as a direct factor influencing behaviours and investigate determinants of Intention. However, whilst the TPB argues that behaviours are decided only by people's consciousness, the TIB states that behaviours can also be influenced by an unconscious factor, namely Habit (Triandis, 1977, 1979). Moreover, the influences of both Habit and Intention on actual behaviour are moderated by Facilitating Conditions, which are barriers or constraints to undertaking a given behaviour (equivalent to Control Beliefs, a component of Perceived Behavioural Control (PBC) in the TPB) (Triandis, 1977, 1979). Nevertheless, individuals' beliefs about their power to overcome these barriers, which is the second component of the construct of PBC in the TPB, are not considered in the TIB (Baumann, Brown, Fontana, & Cameron, 1993).

Variables determining Intention are broader in the TIB than in the TPB, with three main antecedents, which are Attitude, Affect and Social Factors. Attitude involves individuals' beliefs about possible consequences of the given behaviour (Behavioural Beliefs). Affect refers to positive or negative emotions of people about a given behaviour. Social Factors contain Norms, Roles and Self-concept. Norms refer to social rules about whether a behaviour is correct, moral and appropriate or not. Roles are 'sets of behaviours that are considered appropriate for persons holding particular positions in a group' (Triandis, 1977, p. 8). Meanwhile Self-concept captures personal norms, which are the self-

judgment of individuals regarding the correctness of the given behaviour as well as their own relevant goals and values.

Application

The application of the TIB has been limited, especially in the area of pro-environmental behaviours. It has been used to explain personal Internet use at workplace (Pee, Woon, & Kankanhalli, 2008), and intention and behaviour toward exercise (Valois et al., 1988). Both studies proved strong predictive and explanatory power of the TIB, which exceeded that of the TPB when the two models were compared. Similarly, in the field of environment related behaviours, Bamberg and Schmidt (2003) found that the TIB's predictive power was 8% higher than the TPB's when they investigated private car use behaviour. TIB constructs were able to explain 68% and 51% of the variance in intention to drive and actual driving, whilst TPB constructs explained 60% and 45% respectively. The difference was explained by the strong influence of Habit on daily commuting and the powerful impact of the Role construct on Intention. However, the findings of Bamberg and Schmidt (2003) also demonstrate that one construct of the TPB that is not considered in the TIB, the PBC, had significant impacts on Intention. In general, even though the TIB has been used much less frequently than the TPB, it has better predictive power thanks to its broader range of variables (Jackson, 2005). Other applications of the TIB comprise investigations of family planning (Jaccard & Davidson, 1975), health, including adoption of telemedicine, mammography and condom use (Apostolopoulos, Sonmez, & Yu, 2002; Baumann et al., 1993; Gagnon et al., 2003; Gagnon, Sánchez, & Pons, 2006; Maticka-Tyndale, Herold, & Mewhinney, 1998), as well as willingness to select Islamic mortgage products (Amin et al., 2016).

Pros and cons

Pros

- The TIB is regarded as an integrative theory of behaviour (Jackson, 2005). It covers a wide range of determinants of pro-environmental behaviours, including almost all of TPB's factors and personal norms of the NAM as well as its own constructs including Habit and Affect.
- The TIB has strong predictive ability.

Cons

- The TIB is more complex than the TPB and the NAM. The lack of parsimony and vague operational definitions of its variables are two main reasons for limited utilization of the TIB (Araújo-Soares & Pesseau, 2008; Loo et al., 2013). Therefore, some researchers, instead of applying the whole TIB, combined its important constructs, such as Habit, with other models (Venkatesh, Thong, & Xu, 2012).

2.1.3 Comparison of the three considered models

As assessed above, the three models have their advantages and disadvantages that make them optimal in certain cases but not in others. Regarding the purposes of the study, which attempt to scrutinize determinants of ethanol purchasing behaviour, an evaluation of these models' appropriateness according to the selection criteria is undertaken as below:

- The Norm Activation Model (NAM): despite the NAM's parsimony, its ability to predict and explain is inadequate when applied to behaviours that are significantly influenced by external variables. For consumption behaviours such as fuel purchasing, the potential determinants are expected to be much broader than only personal norms as NAM models it.
- The Theory of Planned Behaviour (TPB): the TPB reaches the balance of parsimony and predictive ability, as shown in its applications. However, in several cases, TPB's variables appear narrow. For example, according to Bamberg and Schmidt's (2003) investigation of car use, habit plays an important determining factor. Although the influence of personal norms on actual behaviours is diverse in cases where it is applied, its absence while investigating pro-environmental behaviours also seems unpersuasive (Bamberg & Schmidt, 2003; Heath & Gifford, 2002). Thus, the case for applying the TPB only is not entirely convincing.
- The Theory of Interpersonal Behaviour (TIB): the TIB has strong predictive power, especially when it is used to scrutinise daily activities. It is able to cover almost all of the determinants of the TPB and the NAM. Even though the TIB is not as parsimonious as the TPB and the NAM, its additional constructs do not require too much effort to collect data. Therefore, the TIB is still suitable for operationalization.

Generally, each model possesses strengths and weaknesses. The NAM is least suitable for the research because it limits itself to Personal Norms and external factors known to be important, such as social conditions, are excluded. The TPB, in spite of its popularity, does not take into account factors proved to be important in daily activities such as habit. The TIB, in this case, appears to be the most suitable choice as it satisfies both predictive power and ability to operationalize/practicability. It covers most of TPB's constructs, plus Personal Norms and Habit. Its supplementary factors, on the other hand, are not too complicated to measure, therefore the TIB is still practical.

2.1.4 Additional factors

Although almost all TIB applications demonstrated strong predictive capability of the theory, a number of its users suggested that either additional paths between TIB's constructs (e.g. Baumann et al., 1993; Godin et al., 1996) or inclusion of other variables (e.g. Maticka-Tyndale et al., 1998) could further enhance explanatory power of the TIB. Deriving from these recommendations, the original TIB was

supplemented with two variables (Environmental Knowledge related to biofuels and PBC) and one path (from Habit to Intention), which have been proved to have significant roles in explaining behaviours in previous studies.

Environmental Knowledge

Many studies have attempted to investigate the influence of Environmental Knowledge on environmentally friendly behaviours. Environmental Knowledge is defined as general understanding of 'facts, concepts, and relationships' with regard to the ecological environment (Fryxell & Lo, 2003). Numerous researchers believed that there is a connection between Environmental Knowledge and pro-environmental behaviours (e.g. Diekmann & Preisendörfer, 2003; Frick, Kaiser, & Wilson, 2004; McKenzie-Mohr et al., 1995; Mobley, Vagias, & DeWard, 2009; Schahn & Holzer, 1990). Kaiser, Wölfing, and Fuhrer (1999) claimed that this connection is established through a process, in which Environmental Knowledge is the precondition of the development of environmental Attitude, which in turn is a predictor of environmental behaviour. This argument is in line with the Knowledge – Attitude – Action linear model established in the early 1970s, which stated that enhanced Knowledge about the environment would lead to pro-environmental Attitude, which then would result in pro-environmental behaviours (Kollmuss & Agyeman, 2002). Similarly, Arcury (1990) and Laroche, Bergeron, and Barbaro-Forleo (2001) reported a direct connection between Knowledge and Attitude about the environment. Many other studies also suggested that increases of general Environmental Knowledge, from providing people with more information in environmental issues, would encourage positive Attitude toward the environment (e.g. Bradley, Waliczek, & Zajicek, 1999; Ramsey & Rickson, 1976). Zelezny (1999), who conducted a meta-analysis of 18 studies regarding responsible environmental behaviour, indicated that educational interventions to improve Knowledge were able to promote pro-environmental behaviours, especially for young learners. Responding to the strong support for the importance of Environmental Knowledge, the present research incorporates a Knowledge variable in the original TIB as an antecedent of Attitude.

Perceived Behavioural Control (PBC)

The Triandis' (1977) theory took into account the influence of external situations on the performance of a certain behaviour in the form of the Facilitating Conditions variable. This theory, nonetheless, did not consider how individuals react or cope with these conditions and how their confidence in overcoming potential barriers affects their behaviour. This factor is however addressed in the PBC construct of the TPB (Ajzen, 1991). PBC consists of two components, one is Control Beliefs, which is similar to the Facilitating Conditions in the TIB, and one is Perceived Power over Control Beliefs, which deals with perceptions of individuals to adapt to or overcome external conditions. Applications of the TPB reported strong explanatory power of PBC (e.g. Heath & Gifford, 2002; Kumar, 2012; Nguyen & Ho, 2014). PBC can either directly influence a given behaviour, or indirectly do so through its impact

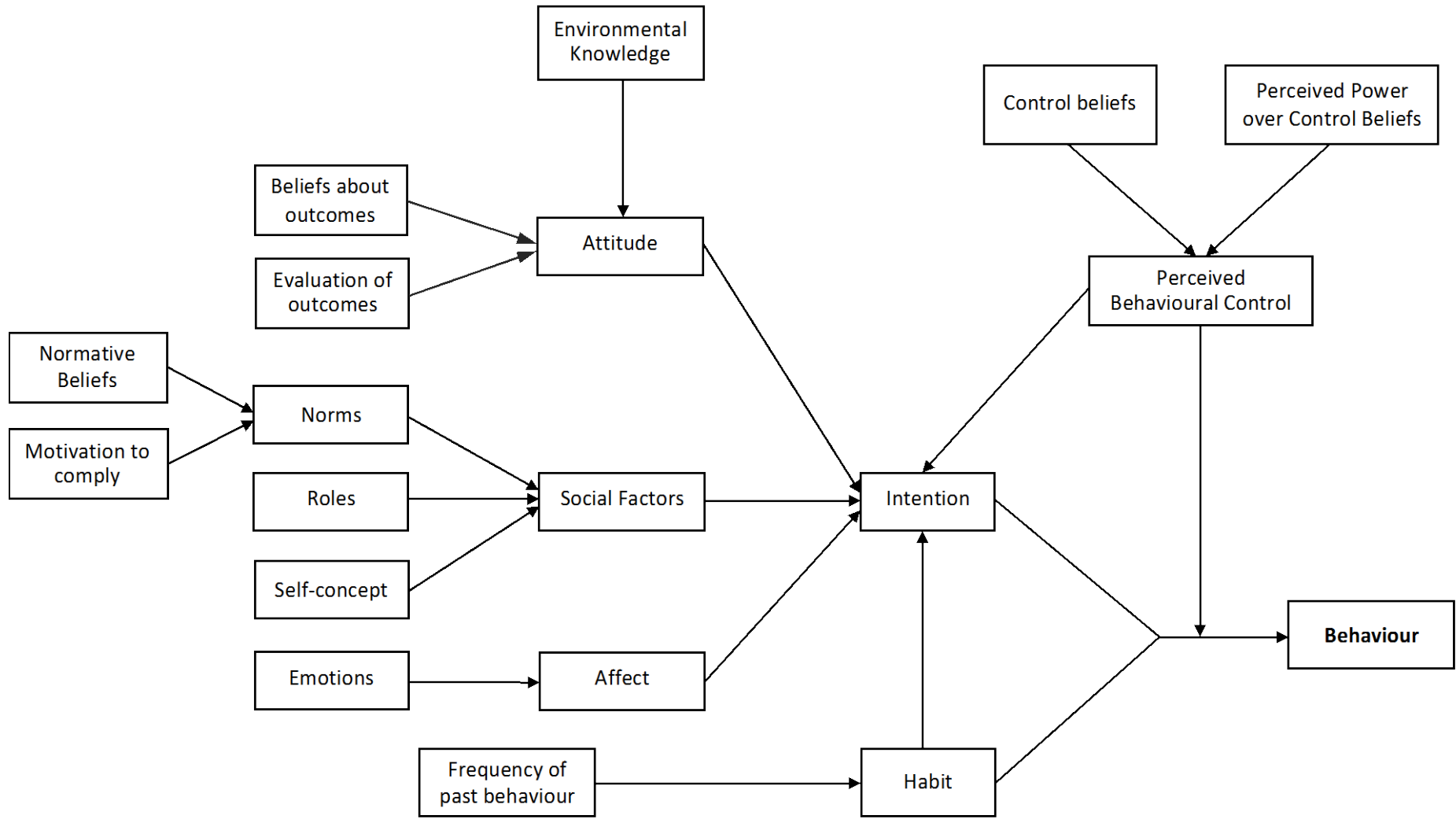
on behavioural Intention (Ajzen, 1985, 1991). Mahmud and Osman (2010) found PBC to be the strongest predictor of Intention of Malaysian students to recycle, while Davies, Foxall, and Pallister (2002) proved a significantly positive relationship between PBC and recycling behaviour. Deriving from these findings, the current study examines the influence of PBC on E5 purchasing Intention and Behaviour, rather than only considering one of its components as in the original TIB.

Additional path from Habit to Intention

Triandis (1977) did not take into account the relationship between Habit and Intention when investigating social behaviour. Nonetheless, applications of the TIB showed that this added link was statistically significant, plus it could improve model fit of the original TIB (Baumann et al., 1993). Godin, Vezina, and Leclerc (1989), who employed the TIB to investigate Intention of pregnant women to do exercise after their labour, found the same positively significant connection between Intention and Habit. The inclusion of Habit into the Intention portion of the TPB model, as Conner et al. (1999) reported, improved the variance of Intention explained by 6.9% with R-square value rising from 35.3% to 42.2% (p.1684). Similarly, when incorporating Habit into the TPB, Rhodes and Courneya (2003) found that it was the strongest determinant of Intention to exercise. These two authors, therefore, recommended that the influence of Habit on Intention needed to be taken into consideration in future research. According to these suggestions, the present study adds a path from Habit to Intention to the original TIB.

In general, the present study employs a modified version of the Triandis' (1977) TIB, to investigate E5 purchasing behaviour of Vietnamese consumers. The modified model adds Environmental Knowledge, PBC and a connection between Habit and Intention. Figure 2.5 presents the theoretical framework.

Figure 2.5. The theoretical framework



2.2 Hypothesis development

This section presents twelve hypotheses developed in order to answer the research questions on determinants of E5 purchasing behaviour. These hypotheses test the causal relationships between constructs of the original TIB as well as additional variables that are incorporated into the theoretical framework.

2.2.1 Influence of Intention

Along with Habit and Facilitating Conditions, Intention is another immediate predictor of Behaviour in the TIB (Triandis, 1977, 1979). Attitude, Social Factors, PBC and Affect mediate their influence on Behaviour through Intention. In other words, in the theoretical framework of the present study, Intention is a function of Attitude, Social Factor, PBC and Affect.

Intention reflects whether or not individuals consider behaving in a certain way (Triandis, 1977). Fishbein and Ajzen (1975) and Ajzen (1985, 1991) regarded this cognitive element as the only factor driving people's behaviour in their TRA and TPB theories. Numerous applications of either the TPB or the TIB found significant impacts of Intention on Behaviour.

According to Triandis (1977) and Ajzen (1985), if people intend to perform a behaviour, it is very likely that they will actually do it. Following these two authors and empirical findings, the present research proposes that there is a positive relationship between Intention to buy E5 and actual E5 purchasing.

H1. Intention to buy E5 and actual purchase of E5 are positively related.

2.2.2 Influence of Habit

Contrary to Ajzen (1985), who argued that individuals' Behaviour is only decided by their consciousness, Triandis (1977) suggested that people performance is driven not only by Intention but also by Habit, which is defined as frequency of past behaviour. Supporting Triandis (1977), Ouellette and Wood (1998) and De Bruijn et al. (2007) asserted that predicting ability of Intention can be limited if individuals have strong habit concerning the considered behaviour. Bamberg and Schmidt (2003), who used both the TPB and the TIB to explain behaviour of car use, also reported that Habit was better able to explain Behaviour than Intention. Almost all TIB applications (e.g. Maticka-Tyndale et al., 1998; Moody & Siponen, 2013; Pee et al., 2008) and Habit-included TPB models (e.g. Conner et al., 1999; de Bruijn, Kremers, Singh, van den Putte, & van Mechelen, 2009; Rhodes & Courneya, 2003) proved a positive influence of Habit on Behaviour.

Despite the direct impact of Habit on Intention being excluded in the original TIB, modified TIB model applications (e.g. Baumann et al., 1993; Godin et al., 1996) and other researchers investigating power

of Habit (e.g. Conner et al., 1999; Knussen, Yule, MacKenzie, & Wells, 2004; Ouellette & Wood, 1998; Rhodes & Courneya, 2003) showed this relationship to be significant. Only Gagnon et al. (2003) found Habit to be not a significant predictor of Intention when they tested this connection in a study of physicians' use of telemedicine.

E5 use habit refers to petrol purchasers' past pattern of E5 consumption, i.e. whether they never try this fuel, or occasionally buy it, or have been using it very often. Consistent with previous studies, Habit is expected to have positive relationships with Intention and E5 purchase Behaviour. It is projected that the more often petrol users purchase E5 in the past, the more likely that they will plan to or actually buy E5 the next time they fill their fuel.

H2. Habit of buying E5 and actual purchase of E5 are positively related.

H3. Habit of buying E5 and Intention to buy E5 are positively related.

2.2.3 Influence of Facilitating Conditions

Arguing that when a targeted behaviour is not under full volitional control, individuals might require essential resources to display it, Triandis (1977) included Facilitating Conditions into his model as an antecedent of Behaviour. In other words, a shortage of resources or unsupporting conditions is barriers to individuals behaving in a certain way. Consistent with Triandis (1977), Ajzen (1985) reflected this issue into Control Beliefs, a component of PBC, as mentioned above. The obstacles that people think they might need to overcome are various, based on the nature of the targeted behaviour. A barrier to the performance of a behaviour can be availability of resources, including technical resources, time, financial ability, skills or confidence (Triandis, 1977).

