

https://dspace.org/

Adoption of sustainable technology: hybrid electric vehicles (HEVs)

Preston, Kelli-Paige

2016

http://hdl.handle.net/10539/21808

Preston, Kelli-Paige (2016) Adoption of sustainable technology: hybrid electric vehicles (HEVs), University of the Witwatersrand, Johannesburg, <http://hdl.handle.net/10539/21808>

Downloaded from a DSpace repository. https://dspace.org/

Adoption of Sustainable Technology: Hybrid Electric Vehicles (HEVs)



The University of Witwatersrand
School of Human and Community Development

Student: Kelli-Paige Preston (537954)
Research Supervisor: Prof. Andrew Thatcher

A research report submitted to the Faculty of Humanities
University of the Witwatersrand
In partial fulfilment of the requirements for the degree of
Masters of Arts in Organisational Psychology
2016

Declaration

I declare that this research project is my own, unaided work. It has not been submitted before for any other degree or examination at this or any other university.

A research project submitted in partial fulfilment of the requirements for the degree of Masters of Arts in Organisational Psychology in the Faculty of Humanities, University of Witwatersrand, Johannesburg, March 2016.

_____

Kelli-Paige Preston

_____

Date

Acknowledgements

I would like to express my sincerest gratitude to my supervisor, Professor Andrew Thatcher, for all of his guidance and support throughout my postgraduate studies. He has instilled a passion for the discipline in me and I am forever grateful and indebted for this and for his valuable contributions throughout the research process.

I would also like to express my heartfelt gratitude to my parents for their love and support towards me fulfilling my dreams and throughout my academic career. I would like to express how I feel blessed to have them as my parents and for everything that they do for me.

I would like to dedicate this report in loving memory of my granny Doreen, for always inspiring me to achieve my dreams.

Abstract

Recent environmental awareness has led to an expanding interest surrounding environmental consciousness and a greater social shift world over towards energy efficiency and the sustainability of technologies and resources. Consequently, there has been the development of sustainable technologies within the automobile industry including that of hybrid electric vehicles (HEVs). With the development of these technologies, it becomes necessary to investigate the factors that underpin the use and adoption of them within our society, so as to ensure their greater diffusion, use and adoption. In this light, this study aimed to investigate the factors that function in predicting the Intention to Adopt the sustainable technology of HEVs. This has been investigated in accordance with the constructs of the Unified Theory of Acceptance and Use of Technology (UTAUT) model. This model comprises the constructs of: Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions. This study also intended to examine these constructs and determine whether they are moderated by the constructs of Pro-Environmental Behaviour and Dispositional Resistance to Change in predicting the Intention to Adopt HEVs. The sample for this study was comprised of 133 final year Law students from the University of the Witwatersrand. The adapted UTAUT Scale, the adapted Dispositional Resistance to Change Scale and the Pro-Environmental Scale were utilised as the measures within this study. Several subscales of the UTAUT Scale as well as the Pro-Environmental Behaviour (PEB) Scale had low Internal Consistency Reliabilities within both the Pilot and Main study. However, the researcher chose to run the analyses taking this into consideration. Several subscales of the UTAUT Scale as well as the Dispositional Resistance to Change (DRC) Scale had acceptable levels of Internal Consistency Reliabilities for use in conducting analyses. Multiple regression equations and moderated multiple regression equations were run in order to investigate the effects of these constructs in predicting the Intention to Adopt HEVs. The results drawn from this study illustrated that there was a positive, significant effect of two questions concerning lifestyle factors and a reduced taxed levy of the construct Facilitating Conditions on Intention to Adopt HEVs. The results also showed that the constructs of PEB and DRC had no direct moderating influence on Intention to Adopt HEVs.

Table of Contents

Declaration…….2

Acknowledgements...…….3

Abstract…….…….4

Table of Contents……..…….5

List of Appendices……..……..….8

Chapter 1: Literature Review

1.1. Hybrid Electric Vehicles (HEVs)…..…….…..9

1.2. Sustainable Technology……...…...…...…10

1.3. Adoption and Constraints of Adoption…..…….....11

1.4. Models and Theories of Technology Acceptance ……...…..…13

1.4.1. Theory of Reasoned Action (TRA)……...…….13

1.4.2. Technology Acceptance Model (TAM and TAM2)……..…14

1.4.3. Diffusion of Innovations Theory (DOI)……..……..…….16

1.4.4. Unified Theory of Acceptance and Use of Technology (UTAUT) Model.....20

1.5. Key Constructs of the UTAUT Model……...…….…….20

1.5.1. Behavioural Intention as Intention to Adopt…….....21

1.6. Pro-Environmental Behaviour……...25

1.7. Dispositional Resistance to Change……..…27

1.8. Research Questions……...29

Chapter 2: Method

2.1. Research Design……...31
2.2. Sample and Sampling ……...…32
2.3. Descriptives……...……...……33
2.3.1. Age……...……..34
2.3.2. Gender……...……34
2.3.3. Race……34
2.3.4. Self-owning Vehicle……...35
2.3.5. Family-owned Vehicle……...35
2.3.6. Access to a Motor Vehicle……35
2.3.7. Transmission Type……35
2.4. Procedure……...…36
2.5. Measures……38
2.5.1. Demographic Questionnaire……..……..38
2.5.2. The Adapted UTAUT Scale……...38
2.5.3. The Adapted Pro-Environmental Scale……..42
2.5.4. Dispositional Resistance to Change Scale……..…43
2.6. Data Analysis ……...…43
2.6.1. Pilot Study……...…43
2.6.2. Main Study……..…44
2.6.2.1. Descriptives……44
2.6.2.2. Assumptions……44
2.6.2.3. Normality……45
2.6.2.4. Homoscedasticity……45
2.6.2.5. Multicollinearity…….....45
2.6.2.6. Multiple Regression……46
2.6.2.7. Moderated Multiple Regression……..47
2.6.2.8. Ethical Considerations……47

Chapter 3: Results

3.1. Abbreviations of Main Variables for Statistical Analyses……...……..……..…49
3.2. Pilot Study……...……...……..…49
3.3. Multiple Regression……..52
3.4. Moderated Multiple Regression……53

Chapter 4: Discussion

4.1. Discussion of Research Questions and Findings……...……..…55

4.1.2. Pilot Study and Main Study……...55

4.1.2.1. Independent Variables Predicting Intention to Adopt…….56

4.1.2.2. Moderating Effects of Pro-Environmental Behaviour and Dispositional Resistance to Change…….59

4.3. Practical and Theoretical Implications……..61

4.4. Limitations……63

4.5. Directions for Future Research…….66

Chapter 5: Conclusion

Conclusion……...…….68

Reference List…….....…….……70

Appendices……...…82

List of Appendices

Appendix 1: Participant Information Sheet...……..…82

Appendix 2: Demographic Questionnaire...……84

Appendix 3: Adapted UTAUT Scale...……...……85

Appendix 4: Adapted Pro-Environmental Behaviour Scale...…….……88

Appendix 5: Dispositional Resistance to Change Scale……...…...……89

Appendix 6: Ethical Clearance Certificate ...…….……..……91

Chapter 1

Literature Review

This chapter will provide a discussion on the main variables upon which this study is focussed, namely the sustainable technology of hybrid electric vehicles (HEVs) and how this variable relates to the constructs of the UTAUT model – Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions in terms of individual's behavioural Intention to Adopt this sustainable technology. The UTAUT model will be discussed and explained in terms of the various theories of technology acceptance of which this model is comprised. Furthermore, the constructs of Pro-Environmental Behaviour (PEB) and Dispositional Resistance to Change (DRC) will be discussed in relation to their effects in individuals' behavioural Intention to Adopt HEVs. This chapter will also situate this study and its variables within a broader context of literature and determine the constraints affecting technology use and adoption. It will explore how this current study builds on previous literature conducted as it identifies a gap within the existing literature and consequently the aims and research questions of this study logically arise.

1.1. Hybrid Electric Vehicles (HEVs)

Hybrid Electric Vehicles (HEVs) are vehicles powered by both a combustion engine and an electric motor (De Jong, Ahman, Jacobs & Dumitrescu, 2009; Hannan, Azidin & Mohamed, 2014). These combined vehicle features allow HEVs to reduce fuel consumption in comparison to conventional combustion vehicles, as well as reduce the vehicles' air pollution emissions (De Jong et al., 2009; Hannan, Azidin & Mohamed, 2014; Poullikkas, 2014). However, this reduction in fuel consumption may vary, as it is also dependent on: the vehicle application (such as the types of journey that the vehicle may endure), vehicle maintenance, driving behaviour (driver acceleration and break usage behaviours), as well as varying fuel prices (De Jong et al., 2009). Globally, it has been estimated that road transport through the utilisation of fossil fuels, contributes to approximately 17% to 18% of carbon dioxide emissions (De Jong et al., 2009). Within South Africa, the road transport sector actively contributes to the production of a large proportion of greenhouse gases. Greenhouse gases are created through a process of chemical reaction with a fossil fuel. (Tran:SIT, 2007). In particular, the predominant greenhouse gas emitted from vehicles on the road is carbon dioxide (Tran:SIT, 2007). This greenhouse gas contributes to global

warming through aiding in the rise of global temperatures and sea levels as well as leading to extreme weather conditions (Laughton, 2010). In this instance carbon dioxide is created through the chemical reactions of vehicles' internal combustion engines with the fossil fuel - petroleum (Tran:SIT, 2007). It has been estimated that the transport sector will expand in the coming years, and thus there will be a greater proportion of vehicles on the road, which may in turn produce a greater proportion of greenhouse gas emissions that will be released into the atmosphere (Tran:SIT, 2007). In order to alleviate climate change, there has been a suggested 50% to 80% reduction in carbon dioxide emissions by the year 2050 (De Jong et al., 2009). Furthermore, the increase of fuel efficiency in light motor vehicles has been considered as one of the most effective ways to assist in reaching this goal (De Jong et al., 2009).

Plug-In-HEVs may reduce air pollution emissions (De Jong et al., 2009). However, the use of Plug-in-HEVs may also place strain on the power grid as the world over petroleum levels are reaching critical stages (De Jong et al., 2009; Laughton, 2010). With reference to South Africa, the country is facing an over-extension of coal resources, which has been evident in the recurrent power failures that have occurred in the country recently (Sonnenberg, Erasmus & Donoghue, 2011; Rosnes & Vennemo, 2012). Thus, the use of electricity to power Plug-in-HEVs in South Africa would place even more strain on the existing limited coal resources. However, it has been suggested that if Plug-in-HEVs were to be widely adopted within the country, renewable energy resources such as solar and wind energy could be used as alternatives to electrical power. This would assist in reducing strain on power plants and almost drastically reducing air pollution emissions (De Jong et al., 2009).

1.2. Sustainable Technology

Morelli (2011, p. 6) defines environmental sustainability as "…a condition of balance, resilience, and interconnectedness that allows human society to satisfy its needs while neither exceeding the capacity of its supporting ecosystems to continue to regenerate the services necessary to meet those needs nor by our actions diminishing biological diversity." In this way, an environmentally sustainable technology may be considered technology that reduces the use of environmental resources as well as limits the effect that that technology has on the environment so as to maintain the quality and quantity of resources in the physical environment, thereby maintaining a level of balance with

the environment in which its organisms may thrive for now and in the future (Sutton, 2004). HEVs may be considered an example of a sustainable technology as they reduce fuel consumption and air pollution emissions thereby actively maintaining the quantity and quality of resources within the physical environment. The use and adoption of sustainable technology such as HEVs, may function as an effective means through which to assist in the alleviation of our reliance on limited power resources as well as actively assist in the reduction of air pollution emissions which are contributing to global warming. In this way, this study functions in determining the factors contributing to adoption and use of this sustainable technology within the South African context thereby helping to contribute to research within this area and thus assisting in the greater adoption of sustainable technologies, with their associated benefits.