The predictive power of Facilitating Conditions to explain Behaviour has been mixed among TIB applications. It was found to be strong in studies of mammogram examination, and involvement in casual sex (Baumann et al., 1993; Maticka-Tyndale et al., 1998), but not significant for explaining why workers use the Internet for non-working purposes (Chang & Cheung, 2001; Moody & Siponen, 2013). It has been proved that people are more likely to display a behaviour if they think there are only a few constraints to face or the constraints are easy to overcome (Gagnon et al., 2003; Moody & Siponen, 2013). In the context of this research, petrol users are also predicted to be more likely to buy E5 if they think potential barriers to E5 purchase, including availability of E5 pumps, support of petrol sellers and E5 price, are not severe or they are confident to cope with them. More details of the identified obstacles of E5 purchase are presented in Chapter 3.

H4. Facilitating Conditions regarding E5 purchase and actual purchase of E5 are positively related.

2.2.4 Influence of PBC

PBC is considered as the most important antecedent of Behaviour in the TPB model when the TPB is used to investigate behaviours that are 'partially under volitional control' (Paul et al., 2016, p. 125). In the TPB model, this factor is decided by Control Beliefs and Perceived Power over Control Beliefs. Control Beliefs demonstrate individuals' expectations about difficulties they might face when undertaking a particular behaviour, while Perceived Power over Control Beliefs illustrates their perception about their ability to cope with these barriers. PBC in this study refers to confidence of Vietnamese petrol purchasers in coping with three identified constraints to buying E5 as mentioned earlier, including availability of E5 pumps, support of petrol sellers and E5 price.

PBC is regarded as an important and powerful construct of the TPB based on empirical evidence. Many studies have proved a positive relationship between PBC and Intention in a wide array of environmentally responsible behaviours (Albayrak, Aksoy, & Caber, 2013; Bamberg & Schmidt, 2003; Chen & Tung, 2014; Han, Hsu, & Sheu, 2010), and between PBC and Behaviour (Davies et al., 2002; Mahmud & Osman, 2010). On the other hand, several researchers reported that the relationships were insignificant or weak when individuals experienced the targeted behaviour quite often in the past (Boldero, 1995; Tonglet, Phillips, & Read, 2004). Since most of the empirical findings supported PBC's importance, the present research predicts that PBC is positively related to E5 purchasing Intention and Behaviour. It is hypothesised that the more confident petrol users are that they can control or overcome obstacles to purchase, the more likely that they will be to intend to and actually buy E5.

H5. PBC regarding E5 purchase and actual purchase of E5 are positively related.

H6. PBC regarding E5 purchase and Intention to buy E5 are positively related.

2.2.5 Influence of Attitude

Attitude about a particular behaviour deals with the "degree to which a person has a favorable or unfavorable evaluation of the behavior in question" (Ajzen, 1991). The evaluation can be in the form of an internal cost benefit analysis (Cheng, Lam, & Hsu, 2006), in respect of their beliefs about potential outcomes when performing the given behaviour (Triandis, 1977). Individuals might hold more than one belief and different beliefs might not be equally important to them. Therefore, Attitude is developed by interacting beliefs about consequences and their evaluated importance to individuals (Ajzen, 1985, 1991).

Attitude is regarded as the most powerful antecedent of Intention (Kotchen & Reiling, 2000; Nguyen & Ho, 2014; Paul et al., 2016). Other applications of either the TIB or the TPB and the TRA also reported significant effects of Attitude on behavioural Intention (e.g. Ha & Janda, 2012; Kuhlemeier, Van Den

Bergh, & Lagerweij, 1999). Accordingly, people tend to consider displaying a behaviour if they hold a positive Attitude toward the behaviour.

Vietnamese petrol customers believe there are both negative and positive potential consequences of E5 consumption. Positive outcomes mentioned by respondents included possible contributions of E5 to better environmental and community health, whereas its debatable technical quality was counted as potential negative. Details on the consequences of E5 that were identified in the data collection phase are described in the section of variable measurement of Chapter 3. In accordance with findings of preceding studies regarding influence of Attitude on Intention, the current research proposes a positive relationship between Attitude toward E5 consumption and Intention to purchase E5.

H7. Attitude regarding E5 purchase and Intention to buy E5 are positively related.

2.2.6 Influence of Social Factors

As Triandis (1977) noted, one of the advantages of the TIB compared with the TPB is a broader explanation of social influences on individuals' Behaviour. Rather than solely considering roles of Social Norms, the TIB expands upon the impacts of the social environment on people's Intention to engage in particular Behaviour through the two extra variables, Roles and Self-concept.

Similar to the TPB, Norms in the TIB deals with influences of individuals' known social group. It captures opinions of individuals' perceived important referring persons. Individuals might expect each referring person to have different opinions on their targeted behaviour (Normative Beliefs) and also different referees might be of different levels of importance to the individuals' decision (Motivation to comply). Norms consist of two component items, indicating that whilst individuals might experience social expectations or pressures to perform or not perform a certain act from particular referring persons, it only matters to them if they consider opinions of the referees important or worth complying. Relatives, friends as well as other information sources such as mechanics, experts about vehicle engines and E5 users can all form expectations or cause pressures on petrol purchasers' consideration to use or not use E5. Roles refer to individuals' beliefs in what they should do to be appropriate given their positions in the social group, while Self-concept demonstrates internal principals, goals or values that guide individuals to choose whether undertaking a behaviour is consistent with who they are. Detailed components of social influences in the present context are provided in the Variables measured section of Chapter 3.

A number of studies applying the TPB and the TIB showed that the explanatory power of social influences on Intention is not as strong as Attitude (e.g. Godin et al., 1989; Joshi & Rahman, 2015; Knussen et al., 2004). In the field of green consumption, empirical evidence of the TPB shows that Subjective Norms were not as strong predictors of Intention as Attitude (e.g. Nguyen & Ho, 2014; Paul

et al., 2016). However, almost all TIB applications reported Social Factors as a statistically significant predictor of people's Intention to act (e.g. Chang & Cheung, 2001; Gagnon et al., 2003; Maticka-Tyndale et al., 1998; Moody & Siponen, 2013). Accordingly, the present study also expects a positive relationship between Social Factors and Intention of petrol purchasers to use E5 in Vietnam.

H8. Social Factors regarding E5 purchase and Intention to buy E5 are positively related.

2.2.7 Influence of Affect

When first introducing the TIB, Triandis (1977) regarded it as a theoretical alternative to the TPB, which was very popular at that time. Triandis argued that by concentrating solely on the cognitive dimension of behaviour, the TPB underestimated significance of emotional elements, which is an instinctive and unconscious stage in the decision making process. Given that people also respond to their feelings to a certain situation, Triandis considered Affect an antecedent of Intention. Supporting Triandis (1977), Magnusson, Arvola, Hursti, Åberg, and Sjöden (2003) and McEachern, Seaman, Padel, and Foster (2005) revealed that most studies did not consider the TPB an adequate model for investigating ethical behaviour due to the absence of affective aspects. According to Ali et al. (2011), green purchasing is also a moral behaviour.

Empirical evidence with respect to the effect of Affect, however, appears mixed among TIB applications. Whilst Affect was found a strong predictor of intention of condom use, casual sex and non-work use of internet in offices (Chang & Cheung, 2001; Godin et al., 1996; Maticka-Tyndale et al., 1998; Moody & Siponen, 2013), its influence was not significant for daily car use and telemedicine (Bamberg & Schmidt, 2003; Gagnon et al., 2003). Gagnon et al. (2003) explained their findings of insignificant effects of Affect on physicians' Intention to employ telemedicine as because in disease treatment, physicians appeared to follow their 'professional responsibility' rather than personal feelings (p.111). Once being significant, Affect was found positive related to Intention. According to these findings, it is expected that the more positive that petrol purchasers feel about E5, the more possible that they intend to buy this fuel.

H9. Affect regarding E5 purchase and Intention to buy E5 are positively related.

2.2.8 Influence of Environmental Knowledge

In the modified TIB adopted for this study, Environmental Knowledge affects individuals' pro-environmental behaviours through its influence on Attitude toward the environment. A wide array of studies has revealed a strong positive relationship between Environmental Knowledge and Attitude. For example, stemming from an argument that customers that are equipped with Environmental Knowledge would make effort to buy environmentally responsible products, Kumar (2012) considered

environment related knowledge as an antecedent of Attitude toward the behaviour of green product consumption. His research findings revealed a positive and significant relationship between Environmental Knowledge and Attitude as well as between Attitude and Behaviour. Also in the research on green consumption, Nguyen and Ho (2014) proved that the relationship between Vietnamese consumers' Environmental Knowledge and their Attitude toward green electricity products were strong. Similarly, Ramayah, Lee, and Lim (2012) and Flamm (2009) asserted that individuals having higher levels of Environmental Knowledge were more likely to recycle and purchase fuel-saving cars as well as drive less frequently. On the other hand, Kellert (1990) found a weak influence of environment-related Knowledge on conservation Attitude, while Noordin and Sulaiman (2010) indicated that increased Environmental Knowledge of secondary students did not transfer to better Attitude for environmentally friendly activities. However, generally such findings are limited and overwhelmed by the number of studies supporting significantly positive impacts of Knowledge on Attitude. As a result, the present research proposes that Environmental Knowledge related to E5 positively affects Attitude toward E5 purchasing behaviour.

Environmental Knowledge considered in the present study comprises of general issues related to climate change and biofuels. It is scoped as understanding of the causes of climate change and its influence on Vietnam, the nature of E5 and traditional petrol, as well as differences in levels of discharged greenhouse gas of vehicle between these two fuels. It is expected that Vietnamese petrol purchasers who have better Knowledge regarding these issues will have more positive Attitude about consuming E5.

H10: Knowledge about environmental issues relevant to E5 consumption and Attitude toward E5 purchase are positively related.

2.2.9 Influence of Demographic factors

Neither the TIB nor the TPB takes into account the influence of demographics on behaviour. In the field of pro-environmental behaviours, findings of previous studies on demographic influence appear equivocal. There was no consistent answer on either whether demographic factors are significant predictors of environmentally responsible Behaviour and Intention, or what the relationships between them are. However Lee, Kurisu, and Hanaki (2013) asserted that demographic characteristics did affect people's Intention to act environmentally friendly, while Wright (2013) and Tilikidou (2007) proved the importance of age to levels of effort to recycle. Considered dimensions of demographics usually include: gender, age, occupation, education and income. In order to clarify roles of these factors on E5 purchasing Behaviour, the present research hypothesises that there are connections between demographic characteristics and E5 purchasing Intention and actual E5 purchase.

H11. Demographic factors influence actual purchase of E5.

H12. Demographic factors influence Intention to buy E5.

2.3 Chapter summary

The chapter provides the theoretical framework and hypotheses to investigate the research objectives on determinants of E5 purchasing behaviour in Vietnam. Given E5 purchase can be either a regular activity, a consumption act or an ethical action, the theoretical model is expected to capture all these characteristics of this targeted behaviour. Moreover, it should have strong predictive power as proved in previous empirical findings, and needs to be feasible for data collection and interpretation as well. Three models were examined based on the criteria: the Theory of Planned Behaviour (Ajzen, 1985), the Norm Activation Model (Schwartz, 1977) and the Theory of Interpersonal Behaviour (Triandis, 1977). The TIB was selected because it is able to cover almost all factors in the TPB and the NAM, while its additional variables do not require much effort to measure. Preceding studies established that the TIB had stronger explanatory ability than the TPB, despite TPB being so far a more popular theory to examine social behaviour. Three additional factors were incorporated into the original TIB: Environmental Knowledge, PBC and a relationship between Habit and Intention due to their importance as shown in the previous research. Twelve hypotheses were then developed based on the proposed theoretical framework to answer the research questions.

Chapter 3

Research methodology and design

This research aims to investigate the determinants of E5 purchasing behaviour in Vietnam through applying a modified Theory of Interpersonal Behaviour. This chapter proposes methods to collect and analyse the data required in the theoretical model. To do so, it is structured into two main sections. The first section draws out the research methods and design. The methods are developed based on Triandis' (1977) guidelines and recent applications of the TIB, as well as other studies on consumption of environmentally friendly products. The second section demonstrates the strategy of data analysis including measurement of the model's constructs and validity testing.

3.1 Review of data collection methods in previous TIB applications

Most researchers have implemented a three-phase process of data collection when applying the TIB, involving identification of salient beliefs, attitudes or experiences about a given behaviour to develop a preliminary questionnaire (phase 1), pre-testing (phase 2) and launch of the final questionnaire (phase 3) (e.g. Apostolopoulos et al., 2002; Chang & Cheung, 2001; Gagnon et al., 2006; Maticka-Tyndale et al., 1998; Moody & Siponen, 2013; Pee et al., 2008). Details of methods used in each phase in previous TIB applications follow:

3.1.1 Phase 1 - Identification of salient beliefs

Methods for developing a preliminary TIB questionnaire vary amongst researchers. Some researchers created their questions based on previously validated and reported instruments to measure similar constructs (e.g. Chang & Cheung, 2001; Moody & Siponen, 2013), whilst others conducted either individual or focus group interviews, (e.g. Apostolopoulos et al., 2002; Maticka-Tyndale et al., 1998) or distributed open-ended postal questionnaires to a purposively selected group (e.g. Gagnon et al., 2006). The purposes of the open-ended questionnaires or interviews were to elicit salient beliefs about assessed behaviours and to identify appropriate language for questions. Salient beliefs, as Gagnon et al. (2006) defined them, are the first responses of informants when they were asked open-ended questions relevant to TIB constructs. Pee et al. (2008, p. 124) combined the two approaches, in which, previous instruments for measuring similar 'fixed-content' constructs were adapted, if available, while expert consultation was applied to address 'variable-content' constructs (including social factors, perceived consequences and facilitating conditions).

Though developing preliminary questionnaires through reviewing relevant studies can be cost saving, it is only useful if instruments to measure similar constructs have been extensively developed and

tested. Pro-environmental behaviours in general, and biofuel consumption in particular, however, have not been widely addressed by the TIB (Bamberg & Schmidt, 2003), leading to a limited number of relevant instruments to draw upon. Therefore, it is necessary for the present research to implement either focus group discussions or surveys using open-ended questions to identify E5 related salient beliefs. A selection between the two approaches based on analysis of their advantages and disadvantages will be presented in the methods of data collection section.

3.1.2 Phase 2 - Pre-testing

Most previous TIB applications conducted a pre-test to refine the preliminary questionnaires. The purpose of pre-tests is to identify wording issues or confusing questions and to estimate length of time to complete the questionnaires (Moody & Siponen, 2013; Pee et al., 2008; Sarantakos, 1998). The preliminary questionnaires were then finalised based on pre-test responses (Apostolopoulos et al., 2002; Gagnon et al., 2006; Maticka-Tyndale et al., 1998; Moody & Siponen, 2013; Pee et al., 2008).

Two approaches for pre-testing have been employed in recent TIB applications. Moody and Siponen (2013) and Apostolopoulos et al. (2002) pre-tested their questionnaires through interviews with persons from the targeted population, while Pee et al. (2008) distributed paper-based questionnaires with spaces where feedback on questions could be left.

Compared with paper-based questionnaires, interview pre-testing seems to allow better interaction between the researchers and pre-testing participants because the researchers can observe points where the testers are confused or get bored (Reynolds & Diamantopoulos, 1998; Sarantakos, 1998). However, in the present research, this technique was not feasible because flying back to Vietnam to do pre-testing interviews was too expensive. Hence, the preliminary questionnaire was pre-tested via email instead. Details of the pre-testing procedure are discussed in the section of methods of data collection.

3.1.3 Phase 3 – Questionnaire launching

Surveys are required to collect data for the TIB. Two types of surveys have been applied in recent TIB applications, postal surveys and a survey of respondents gathered together for purposes. For postal surveys, data collection consisted of two-steps (Baumann et al., 1993; Gagnon et al., 2003; Gagnon et al., 2006; Maticka-Tyndale et al., 1998). The first step was to solicit participation through telephone, face-to-face contact, or short postal questionnaires. The final TIB questionnaires were then mailed to respondents as follow-ups. Pee et al. (2008) gathered respondents in survey sessions to collect their responses. However, the authors did not report their specific method of data collection.

The final sample size of previous TIB applications ranged from 96 to 538, while the number of people invited to participate was from 151 to 3832 (Baumann et al., 1993; Gagnon et al., 2003; Gagnon et al., 2006; Maticka-Tyndale et al., 1998; Pee et al., 2008). The response rate has varied by survey methods. Collecting responses in survey sessions received the highest response rate (83%) (Pee et al., 2008), while postal surveys received from 21% to 78% (Baumann et al., 1993; Gagnon et al., 2006; Maticka-Tyndale et al., 1998).

3.2 Targeted respondents and methods of data collection

3.2.1 Targeted population

The research was conducted in Hanoi. The location was selected because fuel provision infrastructure, such as gas stations, is extensive there. Hanoi is also one of the seven provinces where E5 was first introduced, so residents have had time to become familiar with the product. Moreover, as I live in Hanoi, conducting the research in this location reduced accommodation related expenses.

The research was based on a random sample of petrol purchasers from the general public in Hanoi. As the purpose of the study is to identify factors either facilitating or constraining biofuel consumption, both E5 and non-E5 consumers were addressed.

3.2.2 Methods of data collection

A survey was employed to investigate determinants of E5 purchasing behaviour in Hanoi. The research followed the three-phase techniques of previous TIB applications, in which salient beliefs about E5 were identified to develop a preliminary questionnaire, which was then tested, before the final version was launched. Methods for data collection in each phase are presented in the following sections.

Phase 1 - Identification of salient beliefs

As discussed earlier, either a focus group discussion or a small survey using open-ended questions is necessary to identify salient beliefs about E5 purchase. Each of the approaches has its advantages and disadvantages. Focus groups are a helpful pre-research technique to reveal ideas or beliefs about a certain issue (Babbie, 1998, 2015; Sarantakos, 1998). The method can provide unexpected and fresh ideas through interaction between members, which might not be achieved in open-ended questionnaires (Sarantakos, 1998). Focus groups are also preferred due to their flexibility and speedy results (Krueger, 1988). However, this technique has several disadvantages, including difficulty of group recruitment and unequal contributions of participants (Krueger, 1988). It was not easy to find an appropriate number of Vietnamese people who were both experienced E5 in Vietnam and were easily accessible to the researcher in Christchurch. Discussion in groups also faces the issue of domination of some persons and hidden voices, which would likely to be a significant issue in this case

because Vietnamese people are hesitant about speaking in public. The weaknesses of focus group discussion can be overcome in open-ended questionnaires. Open-ended questionnaires are more convenient for respondents because they can complete the survey whenever they want. They are also amenable for application from distance. More importantly, the technique allows respondents to freely express their opinions (Sarantakos, 1998). Hence, the present research employed a short questionnaire using open-ended questions to identify E5 related beliefs.

The informants were 31 Vietnamese people, who were living in Hanoi when E5 first came onto the market in December 1st, 2014. They belonged to different occupations, ages and genders. A snowball technique was used. I first contacted my friends and colleagues to ask for their participation. The contacted persons voluntarily decided whether to take part in the research or not. The open-ended questions along with a research information sheet and a consent form were sent to their personal email addresses. These respondents were asked to introduce other persons that might be willing to participate in the research. A mobile phone top-up card valued at NZ\$1.4 was sent to them after their responses were collected to show appreciation for their participation and their introduction of other participants. The most common beliefs/attitude collected from the questions were used to develop the preliminary questionnaire.

Phase 2 - Pre-testing

Pre-testing was conducted to refine the preliminary questionnaire. 20 Vietnamese people living in Hanoi were recruited to be testers. As discussed earlier, because going back to Vietnam to conduct pre-testing interviews would be too costly and time consuming, the present research approached testers via email instead. A snowball technique was applied similar to the steps in developing the preliminary questionnaire above. There were spaces in the questionnaires where remarks and/or feedback on the questions could be made. Modifications of word choices and sentence structures were made according to data collected in the pre-testing.

Phase 3 – Final questionnaire launching

A number of survey options were considered for data collection in this step, including postal surveys, telephone surveys, personal interviews and electronic surveys (Babbie, 1998, 2015; Dillman et al., 2009). Each of the methods has its advantages and disadvantages.

As Babbie (1998) stated, postal surveys usually require a significant amount of time for the questionnaire to be sent and returned, while the risk of being mislaid or lost is high. The technique also has significant printing costs. Even though the postal approach has been dominant in previous TIB

applications, it was not feasible for the present research, which had a limited budget and was conducted in a limited timeframe.

Telephone surveys and personal interviews allow confusion about the questions to be explained by interviewers on the spot. Personal interviews, however, are not easy to achieve for a large sample size, especially when research time, costs and labour are limited (Sarantakos, 1998). Telephone surveying, as Dillman et al. (2009) indicated, sometimes does not give the respondent enough time to place each answer choice into long-term memory. Consequently, respondents tend to select the last option. This issue becomes more severe when the questionnaire contains a wide range of options, as occurs with the Likert scale. Therefore, telephone and personal interview surveys were not applied in the present research.

An electronic survey was the most appropriate option in this case. This technique, as Dillman (2007) suggested, can target a large sample in an insignificant amount of time with low cost. Internet surveys provide more convenience for respondents because they can choose to answer the questions whenever it is suitable for them. Therefore, it is more flexible than aural communication (telephone and personal interviews). Additionally, electronic surveys have faster response time than postal surveys. The response time has varied by surveys but is about 5.59 days on average (Ilieva, Baron, & Healey, 2002). No printing is needed, leading to lower cost of electronic surveys (Dillman, 2007). Whilst surveying instructions for the respondents in the Internet mode cannot be as good as aural surveys, it is better than in postal questionnaires. Further explanations or reminders (for example, notification of a missed question) can be made through pop-up instructions (Dillman, 2007). In general, electronic surveys can overcome weaknesses of postal, telephone surveys and personal interviews.

However, the electronic survey mode has some disadvantages. Firstly, response rates of Internet surveys are significantly influenced by Internet access of the targeted population (Dillman, 2007; Ilieva et al., 2002). In a study by Dillman et al. (2009) that compared different types of survey, Internet surveys had the lowest response rate (13%) due to respondents' limited access to Internet or computers. This issue, however, was expected to be less severe in the present study because Vietnam is one of the 20 countries having the highest number of Internet users, with 50.1% of the population using the Internet in November 2015 (Internet World Stats, 2016). This proportion might be even higher in Hanoi thanks to the development of social infrastructure there. The second disadvantage of the electronic mode is availability of an email address database (Ilieva et al., 2002). Whilst postal respondents have physical addresses, people can either have no, single or multiple email addresses, leading to difficulty in determining the sampling frame (Dillman, 2007; Sheehan, 2001). A database of email addresses is not officially available in Vietnam. In the limited studies that have employed electronic surveys in Vietnam, the snowball technique was used rather than random sampling (e.g.

Bengtsson et al., 2012). To overcome the lack of an email address database in Viet Nam, a strategy to collect email addresses of targeted respondents was developed as follows:

Potential respondents were approached at two gas stations in Hanoi, whose permission to approach their costumers had been obtained beforehand. The respondents in the first two phases of data collection (i.e. identification of salient beliefs and pre-testing) were excluded in the final survey. Surveying in gas stations played an important role to guarantee both E5 and non-E5 consumers were targeted. According to Lesser et al. (1999) and Dillman et al. (2009), financial incentives are able to significantly improve response rates of general public surveys and unconditional incentives (which are sent before the filled questionnaire is returned) are more effective than those following the survey completion. Hence, at the gas stations, targeted respondents were given: (i) an information sheet about the research, (ii) an invitation to participate in the research, which included a web link to the final questionnaire and indicated a mobile phone top-up card valued NZ\$1.4 that would be sent to their email upon their survey completion and (iii) a small gift (snack) to encourage their participation. Their email addresses were also collected for follow-ups. A reminder was sent to their emails when the questionnaire was not returned in five days.

However, because this strategy was totally dependent on the permission of gas station managers, a backup plan was also developed in case permission was withdrawn. In this case, a household drop-off/pick-up survey would be employed. Households would be randomly selected based on a spatial sampling technique, in which, a grid with numbered columns and rows would be overlaid on the map of Hanoi. Two sampling points would be chosen through randomly selecting columns and rows. In each selected location, I would walk in a randomly choosen direction and approach every 4th house. The questionnaire would be handed to petrol purchasers in each household and would the collected the following day. The households would be approached in the evening (after 7p.m) to ensure targeted respondents are home from work. However in the present study, permissions of the gas station managers were obtained and not withdrawn, so this backup plan was not implemented.

Written consent was asked for and collected from all respondents. Consultation with and approval from the Lincoln University's Human Ethics Committee (HEC) for each phase of data collection was obtained before any fieldwork was undertaken. HEC's approval letter and the research's information sheet are presented in Appendix B.

3.2.3 Final questionnaire design

The final questionnaire was designed to collect information for quantified measurement of the constructs of the modified TIB. It was developed as the outcome of the first two phases of the data collection, i.e. identification of salient beliefs about E5 and pre-testing, of the data collection. The final

questionnaire, as shown in Appendix A, was structured into four sections. The first section was the consent form, which was presented in the form of a question 'Do you consent to take part in this survey?' with two answer options – 'Yes'/'No'. Further questions only showed up if respondents chose 'Yes'. Meanwhile, when 'No' was selected, respondents went directly to the end of the questionnaire. The second section contained a question that was used to divide participants into two groups, one included those who had heard about E5 and one included those who were unaware of E5. The third section applied only to respondents who knew about E5. It consisted of a series of 55 Likert-scale questions measuring constructs of the theoretical framework. The final section targeted demographic information of the survey population, including gender, age, occupation, educational levels and monthly income. Those questions applied to every respondent.

An information sheet (which is presented in Appendix B) was handed to potential respondents at the gas stations, briefing them on the nature and aims of the research as well as the time requirement for the questionnaire. It also informed readers that their participation was voluntary and they were permitted to withdraw their responses, which was reaffirmed at the end of the questionnaire. The approach to ensure anonymity of the respondents in case the research findings are published was also provided. Detailed contacts of the researcher and the supervisor were included at the end of the information sheet.

Care was taken in the online questionnaire design to reduce risks that respondents missed questions. A reminder would pop-out if respondents missed a question. However, according to Dillman (2000), to ensure a friendly surveying atmosphere, the questionnaire provided the option of not answering the questions, which was mentioned at the beginning of the survey. Once the respondents completed the questionnaire and clicked the 'submit' button, a message was triggered to demonstrate appreciation and offer a thank-you gift valued at NZ\$1.4, which would be sent to respondents' emails if they were willing to provide this information.

3.2.4 Sample size

As Sarantakos (1998) suggested, the sample size is highly dependent on data collection methods, scale, timeframe and budget. Sample sizes have varied amongst previous TIB applications. The minimum number of responses was 96 in the TIB application of Gagnon et al. (2006) to understand physicians' use of Health Technology Assessment (HTA). As the authors suggested though, this small sample did not impact the validity of the research based on results of 'stability' tests, but caution is required when interpreting the results (Gagnon et al., 2006, p. 9). Based on the recommendation, the present research attempted to gain at least 96 responses.

The number of actual survey invitations is different from the sample size and is based on the response rate (Sarantakos, 1998; Sheehan, 2001). According to a review of Internet surveys, the response rate for this method was in the range from 25% to 80% (Ilieva et al., 2002). Cook, Heath, and Thompson (2000), in their meta-analysis of response rates in web- or Internet-based surveys, concluded that the mean response rate of the Internet survey mode was 34.6%. However, as the authors suggested, because studies with smaller response rates might not be submitted for publication, the average figure could be overestimated. Moreover, a review by Hung and Law (2011) of applications of Internet-based surveys in tourism and hospitality journals, indicated that most of the reviewed studies had response rates lower than 30%. Hence, though the personal approach might result in a better response rate, to prepare for the worst scenario, it was assumed that the response rate of the present research would equal the lowest value of previous Internet survey response rates, 25%. Accordingly, the number of participants invited would be 384. The estimated time of survey distribution was 20 days based on approaching 20 people each day at the gas stations. In fact, I distributed 455 invitations in the form of the information sheet after 27 days of data collection (i.e. approximately 17 invitations/day). Detailed reports of responses collected and the response rate of the final questionnaire distribution are provided in Chapter 4.

3.3 Data analysis strategy

Data collected from the open-ended questions in phase 1 was manually analysed to determine key themes or words. Phase 3 followed established practice of data analysis for the model. Data collected from the final questionnaire was coded and analysed with linear regression, multiple regression and Structural Equation Modelling (SEM). Statistical Package for the Social Sciences (SPSS) and Analysis of Moments Structures (AMOS) on the Lincoln University network were employed to process data.

3.3.1 Measurement scales

The final questionnaire consisted of 55 items quantifying twelve constructs of the modified TIB. Data collected from the final questionnaire were manually coded and transformed to be suitable for the use of the data analysis software, SPSS. Numerical codes were assigned for all answers. Most of the TIB constructs were scored on a 7-point Likert scale, which ranged from 'strongly agree' (1) to 'strongly disagree' (7), and 'neither agree nor disagree' as the mid-point (4). In the constructs of Beliefs about outcomes, Evaluation of the outcomes, Self-concept and Roles as well as Emotions, response item codes were reversed so that higher scores reflected more positive attitude or feelings about E5 purchasing. For Normative Beliefs and Motivation to comply, higher numbers show greater perceived support from others for the individuals to buy E5 and higher influence of others' opinions on the respondents. For Control Beliefs (or Facilitating Conditions) and Perceived Power to Control Beliefs,

higher numbers indicate lower impacts of constraints to buy E5 and greater confidence in overcoming these obstacles.

Response items of Habit, Intention and Behaviour were coded so that higher values denote more positive attitude about E5. To measure Habit, participants were asked to reflect on the frequency of their past behaviour of using E5 on a scale ranging from 1 to 3, of which 1 represents 'Never', 2 represents 'Sometimes' whilst 3 denotes 'Always'. Intention of respondents to buy E5 was measured by a 5-level Likert scale ranging from 'definitely yes' (1) to 'definitely not' (5) with 'might or might not' as the mid-point (3). The higher value denotes higher probability of using E5 the next time of petrol purchase.

3.3.2 Variables measured

The theoretical framework for this research comprises 12 constructs, namely Behaviour, Intention, Attitude, Social Factors, Habit, Facilitating Conditions, Affect, Perceived Behavioural Control, Environmental Knowledge, Norms, Roles and Self-concept. Descriptions of these variables, including their measurement items, coding and formulas are presented in Table 3.1.

Behaviour, Intention and Habit

Behaviour refers to participants' self-reported past behaviour of E5 purchase. They were asked whether they bought E5 the last time they topped their vehicle up. Intention refers to probability that respondents would buy E5 in the next petrol purchase. Petrol purchasers also demonstrated their habit of buying E5 by whether they purchase it very often, occasionally or never. Habit, Intention and Behaviour were each measured by a single item.

Roles

The Roles component of the TIB deals with respondents' beliefs about how individuals should act to be proper or appropriate as determined by the position that they hold in a social group (Triandis, 1977). In the present research, Roles are identified as respondents' perceptions about whether using E5 is appropriate for themselves in their occupations, at their ages, as a citizen of a country suffering from climate change, and as a member of the current generation who feel responsible for health and well-being of the community and future generations. Consequently, four questions were developed to measure respondents' role beliefs regarding E5 purchasing behaviour. The value of Roles construct was computed by the simple sum of its four component items (Baumann et al., 1993; Chang & Cheung, 2001; Moody & Siponen, 2013).

Self-concept

Consistent with Triandis (1977), Self-concept regarding E5 purchasing behaviour refers to individuals' opinions about who they are in terms of petrol consumption. This includes whether they consider

themselves green or responsible consumers, or a follower of the crowd, someone who will buy a petrol type that everybody uses, or a utility maximising shopper who purchases cheapest petrol. These three aspects were reflected in three measurement items, whose values were summed to create the Self-concept variable (Baumann et al., 1993; Chang & Cheung, 2001; Moody & Siponen, 2013).

Facilitating Conditions

Three barriers to buying E5 were identified as the outcome of phase one of data collection, i.e. identification of salient beliefs. The first constraint was ability to access E5. Given that not all gas stations sell E5, petrol purchasers might not find an E5 pump when they buy petrol, or might need to drive further to get to stations providing E5. Second, it was mentioned that petrol attendants tended to sell traditional petrol if they were not asked specifically to serve E5. Some attendants also did not introduce or encourage customers to try E5. Several petrol purchasers said they hesitated to ask petrol attendants to change to E5 if they were about to sell conventional fuel. The third issue is in regard to E5 price. The price of E5 was generally lower than conventional fuel's (MOIT, 2014). However, several petrol purchasers while answering the open-ended questionnaire mentioned that this price was still higher than their expectation for a new and quality-controversial product. These three identified constraints to buying E5 were developed into three measurement questions of the Facilitating Conditions variable in the final questionnaire. Responses coded of these three questions were aggregated to create the value of Facilitating Conditions (Baumann et al., 1993; Chang & Cheung, 2001; Moody & Siponen, 2013).

Affect

Affect refers to emotions of petrol purchasers when they think about or buy E5. Six emotions were recognised, including happy, excited, worried, doubtful, curious and not interested. Following previous TIB applications (e.g. Baumann et al., 1993; Gagnon et al., 2003; Maticka-Tyndale et al., 1998), item scores measuring Affect were summed to form the overall value of Affect.

Environmental Knowledge

Knowledge was not considered in Triandis' (1977) theory, but it was integrated into the theoretical framework because previous studies demonstrated its importance in explaining pro-environmental behaviours. Respondents' Environmental Knowledge related to E5 was assessed with five True/False questions. The option of 'Don't know' was not provided but the respondents could choose whether to answer the questions or not as instructed at the beginning of the survey. Missing answers for the knowledge questions were coded as incorrect responses. This technique is consistent with the approach that Hausbeck, Milbrath, and Enright (1992) and Levine and Strube (2012) employed to examine environmental knowledge of 11th-grade students and children, and with how Flamm (2009) measured vehicle owners' knowledge related to the environment in his studies on influence of

environmental knowledge and attitude on vehicle consumption. Knowledge items tested in the present research comprised the nature of traditional petrol and E5, comparison of the amount of CO₂ discharged by vehicles using E5 or regular fuel, influence of climate change on Vietnam, and main cause of climate change. Responses were coded as the number of correct answers that respondents achieved.