1.3. Adoption and Constraints of Adoption

The benefits of sustainable technologies such as HEVs are evident, yet it is possible this may not be reflected in the marketplace. Thus, despite the environmental efficiency of these technologies, individuals may exhibit some reluctance in their intention to purchase and use these technologies.

Graham-Rowe, Gardner, Abraham, Skippon, Dittmar, Hutchins and Stannard (2012) have identified a number of constraints affecting the adoption of electric vehicles and hybrid electric vehicles. Their research suggests that individuals may not choose to use or adopt the technology as a result of the high initial purchase cost (Graham-Rowe et al., 2012). They also discuss how many individuals perceive the technology to produce a sub-standard driving experience, which is believed by the participants that were assessed, to induce greater safety risks (Graham-Rowe et al., 2012). Other individuals in the study perceived that the environmental benefits of the technology contributed to their adoption and use of the technology (Graham-Rowe et al., 2012).

Jongh, Ghoorah and Makina (2014) make reference to the South African situation and highlight factors that may function as barriers of technological adoption within the country. Specifically, the country is faced with poverty, poor education and low technological readiness (Jongh, et al., 2014). These factors inhibit technological adoption. Widespread poverty within the country means that there is a small market

for an expensive technology such as an HEV (Jongh, et al., 2014). Furthermore, poor education systems do not provide adequate knowledge of HEV technology, thereby limiting the comprehension of its benefits impinging on its use and adoption (Jongh, et al., 2014). Low technological readiness refers to how on a global scale, South Africa may be considered to have relatively low technological readiness and thus the implementation of new technologies such as HEVs may not be successful within the country (Jongh, et al., 2014).

Since 2010, South Africa has aimed to transition into a 'Green Economy', in which the country intends to develop green technologies and industries so as to reduce the impact that the country has on the environment (Kaggwa, Mutanga, Nhamo, & Simelane, 2014). The development of these technologies and industries also intends to create jobs within this sector (Kaggwa et al., 2014). In 2013, a carbon tax law was announced, and has been implemented since 1 January 2015 (Kaggwa et al., 2014). This tax law has various implications for individuals within the country. Specifically, this law determines that fuel prices for petrol and diesel will have an added tax, resulting in higher costs of these already expensive resources. In light of HEVs, this sustainable technology utilises lower fuel consumption, possibly making this technology appealing for use and purchase by South African consumers, who are concerned about this added fuel cost. Furthermore, some sustainable technologies within the country also have a rebate or cash incentives on the item's purchase (National Treasury, 2015). For example some sustainable technologies such as solar photovoltaic panels and various forms of renewable energy (solar, hydro and wind) have governmental rebates and cash incentives available when they are purchased (National Treasury, 2015). HEVs are thus a potential future source for governmental rebates/incentives. Consequently, this may increase their appeal to a potential South African user/purchaser, as this may function in reducing vehicle costs. However, it is necessary to mention that currently the initial cost of an HEV, for South African consumers, may be quite substantial and a great deal more money than conventional petrol or diesel fuelled vehicles (Jongh, et al., 2014). Thus, possibly impinging on their affordability for South African use and purchase.

If South Africa is to move towards a 'Green Economy' and greater adoption and use of sustainable technologies it is suggested that there be greater research and

development, particularly in terms of policies, within this area within the South Africa context (Kaggwa et al., 2014). Furthermore, the government needs to ensure the development of individuals with skills that will ensure the long-term sustainability and use of these technologies within the country (Kaggwa et al., 2014).

This study functions in fulfilling a gap within the previous research that has been conducted. It is apparent that previous studies have not investigated the constructs of the UTAUT model namely: Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions in relation to the moderators of Pro-Environmental Behaviour and Dispositional Resistance to Change in determining the Intention to Adopt HEVs.

1.4. Models and Theories of Technology Acceptance

The following will provide a description of the models and theories of which the UTAUT model is comprised and that the researcher regards as the most relevant in terms of what is being investigated in this study. The specific models that will be discussed in detail below include: Theory of Reasoned Action (TRA), Technology Acceptance Model (TAM/TAM2) and Diffusion of Innovation Theory (DOI). The UTAUT model has brought together these models, which function in addressing the limitations found in one another. Thus, collectively these models function in providing a more integrated and robust approach to understanding technology user acceptance.

1.4.1 Theory of Reasoned Action (TRA)

Fishbein and Ajzen (1975) developed the Theory of Reasoned Action (TRA) as a way in which to predict the future behaviour of individuals. The TRA is fundamentally comprised of constructs which function in the prediction of the most central determinant in the model - behavioural intention (Venkatesh, Morris, Davis & Davis, 2003). The two central constructs which function in predicting behavioural intention include: (1) Attitude Toward Behaviour and (2) Subjective Norm (Venkatesh, et al., 2003). Attitude Toward Behaviour describes an individual's opinion surrounding the completion of a specific action or behaviour (Fishbein & Ajzen, 1975). Subjective Norm refers to an individual's perception of others whom the individual considers of importance in the completion of specific action or behaviour (Fishbein & Ajzen,

1975). Furthermore, in order for an individual to have behavioural intention, the specific action or behaviour being conducted needs to be volitional and thus of the individual's own free will (Frymier & Nadler, 2013).

There has been much research conducted in support of the TRA in a number of different fields. These include the study of: food preferences (Ackermann & Palmer, 2014), gambling behaviour (Thrasher, Andrew & Mahony, 2011), emotion (Ul-Haque, Azhar & Ur-Rehman, 2014), business decisions (Southey, 2011) and domestic violence reporting (Sulak, Saxon & Fearon, 2014). In terms of sustainable technologies this model has also been applied in research, investigating green electricity (Lei, Jingxiao & Ruyang, 2011) and various sustainable products and technologies (Paul, Modi & Patel, 2016).

The theory is not without its limitations. It has been suggested that the theory is problematic in its assumption that behaviours are entirely volitional, as behaviours may also be controlled by certain systematic measures that are in place as well as non-motivational factors such as resources/opportunities that are accessible (Ajzen, 1991; Kurland, 1995) In addition, Ajzen (1991) indicates a limitation to this theory is in its description of the prediction of behaviours, as this theory does not clearly explain how attitude and behavioural intention are related.

1.4.2. Technology Acceptance Model (TAM and TAM2)

The Technology Acceptance Model (TAM) was created and developed by Davis (1989). This model extended further on constructs from the TRA, and was specifically conceptualised as a means through which to comprehend and predict acceptance and usage of technology within a job-related context (Venkatesh, et al., 2003). Davis (1989) describes two central constructs within this model that function in explaining and predicting acceptance and usage of a technology namely: (1) Perceived Usefulness (PU) and (2) Perceived Ease of Use (PEOU). Perceived Usefulness (PU) may be described as the extent to which an individual perceives that a technology or system may benefit or assist job performance (Davis, 1989). Perceived Ease of Use (PEOU) can be described as an individual's conceptualisation of a technology or system as being easy and simple to use (Davis, 1989). PEOU may be considered similar to the construct of self-efficacy, referred to in other technology

acceptance models (Bandura, 1977; Bradley 2009; Rogers, 2003). The TAM illustrates that PU is directly related to attitudes and behavioural intention in adoption of a technology (Bradley, 2009). PEOU is related to attitudes and PU (Bradley, 2009). This may be understood as the perception of usefulness of the technology may alter one's attitude and intention to adopt the technology and the perception of a technology's ease of use may also influence one's attitude towards the technology in terms of its perception of usefulness.

The TAM was expanded upon by Venkatesh and Davis (2000) and consequently the TAM2 model was developed. This expansion aimed to address the limitations of TAM by asserting greater explanatory power as well as illustrating the relationships between the constructs more explicitly (Bradley, 2009; Venkatesh & Davis, 2000). The TAM2 is comprised of additional variables namely: social influences and cognitive processes (Venkatesh & Davis, 2000). Social influences may include: subjective norms, voluntariness and image (Venkatesh & Davis, 2000). Subjective norms is the same construct found in the TRA and thus describes an individual's perception of others whom the individual considers of importance in the completion of specific action or behaviour (Fishbein & Ajzen, 1975; Venkatesh & Davis, 2000). Voluntariness refers to the free will an individual may have in making a decision (Venkatesh & Davis, 2000). Image describes the extent to which an individual may develop the intention to adopt a technology based on the individual's perception that doing so may enhance their status in society (Venkatesh & Davis, 2000). Cognitive processes may refer to the relevance of the job, the quality of the output, demonstration of results and the PEOU. This model functions in explaining a greater proportion of behavioural intention to adopt a technology (Bradley, 2009; Venkatesh & Davis, 2000). Job relevance determines the way in which an individual perceives the technology to be pertinent to one's work environment (Venkatesh & Davis, 2000). Output quality may be defined as the perception an individual may have about how a technology performs a specific task in the work environment (Venkatesh & Davis, 2000). Result demonstrability describes the tangible results of the technology (Venkatesh & Davis, 2000). PEOU is the same construct from TAM and thus illustrates an individual's conceptualisation of a technology or system as being easy and simple to use (Davis, 1989).

This model has been applied in much research in many different fields. This becomes evident in how it has been used to determine intention to adopt and use technologies such as the internet (Alshare & Alkhateeb, 2008; Garg & Garg, 2013), accounting systems (Abduljalil & Zainuddin, 2015), online games (Zhu, Lin & Hsu, 2012), social networking sites (Choi & Chung, 2013) and financial services (Wentzel, Diatha & Yadavalli, 2013), as well a sustainable technologies including sustainable infrastructure (Carlet, 2015) and solar panels (Vasseur & Kemp, 2015).

This model may also be considered limited in several aspects. The sample sizes for the investigation of this model were small, some of the subscales had very few items hampering reliability and normality, and this study was based on self-report data allowing for biases and thus impinging on validity (Venkatesh & Davis, 2000). In addition, as the model was developed for use in predicting acceptance and usage of technology within a job-related context, the generalizability and applicability of this model to other fields is questionable (Venkatesh, et al., 2003). As such, the research conducted in other fields may not be valid as the constructs measured may only be applicable to a work-related context.

1.4.3. Diffusion of Innovations Theory (DOI)

Rogers' Diffusion of Innovations Theory (DOI) illustrates a series of stages through which an innovation - a concept that is believed to be novel by the potential adopter, is actively communicated within a particular social system (Rogers, 2003). This communication functions in encouraging others to alter their current behaviours (Rogers, 2003). The diffusion process is primarily concerned with the communication of concepts, and not just messages in general (Rogers, 2003). In this way, the DOI illustrates the diffusion of novel concepts over a specific period of time, occurring within a specific social system (Rogers, 2003).

The diffusion process takes place through the communication between members of a particular social system (Ozaki, 2011). The members of a social system may consist of: individuals, groups, organisations as well as subgroups (Rogers, 2003). This theory functions in exploring the factors that contribute to the adoption of a technological innovation that take place though an analysis of a number of stages in which the technological innovation is adopted (Labay & Kinnear, 1981). Thus, this

theory shows how behavioural intention to adopt a technology occurs through a number of stages. Rogers (2003) depicts five steps in this innovation-decision process namely: (1) knowledge, (2) persuasion, (3) decision, (4) implementation and (5) confirmation. The 'knowledge' stage describes the individual or group's first contact with an innovation's existence (Rogers, 2003). The 'persuasion' stage occurs when the individual or groups acquire an attitude about the innovation that could be either positive or negative in nature (Rogers, 2003). The 'decision' stage is concerned with actions of the individual or group to make a choice to either adopt and implement or reject and not implement the innovation (Rogers, 2003). The 'implementation' stage occurs when the individual or group actively makes use of the innovation (Rogers, 2003). The last stage of the decision-process is 'confirmation' and refers to the individual or group's reflection on the choice to either adopt or reject the innovation (Rogers, 2003). Thus, the group or individual may decide that the appropriate or inappropriate decision was reached about the innovation (Rogers, 2003).

Rogers' second stage of the diffusion process, the attitude formation stage, is central in the adoption of the technological innovation (Ozaki, 2011). Rogers further clarifies this stage with a number of constructs that impact the extent of this adoption process within the social system (Ozaki, 2011). These constructs include the technological innovation's: (1) relative advantage, (2) compatibility, (3) complexity, (4) trialability and (5) observability (Rogers, 2003). Researchers have also included another construct, that of (6) 'perceived risk' to these adoption characteristics (Ozaki, 2011). 'Relative advantage' explains the degree to which the new innovation is believed to be more advantageous than any pre-existing innovations (Rogers, 2003). 'Compatibility' refers to extent to which the innovation correlates to the current requirements and values of the potential adopters (Rogers, 2003). 'Complexity' describes the extent to which the innovation is perceived to be challenging to comprehend and use (Rogers, 2003). The construct of 'trialability' refers to the extent to which the innovation may be tested within a limited period of time, prior to its adoption (Rogers, 2003). 'Observability' may be used to explain the degree to which that innovation may be visible to other individuals (Rogers, 2003). Furthermore, the construct of 'perceived risk' may describe the perceived probable economic and social losses resulting from the innovation (Labay & Kinnear, 1981). If an innovation

possesses these described characteristics, then the rate and extent of the adoption of the innovation will be increased (Rogers, 2003).

DOI had been used in many different fields in the understanding and prediction of change behaviours, including the fields of sociology, business, economics, education, health sciences as well as politics (Straub, 2009). This wide use of the theory across different fields may present a limitation to the theory as it becomes challenging to determine whether the theory and the studies undertaken hold the same applicability in the psychology field as it does in the other fields (Straub, 2009).

The DOI has been utilised in a number of diverse fields, within a range of varying contexts, which is reflected in the empirical studies that have been conducted. Research has been conducted using the theory to determine diffusion of innovations in terms of Web automatic teller machines (ATMs) in Nigeria and Taiwan (Olatokun & Igbinedion, 2009; Wang, Wu, Lin, Wang & He, 2013), a new health care practice in Quebec City, Canada (Guilbert, Robitaille, Guilbert & Morin, 2014), communication change in the United States (Kiddie, 2014), agricultural methods in Ethiopia (Weir & Knight, 2004) and e-business adoption in Malaysia (Luqman & Abdullah, 2011).

More specifically, there has been research conducted within the research sphere of environmentally sustainable technology. These sustainable technologies include: solar powered water heaters (Guagnano, Glenn, Hawkes, Acredolo & White, 1986; Labay & Kinnear, 1981), sustainable technologies (Gauthier & Wooldridge, 2012; Lewis & Cassells, 2010; Niemeyer, 2010), green electricity (Ozaki, 2010) and sustainable home appliances within the South Africa context (Sonnenberg, et al., 2011).

Knowledge about a technology could in turn also contribute to its successful adoption. Jacobsson and Bergek (2011) have illustrated how knowledge about the technology contributes to its successful adoption within a social system. They also reflect on the necessity of cohesion between the different social system elements in successful adoption (Jacobsson & Bergek, 2011). In this way, it becomes imperative for government and markets to work collaboratively in the implementation of policies

and access of knowledge, as this is associated with the adoption of technology (Jacobsson & Bergek, 2011).

This theory is comprised of a number of limitations. Bayer and Melone (1989) suggest that the construct of 'adoption' is imprecise, as it can only be operationalized to describe the binary occurrence of either the 'adoption' of an innovation or the 'non-adoption' of an innovation, therefore neglecting to account for 'partial adoption' of an innovation (Bayer & Melone, 1989). In addition, the 'pro-innovation bias' explains that this theory indicates that an innovation will be diffused and adopted, not rejected nor changed, within a social system (Kinnunen, 1996). In this way, this creates a limitation of the theory as this bias does not account for other variables that may prevent the diffusion process from taking place such as: ignorance about an innovation, rejection of an innovation, or re-invention of an innovation (Rogers, 2003). Also, Rogers' Diffusion of Innovations research also outlines results that are individual-focussed rather than social-system focussed (Larsen, 2005). In this way, the results of the Diffusion of Innovations research suggest that the non-adoption of the innovation occurs as a result of individual characteristics (Rogers, 2003). This is problematic as certain factors of the social system that may be influencing the individuals' non-adoption are not taken into account including: socio-economic conditions, culture and politics, which may function in jeopardising the validity of the research claims (Larsen, 2005).

1.4.4. Unified Theory of Acceptance and Use of Technology (UTAUT) Model

Venkatesh, et al. (2003) developed the User Acceptance and Use of Technology Model. This model is comprised of the central components of eight dominant technology user acceptance models. Thus, this model attempts to combine several acceptance and use of technology models to develop an integrated model that intends to account for varying perspectives of technology acceptance and use. This research focussed on those most applicable to the current research namely: Theory of Reasoned Action (TRA), Diffusion of Innovations Theory (DOI) and Theory of Planned Behaviour (TPB) (Venkatesh, et al., 2003).

Venkatesh, et al. (2003) have established five key constructs in the UTAUT model revealing technology user acceptance and user behaviours including: 'Performance Expectancy', 'Effort Expectancy', 'Social Influence', 'Facilitating Conditions' and 'Behavioural Intention'. Furthermore, Venkatesh, et al. (2003) have also identified a number of moderators of behavioural intention in this model namely: 'Gender', 'Age', 'Experience' and 'Voluntariness of Use'. However, for the purposes of this study, these moderators will not be discussed and only the key constructs will be investigated. This study will not have to determine whether these variables function as moderators, as these variables remain relatively consistent for the sample selected. The sample selected is relatively homogenous –it consists of participants in a similar age range, an almost equal representation of gender, with relatively the same level of driving experience and voluntariness of use.

1.5. Key Constructs of the UTAUT Model

Venkatesh, et al. (2003) illustrate the first construct of 'Performance Expectancy' as being the extent to which an individual perceives that the use of the technology will contribute to better performance. In terms of the current research, this construct may pertain to an individual utilising an HEV if the individual perceives that its use will contribute to increased driving and personal performance objectives. This construct is derived from a number of behavioural models namely: the construct of Perceived Usefulness from TAM/TAM2 and the construct of Relative Advantage from DOI (Venkatesh, et al., 2003). The second construct of the model, 'Effort Expectancy' is depicted by Venkatesh, et al. (2003) as the extent to which the technology may be perceived to be uncomplicated to use. In terms of intention to use HEVs, this construct refers to the effort that is perceived necessary to be expended for its use and the ease of its availability. This construct is derived from Perceived Ease of Use from TAM/TAM2 and Ease of Use from DOI (Venkatesh, et al., 2003). Venkatesh, et al. (2003) explain the third construct of 'Social Influence' as the extent to which an individual attributes significance to other individuals' perception of the use of the technology. In relation to the current study, this construct explains how positive perceptions and use of the technology by: fellow students, lecturers, friends, significant others, family and celebrities whose opinions may hold importance for the individual, may influence the individual to use the technology. This construct may have origins as Subjective Norm in TRA and TAM/TAM2 as well as Image in DOI

(Venkatesh, et al., 2003). The construct of 'Facilitating Conditions' may be understood as referring to the extent to which an individual may perceive there to be support systems in place in order to facilitate the use of the system (Venkatesh, et al., 2003). In terms of HEVs, this could be in terms of the technology being compatible with lifestyle resources and objectives. This construct arises from the behavioural model of DOI in terms of its construct Compatibility (Venkatesh, et al., 2003).

1.5.1. Behavioural Intention as Intention to Adopt

The construct of 'Behavioural Intention' is predicted by the four constructs of 'Performance Expectancy', 'Effort Expectancy', 'Social Influence' and 'Facilitating Conditions'. Behavioural Intention is not specifically defined by Venkatesh et al. (2003) in their development of the UTAUT model. However, Davis et al. (1989) define behavioural intention within the TAM model, from which this construct is derived. This construct may be defined as the extent to which an individual intends to perform a particular behaviour (Davis et al., 1989). This construct is central to this study as it specifically explores consumers' intention to use and/or purchase hybrid electric vehicles.

The UTAUT model is derived predominantly from the TAM model, which has been coined as the dominant technology acceptance model (Brown, Dennis & Venkatesh, 2010). The UTAUT was developed from the TAM through the addition of a number of moderators and the two constructs of Social Influence and Facilitating Conditions (Brown, Dennis & Venkatesh, 2010). The UTAUT model also encompasses other user technology acceptance models in trying to provide a collaborative model of technology user acceptance, has been previously discussed. A diagram of the UTAUT model and its associated constructs is provided in Figure 1, below.

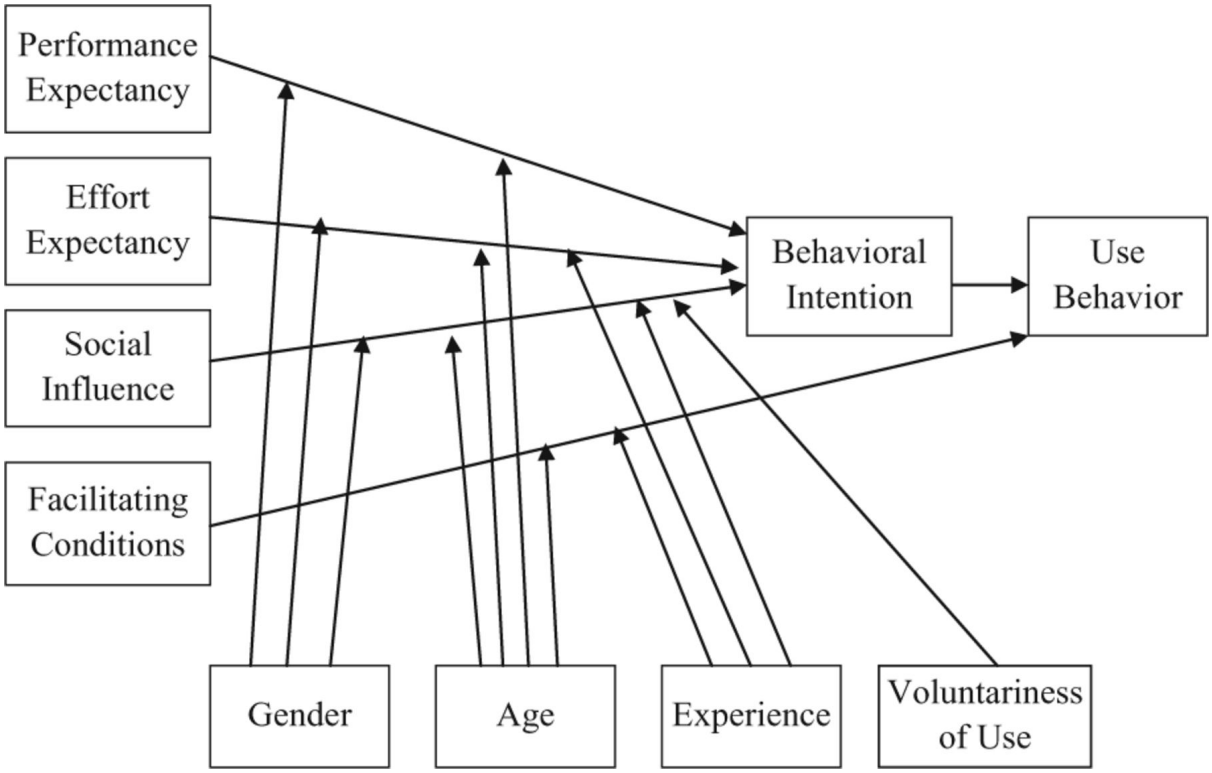


Figure 1: UTAUT Model

Previous research undertaken has made use of the UTAUT model to assess technology user acceptance and user behaviours in a number of different technologies. By way of illustration a small number of studies using the UTAUT model are reviewed here. Magsamen-Conrad, Upadhyaya, Joa and Dowd (2015) completed quantitative research in Ohio, United States, which investigated whether the constructs of the UTAUT model namely: Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions, functioned in predicting Behavioural Intention of tablet use. The results revealed that the UTAUT model constructs of Performance Expectancy and Facilitating Conditions were predictors of Behavioural Intention to use the technology (Magsamen-Conrad, et al., 2015).