Attitude

Attitude of petrol purchasers toward E5 consumption was derived from their beliefs about consequences of using E5 and how they evaluated these consequences. The previous stage of data collection revealed nine potential outcomes of E5 purchase, including four positive outcomes and five negative consequences. The respondents expected E5 use to contribute to better environment, human health, and reductions of climate change as well as energy imported. On the other hand, they held beliefs that their vehicles would burn more E5 than traditional petrol to travel the same distance, and consuming E5 possibly would harm their vehicle engines, cause fire, be costly and lead to less food crops grown by Vietnamese farmers. These nine consequences were developed into nine questions regarding beliefs about outcomes of E5 purchasing behavior, and nine corresponding questions regarding their evaluated importance to individuals. Following Ajzen (1985, 1991) and TPB applications (e.g. Paul et al., 2016; Tarkiainen & Sundqvist, 2005; Tonglet et al., 2004), these nine items were multiplied in pairs to create nine composite indicators of Attitude (ATT_i), which were then summed together as the general Attitude towards E5 purchasing.

$$ATT = \sum_{i=1}^9 ATT_i = \sum_{i=1}^9 \mathbf{Belief\ about\ outcome\ } i \times \mathbf{Evaluation\ of\ outcome\ } i$$

Norms

Norms are the products of respondents' perceptions about opinions of a reference group regarding their potential use of E5 (Normative Beliefs) and their motivation to conform to these opinions. In the present research, the reference groups included families, friends, vehicle experts, mechanics and E5 users. Accordingly, five pairs of questions were developed to measure subjective norms regarding E5 purchasing behaviour. Norms was the sum of the five Norm components (Norm_i), which were derived by multiplying Normative Beliefs and Motivations to comply (e.g. Paul et al., 2016; Tarkiainen & Sundqvist, 2005; Tonglet et al., 2004).

$$Norms = \sum_{i=1}^5 Norm\ i = \sum_{i=1}^5 \mathbf{Normative\ belief\ } i \times \mathbf{Motivation\ to\ comply\ } i$$

Social Factors

According to Triandis (1977), social influences consist of not only Subjective Norms (Ajzen, 1985) but also Roles and Self-concept. Following previous TIB applications (e.g. Gagnon et al., 2006; Maticka-Tyndale et al., 1998; Moody & Siponen, 2013; Pee et al., 2008), Social Factors are calculated as follow:

$$\mathbf{Social\ Factors = Norms + Roles + Self-concept}$$

Perceived Behavioural Control (PBC)

PBC deals with the perceived level of controls that individuals hold to engage in a given behaviour (Ajzen, 1985). PBC comprises two component items, namely Control Beliefs and Perceived Power over Control Beliefs. Controls Beliefs is similar to the construct of Facilitating Conditions in the original TIB, which refers to impediments that individuals believe that they have to overcome to undertake the given behaviour. Three questions measuring how severe respondents think obstacles to buying E5 were developed based on the three identified barriers, which are access to E5 stations, cooperation of petrol attendants and E5 price. Corresponding to the three Control Beliefs, three questions were created to measure respondents' perceived power to overcome these barriers. The PBC components (PBC_i) were computed by multiplying possible constraints and respondents' ability to get over each obstacle before they were summed across to generate the overall PBC (e.g. Paul et al., 2016; Tarkiainen & Sundqvist, 2005; Tonglet et al., 2004).

$$PBC = \sum_{i=1}^3 PBC_i = \sum_{i=1}^3 \mathbf{Control\ Belief\ } i \times \mathbf{Perceived\ Power\ over\ Control\ Belief\ } i$$

Table 3.1. illustrates detailed characteristics of the variables in the theoretical framework.

Table 3.1. Descriptions of variables in the proposed model

Construct	Coding	Item	Item code	
Behaviour	Yes	1	I used E5 last time when I filled up.	Behaviour
	No	0		
Intention	Definitely yes	1	I will buy E5 next time when I fill up. (R)	Intention
	Probably yes	2		
	Might or might not	3		
	Probably not	4		
	Definitely not	5		
Habit	Never	1	I have used E5 in the past. (R)	Habit
	Sometimes	2		
	Always	3		
Knowledge Numbers of correct answers	True False	1 0	Greenhouse gas emissions are the main cause of climate change.	Know 1
			Traditional petrol (A92, A95) is a fossil fuel.	Know 2
			E5 is produced from organic materials including plant materials and animal waste (5%) and fossil fuel (95%).	Know 3
			Burning traditional petrol in vehicle engines produces less greenhouse gases than burning bioethanol petrol (E5) does.	Know 4
			Vietnam will not be affected by climate change.	Know 5
Roles Roles = $\sum_{i=1}^4$ Role i	Strongly agree	1	Using E5 is correct for a person in my occupation. (R)	Role 1
	Agree	2	Using E5 is correct for a person at my age. (R)	Role 2
	Somewhat agree	3	Using E5 is correct for me as a citizen in a country suffering from climate change. (R)	Role 3
	Neither agree nor disagree	4		
	Somewhat disagree	5	I should use E5 to improve health and well-being of the community and future generations. (R)	Role 4
	Disagree	6		
	Strongly disagree	7		

Construct	Coding	Item	Item code	
Self-concept Self-concept = $\sum_{i=1}^3$ Self i	Strongly agree	1	I consider myself as a green/responsible consumer. (R)	Self 1
	Agree	2	I will buy the petrol that everybody uses.	Self 2
	Somewhat agree	3		
	Neither agree nor disagree	4		
	Somewhat disagree	5	I like to buy the cheapest petrol.	Self 3
	Disagree	6		
	Strongly disagree	7		
Facilitating Conditions (FCs) FCs = $\sum_{i=1}^3$ Faci i	Strongly agree	1	A few gas stations sell E5.	Faci 1
	Agree	2	E5 price is higher than I expected.	Faci 2
	Somewhat agree	3		
	Neither agree nor disagree	4		
	Somewhat disagree	5	Petrol attendants tend to serve me traditional petrol if I don't ask for E5.	Faci 3
	Disagree	6		
	Strongly disagree	7		
Affect Affect = $\sum_{i=1}^6$ Emo i	Strongly agree	1	Happy (R)	Emo 1
	Agree	2	Excited (R)	Emo 2
	Somewhat agree	3	Worried	Emo 3
	Neither agree nor disagree	4	Doubtful	Emo 4
	Somewhat disagree	5	Curious	Emo 5
	Disagree	6		
	Strongly disagree	7	Not interested	Emo 6

Table 3.1. Descriptions of variables in the proposed model (cont.)

Construct	Coding		Items	Item code	
<p>Attitude (ATT)</p> <p>$ATT = \sum_{i=1}^9 ATT_i$ = \sum Belief about outcome i x Evaluation of outcome i</p>			<p><i>Beliefs about outcome</i></p> <p><i>Evaluation of outcomes</i></p>		
	Strongly agree	1	If I buy E5, it will contribute to a better environment. (R)	A better environment is important to me. (R)	ATT 1
	Agree	2	If I buy E5, it will be better for human health. (R)	Better human health is important to me. (R)	ATT 2
	Somewhat agree	3	If I buy E5, it will reduce climate change. (R)	Reducing climate change is important to me. (R)	ATT 3
	Neither agree nor disagree	4	If I buy E5, it will reduce energy imports. (R)	Reducing energy imports is important to me. (R)	ATT 4
	Somewhat disagree	5	If I buy E5, it will mean farmers grow less food crops.	The amount of food crops grown is important to me.	ATT 5
	Disagree	6	Using E5 will harm my vehicle engine.	Not harming my vehicle is important to me.	ATT 6
	Strongly disagree	7	My vehicle consumes more E5 than A92/A95.	The amount of petrol consumed in my vehicle is important to me.	ATT 7
			Using E5 in my vehicle is more likely to cause fire than using A92/A95.	Fire safety is important to me.	ATT 8
<p>Norms</p> <p>$Norms = \sum_{i=1}^5 Norm_i$ = \sum Normative belief i x Motivation to comply i</p>	Strongly agree	1	<i>Normative beliefs</i>	<i>Motivation to comply</i>	
	Agree	2	My family thinks I should use E5. (R)	My family's opinions are important to me. (R)	Norm 1
	Somewhat agree	3	My friends think I should use E5. (R)	My friends' opinions are important to me. (R)	Norm 2
	Neither agree nor disagree	4	Vehicle engine experts think I should use E5. (R)	Vehicle engine experts' opinions are important to me. (R)	Norm 3
	Somewhat disagree	5	My mechanic thinks I should use E5. (R)	My mechanic's opinions are important to me. (R)	Norm 4
	Disagree	6	E5 users think I should use E5. (R)	E5 users' opinions are important to me. (R)	Norm 5
	Strongly disagree	7			

Construct	Coding	Items	Item code		
PBC $PBC = \sum_{i=1}^3 PBC_i$ = \sum Control Belief i x Perceived Power to overcome Control Belief i	Strongly agree	1	<i>Control Beliefs</i>		
	Agree	2		<i>Perceived power to overcome control beliefs</i>	
	Somewhat agree	3	A few gas stations sell E5.	I can access E5 if I want to. (R)	PBC 1
	Neither agree nor disagree	4	E5 price is higher than I expected.	I can afford to buy E5. (R)	PBC 2
	Somewhat disagree	5	Petrol attendants tend to serve me traditional petrol if I don't ask for E5.	I don't mind asking petrol sellers to give me E5 if they intend to sell me A92/A95. (R)	PBC 3
	Disagree	6			
	Strongly disagree	7			

Note: "R" denotes that codes of the responses have been reversed.

3.3.3 Validity test

Test of the measurement model

The variables or constructs in the modified TIB are divided into two groups, namely latent variables and manifest variables. Latent variables are factors that cannot be directly measured by commonly 'accepted measuring instruments' (Blunch, 2012; Byrne, 2013); in other words, they are not observable. Therefore they need to be measured by indicators, which are the so-called manifest variables (Blunch, 2012), which in this research are questions in the final questionnaire. The measurement model describes the connection between latent constructs and their manifest indicators (Blunch, 2012; Byrne, 2013).

Methods to evaluate validity of measurement models are dependent on whether latent variables are reflective or formative (Jarvis, MacKenzie, & Podsakoff, 2003; Moody & Siponen, 2013). In a reflective construct, the indicators or manifest variables are caused by the latent variable and the indicators are 'theoretically interchangeable' with each other (Christophersen & Konradt, 2012, p. 840). Reliability of a reflective construct, therefore, can be indicated by high correlations between the indicators, which are often reflected in indices such as Cronbach's Alpha (Christophersen & Konradt, 2012; Field, 2013; Jarvis et al., 2003).

In a formative latent construct, the opposite direction of causal connections is presented. More specifically, indicators cause the formative latent variable and strong correlations between the indicators might not be expected (Christophersen & Konradt, 2012; Diamantopoulos & Sigauw, 2006; Jarvis et al., 2003). Petter, Straub, and Rai (2007) argued that, different from reflective constructs, where high correlation is desired, multicollinearity between indicator items in formative latent constructs instead leads to the model's destabilization, and therefore should be assessed through the Variance Inflation Factor (VIF) statistic. Moody and Siponen (2013), whilst stating that validating formative constructs can be challenging and there is not yet a generally agreed method to do so, suggested checking correlations between indicators of the construct and the construct value in TIB applications.

Based on these definitions, the formative latent constructs in the assessed models are: Attitude, Norms, Social Factors, Facilitating Conditions and PBC, while Affect is defined as a reflective latent variable.

Test of the structural model

The structural model indicates causal relationships among latent variables (Blunch, 2012; Kline, 2015). Structural models considered in this paper include the original TIB, the proposed theoretical framework and a modified model developed based on results of the two previous models.

3.4 Chapter summary

This chapter presents the research methods of data collection and analysis to address the two research questions. The data collection comprised three phases. An open-ended questionnaire was developed to identify salient beliefs about E5, which were used to create the final questionnaire. An Internet-survey was chosen as the distribution mode of the final questionnaire as it was the most economic and time saving technique. Invitations to participate in the survey were handed to the petrol purchasers in the gas stations. The present research was conducted there to ensure that it reached both E5 and non-E5 users. Responses from the questionnaire were coded and analysed using SPSS and AMOS software. Validity of the proposed model's constructs was tested before any further analysis was undertaken. Methods of validity testing were dependent on whether the construct is formative or reflective.

Chapter 4

Descriptive statistics and Empirical results

This chapter describes empirical results from the Structural Equation Models (SEM), a logistic regression model and a multiple regression model. To do so, it is structured into three main sections. The first section is an overview of the research sample, which provides the response rate of the final questionnaire and the demographic characteristics of the survey respondents. The second section provides validity tests of the measured latent reflective and formative variables. The final section evaluates the structural models, which demonstrate causal connections between E5 purchasing behaviour and its expected determinants. The original TIB and the proposed model are assessed before their results are used to develop the final model, which is employed to test the research hypotheses.

The research hypotheses are:

Concerning E5 purchasing Behaviour:

- H1. Intention to buy E5 and actual purchase of E5 are positively related.
- H2. Habit of buying E5 and actual purchase of E5 are positively related.
- H4. Facilitating Conditions regarding E5 purchase and actual purchase of E5 are positively related.
- H5. PBC regarding E5 purchase and actual purchase of E5 are positively related.
- H11. Demographic factors influence actual purchase of E5.

Concerning Intention to buy E5:

- H3. Habit of buying E5 and Intention to buy E5 are positively related.
- H6. PBC regarding E5 purchase and Intention to buy E5 are positively related.
- H7. Attitude regarding E5 purchase and Intention to buy E5 are positively related.
- H8. Social Factors regarding E5 purchase and Intention to buy E5 are positively related.
- H9. Affect regarding E5 purchase and Intention to buy E5 are positively related.
- H10. Knowledge about environmental issues relevant to E5 consumption and Attitude toward E5 purchase are positively related.

- H12. Demographic factors influence Intention to buy E5.

4.1 Descriptive results

4.1.1 Response rate

Table 4.1 summarises responses to the final questionnaire. The response rate was calculated as a percentage of the total invitations handed to petrol purchasers at the gas stations and the total responses received.

Table 4.1. Response rate of the final questionnaire

Items	Number of invitations sent and returns
Invitations sent	455
Email invitations sent	442
Undelivered	48
Reminding emails sent	25
Responses without reminders	151
Total responses	159
<i>Response rate (%)</i>	34.95

455 invitations in the form of the information sheet, which included a web link to the final questionnaire, were given to petrol purchasers at the two gas stations. 442 petrol buyers provided their email addresses and agreed to receive the link to the survey via their emails. 48 email addresses (10.86%) were incorrect or no longer existed though. The high ratio of wrong email addresses can be explained by two reasons: (i) respondents were in a hurry or did not use their emails for a while, leading to accidentally mistaken emails provided, or (ii) respondents deliberately gave fake addresses to avoid frankly denying participation to the survey. 25 email reminders were sent out, which increased the response rate from 33.19% to 34.95%. The final response rate is very close to the mean response rate for web-based surveys (34.6%) (Cook et al., 2000).

4.1.2 Descriptive statistics

The survey received 159 responses from petrol purchasers. Fourteen responses were deleted as they did not respond to more than 10% of the total questions. Of the 145 petrol purchasers who completed the whole questionnaire, 21 persons (14.48%) had not heard about E5, whilst the rest (85.52%, 124 persons) were aware of this product. The present research only uses responses of people knowing about E5, therefore, the final sample size is 124. Of those 124, 37.90% (47 petrol purchasers) bought E5 the last time they topped their vehicles up with petrol.

Characteristics of the sample in terms of gender, age, occupation, education and income are presented in Table 4.2:

Table 4.2. Characteristics of the sample

Characteristics	Frequency	Percent	N
<i>Gender</i>			<i>124</i>
Female	60	48.4	-
Male	64	51.6	-
<i>Age</i>			<i>124</i>
20-29	67	54.0	-
30-39	29	23.4	-
40-49	18	14.5	-
50 and over	10	8.1	-
<i>Occupation</i>			<i>118</i>
Unemployed	7	5.9	-
Agriculture, forestry and fishing	7	5.9	-
Industry and construction	17	14.4	-
Services	87	73.7	-
<i>Highest educational qualification</i>			<i>122</i>
Upper secondary school	13	10.7	-
University and college	86	70.5	-
Postgraduate	23	18.8	-
<i>Monthly income (1,000 VND)</i>			<i>124</i>
None	7	5.6	-
Lower than 3,000	2	1.6	-
3,000 - 6,000	50	40.3	-
6,001 - 9,000	26	21.0	-
9,001 - 12,000	17	13.7	-
12,001 - 15,000	8	6.5	-
Over 15,000	14	11.3	-

Note: 1 NZD = 16,230 VND

Of 124 respondents, 51.6% are male and 48.4% are female. Most of the respondents (54.0%) belong to the 20 – 29 age group. They mostly work in the service sector (73.7%). 70.5% of participants have reported university and college as their highest educational level. Three to six million VND is the modal monthly earnings. These sample characteristics are consistent with those of the population in Hanoi in 2014 in terms of income and occupation (General Statistics Office Of Vietnam, 2014). The average monthly income of Hanoi residents was 4,113,000 VND in 2014. Services are the main occupational field in the capital city.