Lin, Jan and Jin (2014) conducted quantitative research on 300 participants in Singapore, which aimed to determine Behavioural Intention to adopt instant messaging among university students according to the constructs of the UTAUT model including: Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions. The results of this study showed that the construct of

Performance Expectancy predicted Behavioural Intention to adopt instant messaging (Lin, et al, 2014).

Phichitchaisopa and Naenna (2012) completed quantitative research on 400 hospital employees in the provincial parts of Thailand. This research intended to investigate the Behavioural Intention of hospital employees to adopt healthcare information technology according the constructs of the UTAUT model including: Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions (Phichitchaisopa & Naenna, 2012). The results revealed that the constructs of Performance Expectancy, Effort Expectancy and Facilitating Conditions were significant predictors of Behavioural Intention to adopt and use healthcare information technology (Phichitchaisopa & Naenna, 2012). The constructs of Social Influence also predicted Behavioural Intention to use the technology (Phichitchaisopa & Naenna, 2012).

Alshehri, Drew, Alhussain and Alghamdi (2012) conducted quantitative research on 400 participants from Saudi Arabia. The research investigated Behavioural Intention of citizens to use e-government services according to the constructs of the UTAUT model including: Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions (Alshehri, et al., 2012). The results illustrated that the constructs of Performance Expectancy, Effort Expectancy and Facilitating Conditions were significant predictors of Intention to use the e-government services (Alshehri, et al., 2012).

More specifically, there has also been research undertaken that has made use of the UTAUT model to assess sustainable technology user acceptance and user behaviours. Malkani and Starik (2013) conducted quantitative research on 69 participants in Washington D.C., United States, which aimed to determine Behavioural Intention to adopt LEED and ENERGY STAR rated buildings according to the constructs of the UTAUT model including: Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions. The results revealed that the UTAUT constructs of: Social Influence and Effort Expectancy were significant predictors of Behavioural Intention of potential buyers to Adopt the green buildings (Malkani & Starik, 2013).

Cowan and Daim (2013) conducted research on the adoption and use of energy efficient LED lighting according to the UTAUT model constructs of: Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions. Social Influence and Facilitating Conditions were found to be significant predictors of user acceptance and use of the energy efficient technology (Cowan and Daim, 2013).

Hosun, Namyeon and Ohbyung (2015) carried out a study in which they explored HEV user acceptance and adoption of 402 participants in South Korea according to the UTAUT model constructs of: Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions (Hosun, et al., 2015). The results of the study showed that the constructs of Effort Expectancy and Social Influence were significant predictors of Behavioural Intention to use and Adopt HEVs (Hosun, et al., 2015).

Lekitlane (2015) carried out quantitative research on 114 employees, at a Law firm in Johannesburg, South Africa. The study specifically explored the participants' Behavioural Intention to Adopt sustainable carpets within the organisation according to the constructs of the UTAUT model namely: Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions, moderated by the variables of age and gender (Lekitlane, 2015). The results revealed that the constructs of Performance Expectancy and Facilitating Conditions predicted Behavioural Intention to Adopt the sustainable carpets within the organisation (Lekitlane, 2015).

Riga (2015) conducted quantitative research on 235 university students in Johannesburg, South Africa. This study investigated behavioural Intention to Adopt Hybrid Electric Vehicles (HEVs) according to the constructs of the UTAUT model including: Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions moderated by the variables of Aesthetic Appeal, Moral Justification and Environmental Concern (Riga, 2015). The results showed that the UTAUT model constructs were significant predictors of Intention to Adopt the HEVs (Riga, 2015). Furthermore, the results also illustrated that the construct of Moral Justification produced significant moderator effects between both the UTAUT model constructs of Performance Expectancy and Social Influence and Intention to Adopt HEVs (Riga, 2015). Social influence has been associated with sustainable technology adoption as it is related to increased self-identity and social-status in participants'

Intention to Adopt electric vehicles (Noppers, et al., 2014). These findings illustrate the influence of both pro-environmental behaviours and social influence on participants' Intention to Adopt sustainable technology.

The next section intends to explore whether the constructs of Pro-Environmental Behaviour (PEB) and Dispositional Resistance to Change (DRC) influence the relationship between the constructs of the UTAUT model including: Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions in terms of predicting the Intention to Adopt HEVs.

The researcher has added constructs to the UTAUT model in an attempt to account for the variance that is not explained by the variables in predicting Intention to Adopt as evident in the previous literature conducted (Alshehri, et al., 2012; Cowan & Daim, 2013; Hosun, et al., 2015; Lekitlane, 2015; Lin, et al, 2014; Magsamen-Conrad, et al., 2015; Malkani & Starik, 2013; Phichitchaisopa & Naenna, 2012; Riga, 2015; Venkatesh, et al., 2003).

The constructs of PEB and DRC were deliberately chosen by the researcher for use in this study as in previous literature the constructs of PEB and DRC were found to influence use and adoption of sustainable technologies. Thus, the researcher aimed to determine whether this would hold true for HEVs within the South African context. The relationships that the researcher intends to explore are evident in Figure 2, at the end of this chapter.

1.6. Pro-Environmental Behaviour

Kollmuss and Agyeman (2002) describe Pro-Environmental Behaviour (PEB) as "…behavior that consciously seeks to minimize the negative impact of one's actions on the natural and built world (e.g. minimize resource and energy consumption, use of non-toxic substances, reduce waste production)" (p. 240). Sawitri, Hadiyanto and Hadi (2015) expand on this definition of PEB by stating that PEB may also be considered behaviours, which aim to create an improvement in the quality of the natural environment. For the purposes of this study, it is hypothesized that those individuals with high scores on the Pro-Environmental Behaviour Scale will have a greater propensity for the use and adoption of HEVs.

Research previously undertaken has investigated PEB and the adoption of sustainable technologies. Schuitema, Anable, Skippon and Kinnear (2012) completed a study, which investigated the role of individuals' attitudes towards electric vehicles' attributes in their intention to adopt the technology, within the United Kingdom. This study determined whether individuals' who perceived themselves to be pro-environmental would perceive the electric vehicles' attributes positively and thus intend to adopt the electric vehicles (Schuitema, et al., 2012). The results of the study revealed that there was a strong, positive correlation between perceived PEB and the electric vehicle's attributes (Schuitema, et al., 2012). Further results showed that intention to adopt the electric vehicles was higher if their attributes were perceived positively (Schuitema, et al., 2012). Thus, the results suggest that perceived PEBs may lead to positive attitudes towards electric vehicles, which is related to individuals' intention to adopt the technology. Furthermore, Noppers, Keizer, Bolderijk and Steg (2014) conducted research on 109 participants from households in a city within Northern Netherlands (Noppers, et al., 2014). The researchers have identified that environmental attitudes have a direct, positive relationship to the intention to adopt electric vehicles.

Wolf and Seebauer (2014) performed a study that determined the characteristics of early adopters of electric bicycles in Austria. Electric bicycles may be considered to be a sustainable technology as they are more fuel-efficient than the conventionally fuelled motorcycle frequently used in this hilly terrain. The results of the study revealed that the adopters of the green technology had high pro-environmental values as measured by the New Environmental Paradigm Scale (Wolf & Seebauer, 2014). Thus, this study may show how adopters of a green technology and possibly those who intend to adopt a green technology may have higher PEB than those who do not intend to adopt the technology. Thus, these studies function in illustrating how in terms of HEVs, individuals who exhibit high PEB scores may have a more positive attitude contributing to greater use and adoption of HEVs. Furthermore, high PEB scores may also contribute to use and adoption of HEVs as those individuals who score high on this measure, may have personal environmental objectives that align with the use and adoption of this technology. Thus, the PEB construct functions as a moderator within this study between the constructs of the UTAUT model namely:

Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions and the construct Intention to Adopt, as a means in which to determine whether scores on this construct will strengthen the relationship between use and adoption of HEVs.

1.7. Dispositional Resistance to Change

Oreg et al. (2008) propose that Dispositional Resistance to Change is a construct, which describes individuals with high scores as those who are averse to initiating change and who may form negative attitudes towards situations of change. In terms of the current research being undertaken, the construct of Dispositional Resistance to Change may prove useful to investigate as HEVs are a novel technology and those who score high on this construct may be averse to the adoption of such a novel technology as it may present them with a change to the conventional ways in which a vehicle functions. Furthermore, high scorers on this construct may also form negative opinions about this novel technology thus preventing their adoption. Thus, this study intends to determine whether Dispositional Resistance to Change may moderate the effect of the UTAUT factors on the Intention to Adopt hybrid electric vehicles.

It has been suggested that this personality construct is comprised of four dimensions namely: 'routine seeking', 'emotional reaction', 'short-term focus' and 'cognitive rigidity' (Oreg et al., 2008). The dimension of 'routine seeking' may illustrate the manner in which individuals tend towards predictable situations and behaviours (Oreg et al., 2008). The dimension of 'emotional reaction' illustrates the psychological response of stress and discomfort to those situations involving change (Oreg et al., 2008). The dimension of 'short-term focus' may be used to explain the extent to which an individual may tolerate short-term disruptions as a way in which to avoid long-term changes (Oreg et al., 2008). The final dimension of 'cognitive rigidity' explains how an individual may be fixed in thoughts and ideas and uncompromising in altering these (Oreg et al., 2008). This scale may be useful in determining the extent to which individuals may be resistant in their intention to adopt technologies, thus this construct may moderate the Intention to Adopt hybrid electric vehicle technologies (Oreg et al., 2008).

Ozaki (2010) investigated the behaviours contributing to consumers' adoption of green electricity. The study made use of Rogers' Diffusion of Innovations Theory

framework. The results from the study illustrated that positive attitudes towards green electricity led to the intention to adopt it (Ozaki, 2011). This study reveals how a positive attitude about a specific technology formed from positive attitudes towards initiating change, may lead individuals to adopt a technology. Thus it may be suggested that negative attitudes towards novel technologies could lead to the non-adoption of the technology. Lane and Potter (2007) also propose that subjective psychological factors, particularly attitudes, play a role in the behaviour of technology adoption specifically in terms of vehicles. This study also illustrates the necessity of information and knowledge for users and adopters of a technology, as those individuals given accurate information about a technology may form a positive attitude towards it, knowing its potential benefits and uses. This accurate information and knowledge may in turn function in the use and adoption of the technology.

Sawang, Newton and Jamieson (2012) carried out research that investigated the role of the opposite construct to Resistance to Change, that being the construct of Openness to Change, in predicting the intention to adopt e-learning in students. The results showed that the construct of Openness to Change functioned in moderating the effect in predicting the students' intention to adopt e-learning (Sawang, et al., 2012).

Nov and Ye (2008) completed a study that measured whether the construct of Resistance to Change could be used to predict the perceived ease of use and related adoption of digital libraries in a North Eastern University, in the United States. The results of the study revealed that Resistance to Change was a negative, significant predictor of ease of use and its related adoption of the technology (Nov & Ye, 2008).

Sanford and Oh (2010) explored the role of the construct of Resistance to Change in the adoption of a mobile data service. The results illustrated that the construct of Resistance to Change had a significant, negative effect on the intention to use and adopt the technology (Sanford & Oh, 2010). Furthermore, the results also showed that Resistance to Change also had a significant, negative effect on the participants' ease of use of the technology (Sanford & Oh, 2010).