The gender ratio of the sample, however, is not consistent with that of the Hanoi population, which was 48.7% male and 51.3% female in 2014 (General Statistics Office Of Vietnam, 2014). This difference might be caused by the fact that the gender proportion of vehicle users is probably not the same as the general population. The sample's average age appears young. This might be explained by the Internet survey mode. Several researchers have identified a difference in response rates to Internet surveys among different age groups (e.g. Bech & Kristensen, 2009; Gigliotti & Dietsch, 2014; Kaplowitz, Hadlock, & Levine, 2004; Kwak & Radler, 2002). Bech and Kristensen (2009) and Kaplowitz et al. (2004) observed that older respondents do not respond to web-based surveys as frequently as younger respondents do, and Kwak and Radler (2002) stated that younger individuals appear 'over-represented' in this mode of survey.

There were no respondents with highest educational qualifications lower than Upper secondary school. This reflects the fact that the primary and lower secondary school are universal educational levels in Vietnam (National Assembly Vietnam, 2005). The very high proportion of university and college in the research sample (70.5%), on the other hand, appears unconvincing. This can be explained by two main factors, which are (i) location of the gas stations, and (ii) misunderstanding about the question. The surveyed gas stations are located nearby many universities and colleges in Hanoi, including two national universities (Vietnam National University and Foreign Trade University). That leads to a higher percentage of students in the local population than in the national population³. Moreover, while the response category was completion of a degree, several students who have not yet completed their degrees have used this response. This problem was not identified in the snowball-sampling based pilot survey, which only included one student, who provided the correct answer for this question. Other participants of the pre-testing phase have been working and did not indicate any confusion about this question. Hence, it was not possible to identify and solve this problem at the pre-testing stage.

4.2 Tests of the measurement model

This section provides validity tests of the measurement models, which are divided into reflective and formative latent constructs based on differences in their nature. Accordingly, different tests were used to evaluate their reliability. Validity of the reflective latent construct was tested based on Cronbach's Alpha, while VIF statistic and Pearson's correlation coefficients were employed to assess validity of formative latent constructs. Formative latent constructs in the models consist of Attitude, Norms, Social Factors, Facilitating Conditions and PBC. Affect is the only reflective latent variable.

³ Numerous surveying students have part-time jobs, which they have reported as services related work.

4.2.1 Reflective latent construct

Cronbach’s Alpha coefficient was used as a validity indicator of the reflective latent variable, Affect. Six emotions served as observable indicators of Affect, including happy, excited, worried, doubtful, curious and not interested. Cronbach’s Alpha of 0.745 shows ‘adequate’ internal consistency reliability of the Affect measurement model (Kline, 2015). None of the item indicators cause a significant increase of Cronbach’s Alpha if they are removed. Correlations between items (Corrected Item-Total Correlation) are all over 0.3, which is often recommended as a rule-of-thumb for inclusion (Blunch, 2012). Table 4.3 reports results of the validity test of the Affect construct.

Table 4.3. Means, Standard Deviation and Results of reliability test of the reflective latent construct (N = 124)

	Mean	Std. Dev.	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Happy	5.557	1.238	0.357	0.740
Excited	5.548	1.265	0.338	0.744
Worried	3.758	1.558	0.733	0.631
Doubtful	3.960	1.640	0.713	0.635
Curious	3.065	1.486	0.319	0.753
Not interested	4.960	1.684	0.460	0.718
Cronbach's Alpha			0.745	

4.2.2 Formative latent constructs

Pearson’s correlations between indicators of the construct and the construct value are used to evaluate the formative construct’s validity. Indicators that do not significantly correlate with their latent constructs at the 0.10 level of significance are removed. Correspondingly, one measuring item of the Self-concept construct regarding whether respondents consider themselves as green purchasers (Self 1), is dropped out of the model. VIF was used to assess multicollinearity. 10 is recommended as maximum value of VIF and variables having VIF above 10 should be eliminated (Hair, Anderson, Tatham, & William, 1998; Kennedy, 2003). All variables in the original TIB model and the modified TIB model have VIF values lower than 10. Details of validity tests of formative measurement constructs are illustrated in Table 4.4.

Table 4.4. Means, Standard Deviation and Results of reliability tests of the non - reflective latent constructs (N = 124)

	Mean	Std. Dev.	Correlation	VIF
Behaviour	0.379	0.487	-	-
Intention	3.944	0.829	-	-
Habit	1.774	0.742	-	-
Knowledge	4.089	0.856	-	-
Attitude (ATT) ^a				
ATT 1 ^b	41.669	7.322	0.731**	3.302
ATT 2 ⁴	40.161	8.251	0.710**	4.017
ATT 3	39.815	8.194	0.752**	2.885
ATT 4	34.750	11.506	0.626**	1.798
ATT 5	12.468	8.458	0.270**	1.090
ATT 6	10.097	5.994	0.233**	1.456
ATT 7	10.807	5.959	0.359**	1.447
ATT 8	8.000	3.992	0.259**	1.614
ATT 9	11.742	6.950	0.461**	1.157
Norms				
Norm 1	30.637	11.178	0.778**	2.868
Norm 2	28.137	10.170	0.892**	4.332
Norm 3	31.548	9.937	0.873**	3.714
Norm 4	28.694	10.789	0.878**	3.393
Norm 5	31.605	10.284	0.821**	2.707
Roles				
Role 1	5.331	1.348	0.847**	3.784
Role 2	5.194	1.401	0.918**	4.886
Role 3	5.936	1.065	0.820**	3.823
Role 4	6.097	0.896	0.757**	3.049
Self-concept				
Self 1	6.121	0.968	0.166	1.066
Self 2	2.524	1.252	0.737**	1.404
Self 3	3.355	1.678	0.861**	1.346
Perceived Behavioural Control (PBC)				
PBC 1	11.403	6.443	0.519**	1.060
PBC 2	18.073	9.557	0.648**	1.056
PBC 3	20.145	13.222	0.823**	1.099
Facilitating Conditions (Control Beliefs) (Faci)				
Faci 1	2.024	1.024	0.575**	1.084
Faci 2	3.048	1.436	0.644**	1.053
Faci 3	3.484	1.911	0.793**	1.080
Social Factors				
Norms	22.557	3.980	0.996**	1.441
Self-concept	5.879	2.552	-0.399**	1.559

⁴ Details of indicator items are reported in Table 3.1.

	Mean	Std. Dev.	Correlation	VIF
Roles	150.621	44.353	0.600**	1.203

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

a. Latent constructs

b. Indicator items

Since Behaviour, Intention, Habit and Knowledge were measured by only one indicator, it is not possible to either correct their measurement errors or check their validity.

4.3 Tests of the structural models

In the second stage of data analysis, two models, the original TIB and the proposed model, were assessed before a revised structural model was finalised and the hypotheses were tested. The models were evaluated in terms of (i) model fit, and (ii) significance of relationships between their components. Regarding evaluation of model fit, Lei and Wu (2007) and Blunch (2012) recommended the use of the following indices: P(Chi-Square (CMIN), degree of freedom (DF)), CMIN/DF, Root Mean Square Error of Approximation (RMSEA) along with its P-value (PCLOSE), and Comparative Fit Index (CFI). Other applications of the TIB also reported the value of Normalized Fit Index (NFI) (e.g. Chang & Cheung, 2001; Gagnon et al., 2003). Different from the traditional norm of P-value, a P(CMIN/DF) less than 0.05 in SEM indicates poor model fit, denoting that the null hypothesis of a correct model is rejected (Blunch, 2012). A value of CMIN/DF close to 1 is considered a good fit (Blunch, 2012; Byrne, 2013). While Kline (2015) suggested that $RMSEA \leq 0.05$ is acceptable as a rule of thumb, Blunch (2012) asserted that $RMSEA > 0.10$ is unacceptable. $PCLOSE \geq 0.05$ is considered a sign of good model fit as it accepts the null hypothesis of $RMSEA < 0.05$ (Blunch, 2012). $CFI \geq 0.95$ and $NFI \geq 0.90$ usually indicate a good model fit (Blunch, 2012; Byrne, 2013; Kline, 2015).

Table 4.5 summarises acceptable ranges of measures of SEM model fit.

Table 4.5. SEM model fit tests

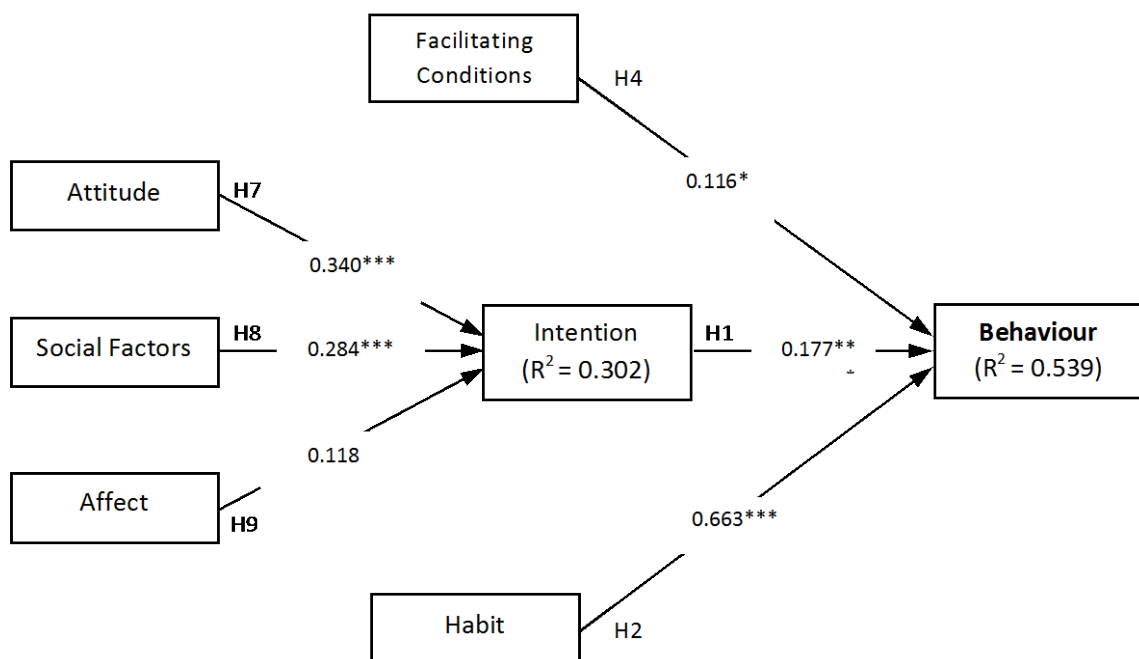
Measure/Test	Acceptable	Sources
P(CMIN, DF)	≥ 0.05	Blunch (2012); Byrne (2013)
CMIN/DF	Close to 1	Blunch (2012); Byrne (2013)
CFI	≥ 0.95	Blunch (2012); Byrne (2013) and Kline (2015)
NFI	≥ 0.90	Blunch (2012); Byrne (2013) and Kline (2015)
RMSEA	< 0.10	Blunch (2012)
PCLOSE	≥ 0.05	Blunch (2012)

4.3.1 Original TIB

The original TIB has poor model fit with CMIN/DF = 3.617, P(CMIN, DF) = 0.000, RMSEA = 0.146, PCLOSE = 0.001, NFI = 0.857 and CFI = 0.887.

Habit, Facilitating Conditions and Intention are significant antecedents of actual Behaviour of E5 purchase, while Social Factors and Attitude are significant predictors of Intention. Affect has no significant influence on Intention. Results for the original TIB are shown in Figure 4.1.

Figure 4.1. Results for the original TIB model (Standardised coefficients)



H_n ≡ Hypothesis n.

*** p < 0.01, ** p < 0.05, * p < 0.10.

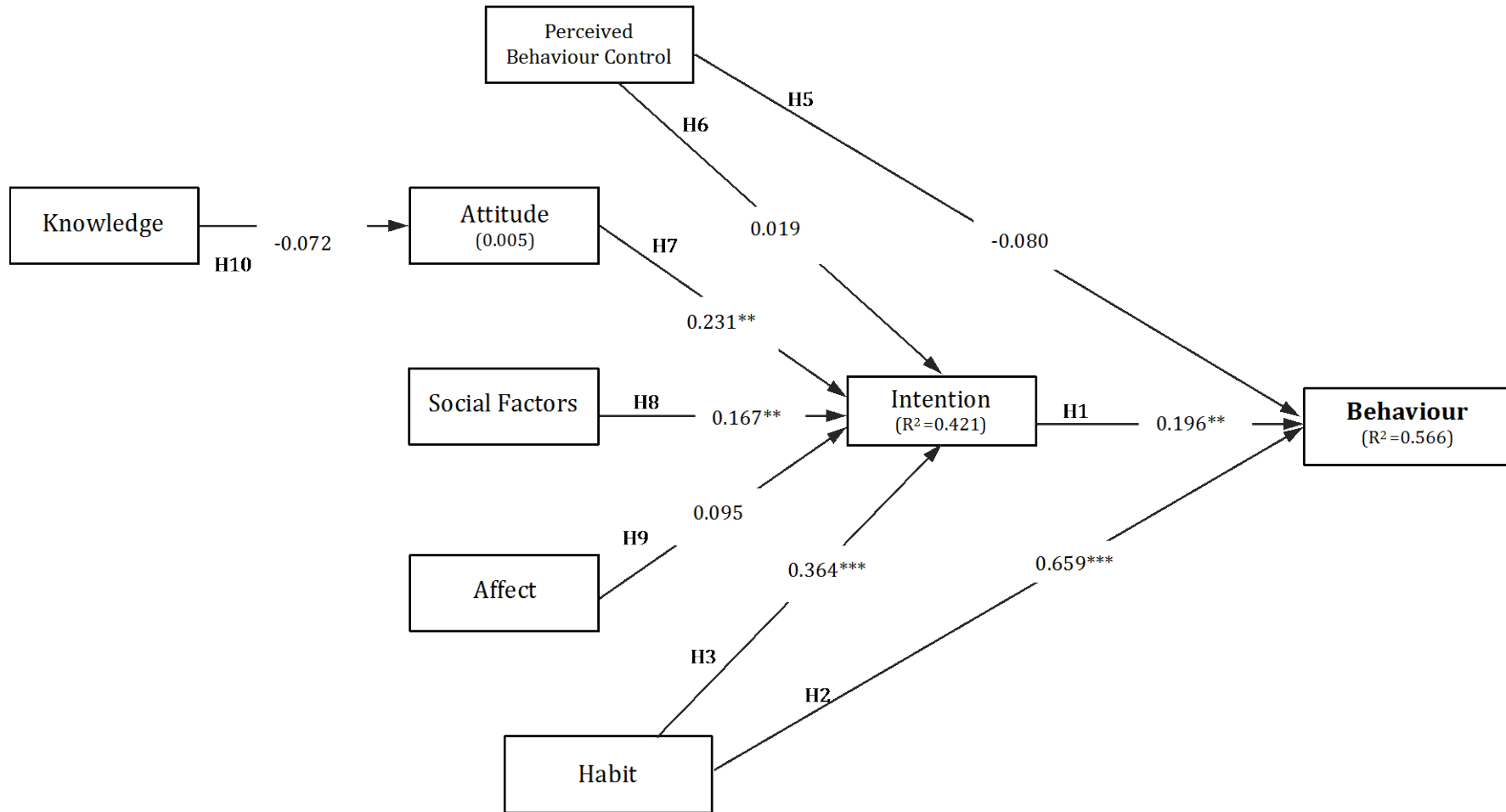
Joreskog and Sorbom (2005) and Blunch (2012) recommended that a Modification Index (M.I.) over 5 is worthy of consideration to improve model fit. Addition of the path from Habit to Intention (M.I. = 13.308) increases fit of the original TIB. This connection is a component of the proposed theoretical framework, a modified TIB, which is assessed in the following section.

4.3.2 Modified TIB

The proposed theoretical framework is a modification of the TIB. In this modified model, PBC is considered instead of Facilitating Conditions; Environmental Knowledge is included as an antecedent to Attitude, and a path from Habit to Intention is added.

Fit indices of the modified TIB are: CMIN/DF = 1.712, P(CMIN, DF) = 0.128, RMSEA = 0.076, PCLOSE = 0.256, CFI = 0.987 and NFI = 0.971, which are better than corresponding scores of the original TIB. These statistics indicate that the modified TIB is an acceptable model to explain E5 purchasing behaviour. However, the model possesses several insignificant structural coefficients. Contrary to expectations, PBC is not a significant predictor of either Intention or Behaviour. Knowledge also has no significant effect on Attitude, while Affect still does not significantly influence Intention. On the other hand, the connection between Habit and Intention is significant. Social Factors and Attitude remain significant predictors of Intention, and so are Intention and Habit to Behaviour. Figure 4.2 demonstrates results for the modified TIB model.

Figure 4.2. Results for the modified TIB (Standardised coefficients)



H_n ≡ Hypothesis n.

*** p < 0.01, ** p < 0.05, * p < 0.10.

4.3.3 Final structural model

Hays (1989) and Gagnon et al. (2003) recommended that a SEM model can be improved and re-estimated through eliminating insignificant parameters. As Affect has no significant influence in both previous models, it is dropped out in the final model. Similarly, Knowledge is no longer a determinant of Attitude. Facilitating Conditions is included instead of PBC.

The diagnostic analysis of fit indices indicates good fit of the final model to the data. Moreover the final model does not have any insignificant coefficients, plus it is more parsimonious than either the original or the modified TIB models, showing that the model is the most suitable to predict E5 purchasing behaviour compared with the original TIB and the modified TIB. Summary of fit assessment of the three models is demonstrated in Table 4.6.