Egbue and Long (2012) conducted a study that assessed the acceptance and adoption of electric vehicles at a technological university in Missouri, United States. The

results showed that Resistance to Change and its associated failure to adopt the technology occurred when the technology was perceived to be unknown and foreign to the students (Egbue & Long, 2012). Harich (2010) suggests that Resistance to Change is the core of unsustainable behaviours of individuals within a society. Harich (2010) proposes that a way in which to challenge this Resistance to Change is to develop ways to alter individuals' attitudes towards sustainable behaviours.

Nov and Schecter (2012) carried out research which assessed electronic medical records (EMR) acceptance and adoption by physicians. This research was carried out on 72 physicians in a hospital in Munich, Germany (Nov & Schecter, 2012). The results revealed that the construct of Dispositional Resistance to Change negatively predicted perceived ease of use and perceived usefulness of the technology (Nov & Schecter, 2012).

In conclusion, this study intends to investigate the main variable of hybrid electric vehicles (HEVs) and how this variable relates to the constructs of the UTAUT model in relation to an individual's behavioural Intention to Adopt this sustainable technology. The UTAUT model has been contextualised and explained through a discussion of the theories of technology acceptance, which this model is comprised. In addition, the constructs of Pro-Environmental Behaviour (PEB) and Dispositional Resistance to Change (DRC) were discussed, in terms of their effects in individuals' behavioural Intention to Adopt HEVs. This chapter has contextualised the study's variables within a broader context of technology use and adoption literature and has successfully identified how the current study fulfils a gap within the existing literature, and that the aims and research questions of the current study logically arise.

1.8. Research Questions

- Do the theoretical constructs of the Unified Theory of Acceptance and User of Technology (UTAUT) model namely: 'Performance Expectancy', 'Effort Expectancy', 'Social Influence', 'Facilitating Conditions' predict Intention to Adopt hybrid electric vehicles?

- Does the construct of 'Pro-Environmental Behaviour' moderate the relationship between the theoretical constructs of the Unified Theory of Acceptance and User of Technology (UTAUT) model namely: 'Performance Expectancy', 'Effort Expectancy', 'Social Influence', 'Facilitating Conditions' in terms of the Intention to Adopt hybrid electric vehicles?

- Does the construct of 'Dispositional Resistance to Change' moderate the relationship between the theoretical constructs of the Unified Theory of Acceptance and User of Technology (UTAUT) model namely: 'Performance Expectancy', 'Effort Expectancy', 'Social Influence' and 'Facilitating Conditions' in terms of the Intention to Adopt hybrid electric vehicles?

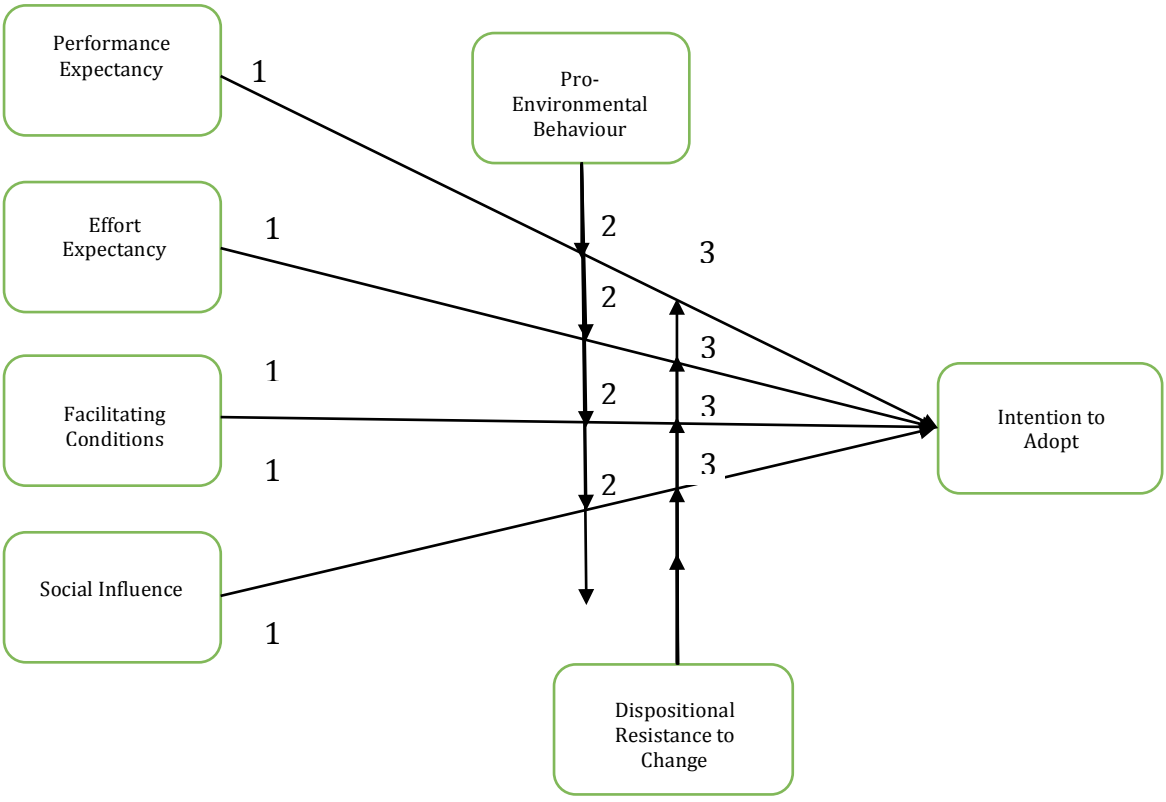


Figure 2: Adapted UTAUT Model

Chapter 2

Method

This chapter will function to discuss the method undertaken to investigate the variables used in the study. This chapter intends to illustrate the research design, the sampling and the procedure that have been utilised within this study. Furthermore, this study will present the instruments utilised to measure the variables within the study as well as provide a discussion of the statistical analyses that were utilised to answer the research questions. Also, the ethical considerations that the study has adhered to will be mentioned.

2.1. Research design

This study made use of a quantitative form of inquiry, as the study intended to investigate the relationships between specific variables. The relationship between the independent variables of: Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions and the dependent variable of: Intention to Adopt as moderated by the variables of Pro-Environmental Behaviour and Dispositional Resistance to Change were investigated.

The relationships between the variables were analysed using statistical analyses. These statistical analyses were devised from the data retrieved from the self-report, closed-ended questionnaires, which reflected the behavioural traits reported by the voluntary student participants on these scales. The results of these analyses were presented in the form of numbers. The quantitative form of inquiry was utilised as it allows for the researcher to objectively predict phenomena and generalise the results of her findings.

The research design utilised within this study is descriptive, non-experimental, cross-sectional, ex-post facto in nature. This research design arises as the study describes existing phenomena of the sample. Furthermore, this study may be considered as being non-experimental, as there is no random assignment or random selection of the sample from an entire population. Furthermore, the sample does not contain a control group and the independent variables are not manipulated. This study occurred at a specific point in time and investigated phenomena that had already occurred.

Specifically, this study intended to investigate the behavioural factors that underlie the intention to use and adopt the sustainable technology of an HEV through the adapted UTAUT model and how this interacted with the various moderators in order to explore the research questions discussed previously.

2.2. Sample and Sampling

The final sample for this study was comprised of 133 final year students in the School of Law of the Commerce Faculty at the University of the Witwatersrand. A different sample of final year students in the this faculty at same the university was utilised for the purpose of the pilot study, so as to ensure the pilot study was representative of the study population. There were 28 students who participated in the pilot study.

The Commerce Faculty was specifically chosen as previous research on the adoption of HEVs within this university, has assessed the Engineering and Psychology students (Riga, 2015). Thus, it was beneficial to conduct this research utilising a different sample, with different characteristics so as to build on previous research conducted and determine whether the statistical results previously found, held true for a different population.

A student sample has been selected, as final year students are of an age whereby they may be intending the purchase of a motor vehicle. In the following year they may be earning an incoming and a motor vehicle purchase is a viable consideration. Specifically, Law students were useful in this regard as after the completion of their degree, a paid internship usually ensues. Furthermore, a student sample may also be comprised of individuals who have purchased their first motor vehicle and may be considering the intention of a purchase of a more sophisticated and expensive motor vehicle as they move into their first year of work. In addition, the 'Generation Y' or 'Millennials', those born between 1980-2000s, may be considered more environmentally conscious and accepting of new products in comparison to older generations (Corodeanu, 2015; Kanchanapibul, Lacka, Wang & Chan, 2014). This generation also has powerful consumer behaviours with a greater income than previous generations (Kanchanapibul, et al., 2014). Thus it will be useful to determine

whether these pertinent generational characteristics influence the Intention to Adopt the sustainable technology.

The sample size of approximately 200 students was selected, so as to ensure that there would be a sufficient sample size to adequately conduct the statistical analyses. However, a smaller sample was collected than initially proposed and expected. This could be attributed to the interruptions of the lectures, during which the questionnaires were distributed and completed by the students. Lectures were interrupted as a result of the student protests during October and November 2015. After lectures resumed there was also a poor response rate to the research questionnaires, which could possibly be attributed to low morale of the students towards activities associated with the academic institution as well as presence of the impending examinations. Consequently, the researcher decided to complete the analysis with the smaller sample size.

The sample characteristics of the main study may be considered somewhat diverse. It is comprised of students who are relatively of a similar age. The sample consists predominantly of female and black participants. However, the age and race categories are represented from both genders and an array of different races. Furthermore, the sample also represents drivers who utilise different transmission types such as: petrol, diesel and HEV, with the majority making use of petrol transmission types. The demographics discussed are represented in more detail in the tables on the following page.

2.3. Descriptive Statistics

The demographic characteristics of the sample will be analysed by reporting on the descriptive statistics of data including: sample size, mean, standard deviation, range, minimum value, maximum value and Kolmogorov-Smirnov percentage values for each of the respective groups analysed within the sample. The Kolmogorov-Smirnoff test was run for each of the constructs assessed in the study and its associated percentage values are reported in the tables on the following page in order to illustrate these constructs' normality.

2.3.1. Age

The descriptive statistics for age are depicted in table 1 below and show a mean age of 22.82 with a standard deviation of 3.92, and a minimum age of 18 years old and a maximum age of 48 years old.

Table 1: *Descriptive Statistics for Age*

Mean	Standard Dev.	Minimum	Maximum	K-S p-value
22.82	3.92	18. 00	48.00	>0.05

2.3.2. Gender

Table 2 below reveals that the majority of the sample were female, with 89 participants (67%) and the remainder were male with 44 participants (33%).

Table 2: *Descriptive Statistics for Gender*

	N	%	K-S p-value
Male	44	33.00	>0.05
Female	89	66.9	>0.05
Total	133	100	>0.05

2.3.3. Race

The descriptive statistics for race shown in table 3 below, reveal that the majority of the participants were either Black (57.8%) or White (18.8%). The remainder of the participants were Indian (11.2%), Coloured (6.0%), Other (2.3%) or Asian (1.5%), revealing much lower representations of these races within the sample. The race category, Other, was added to allow for those participants who did not want to classify their race. The small proportion of this group indicated that the majority of the sample were comfortable with classifying their racial group.

Table 3: *Descriptive Statistics for Race*

	N	%
Black	77	57.80
Coloured	8	6.01
Asian	2	1.50
Indian	15	11.20
White	25	18.80
Other	3	2.30
Total	133	100.00

2.3.4. Self-Owning a Motor Vehicle

Most of the sample did not self-own a motor vehicle (56.3%), whilst some of the sample did self-own a motor vehicle (43.7%), as seen in table 4 below.

Table 4: *Descriptive Statistics for Self-Owning a Motor Vehicle*

	N	%	K-S p-value
Yes	58	43.70	>0.05
No	75	56.30	>0.05
Total	133	100.00	>0.05

2.3.5. Family-Owned Motor Vehicle

Table 5 below shows that nearly half of the participants, 71 students drove a motor vehicle owned by their family (53.3%) whilst, 62 (46.6 %) drove a car not owned by their family.

Table 5: *Descriptive Statistics for Driving a Motor Vehicle Owned by Family*

	N	%	K-S p-value
Yes	71	53.38	>0.05
No	62	46.61	>0.05
Total	133	100.00	>0.05

2.3.6. Access to a Motor Vehicle

Table 6 below reveals that the majority of the sample had access to a motor vehicle (82%), with a small proportion not having any access to a motor vehicle (18.0%).

Table 6: *Descriptive Statistics for Having Access to a Motor Vehicle*

	N	%	K-S p-value
Yes	109	81.95	>0.05
No	24	18.04	>0.05
Total	133	100.00	>0.05

2.3.7. Transmission Type

Table 7 below illustrates that those participants with access to a motor vehicle, mostly had access to those motor vehicles with petrol transmission (78.9%), followed by a small proportion of those who had access to motor vehicles with diesel transmission

(17.9%). Thus table 7 below shows that the sample consists of only 4 HEV-transmission type users (3.1%).

Table 7: *Descriptive Statistics for Motor Vehicle Transmission Type*

	N	**%**	**K-S p-value**
Petrol	101	78.90	>0.05
Diesel	23	17.96	>0.05
HEVs	4	3.12	>0.05
Total	128	100.00	>0.05

The sampling utilised within this study is a type of non-probability sampling as the sample selected is not random and the population is not completely known (Gravetter & Forzano, 2003). Specifically, this type of non-probability sampling may be considered a convenience sample as it is comprised of volunteer participants who were available and willing to complete the questionnaires (Gravetter & Forzano, 2003). The researcher was able to attain access to the students who attend the university that she attends. There is a limitation in convenience sampling as it allows for certain biases (Stangor, 2011). Volunteers have certain characteristics, which differ from the population as a whole. Thus, due to the non-random nature of the sampling method, it is difficult to make generalisations from the results of the study. It also becomes challenging to ascertain the reasons why some students participated in the study, whilst others did not and the differences that could be attributed to these two groups of students and the differences that they could contribute to the results of the research. Thus, this form of sampling does not allow for generalisations to be made about the sample to the population as a whole. However, this form of sampling does allow for time and cost benefits in the collection of research and thus functions as a suitable method to collect large proportions of participants for quantitative research studies.

2.4. Procedures

Prior to the data collection for the main study, the researcher carried out a pilot study in order to determine whether the scales were appropriate for measuring the desired constructs of the adapted UTAUT subscales and the adapted Pro-Environmental Scale. This pilot study was carried out approximately 1 month prior to the

commencement of the main study with 28 participants from the School of Law of the Commerce Faculty at the University of the Witwatersrand. The pilot study consisted of a trial of the various scales namely: the UTAUT Scale, the Pro-Environmental Scale and the Dispositional Resistance to Change Scale. These scales were assessed in order to determine whether they were reliable and valid for the main study.

The researcher initially obtained permission to obtain data for the study from the students through emailing, or contacting via telephone, the course coordinators within the School of Law. Once this permission had been obtained from the course coordinators, the course coordinators contacted the lecturers within the respective final year Law courses to express permission for the lecturers' students to participate in the study. The researcher then coordinated with the lecturers to distribute and collect the research questionnaires to volunteer students before or after the classes. The researcher waited until the questionnaires were completed and then collected them. These research questionnaires contained the participant information sheet, the participant consent form, the demographic questionnaire to complete, the adapted UTAUT Scale, the adapted Pro-Environmental Scale and the Dispositional Resistance to Change Scale.

Once the researcher had checked the reliability and construct validity of these scales, the main study was carried out, with a different set of students from the same faculty at the same university so to ensure that the study's validity was maintained. For the main study, the researcher completed the same procedure as that of the pilot study. The researcher ensured that the pilot study sample was different from the main study sample through ensuring that the questionnaires were distributed to different Law lectures to those in the pilot study. Furthermore, the researcher made an announcement prior to handing out the questionnaires, stating that only those students who had not previously filled in the questionnaires (for the pilot study) could fill in questionnaires at that time (for the main study), in order to ensure that a different sample was collected for those students taking both classes.

Once the response rate was substantial for statistical analyses and the researcher was unable to obtain any more completed questionnaires, the data collection was suspended. The completed questionnaires were coded manually and the data was

entered into the statistical program SPSS and the statistical analyses were run. After which the results from the analyses were reported and analysed.

2.5. Measures

The research questions that this study intended to explore lend themselves to a quantitative form of inquiry and thus a series of questionnaires were chosen as the most appropriate method in which to obtain data. Four separate scales were selected to obtain the appropriate data in order to answer the research questions namely: Demographic Questionnaire, the Adapted UTAUT Scale, the Adapted Pro-Environmental Behaviour Scale and the Dispositional Resistance to Change Scale.

2.5.1. Demographic Questionnaire

The demographic questionnaire was created by the researcher in order to determine the sample's demographic characteristics. It utilised close-ended questions in order to assess and describe the participants': age, gender, race, whether the participants had access to a motor vehicle and if so the transmission type of the motor vehicle. The options provided for the transmission type of motor vehicle included: petrol vehicle, diesel vehicle or hybrid electric vehicle (HEV). (Please refer to Appendix 2).

2.5.2. The Adapted UTAUT Scale

The UTAUT model was utilised in order to assess participants' Intention to Adopt the HEV technology according to the theoretical constructs presented in the model including: 'Performance Expectancy', 'Effort Expectancy', 'Social Influence', 'Facilitating Conditions' as well as 'Behavioural Intention'. The scale that this study made use of is one that is altered for the purposes of the study from the adapted UTAUT Scale developed by Riga (2015), who also looked at Intention to Adopt HEVs. The final scale adapted for use in the current study consisted of 26 items with subscales measuring different constructs of the model including: 'Performance Expectancy', 'Effort Expectancy', 'Social Influence', 'Facilitating Conditions' as well as 'Behavioural Intention'. The pilot study revealed poor internal consistency reliability for some of the subscales of the model and consequently the scale by Riga (2015) was adapted in order to ensure better internal consistency reliability for the main study.

As the UTAUT Scale was adapted for use in this study it is imperative to mention the psychometric properties of the Adapted UTAUT Scale. Riga (2015) has reported Internal Reliability Consistency in the form of Cronbach Alpha Coefficients for each of the subscales in her study, which ranged from unacceptable to acceptable reliability. It has been established that a scale with a value of 0.70-0.80 is considered to be an acceptable level of internal consistency reliability, whilst values lower than this indicate poor levels of internal consistency reliability, and may be considered unacceptable for use in statistical analyses (Cramer, 2003; Field, 2009). The Cronbach Alpha Coefficients for the subscales in the study completed by Riga (2015) included: 'Performance Expectancy'= 0.67, 'Effort Expectancy'=0.55, 'Social Influence'= 0.80, 'Facilitating Conditions'=0.58 and 'Behavioural Intention'=0.87. The internal reliabilities the constructs of 'Performance Expectancy', 'Social Influence' and 'Behavioural Intention' show how these scales are adequate for measuring the UTAUT constructs. However, the internal reliabilities for the constructs of 'Effort Expectancy' and 'Facilitating Conditions' indicate internal reliabilities that fall within an unacceptable range for use, indicating that these subscales require further development as suggested by Riga (2015). As such the adaptations made to the scale were implemented as discussed earlier in this chapter.

The researcher assessed the internal reliabilities for the UTAUT subscales from the pilot study. Prior to carrying out the main study, the UTAUT adapted scale was further adapted by the researcher for use in the main study. The pilot study for the current research study illustrated that the Performance Expectancy subscale had an unacceptable internal consistency reliability of -0.27. The Performance Expectancy subscale was thus adapted through the addition of four items and the removal of one item. The four new items included: "Using a Hybrid Electric Vehicle will lower my fuel consumption", "Using a Hybrid Electric Vehicle will reduce my impact on the environment", "Using a Hybrid Electric Vehicle will reduce toxic emissions to the environment" and "Using a Hybrid Electric Vehicle will give me similar driving power performance to a conventional combustion vehicle". The one original item of this sub-scale was also adjusted through the use of rewording in order to ensure the participants understood the items' wording. The item "Using a Hybrid Electric Vehicle will be more cost effective" was altered to "Using a Hybrid Electric Vehicle will help reduce my travelling costs over time". The item "Using a Hybrid Electric

Vehicle does not serve as a good alternative to general combustion vehicles" was removed and replaced with a more specified item that stated: "Using a Hybrid Electric Vehicle will give me similar driving power performance to a conventional combustion vehicle". This item was adjusted so that the specific feature of the HEVs' driving performance could be determined in terms of the participants' Intention to Adopt HEVs.

The pilot study for the current research also illustrated that the Effort Expectancy subscale had poor internal consistency reliability of 0.45. Consequently, some items of the Effort Expectancy subscale were also adjusted through the use of rewording in order for the participants to have greater understanding of the words used. These item changes included: "It would be easier to use a Hybrid Electric Vehicle than using a general combustion vehicle" was altered to "It would be as easy to use a Hybrid Electric Vehicle as using a general combustion vehicle", "Learning to use a Hybrid Electric Vehicle would not be easy for me" was changed to "Learning to use a Hybrid Electric Vehicle would be difficult for me", " There are lots of places where you can purchase a Hybrid Electric Vehicle" was reworded to state "Hybrid Electric Vehicles are readily available to purchase" and "My interaction with a Hybrid Electric Vehicle would not be simple and easily understandable" was changed to "My interaction with a Hybrid Electric Vehicle would be complex and difficult to understand". Items 8 and 11 were reverse scored in order to avoid response bias from occurring.

Riga (2015) suggested adding two additional items in order to improve the overall UTAUT Scale in further research. She suggested adding an item in order to measure whether participants believe that adopting a hybrid electric vehicle would cause a reduction in Greenhouse Gas Emission Tax Levy (Riga, 2015). The suggested item was added to the Facilitating Conditions subscale and stated "I would adopt a Hybrid Electric Vehicle due to a reduction in my Greenhouse Gas Emission Tax Levy". Furthermore, Riga (2015) also suggested that the inclusion of an item in order to measure whether celebrity adoption of the technology would result in increased adoption of the technology. The suggested item was also added to this subscale and states "I would use a Hybrid Electric Vehicle if celebrities I admire use it".

Riga (2015) also mentioned several improvements for items in future research in order to make the wording and phrases easily understandable for the participants. The changes were implemented within the pilot study of the current research. Consequently, two items of the Facilitating Conditions subscale were improved upon by adjusting the phrasing from "I will have personal control over whether or not I choose to access a Hybrid Electric Vehicle" to "I will have control over whether or not I choose to get a Hybrid Electric Vehicle" and the item "Using a Hybrid Electric Vehicle fits well with the way I like to live" was changed to "Using a Hybrid Electric Vehicle fits in well with my lifestyle". Furthermore, the wording of one of the items in the 'Facilitating Conditions' subscale was altered. The item "I would not adopt a Hybrid Electric Vehicle due to the availability of spare parts", was improved upon by changing the word of "availability" to "unavailability". The items numbered 20, 22 and 23 of the Facilitating Conditions subscale were also reverse scored in order to avoid response bias from occurring.

The pilot study of the current research depicted the internal consistency of the Behavioural Intention subscale as 0.80. As this subscale functioned as the dependent variable for the study, the researcher intended to increase the scales' internal reliability through the removal of one item from the Behavioural Intention subscale. The researcher then removed the item "My feelings towards using a Hybrid Electric Vehicle are not positive", as its removal was perceived to increase the subscales internal reliability. However, the removal of this item lowered the internal reliability to 0.70, which however can still be considered to have an acceptable level of internal reliability for use.