Table 4.6. Fit indices of the assessed models

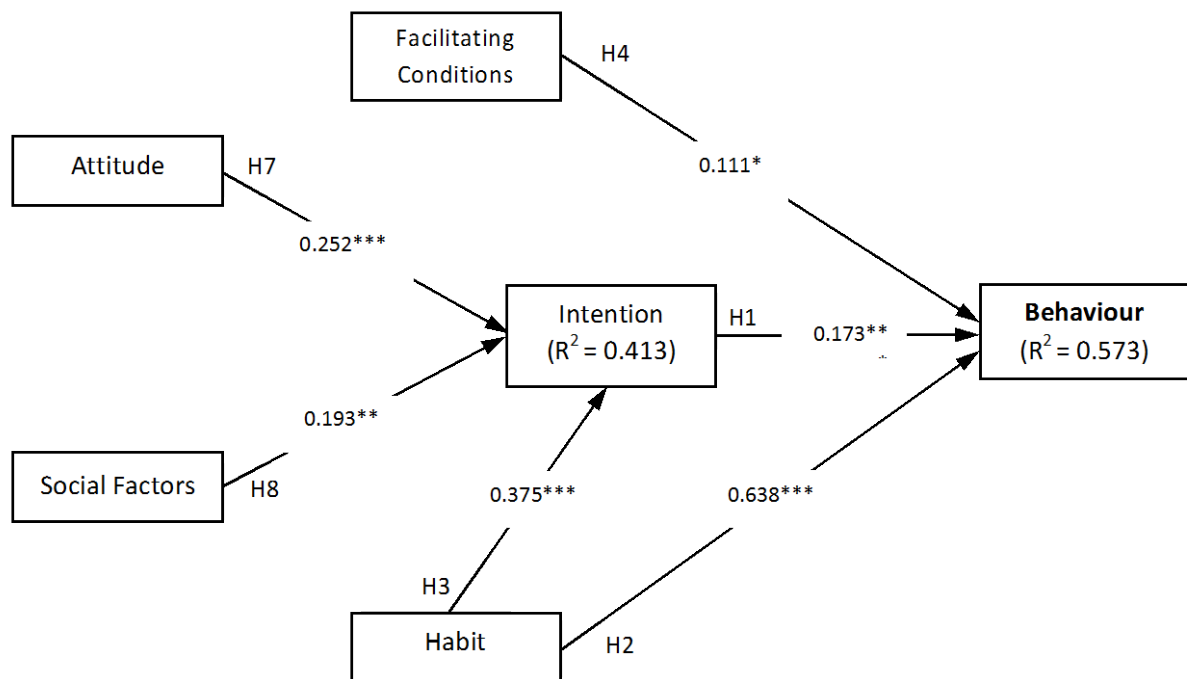
	Final model	Modified TIB	Original TIB
P(CMIN, DF)	0.823 (2.884, 6)	0.128 (8.561, 5)	0.000 (36.165, 10)
CMIN/DF	0.481	1.712	3.617
CFI	1.000	0.987	0.887
NFI	0.987	0.971	0.857
RMSEA	0.000	0.076	0.146
RMSEA low	0.000	0.000	0.096
RMSEA high	0.071	0.160	0.198
PCLOSE	0.905	0.256	0.001

The final model therefore is used to test the research hypotheses. Hypotheses 5, 6, 9 and 10 are not considered in the final model because they have been tested and disproved in the original TIB model and the modified TIB model. Hypotheses 11 and 12 are tested with a logistic regression model, and a multiple regression model respectively.

Figure 4.3 presents results of the hypotheses in the final model. These hypotheses are:

- H1. Intention to buy E5 and actual purchase of E5 are positively related.
- H2. Habit of buying E5 and actual purchase of E5 are positively related.
- H3. Habit of buying E5 and Intention to buy E5 are positively related.
- H4. Facilitating Conditions regarding E5 purchase and actual purchase of E5 are positively related.
- H7. Attitude regarding E5 purchase and Intention to buy E5 are positively related.
- H8. Social Factors regarding E5 purchase and Intention to buy E5 are positively related.

Figure 4.3. Results for the final structural model (Standardised coefficients)



H_n ≡ Hypothesis n

*** p < 0.01, ** p < 0.05, * p < 0.10.

4.4 Hypothesis testing

4.4.1 Hypotheses 1, 2 and 4: Factors influencing Behaviour

Hypotheses 1 and 2 are strongly supported by the data. The standardized path coefficient (β) of Habit to Behaviour equals 0.638 ($p < 0.01$), indicating the strongest relationship in the structural model, which is stronger than the influence of Intention on Behaviour ($\beta = 0.173$, $p < 0.05$). While Intention directly impacts Behaviour, Habit generates its total influence on Behaviour (0.703) through its direct effect on the actual purchase of E5 (0.638) and also through its indirect effect via Intention to buy E5 (0.065). The result confirms the positive connections between Habit and Intention to Behaviour. It implies that if individuals have either a strong habit of using E5 or greater intention to buy E5, it is more likely that they actually purchase this product when they buy petrol.

Facilitating Conditions addressed in hypothesis 4 is also proved to be a predictor of E5 purchasing behaviour. The path from Facilitating Conditions to Behaviour has a standardised coefficient of 0.111 ($p < 0.10$). This significant positive relationship between the two variables demonstrates that if such external conditions as the availability of E5 stations or cooperation of petrol attendants are better, petrol purchasers are more likely to buy E5. Nevertheless, Facilitating Conditions are the weakest

antecedent of Behaviour with the smallest standardised coefficient, which also has the lowest level of significance ($p = 0.059$). Habit, Intention and Facilitating Conditions together explain 57.3% (R-Squared) of the variance of actual purchase of E5.

4.4.2 Hypotheses 3, 7 and 8: Factors influencing Intention

Consistent with Triandis' (1979) theory, Attitude and Social Factors are significant predictors of Intention. The standardised coefficients of the paths from these two constructs to Intention are 0.252 ($p < 0.01$) and 0.193 ($p < 0.05$) respectively. On the other hand, while Triandis did not include the influence of Habit on Intention in his theory, this connection is highly supported by the data. Moreover, it is the second strongest relationship in the structural model with a standardised coefficient of 0.375 ($p < 0.01$). Together with Attitude and Social Factors, Habit explains 41.3% (R-Squared) of the variance of Intention to purchase E5.

A summary of hypothesis tests using the SEM is demonstrated in Table 4.7:

Table 4.7. Summary of hypothesis testing

Hypothesis	Dependent variable	Independent variable	Std. Coef.	P-value	Hypothesis is supported?
1	Behaviour	Intention	0.173	0.015	Yes
2	Behaviour	Habit	0.638	0.000	Yes
4	Behaviour	Facilitating Conditions	0.111	0.059	Yes
3	Intention	Attitude	0.252	0.001	Yes
7	Intention	Social Factors	0.193	0.013	Yes
8	Intention	Habit	0.375	0.000	Yes

4.4.3 Hypotheses 11 and 12: Influence of demographic factors

Hypothesis 11: Influence of demographic factors on Behaviour

Hypothesis 11 tests the influence of demographic factors on actual purchase of E5 (which is not addressed in the TIB). This follows earlier research on pro-environmental behaviours (e.g. Dalen & Halvorsen, 2011; Lee et al., 2013; Lynn, 2014), which has shown significant impacts of gender, age and income on participation in environmentally friendly activities. Because Behaviour is a binary variable⁵, a logistic regression analysis (or Logit model) was used to investigate influence of demographics on E5 purchasing behaviour (Field, 2013; Wagner lii, 2016).

⁵ Binary variables are variables which have only two values (Field, 2013). In the present research, the Behaviour variable only has Yes and No values.

Definitions of the variables used in the logistic regression analysis

Demographics assessed in the present research include gender, age, occupation, education and income. In order to apply the Logit model, five dummy variables were created corresponding to five aspects of demographics. A dummy variable is defined as a numerical variable that only takes on the value of 1 or 0 (Suits, 1957; Wagner Iii, 2016). Male is the first dummy variable, which is 1 if the petrol purchasers are male and 0 if they are female. The variable Young is coded so that a value of 1 denotes under 30 year-old respondents, while 0 defines those who are 30 years old or older. Services is a dummy variable defining people working in the services sector, which is the main career field of E5 survey participants. Services sector workers are coded as 1, and those working in all other sectors or unemployed are 0. Low Education is another dummy variable, which is 1 if respondents only achieved an upper secondary qualification, and 0 if respondents are doing or have obtained degrees of other higher educational levels. Low Income variable equaling 1 denotes petrol purchasers that earn less than six million VND a month and 0 represents higher-income purchasers. Descriptions of the variables in the Logit model are provided in Table 4.8.

Table 4.8. Descriptions of the dependent and dummy variables in the Logit model

	Mean	Std. Dev.
Behaviour ^a	0.379	0.487
Male	0.520	0.502
Young	0.540	0.500
Services	0.740	0.442
Low Education	0.110	0.310
Low Income	0.476	0.501

a. Dependent variable

In accordance with the results of SEM models, three proved predictors of Behavior (Intention, Habit and Facilitating Conditions) are added to the Logit models so that demographic effects are unconfounded. To test contributions of demographic factors on Behaviour, predicting power and goodness of fit between the two Logit models are compared, one model includes only SEM-proved predictors of Behavior and one model includes SEM-proved predictors of behavior as well as demographic variables. Field (2013) suggested use of predictive accuracy as an indicator of predictive power of the Logit model. To compare fitness between the two models (which have the same data set), Allison (2012) recommended Cox & Snell R-Squared and McFadden's R-Squared statistics as the two most common tools, while Field (2013) suggested implementation of a Likelihood Ratio Test (LRT), which follows the Chi-squared distribution.

Results of logistic regression analysis

Table 4.9 reports the Logit models of E5 purchasing behavior. Consistent with the SEM results, Habit, Intention and Facilitating Conditions remain significant predictors of E5 purchasing behaviour. Male, Services and Low Education were excluded in the model due to their insignificant impacts on Behaviour.

Table 4.9. Logit model for determinants of E5 purchasing behaviour

	Non-demographics model (M1)				Demographics model (M2)			
	Coef. (B)	S.E.	P-value	Odds ratio	Coef. (B)	S.E.	P-value	Odds ratio
Constant	-13.614***	2.992	0.000	0.000	-16.804***	4.673	0.000	0.000
Habit	4.051***	1.039	0.000	57.456	5.072***	1.328	0.000	159.541
Intention	0.968**	0.451	0.032	2.633	1.476**	0.650	0.023	4.376
Facilitating Conditions	0.184*	0.102	0.072	1.202	0.250**	0.124	0.043	1.284
Young	-	-	-	-	-1.275*	0.727	0.079	0.279
Low income	-	-	-	-	-2.342**	0.995	0.019	0.096
Cox & Snell R ²				0.530				0.586
McFadden's R ²				0.569				0.664
% correctly predicted				84.7%				90.3%
% correctly predicted (<i>Constant model</i>)				62.1%				62.1%
Log-likelihood				-35.453				-27.672
Log-likelihood (<i>Constant model</i>)				-82.285				-82.285
LRT (χ^2 (DF) / P-value) (<i>vs Constant model</i>)								109.226 (5) / 0.000
LRT (χ^2 (DF) / P-value) (<i>vs M1</i>)								15.561 (2) / 0.000

*** p < 0.01, ** p < 0.05, * p < 0.10.

The significant negative impact of Young on Behaviour ($B = -1.275$, $p < 0.1$) implies that petrol purchasers under 30 years old have lower propensity to buy E5. Its statistically significant odds ratio of 0.279 indicates that the young respondents are only 0.279 times as likely as the older respondents to purchase E5, all else being equal. Similarly, Low Income has a significant negative effect on Behaviour at the 2% level ($B = -2.342$). The odds ratio value (0.096) denotes that purchasers having monthly income lower than six million VND are only 0.096 times as likely to buy E5 as higher-income consumers.

The demographics model correctly predicted 90.3% of observations, which is considerably higher than the explanatory ability of either the model having only the constant (62.1%) or the model considering only SEM model predictors (84.7%) (Table 4.9).

Concerning the model's goodness of fit (Table 4.9), in comparison with the constant model, the demographics involved model has a Chi-squared statistic significant at the 0.1% level ($p = 0.000$), indicating a good model fit (Field, 2013; Wagner Iii, 2016). According to results of the Likelihood Ratio Test between the non-demographics model and the demographics model, a significant Chi-squared value (15.561) at the 0.1% level rejects the null hypothesis of no explanatory power of added demographic variables. Consistently, larger Cox & Snell R^2 and McFadden's R^2 scores of the demographics model imply that inclusion of demographic factors contributes to better explanation of E5 purchasing behaviour (Allison, 2012; Field, 2013; Wagner Iii, 2016).

Hypothesis 12: Influence of demographic factors on Intention

Hypothesis 12 addresses the influence of demographic factors on intention to buy E5. Intention is assumed to be an ordinal variable, and multiple regression analysis was used to investigate relationships between Intention and eight independent variables, including five demographic aspects and three Intention's antecedents as tested in the SEM, namely Attitude, Social Factors and Habit. Table 4.10 presents results of multiple regression. Male, Services, Low Income and Low Education were excluded from the model due to their insignificant impacts on Intention. Because no VIF values exceed 10, the model has no significant multicollinearity (Blunch, 2012; Field, 2013). Pearson's R-Squared value equals 0.431 meaning 43.1% of the variation of Intention is explained by the independent variables in the model. The demographics model's Adjusted R-Squared value is 0.421, which is higher than of the model only including the three SEM model antecedents (0.398). This implies that inclusion of Young contributes to better explanation of Intention (Field, 2013).

Table 4.10. Multiple linear regression model of Intention to buy E5

	Non-demographics model (M1)				Demographics model (M2)			
	Coef. (B)	S.E.	P-value	VIF	Coef. (B)	S.E.	P-value	VIF
Constant	1.308***	0.378	0.001	-	1.494***	0.385	0.000	-
Habit	0.419***	0.091	0.000	1.357	0.381***	0.092	0.000	1.419
Attitude	0.006***	0.002	0.002	1.250	0.006***	0.002	0.001	1.265
Social Factors	0.004**	0.001	0.016	1.268	0.003**	0.001	0.033	1.297
Young	-	-	-	-	-0.235*	0.120	0.053	1.105
R-Squared				0.413				0.431
Adjusted R-Squared				0.398				0.421
F-Statistics				28.139***				22.554***

*** p < 0.01, ** p < 0.05, * p < 0.10.

Similar to outcomes of the SEM, Habit, Attitude and Social Factors significantly affect Intention. As witnessed in Table 4.10, Young has a negative (B = -0.235) and significant (p < 0.1) effect on Intention, denoting that under 30 year-old petrol purchasers have less intention to buy E5 than older purchasers (Wagner lii, 2016).

Results of the Logit and multiple regression models used in testing Hypotheses 11 and 12 confirm the findings of the SEM regarding determinants of Behaviour and Intention. They also indicate that the age of E5 respondents significantly influences both intention to buy E5 and actual E5 purchase. The young petrol purchasers are less likely to intend to, and to actually buy E5. Income moderately impacts Behaviour, but not Intention to buy E5. Occupation, educational level and gender do not have significant effects on either Behaviour or Intention.

4.5 Chapter summary

This chapter describes characteristics of E5 survey respondents and evaluation of measurement models and structural models along with hypothesis testing. Regarding the research sample, there are more men participating in the investigation than women. Most survey respondents are young (under 30 years old), have monthly income less than six million VND and work in the services sector. As a result of validity testing of latent constructs, the dimension of Self-concept regarding whether respondents consider themselves as green purchasers, was eliminated from the model. The evaluation of structural models indicates that the original TIB is not adequate to explain E5 purchasing behaviour. The proposed model shows relatively good fit, but includes insignificant predictors, including Affect, PBC and Environmental Knowledge. These outcomes guided development of the final structural model of E5 purchasing determinants. Hypothesis testing results reveal that Habit is the strongest antecedent of E5 actual purchase, along with Facilitating Conditions and Intention. Consistent with the TIB, Social

Factors and Attitude are strong predictors of Intention to buy E5. Demographic factors contribute to better explanation of Intention to use and real purchase of E5. The young are less likely to intend to, or to actually buy E5. Low-income participants have lower probability of intention to purchase E5. Other demographic dimensions, namely gender, occupation and educational levels, do not have significant impacts on either intention or actual purchase of E5.

Chapter 5

Discussion and Conclusion

The purpose of this research is to investigate E5 purchasing behaviour of Vietnamese petrol consumers. It aims to answer two questions, which are (i) what is the Vietnamese consumers' E5 purchasing behaviour?, and (ii) which factors determine E5 purchasing behaviour in Vietnam? Twelve hypotheses were developed to address these questions. This chapter summarises and discusses findings of the study by linking the empirical results of hypothesis testing in Chapter 4 and the theoretical framework in Chapter 2. To do so, it is structured into four sections. The first section presents central research findings, whose contributions are discussed in the second section. The third section provides implications of the present study for either practice or future research, while its limitations are also assessed, before conclusions are drawn in the final section.