Each of the 26 items were measured on five-point Likert type scales, which ranged from '1=strongly agree' to '5=strongly disagree'. Participants had to choose one of the five options that they felt was most applicable to them (Please see Appendix 3 for sample features of the items). Given the importance of the "Behavioural Intention" subscale in measuring intention to adoption HEVs this study, it became important to acknowledge they this subscale is limited as it consists of only two scale items. However, the researcher accepted this limitation of the subscale as much research has been conducted using the scale previously (Alshehri, et al., 2012; Lin, et al., 2014;

Magsamen-Conrad, et al., 2015; Malkani & Starik, 2013; Phichitchaisopa & Naenna, 2012; Riga, 2015).

2.5.3. The Adapted Pro-Environmental Behaviour Scale

The Pro-Environmental Behaviour Scale provided a measure of PEB through determining the extent to which an individual believes that they have reduced the negative impact on the natural environment. This consists of eight items, with each item measured on a five-point Likert type scale. The five-point Likert type scale allowed each participant to select the one most applicable item from the scale which ranged from '1=Never', '2=Rarely', '3=Sometimes', '4=Often', 5=Very Often'.

The construct of 'Pro-Environmental Behaviour' was assessed with statements indicating behavioural-actions that participants may have completed in the last year including: "Looked for ways to reuse things", "Recycled newspapers", "Recycled cans or bottles", "Encouraged friends or family to recycle", "Purchased products in reusable or recyclable containers", "Picked up litter that was not my own", "Composted food scraps" and "Conserved gasoline by walking or bicycling". The wording of final items was adapted to a South African context, as the word "petrol" is more frequently used in the South Africa context than the word "gasoline".

Furthermore, items 2 and 5 were reworded to allow for the avoidance of response biases. Item 2 "Recycled newspapers" was changed to "Did not recycle newspapers" and item 5 "Purchased products in reusable and recyclable containers" was altered to state "Did not purchase products in reusable and recyclable containers". These items were also reverse scored in order to prevent response biases.

Milfont, Duckitt and Wagner (2010) reported fair internal reliability consistency as the Cronbach Alpha Coefficient for the scale was measured as 0.80. This internal reliability consistency shows how the scale is adequate for measuring the PEB construct. Within a South African context this scale had acceptable levels of internal reliability consistency as the Cronbach Alpha coefficient was measured as 0.72 (Milfont et al., 2006). This scale has also been utilised in a number of other papers in various geographical contexts (Schultz, Zelezny & Dalrymple, 2000; Schultz et al.,

2010). The internal reliability consistency for the current study was measured as 0.70, thus it can be considered acceptable for use in the current study.

2.5.4. Dispositional Resistance to Change Scale

This measure assesses the level of an individual's Dispositional Resistance to Change through the assessment of four theoretical constructs namely: (1) 'routine seeking', (2) 'emotional reaction' (3) 'short-term focus' and (4) 'cognitive rigidity' (Oreg et al., 2008). This scale consists of 17 items and is measured on a six-point Likert type scale that ranges from "1=Not like me at all" to "6=Very much like me". The construct of 'Routine Seeking' was measured with items such as "I like to do the same old things rather than try new and different ones". The construct of 'Emotional Reaction' was measured with items including "When I am informed of change plans, I tense up a bit". The construct of 'Short-term Focus' was assessed with items such as "Often I feel a bit uncomfortable about changes that may improve my life". The construct of 'Cognitive Rigidity' was measured with items such as "Once I've come to a conclusion, I'm not likely to change my mind". The internal reliability for the scale across the seventeen nations were all reported as high. These included the following: "Australia=0.82", "China=0.85", "Croatia=0.84", "Czech Republic=0.86", "Germany=0.77", "Greece=0.72", "Israel=0.85", "Japan=0.75", "Lithuania=0.77", "Mexico=0. 79", "Netherlands=0.85", "Norway=0.84", "Slovakia=0.79", "Spain=0.81", "Turkey=0.77", "United Kingdom=0.78" and "United States=0.83". The mean internal reliability was reported as "M=0.80". This internal reliability consistency shows how the scale is adequate for measuring the Dispositional Resistance to Change construct in other contexts.

The current study measured on a South African sample revealed internal reliability consistency of 0.85, thus indicating high reliability consistency and within the acceptable range for measuring the Dispositional Resistance to Change construct within this context.

2.6. Data Analysis

Due to the quantitative nature of the data collected, statistical analyses were performed in order to examine data obtained from the questionnaires. The statistical analyses were performed using the SPSS Statistics software package, version 22.

2.6.1. Pilot Study

After the data had been collected for the pilot study, analyses of the psychometric properties were conducted in order for the researcher to determine the reliability of the scales used and whether these scales were appropriate for use in the main study. The internal consistency reliability of the scales used, were assessed through the running of statistical tests to produce Cronbach Alpha Coefficients for these scales. Cronbach Alpha Coefficients are a statistical value, which ranges from 0 to 1 (Cramer, 2003). It has been established that a scale with a value of 0.80 is considered to display high internal consistency reliability (Cramer, 2003). The internal reliability consistencies were determined for the Adapted UTAUT Scale (See Appendix 3), the adapted Pro-Environmental Behaviour Scale (See Appendix 4) and the Dispositional Resistance to Change Scale (See Appendix 5). The results revealed that the internal reliability consistencies scores for some of the scales and subscales were unacceptable for use and thus required improvements for use in the main study. The internal reliabilities and the associated changes made to the scales are discussed in more detail in the Results Chapter of this research report.

2.6.2. Main Study

2.6.2.1.Descriptive Statistics

As a result of the quantitative nature of the data collected the researcher ran descriptive statistics and primary analyses in order to determine and describe the demographic characteristics of the sample. The descriptive statistics that were run included the: means, standard deviations, ranges, minimum values, maximum values and Kolmogorov-Smirnov percentage values to assess normality for each of the respective groups analysed within the sample.

2.6.2.2.Assumptions

Prior to the analysis of the data and choice of statistical test, it was necessary to determine whether the data met the required assumptions for parametric tests. The data was devised from closed-ended, self-report questions from the questionnaire and thus was interval scale in nature.

2.6.2.3. Normality

The normality of the data was determined through the running of the Kolmogorov-Smirnoff test. The p-values for the constructs assessed in the study were considered normal, as the percentage values for the test were less than 0.05%. As the Kolmogorov-Smirnoff test has a high degree of sensitivity, histograms were also assessed to determine the normality of the data.

The researcher's analysis of the histograms revealed that data was symmetrical and thus sufficient to conduct further analyses. Once the normality of the data was assumed, statistical tests were chosen in order to investigate the research questions. The statistical tests of multiple regression and moderated multiple regression were chosen by the researcher as the most appropriate statistical analyses to investigate the research questions. A number of assumptions were required for multiple regression and moderated multiple regression. These were carried out by the researcher.

2.6.2.4. Homoscedasticity

This assumption refers to the equal variance for each of the predictor variables (Field, 2009). Homoscedasticity for regression and multiple regression analyses were analysed through an assessment of the residuals on a scatterplot. The residuals formed a rectangular shape falling within the centre of the graph, residual values fell within the normal standard deviation range of +1 and +3, indicating equal variance for the variables assessed and consequently the assumption of homoscedasticity was met (Field, 2009).

2.6.2.5. Multicollinearity

Multicollinearity is high correlation between independent variables. This is identified through assessment of the correlation matrix in order to determine whether there are high correlations between the independent variables, this being correlations that were >0.80 and >0.90 (Field, 2009). The Variance Inflation Factor (VIF) is a value used to determine multicollinearity between variables (Field, 2009). If this value >10, this is an indicator of high multicollinearity (Field, 2009). From the correlation matrix presented in table 12, found in the Results Chapter, it is evident that none of the independent variables are highly correlated, thus indicating no presence of

multicollinearity. However, the VIF values were found to be >10 when the moderators were added to the regression model, thus indicating the presence of high multicollinearity, which is evident from the data in tables 8 and 9 below. In this way, the results and their interpretation presented should be treated with caution.

Table 8: VIF Values for Variables of Moderated Regression Analysis Predicting Behavioural Intention to Adopt (PEB)

Predictor	**Step 1**	**Step 2**	**Step 3**
	VIF	**VIF**	**VIF**
PE	1.31	1.31	65.34
EE	1.40	1.41	48.35
SI	1.22	1.23	42.09
UTAUT_LIFESTYLE	1.16	1.17	49.53
UTAUT_TAXLEVY	1.42	1.44	52.99
PEB		1.08	88.14
UTAUT_LIFESTYLE XPEB			94.19
UTAUT_TAXLEVY XPEB			80.28
PEXPEB			138.25
EEXPEB			147.09
SIXPEB			64.65

Table 9: VIF Values for Variables of Moderated Regression Analysis Predicting Behavioural Intention to Adopt (DRC)

Predictor	**Step 1**	**Step 2**	**Step 3**
	VIF	**VIF**	**VIF**
PE	1.301	1.31	29.28
EE	1.40	1.41	18.37
SI	1.212	1.23	28.99
UTAUT_LIFESTYLE	1.16	1.16	18.62
UTAUT_TAXLEVY	1.42	1.45	26.22
DRC		1.08	35.35
UTAUT_LIFESTYLE XDRC			30.14
UTAUT_TAXLEVY XDRC			52.07
PEXDRC			70.57
EEXDRC			64.78
SIXDRC			49.42

2.6.2.6. Multiple Regression

Multiple linear regression analyses were utilised in order to investigate the first research question and determine whether the independent variables of Performance

Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions predicted Intention to Adopt HEVs.

2.6.2.7. Moderated Multiple Regression

Multiple moderated linear regression analyses were used order to investigate the second and third research questions. Baron & Kenny (1986) suggest that moderation is present when there is a change evident in the independent and dependent variables, as a result of the added moderators. Furthermore, Baron & Kenny (1986) illustrate how moderation is evident through an interaction between the independent and the dependent variables, which is reflected in the simple effects of the independent variable on the different levels of the moderator. As such these analyses specifically aimed to determine whether the independent variables and the dependent variable of Intention to Adopt HEVs were moderated by the constructs of Environmental Efficacy and Dispositional Resistance to Change (Huck, 2012).

2.6.2.8. Ethical Considerations

There exist a number of ethical standards that had to be ensured throughout the research process in order for the research conducted by the researcher to be considered ethically sound in nature.

The researcher initially obtained ethical clearance from the Non-Medical Human Research Ethics Committee, which illustrates that the proposed research project adhered to ethical standards (Please refer to Appendix 6).

The anonymity and confidentiality of the participants was secured (Kitchener, 2000). The researcher strictly ensured the anonymity and confidentiality of the participants throughout the research process including both the pilot and main study. Anonymity was maintained, as the researcher was unaware of the identity of participants who participated in the study. The confidentiality of the participants was assured, as the questionnaires did not contain any identifying information (excluding the demographic information) and only aggregated data were reported.

When the data collection process was completed, the researcher stored the data from the pilot study and the main study on a password-protected Excel document on a

password-protected computer. The researcher and her supervisor were the only individuals who had access to this information. The hardcopy data were stored in a locked cupboard at the university.

The researcher ensured that the participants were not harmed during the data collection process (Kitchener, 2000). The questionnaire items were comprised of close-ended questions, which did not involve probing answers. Thus, the participants were not psychologically harmed during the research process.

Furthermore, the researcher ensured that she attained informed consent from the participants (Kitchener, 2000). Prior to the administration of the questionnaire the participants were given an information sheet and consent was assumed with the completion of a questionnaire. The researcher explained to the participants the nature and aims of the study through the participant information sheet (Kitchener, 2000). The length of time required to complete the questionnaire, in this case approximately twenty minutes, was also included in the participant information sheet. The participants were also made aware that their participation was voluntary and that they had the right not to participate in the study should they wish not to do so and that they could withdraw from the study once the research process had commenced (Kitchener, 2000). They were also informed that the results from the study would be published in a research report and could also be used in other research activities such as publications and conference presentations. The researcher also ensured that the participants understood the information expressed in the participant information sheet and the researcher's contact details were provided for participants to be able to ask questions, should any further questions arise (Kitchener, 2000). By submitting the questionnaire, the participants' consent was assumed (Kitchener, 2000). Furthermore, within the participant information sheet, the participant was also informed that upon their request, they could receive a summary of the study results once it is written up and completed (Kitchener, 2000). In this way, the informed consent of the participants was attained.