5.1 Summary of research findings

The present study collected 145 valid questionnaire responses from petrol purchasers. 124 out of 145 respondents have heard about E5 (85.52%). Of these 124 petrol purchasers, 37.90% bought E5 the last time they purchased fuel. This is broadly consistent with the estimate by PetroVietnam Oil Corporation [(PV OIL), a subsidiary of one of three main petrol providers in Vietnam, Vietnam National Oil and Gas Group (PetroVietnam)], that E5 accounted for approximately 26% of total petrol consumption in Hanoi in the first six months of 2016 (MOIT, 2016). The difference in the E5 proportion between the surveyed responses and PV OIL statistics may stem from the fact that the survey counted the ratio based on purchaser numbers, whereas PV OIL is based on consumed volume of the two fuels. In addition, the difference may also be caused by misleading or concealing responses, which is a potential bias of the self-reported surveying approach (Hite, 1988). A respondent could report erroneously using E5 the last time he or she purchased petrol. This issue will be discussed further in the section of implications of the present study for further research.

The 60-item questionnaire was used to investigate factors influencing E5 purchase in Vietnam. Key findings drawn from analysis of the 124 responses are categorized into two groups: determinants of intention to buy E5, and determinants of actual E5 purchase, as follows:

5.1.1 Determinants of intention to buy E5

The SEM results do not support the three-components model of Intention developed by Triandis' (1977). Only two components, Attitude and Social Factors, are significant antecedents of Intention to buy E5, whereas Affect does not significantly affect Intention. The significant positive effect of Attitude

on Intention is consistent with findings of almost all TIB applications in the field of technology adoption and health (e.g. Baumann et al., 1993; Gagnon et al., 2003; Moody & Siponen, 2013), as well as other research investigating determinants of pro-environmental behaviours through the TPB or the TRA (e.g. Nguyen & Ho, Chan & Lau, 2002; Heath & Gifford, 2002; 2014; Paul et al., 2016). Petrol purchasers who have more positive Attitude towards the contributions of E5 to improving environmental quality and less negative Attitude towards E5 quality are more likely to intend to buy E5. In studies by Paul et al. (2016) and Nguyen and Ho (2014), Attitude was the strongest predictor of Intention to consume green products. In contrast, in the present research, Habit is of more importance than Attitude, while Social Factors have a positive but relatively low influence. The impact of Habit will be discussed later. The positive effect of social influences on Intention in the present study is consistent with findings of other investigations on green product consumption (e.g. Chan & Lau, 2002; Nguyen & Ho, 2014). A positive but weak influence of Social Factors was also found by Arimura, Katayama, and Sakudo (2014), who investigated determinants of energy saving behaviour in households.

For Vietnamese petrol purchasers, Affect is not an antecedent of Intention as Triandis (1977) asserted. Affect is direct feelings of an individual 'at the thought of the behaviour' (Triandis, 1977, p. 9). Influence of Affect appears mixed among TIB applications. Godin et al. (1996) and Maticka-Tyndale et al. (1998) found Affect was a strong predictor of intention to use condoms and to engage in casual sex in students' spring break. Meanwhile, the influence of Affect was not significant in the studies of Bamberg and Schmidt (2003), Baumann et al. (1993) and Gagnon et al. (2003) on car use, adoption of mammography and telemedicine respectively. It is possible that Affect mostly plays an important role in behaviours that can evoke strong emotions, whereas those kinds of feelings might not be experienced in activities such as petrol purchase, daily car use or mammography. Moreover, since Ali et al. (2011) regarded purchasing environmentally responsible products as an ethical behaviour, which is strongly driven by an affective element (Magnusson et al., 2003; McEachern et al., 2005), this may indicate that Vietnamese petrol users do not consider E5 consumption a moral act.

The relationship between Habit and Intention is not addressed in the TIB. But it was proved to be strong in previous modified TIB applications, and so its role was tested in the modified TIB model in this study. The modified model reveals a strong effect of Habit on Intention (please refer to Table 4.7 in Chapter 4). Indeed, Habit is the strongest predictor of Intention to buy E5. This is consistent with the findings of Baumann et al. (1993) and Godin et al. (1989) in their applications of the TIB to explain respectively, the use of mammography and exercise after birth by pregnant women, as well as of Knussen et al. (2004) and Carrus, Passafaro, and Bonnes (2008) on their investigation into determinants of recycling and public transport use. It is also consistent with arguments of habit theories. Ouellette and Wood (1998) stated that normally Intention is positively correlated with Habit because individuals tend to form preferable intention to behave according to their frequent past

behaviour. Moreover, they suggested two possible routes through which Habit influences Behaviour, which are also witnessed in the present study, one is direct to future Behaviour and one is indirect, mediated through Intention.

Environmental Knowledge did not have a significant impact on Attitude towards E5 purchasing behavior, contrary to expectations in the proposed framework. This outcome is in line with Kollmuss and Agyeman (2002), who asserted that the Knowledge – Attitude – Behaviour linear model developed in the early 1970s, which assumed that providing environment-related information to people will lead to a positive Attitude to environmental Behaviour, which in turn will result in pro-environmental behavior, was incorrect. Likewise Kellert (1990), Kuhlemeier et al. (1999), Noordin and Sulaiman (2010) and Levine and Strube (2012) in studies on conservation and pro-environmental behaviours found that Knowledge had either no or very weak influence on Attitude. This result of the present research, on the other hand, differs from the findings of Ramayah et al. (2012) in their application of the modified TPB to explain recycling behaviour. Similar to Ramayah et al. (2012), Nguyen and Ho (2014) found a significant relationship between Knowledge and Attitude in their study on determinants of consumption of green electronic products in Vietnam. Nguyen and Ho (2014) did not report how they questioned and measured Knowledge. The questions used by Ramayah et al. (2012) to measure Knowledge appear instead to address Attitude toward recycling⁶. Rather than providing a clear-cut distinction of answer options such as True/False, which is frequently used in studies investigating Environmental Knowledge (e.g. Gen, 2010; Hausbeck et al., 1992; Leeming, Dwyer, & Bracken, 1995), Ramayah et al. (2012) asked respondents about their agreement levels from strongly disagree to strongly agree, which then were not categorized into any rank of environmental awareness. Additionally, even though Ramayah et al. (2012) reported adapting their Environmental Knowledge questions from Sidique, Lupi, and Joshi (2010), Sidique et al. (2010, p. 167) classified those questions as Attitude instead of Knowledge. Since effects of Knowledge (in the form of information obtained) on Attitude are varied, Chaiken (1980, 1987) explained that for Knowledge information provided could only result in attitudinal changes if individuals pay attention to the information and actively process it, which is usually impeded by strongly habitual act, because people incline to automatically repeat their past behaviour rather than use a cognitively demanding approach (Aarts, Verplanken, & Van Knippenberg, 1997; Verplanken & Aarts, 1999). Similarly, Dahlstrand and Biel (1997) asserted that how actively individuals process their knowledge on pro-environmental behaviours depends on how deep-rooted they are in their old habits. Consequently, campaigns to increase environmental knowledge do not greatly contribute to behaviour change of people having strong environmentally unfriendly habits. In the current case, it is possible that petrol purchasers simply follow their habit of using traditional

⁶ The questions that Ramayah et al. (2012) used to measure Knowledge were: (1) Recycling is a major way to reduce pollution. (2) Recycling is a major way to reduce wasteful use of landfills. (3) Recycling is a major way to conserve natural resources. Responses are 7- point Likert scales from Strongly Disagree to Strongly Agree.

petrol, and do not actively consider their environmental knowledge related to E5 (if it exists), leading to fixed attitudes.

5.1.2 Determinants of E5 purchasing behaviour

The results show that Habit and Intention are both significant predictors of Behaviour, which are consistent with the TIB and previous studies on behaviour through the habit-added TPB model (e.g. Conner et al., 1999; de Bruijn et al., 2009). The stronger influence of Habit than of Intention on Behaviour runs counter to the argument of Fishbein and Ajzen (1975) that conscious intention mainly drives people's behaviour. This outcome of the present study, however, is consistent with findings of Moody and Siponen (2013), who used the TIB to explain personal use of the Internet in the workplace, and of Bamberg and Schmidt (2003), who compared the predictive power of the TPB and the TIB in explaining car use behaviour. Analysing fruit consuming behaviour, De Bruijn et al. (2007) also concluded that effects of intention on behaviour are weak if individuals have strong habits. A strong habit, or a well-practiced habit as Ouellette and Wood (1998, p. 55) named it, is defined as past behaviour that recurs in constant and predictable supporting contexts on a daily or weekly basis, and might appear 'unintentional and nonvolitional' for the actor. When a well-practiced habit exists, people tend to just repeat it as it seems effortless and quick with very little or even minimal contributions of conscious considerations (Bargh, 1989; De Bruijn et al., 2007; Logan, 1989; Ouellette & Wood, 1998). Purchase of traditional petrol, according to this definition, is also a well-practiced habit. Because conventional petrol has been the dominant vehicle energy option for years, Vietnamese petrol purchasers probably quickly formed their habit of regular petrol purchase soon after they started driving. Consequently, as long as gas stations still serve both fuels at similar prices, it is possible that Vietnamese petrol consumers will follow their habitualised behavioural pattern to use conventional petrol because their intention to switch to more environmentally friendly petrol might not be developed, or if they have been developed, they are too weak to successfully overcome the current habitual tendency.

In contrast to the TPB, in this study PBC does not significantly affect Behaviour, whereas one of its component items, Facilitating Conditions⁷ (or Control Beliefs as it is named in the TPB), does. This outcome is similar to research findings of Davies et al. (2002) and Bamberg and Schmidt (2003), who studied antecedents of recycling and daily car use respectively. Moreover, PBC is also not a significant predictor of Intention as reported in previous studies (e.g. Albayrak et al., 2013; Chen & Tung, 2014; Han et al., 2010). This result, nevertheless, is consistent with conclusions of Tonglet et al. (2004) and Boldero (1995), who employed the TPB to explain pro-environmental behaviours. On the other hand,

⁷ The Facilitating Conditions variable in the present study consists of constraints to buying E5, including access to an E5 gas station, cooperation of petrol attendants and E5 price.

while Facilitating Conditions are a statistically significant determinant of E5 purchasing behaviour, their predictive power is weak. This can be explained by the fact that Hanoi has a high proportion of fuel stations selling E5 (MOIT, 2016). Hanoi is also one of the seven provinces where E5 was first introduced, so petrol attendants have become very familiar with introducing and selling it. Further, the very small difference in price between E5 and regular petrol minimises an important situational condition difference. Consequently these potential barriers and purchasers' perceived power to overcome them do not have much influence on E5 purchasing intention and behaviour.

The present research reveals that age of petrol purchasers is the main demographic factor strongly influencing intention to buy E5 and actual E5 purchase. Under 30-year-old petrol purchasers are less likely to intend to, or actually buy E5. Other authors have obtained similar results. Wright (2013) found young people made less effort to recycle than did old people. Similarly, when investigating determinants of a wide range of daily pro-environmental behaviours, including use of electronic devices, shower temperature, water use and so on, Lee et al. (2013) concluded that generally young individuals are less keen to conduct such activities compared with old individuals. A meta-analysis regarding influences of age on environmental sustainability of Hertel, M. Wiernik, S. Ones, and Dilchert (2013) revealed that old people are more likely to undertake pro-environmental behaviours than young people. It is also reported that even though young individuals show more concern about or hold more positive attitude towards environment related issues, they are less inclined to engage in environmentally responsible behaviours than old individuals (Grønhøj & Thøgersen, 2009; Johnson, Bowker, & Cordell, 2004). Unlike earlier studies on effects of demographic factors on pro-environmental behaviours (e.g. Dalen & Halvorsen, 2011; Schahn & Holzer, 1990), in this study gender, educational levels, occupation and income were not found to have significant impacts on E5 purchasing behavior when other model elements were controlled. This finding, however, may be influenced by the over-representation in the sample of respondents reporting university and college degree as their highest educational attainment. This sounds a note of caution about interpreting or generalising this finding.

The present research on the determinants of E5 purchasing behaviour reveals that Habit, Intention and Facilitating Conditions are antecedents of actual E5 purchase, whilst Intention to buy E5 is predicted by Habit, Attitude toward E5 consumption and Social Factors. Habit is the strongest determinant of both Intention and Behaviour. These findings are the same when a different method of variable analysis, Principle Component Analysis (PCA), is applied rather than the multiply and sum technique (Table 5.1). PCA was used in TIB applications of Moody and Siponen (2013) and Gagnon et al. (2003). No significant difference was found in research results between the two analysis techniques, indicating that the conclusion is not sensitive to construct development methods (Field, 2013).

Table 5.1. Empirical results according to PCA analysis

No	Hypothesis		Std. Coef.	P-value	Hypothesis is supported?	Consistent with sum technique?
	Dependent variable	Independent variable				
1	Behaviour	Intention	0.196	0.007	Yes	Yes
2	Behaviour	Habit	0.665	0.000	Yes	Yes
4	Behaviour	Facilitating Conditions	0.129	0.027	Yes	Yes
5	Behaviour	PBC	-0.078	0.237	No	Yes
3	Intention	Habit	0.375	0.000	Yes	Yes
6	Intention	PBC	0.041	0.594	No	Yes
7	Intention	Attitude	0.180	0.024	Yes	Yes
8	Intention	Social Factors	0.223	0.005	Yes	Yes
9	Intention	Affect	0.057	0.439	No	Yes

5.2 Research contributions

My research makes several important contributions to the literature on biofuel purchasing in particular, and green consumption behaviour in general. First, to the best of my knowledge, the present research is the first study that includes impacts of habit on bio-ethanol petrol purchasing behaviour.

Second, the dominant effect of Habit on both Intention and Behaviour emphasizes the benefits of adoption of the modified TIB or other theories considering influence of habit on intentions and behaviours compared with the recently predominant TPB. This finding supports the argument of Sheeran (2002) that it is now necessary to adopt an alternative model, rather than following the intention-driven framework of the TPB. Given that habit is a strong determinant of biofuel purchasing, it should be considered in future research on this behaviour. This research can also serve as a reference of validity of using the modified TIB in investigating pro-environmental behaviours, to which the modified TIB has not been applied so far. Moreover, in terms of practical application, habit should also be regarded as a prime candidate for interventions to promote use of biofuels. This issue will be discussed further in the section on implications for increasing E5 uptake.

Finally, this study suggests that certain intervening actions might have limited capability to promote biofuel consumption. For example, even though barriers to buying E5 are a statistically significant predictor of E5 actual purchase, their influences are weak. Therefore, policy makers should comprehensively analyse the pros and cons of any strategies to promote E5 before implementation. Further discussion on identified interventions to increase E5 uptake is presented in the following section regarding the research implications.

5.3 Research implications

5.3.1 Implications for increasing E5 uptake

The research findings identify several practical implications. My research reveals that Habit is the most powerful predictor of either actual E5 purchase or intention to buy E5. This implies that if individuals have developed their Habit to buy E5, it is likely that they will intend to keep purchasing this petrol. Vice versa, the majority of individuals that still buy traditional petrol, are unlikely to consider E5, or to buy it. This dominant influence of Habit denotes that the most efficient approach to promote E5 consumption is to override the habit of buying traditional petrol. According to previous habit research, deprogramming habit is very challenging (Verplanken, Aarts, & Van Knippenberg, 1997; Verplanken & Orbell, 2003), and usually consists of three main stages, including (1) breaking old habit, (2) forming new intention which will then turn into new behaviour before (3) being set as a new habit (Dahlstrand & Biel, 1997; Danner, Aarts, & Vries, 2008; Lewin, 1947; Verplanken et al., 1997). Reviewing research on pro-environmental behaviours, Steg and Vlek (2009) categorised interventions to encourage environmentally responsible behaviour into two groups: information strategies and structural strategies. Information strategies aim to change motivations, perceptions and so on regarding the encouraged behaviour, while structural strategies concentrate on changing circumstances in which behavioural decisions are made. As Steg and Vlek (2009) and Abrahamse, Steg, Vlek, and Rothengatter (2005) suggested, while information strategies can be highly helpful in the second and third phase of habit transformation, in which new intention is nurtured and gradually developed into new behaviour and habit, they contribute little to breaking the old strong habit in the first stage, which is often effectively targeted by structural strategies. Since E5 related knowledge did not have a significant effect on E5 purchasing behaviour, it is possible that the majority of petrol purchasers in Vietnam are still in the habit of purchasing conventional petrol without much deliberation. Therefore, structural strategies are probably of more importance than information campaigns in this case.

Structural strategies interrupt the constancy of the context in which the habit is practiced (Ouellette & Wood, 1998; Webb, Sheeran, & Luszczynska, 2009). A stable context is defined as facilitating conditions of the current environment which are alike to conditions in which the behaviour was formed and implemented (Ouellette & Wood, 1998). In the present research, the current context in Vietnam, where both of the fuels are sold at relatively similar prices in gas stations, facilitates continued purchases of conventional petrol. Hence, in order to override the habit of using traditional fuel, the current context could be modified. Previous studies suggested that changing or developing an appropriate purchasing environment can encourage consumption of preferred products (e.g. Langrehr, 1991; Park, Iyer, & Smith, 1989; Sherman, Mathur, & Smith, 1997). Liu, Melara, and Arangarasan (2007) and Baker, Levy, and Grewal (1992) revealed that store layout can significantly influence shopping behaviour. This poses the question of whether gas station landscape can affect petrol purchasing choices. For instance, moving conventional pumps to far corners of the gas stations where petrol attendants are rarely present to provide service may possibly be a simple but effective approach to impeding conventional petrol use and promoting E5 purchase, and hence breaking the

old habit to allow formation of new intentions.

The present study reveals that Environmental Knowledge does not affect petrol consumers' decision on purchasing E5. This result suggests that strategies to enhance individuals' knowledge related to the environment will be ineffective to increase the uptake of E5. As a result, rather than investing in strategies to change knowledge in the hope of a corresponding change of people's behaviour, policy makers probably need to consider other practical solutions, of which, modifications of gas stations layout is an example, to encourage Vietnamese consumers' to purchase E5.

5.3.2 Implications for further research

The present study identifies the importance of Habit on Intention to use, and actual purchase, of biofuels. It suggests that overriding the current habit of buying traditional fuel is the most effective way to promote Vietnamese purchase of E5. This study does not, however, possibly shed light on the operationalization of habit, especially how habit changes and how habit forms; in other words, how E5 users could be affected to change their habit of buying traditional petrol and to develop a new habit of biofuel purchase. To address these questions, a longitudinal study looking at each stage of the transformation of petrol consumption might be helpful. With insights to the process, its findings might identify more efficient interventions to promote biofuel use.

The present research affirms the significant effects of Attitude on Intention to buy E5. However, an expected antecedent of Attitude in the proposed theoretical framework, Environmental Knowledge, does not significantly affect Attitude. Therefore, alternative explanations of Attitude formation are required. Further research applying a qualitative approach with interviews might provide understanding of how petrol purchasers developed their Attitude toward biofuels.

Subsidies have been used to encourage consumption of environmentally friendly products in a number of countries, such as Vietnam, China and Brazil (Pimentel & Patzek, 2007; Walter & Ugelow, 1979; Zhang & Bai, 2017; Zhou, Levine, & Price, 2010; Zimmer, Jakob, & Steckel, 2015). Accordingly, a strong price differential in favour of E5 could be an approach to trigger a shift in habit of petrol purchase, leading to an increase of E5 uptake. This study, however, has not examined this option. Therefore, future studies addressing this factor might contribute to identification of effective approach to encouraging Vietnamese petrol consumers' to buy E5.

The present study investigated self-reported E5 purchasing behaviour. Self-reported questionnaire responses are a common approach in applied research on social-psychological behaviour in general, and on environmental psychology in particular (Abrahamse et al., 2005; Steg & Vlek, 2009). However, views on the quality of the self-reported technique are mixed. Whilst some researchers claimed that self-reports are a qualified indicator of actual behaviour (e.g. Fuj, Hennessy, & Mak, 1985; Warriner, McDougall, & Claxton, 1984) or can be 80 to 90% accurate (Tittle, 1980), others indicated significant differences between self-reported behaviour and observed behaviour (e.g. Barker, Fong, Grossman, Quin, & Reid, 1994; Chao, 2012; Corral-Verdugo, 1997). Hite (1988) also warned that the self-reported

approach can be associated with biases due to concealing, misleading or unfaithful responses. This issue can be severe in sensitive behaviours such as taxpayer compliance or drinking driving, however it might be of little importance in neutral behaviours such as petrol purchase, especially when the respondents remained anonymous as in the present research. Notwithstanding, to minimise this problem, it is suggested that future studies might employ more than one technique of data collection, for example, respondents' behaviour can be observed before they are approached for interviews.

5.4 Limitations of the research

The present research has several limitations. First, due to the restricted budget and timeframe, the sample size (124) is medium in general, but relatively small for SEM (Kline, 2015). Even though this number of respondents exceeds the smallest sample size among previous TIB applications, this issue should be borne in mind when generalizing from the results.

Second, the research was conducted in Hanoi, where infrastructure supporting E5 purchase is well developed. This probably explains why barriers to buying E5 have only moderate effects on E5 purchasing behaviour. These barriers can differ between locations, especially in rural areas. Given the Vietnamese government's strategy to promote E5 nationwide, this problem is expected to become less severe over time. Notwithstanding, a study over a broader geographic scale would help overcome this limitation.

Third, there are limitations regarding the survey method. The present study employed an Internet-based survey, which resulted in a disproportionate sample of young respondents. Even though Vietnam has a high number of Internet users, the online survey appears to have been unattractive to old people. Generalisation of the research findings should be treated with caution because of this sampling issue. Besides, the self-reported internet surveying can also be associated with biases due to misunderstanding of questions, which is one of the potential reasons for the implausible proportion of respondents selecting 'university and college' as the highest educational attainment in the present research. These two problems imply that a combination of survey distribution methods, which includes an approach allowing interaction between surveyors and participants, has the potential to provide a more representative sample as well as higher response quality.

5.5 Conclusion

This present study aimed to investigate determinants of E5 purchasing behaviour in Vietnam. It sought to explain how and why Vietnamese consumers use or do not use E5. To do so, it adopted a modified version of the Theory of Interpersonal Behaviour by Triandis (1977). Results indicate that Habit is the strongest determinant of both Intention to buy E5 and actual E5 purchase. Intention and Facilitating Conditions are two other significant antecedents of Behaviour. E5 purchasing Intention is influenced

by Attitude towards purchase of this product and Social Factors, along with Habit. The overwhelming influence of Habit indicated that changing the habit of using conventional petrol is probably the most efficient approach to encourage E5 purchase. The present research reveals that Environmental Knowledge did not affect E5 purchasing Behaviour. Barriers to E5 consumption, including availability of E5 stations, E5 price and cooperation of petrol attendants, was a significant but weak predictor of E5 actual purchase, implying that policies addressing these barriers might still be helpful but their contributions would likely be limited. The present study confirms the adequacy of the modified TIB in explaining E5 consumption behaviour, which has not been so far used to predict biofuel consumption behaviour in particular, and pro-environmental behaviours in general. The modified TIB, however, is not capable of explaining how the habit of using traditional petrol can be changed and how new E5 purchasing habits can be formed. This issue should be addressed in future research in order to identify possible interventions to encourage consumption of the more environmentally friendly petrol.

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Appendix A

Final questionnaire

(exported from online version)

Q1 This survey is related to the research project 'Factors influencing bioethanol fuel purchasing behaviour in Viet Nam'. It investigates your perspectives and experience about petrol consumption. Details of the project are provided in the Research Information Sheet that you have read in the gas station.

As long as you are a petrol purchaser, this survey is suitable for you. You do not need to answer all of the questions but you are encouraged to do so.

Do you consent to participate in this survey?

- Yes (1)
- No (2)

If No Is Selected, Then Skip To End of Survey

Q2 Have you ever heard of the bioethanol fuel E5?

- Yes (1)
- No (2)

Answer If Have you ever heard of the bioethanol fuel E5? Yes Is Selected

Q3 Please select the option that best describes your opinions.

	True (1)	False (2)
Greenhouse gas emissions are the main cause of climate change. (1)	<input type="radio"/>	<input type="radio"/>
Traditional petrol (A92, A95) is a fossil fuel. (2)	<input type="radio"/>	<input type="radio"/>
E5 is a mixture of biological materials and fossil fuel. (3)	<input type="radio"/>	<input type="radio"/>
Burning A92/A95 in vehicle engines produces less greenhouse gases than burning E5 does. (4)	<input type="radio"/>	<input type="radio"/>
Vietnam will not be affected by climate change. (5)	<input type="radio"/>	<input type="radio"/>

Answer If Have you ever heard of the bioethanol fuel E5? Yes Is Selected

Q4 Please select the option that best describes your opinions.

	Strongly agree (1)	Agree (2)	Somewhat agree (3)	Neither agree nor disagree (4)	Somewhat disagree (5)	Disagree (6)	Strongly disagree (7)
If I buy E5, it will contribute to a better environment. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If I buy E5, it will be better for human health. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If I buy E5, it will reduce climate change. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If I buy E5, it will reduce energy imports. (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If I buy E5, it will mean Vietnamese farmers grow less food crops. (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using E5 will harm my vehicle engine. (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My vehicle consumes more E5 per kilometer than A92/A95. (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using E5 in my vehicle is more likely to cause fire than using A92/A95. (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
E5 is expensive. (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Answer If Have you ever heard of the bioethanol fuel E5? Yes Is Selected

Q5

	Strongly agree (1)	Agree (2)	Somewhat agree (3)	Neither agree nor disagree (4)	Somewhat disagree (5)	Disagree (6)	Strongly disagree (7)
A better environment is important to me. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Better human health is important to me. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reducing climate change is important to me. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reducing energy imports is important to me. (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Growing more food crops in Vietnam is important to me. (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Not harming my vehicle is important to me. (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The amount of petrol consumed in my vehicle is important to me. (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fire safety is important to me. (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The price of E5 is important to me. (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Answer If Have you ever heard of the bioethanol fuel E5? Yes Is Selected

Q6 Please select the option that best describes your opinions.

	Strongly agree (1)	Agree (2)	Somewhat agree (3)	Neither agree nor disagree (4)	Somewhat disagree (5)	Disagree (6)	Strongly disagree (7)
My family thinks I should use E5. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My friends think I should use E5. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vehicle engine experts think I should use E5. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My mechanic thinks I should use E5. (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
E5 users think I should use E5. (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Answer If Have you ever heard of the bioethanol fuel E5? Yes Is Selected

Q7

	Strongly agree (1)	Agree (2)	Somewhat agree (3)	Neither agree nor disagree (4)	Somewhat disagree (5)	Disagree (6)	Strongly disagree (7)
My family's opinions are important to me. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My friends' opinions are important to me. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vehicle engine experts' opinions are important to me. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My mechanic's opinions are important to me. (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
E5 users' opinions are important to me. (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Answer If Have you ever heard of the bioethanol fuel E5? Yes Is Selected

Q8 Please select the option that best describes your opinions.

	Strongly agree (1)	Agree (2)	Somewhat agree (3)	Neither agree nor disagree (4)	Somewhat disagree (5)	Disagree (6)	Strongly disagree (7)
Using E5 is correct for a person in my occupation. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using E5 is correct for a person at my age. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using E5 is correct for me as a citizen in a country suffering from climate change. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I should use E5 to improve health and well-being of the community and future generations. (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Answer If Have you ever heard of the bioethanol fuel E5? Yes Is Selected

Q9

	Strongly agree (1)	Agree (2)	Somewhat agree (3)	Neither agree nor disagree (4)	Somewhat disagree (5)	Disagree (6)	Strongly disagree (7)
I consider myself as a green/responsible consumer. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I will buy the petrol that everybody uses. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I like to buy the cheapest petrol. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Answer If Have you ever heard of the bioethanol fuel E5? Yes Is Selected

Q10 Please select the option that best describes your opinions.

	Always (1)	Sometimes (2)	Never (3)
I have used E5 in the past. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Answer If Have you ever heard of the bioethanol fuel E5? Yes Is Selected

Q11

	Yes (1)	No (2)
I used E5 last time when I filled up. (1)	<input type="radio"/>	<input type="radio"/>

Answer If Have you ever heard of the bioethanol fuel E5? Yes Is Selected

Q12

	Definitely yes (1)	Probably yes (2)	Might or might not (3)	Probably not (4)	Definitely not (5)
I will buy E5 next time when I fill up. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Answer If Have you ever heard of the bioethanol fuel E5? Yes Is Selected

Q13 What are your initial feelings when you think about E5? Please select the option that best describes your opinions.

	Strongly agree (1)	Agree (2)	Somewhat agree (3)	Neither agree nor disagree (4)	Somewhat disagree (5)	Disagree (6)	Strongly disagree (7)
Happy (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Excited (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Worried (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Doubtful (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Curious (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Not interested (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Answer If Have you ever heard of the bioethanol fuel E5? Yes Is Selected

Q14 What are your obstacles to buy E5?

Please select the option that best describes your opinions.

	Strongly agree (1)	Agree (2)	Somewhat agree (3)	Neither agree nor disagree (4)	Somewhat disagree (5)	Disagree (6)	Strongly disagree (7)
Few stations sell E5. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
E5's price is higher than what I expected. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Petrol attendants sell me A92/A95 without asking me. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Answer If Have you ever heard of the bioethanol fuel E5? Yes Is Selected

Q15 Please select the option that best describes your opinions.

	Strongly agree (1)	Agree (2)	Somewhat agree (3)	Neither agree nor disagree (4)	Somewhat disagree (5)	Disagree (6)	Strongly disagree (7)
I can access E5 if I want to. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can afford to buy E5. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I don't mind asking petrol sellers to give me E5 if they intend to sell me A92/A95. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q16 You do not need to answer all of the questions but you are encouraged to do so as it allows me to check how representative the sample is.

What is your gender?

- Male (1)
- Female (2)
- Other (3)

Q17 Which one of the following age groups do you fit into?

- 18 - 19 (1)
- 20 - 29 (2)
- 30 - 39 (3)
- 40 - 49 (4)
- 50 - 59 (5)
- 60 and Over 60 (6)

Q18 What is your occupation?

- Agriculture, forestry and fishing (1)
- Industry and construction (2)
- Services (3)
- Unemployed (4)
- Others. Please specify (5) _____

Q19 What is your highest educational qualification?

- Primary school (1)
- Lower secondary school (2)
- Upper secondary school (3)
- University and college (4)
- Postgraduate (5)
- None (6)

Q20 Which of the following groups best matches your monthly income? Unit: 1,000VND

- Lower than 3,000 (1)
- 3,000 - 6,000 (2)
- 6,001 - 9,000 (3)
- 9,001 - 12,000 (4)
- 12,001 - 15,000 (5)
- Over 15,000 (6)
- None (7)

Q21 Thank you very much for your participation.

A mobile phone top-up card valued at 20,000VND (NZ\$1.4) will be sent to your email within one week of your survey completion. Could you please provide your email address and your telecommunications providers (e.g. Vinaphone, Viettel, etc.)?

If you have provided your email address, you may withdraw your participation and the information you have provided by informing me prior to July 15, 2016 by telephone or email. My telephone number and email address are provided in the Research Information Sheet and below. If you do not provide your email address in your response, your response will be anonymous and therefore cannot be tracked for the withdrawal.

Name of principal researcher: Han Hoang

Contact details: +64 27 359 3514 / +84 973 854 964 / hoangngochoan1611@gmail.com

Appendix B

Human Ethics Committee's requirements

B.1 Human Ethics Committee's Approval letter

Research and Innovation

T 64 3 423 0817
PO Box 85084, Lincoln University
Lincoln 7647, Christchurch
New Zealand
www.lincoln.ac.nz

Application No: 2016-24

Title: Determinants of pro-environmental behaviour: bioethanol fuel purchasing in Vietnam

Applicant: H Hoang

The Lincoln University Human Ethics Committee has reviewed the above noted application.
Thank you for your response to the questions which were forwarded to you on the Committee's behalf.

I am satisfied on the Committee's behalf that the issues of concern have been satisfactorily addressed. I am pleased to give final approval to your project.

Please note that this approval is valid for three years from today's date at which time you will need to reapply for renewal.

Once your field work has finished can you please advise the Human Ethics Secretary, Alison Hind, and confirm that you have complied with the terms of the ethical approval.

May I, on behalf of the Committee, wish you success in your research.

Yours sincerely



Grant Tavinor
Chair, Human Ethics Committee

PLEASE NOTE: The Human Ethics Committee has an audit process in place for applications. Please see 7.3 of the Human Ethics Committee Operating Procedures (ACHE) in the Lincoln University Policies and Procedures Manual for more information.

B.2 Information sheet

Faculty of Environment, Society and Design RESEARCH INFORMATION SHEET

You are invited to participate as a subject in a project entitled

Name of project: Factors influencing bioethanol fuel purchasing behaviour in Viet Nam

The aim of this project is:

This research aims to investigate determinants of bioethanol petrol (E5) purchasing behaviour of Vietnamese consumers, i.e. the main factors influencing consumers' decision whether to buy E5 or not. It is hoped that the research findings will contribute to the identification of solutions or channels that are the most effective in encouraging use of biofuel products.

Your participation in this project will involve:

You will be asked to answer a range of questions regarding your perspectives on E5 and your experience in using or not using it. The questionnaire will take you from 10 to 20 minutes to complete. If you are willing to participate in this research, you will need to tick the answer 'Yes' to the first question in the questionnaire 'Do you consent to take part in this project?'

A mobile phone top-up card valued NZ\$1.4 will be sent to your email within one week of your survey completion. Accordingly, you will need to provide your email address if you wish to receive this thank-you gift. No other identifying information is required.

The survey will be closed once 100 responses are received but no later than July 04, 2016.

The results of the project may be published, but you may be assured of your anonymity in this investigation: the identity of any participant will not be made public, or made known to any person other than the researcher, her supervisors, and the Human Ethics Committee, Lincoln University, New Zealand, without the participant's consent. To ensure anonymity and confidentiality the following steps will be taken:

- Identifying information will not be used as a part of data dissemination.
- No individual identifying information will be presented in public.
- Your participation in this research is voluntary. You do not need to answer all of the questions in the questionnaire. You may withdraw your participation and the information you have provided by informing the researcher prior to July 15, 2016 by telephone or email. If you do not provide your email address in your response, your response will be anonymous and therefore cannot be tracked for the withdrawal.

The project is being carried out by:

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Name of Supervisor: Prof. Geoffrey Kerr, Lincoln University.

Contact Details: Geoffrey.Kerr@lincoln.ac.nz

They will be pleased to discuss any concerns you have about participation in the project.

The web link to the survey is:.....

You can enter this link to the web browser to access to the survey. The researcher can also send this link to your email address if you wish to. The email that you provide will also be used for a reminder email if your response has not been collected after four days of the survey link distribution.

The project has been reviewed and approved by the Lincoln University Human Ethics Committee.