Chapter 3

Results Chapter

The following chapter will provide the results of the study through the presentation and analysis of the statistical analyses conducted. The statistical analyses of this study were conducted through the use of SPSS Statistics software package, version 22.

This chapter will begin with a discussion of the internal consistency results found in the pilot study and will compare these to those internal consistencies found in the main study. A discussion of the changes in these internal consistencies evident will also be provided. The internal consistencies will also be presented for the instruments used in the study. Further analyses will also be presented in order to illustrate the relationship between the different variables in the study namely: multiple regression analyses and moderated multiple regression analyses. The results of these analyses will also be outlined and discussed.

3.1. Abbreviations of main variables for statistical analyses

A key of the abbreviated main variables has been provided in table 10 below and may be used to refer to when necessary, in order to allow for ease of reading of the statistical tables in which there was limited space for information.

Table 10: *Summary of Abbreviation for Key Variables*

Variable	Abbreviation
Performance Expectancy	PE
Effort Expectancy	EE
Social Influence	SI
Facilitating Conditions	FC
Behavioural Intention to Adopt	BI
Pro-Environmental Behaviour	PEB
Dispositional Resistance to Change	DRC

3.2. Pilot Study

The pilot study was conducted in order to assess whether the scales including – the UTAUT Scale, the Pro-Environmental Behaviour Scale (PEB) and the Dispositional Resistance to Change Scale (DRC) would be reliable for use in the study, as these

scales were adapted. Table 11 illustrates the change in internal reliabilities present in the pilot study and the main study. The internal consistency reliability of the scales was assessed through the running of statistical tests to produce Cronbach Alpha Coefficients for each of these scales. Cronbach Alpha Coefficients are a statistical value, which ranges from 0 to 1 (Cramer, 2003). It has been established that a scale with a value of 0.70-0.80 is considered to have an acceptable level of internal consistency reliability, whilst values lower than this indicate poor levels of internal consistency reliability, and may be considered unacceptable for use in statistical analyses (Cramer, 2003; Field, 2009).

Table 11 illustrates that there are changes evident between the pilot study conducted and the main study conducted. This may have occurred due to the changes made in the scales/subscales in an attempt to create better internal consistency reliability for the scales in the main study.

There were a number of changes used in the pilot study in preparation for the main study analysis. The changes in the subscales have attributed to the different reliability estimates in the table below. Three items (numbers 3-6) were added to the Performance Expectancy subscale which allowed for the internal consistency reliability to be improved from an unacceptable reliability of -0.27 in the pilot study to a good reliability of 0.84, which was within an acceptable range for use within the analysis.

The items 7, 9 and 10 were removed from the Effort Expectancy subscale in the pilot study, which improved the internal consistency reliability from 0.45 in the pilot study, to 0.62 in the main study. The improved Cronbach Alpha Coefficient indicates improved internal consistency reliability, however this reliability estimate may still be considered somewhat poor for use in the analysis.

The Social Influence Subscale had improved Cronbach Alpha coefficients of 0.74 in the pilot study to 0.87 in the main study. These improved internal reliability consistency estimates indicate a greater internal reliability for use in the data analysis.

The Facilitating Conditions subscale was reduced from a seven-item scale in the pilot study to a three-item scale with the removal of item numbers 20, 22, 23 and 24, in an attempt to remove skewed items from the subscale. However, the internal reliability coefficient of 0.67 for the pilot study was reduced with the omission of these skewed items and created an internal consistency of 0.56 in the main study. Thus, the internal reliability consistency of this subscale for the main study may be considered poor and unacceptable for use in the analysis.

Items 21 (LIFESTYLE) and 24 (TAXLEVY) are the items of the Facilitating Conditions subscale that were found to be significant predictors of Behavioural Intention to Adopt HEVs. Thus, these two items were treated as separate items within the regression model, as a way in which to determine whether these constructs were specifically moderated by the constructs PEB and DRC.

The Behavioural Intention to Adopt subscale was reduced from a three-item scale to a two-item scale and the internal consistency reliability was also reduced from a good internal reliability of 0.80 in the pilot study to an acceptable internal reliability of 0.70 in the main study.

The PEB scale is a standardised scale, thus no items were removed from the scale and the internal consistency reliability remained as 0.70.

The DRC scale had an increased internal consistency reliability of 0.74 in the pilot study to a better internal consistency of 0.85 in the main study, which indicates that this scale is acceptable for use in the analysis.

Table 11: *Internal Consistency Reliability for Scales/Sub-Scales in Pilot Study and Main Study*

Scale/Sub-Scale	N Items	Cronbach's Alpha Coefficient – Pilot Study	N Items	Cronbach's Alpha Coefficient – Main Study
PE	3	-0.27	6	0.84
EE	5	0. 45	2	0.62
SI	6	0. 74	6	0.87
FC	7	0.67	3	0.56
BI	3	0.80	2	0.70
PEB	8	0.70	8	0.70
DRC	18	0.74	18	0.85

Table 12: *Descriptive Statistics and Intercorrelations*

Variable	Mean	Standard Dev.	PE	EE	SI	PEB	DRC	LIFESTYLE	TAXLEVY	BI
PE	22.24	4.36	1							
EE	16.59	2.18	0.42**	1						
SI	14.41	4.53	0.07	-0.10	1					
PEB	28.59	4.36	0.10	0.05	0.15	1				
DRC	56.99	13.05	-0.04	-0.22	0.02	0.01	1			
LIFESTYLE	3.11	0.82	0.36**	0.35**	0.33**	0.21**	133	1		
TAXLEVY	3.38	0.95	0.16	0.25**	0.22**	0.15	133	0.27**	1	
BI	6.63	1.66	0.30**	0.21	0.54**	0.19	0.05	0.54**	0.37**	1

**=Significant

3.3. Multiple Regression

Once the assumptions were met for parametric testing, multiple linear regression analyses were conducted in order to determine whether the independent variables predicted the dependent variable of Intention to Adopt the HEVs (Huck, 2012). The results of the regression analysis revealed that the UTAUT constructs of Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions did not

predict Intention to Adopt HEVs as illustrated in Table 13). However, the individual constructs of LIFESTYLE and TAXLEVY within the Facilitating Conditions construct were significant predictors of Intention to Adopt. LIFESTYLE (**β**=0.87, $p<0.05$), TAXLEVY (**β**=0.39, $p<0.05$) and Intention to Adopt (R^2=0.36; $F_{5,125}$=13.90; $p<0.05$), which is evident in Table 13. The adjusted R^2 illustrates that 36% of the variance was explained by two of the six predictors, revealing that there was a strong positive relationship established by these two predictors as illustrated by the results in Table 13).

Table 13: Unstandardised Coefficients for Moderated Regression Analysis Predicting Behavioural Intention to Adopt (PEB without FC)

Predictor	**Step 1**	**Step 2**	**Step 3**
	B	**B**	**B**
PE	0.04	0.042	0.082
EE	-0.02	-0.01	0.60
SI	0.03	0.02	0.39
UTAUT_LIFESTYLE	0.86**	0.84**	0.37
UTAUT_TAXLEVY	0.39**	0.38	-1.00
PEB		0.03	0.45
UTAUT_LIFESTYLE XPEB			0.02
UTAUT_TAXLEVY XPEB			0.06
PEXPEB			-0.00
EEXPEB			-0.03
SIXPEB			-0.02
R^2	0.36	0.36	0.40
ΔR^2	0.36	0.36	0.40

3.4. Moderated Multiple Regression

In addition, moderated multiple regression analyses were conducted in order to investigate the second research question, and thereby assess whether the construct of Pro-Environmental Behaviour moderates the relationship between the independent variables and the dependent variable of Intention to Adopt HEVs. Initially, the interaction terms were created in order to determine the moderation effect of the construct in this research question. The results revealed that there was no moderation effect present for PEB as evident in Table 13. The interaction between Performance Expectancy and PEB (**β**=-0.00, $p>0.05$). Effort Expectancy and PEB (**β**=-0.03, $p>0.05$). Social Influence and PEB (**β**=-0.02, $p>0.05$). LIFESTYLE and PEB (**β**=0.00, $p>0.05$) and TAXLEVY and PEB (**β**=0.06, $p>0.05$) on the Intention to Adopt.

Furthermore, moderated multiple regression analyses were also conducted in order to investigate the third research question and thus to determine whether the construct of Dispositional Resistance to Change moderates the relationship between the independent variables and the dependent variable of Intention to Adopt HEVs. Once again, the interaction terms were created in order to determine the moderation effect of the construct in this research question. The results revealed that there was no moderation effect present for DRC as evident in Table 14. The interaction between Performance Expectancy and DRC (**β**=-0.00, p>0.05). Effort Expectancy and DRC (**β**=0.00, p>0.05). Social Influence and DRC (**β**=0.00, p>0.05). LIFESTYLE and DRC (**β**=-0.01, p>0.05) on the Intention to Adopt. However, analyses revealed that TAXLEVY and DRC were significant predictors on the Intention to Adopt (**β**=-0.01, p>0.05) , which is illustrated in Table 14. This accounted for 38.1% of the variance in Intention to Adopt (R^2=0.38; $F_{11,119}$=6.65; p>0.05) , which is evident from the data in Table 14).

Table 14: Unstandardised Coefficients for Moderated Regression Analysis Predicting Behavioural Intention to Adopt (DRC without FC)

Predictor	**Step 1**	**Step 2**	**Step 3**
	B	**B**	**B**
PE	0.04	0.04	0.26
EE	-0.02	-0.02	-0.25
SI	0.03	0.02	-0.02
UTAUT_LIFESTYLE	0.86**	0.86**	-0.02
UTAUT_TAXLEVY	0.39**	0.39**	1.23
DRC		0.00	0.01
UTAUT_LIFESTYLE XDRC			0.01
UTAUT_TAXLEVY XDRC			-0.01
PEXDRC			-0.00
EEXDRC			0.00
SIXDRC			0.00
R^2	0.36	0.36	0.38
ΔR^2	0.36	0.36	0.38

Chapter 4

Discussion Chapter

This chapter provides a discussion of the research questions proposed in relation to the results determined from the statistical analyses. This study specifically intended to investigate whether the theoretical constructs of the adapted Unified Theory of Acceptance and User of Technology (UTAUT) model including: 'Performance Expectancy', 'Effort Expectancy', 'Social Influence' and 'Facilitating Conditions' functioned to predict the Intention to Adopt sustainable technology specifically that of HEVs. Furthermore, this study also aimed to determine the moderating effects of the constructs 'Pro-Environmental Behaviour' and 'Dispositional Resistance to Change' in moderating the influences of the UTAUT variables in predicting the Intention to Adopt HEVs. This chapter will function as a discussion of the statistical analyses conducted in an attempt to investigate the predetermined research questions. This will be discussed with reference to the pilot study and the internal reliability coefficients obtained as well as with reference to the main study and multiple and moderated multiple regressions analyses that were conducted. The results outlined will also be discussed in relation to previous literature.

4.1. Discussion of Research Questions and Findings

4.1.2. Pilot Study and Main Study

Within this study, the pilot study functioned as a means through which to determine the appropriateness for use of the adapted UTAUT Scale, the Pro-Environmental Scale and the Dispositional Resistance to Change Scale. The appropriateness for use of these scales was assessed through the analysis of the internal reliability estimates for these scales. As the purpose of this pilot study was solely to determine the appropriateness of the scales, the pilot study made use of research questions and aims.

In the assessment of the internal reliability estimates for the adapted UTAUT subscales namely: Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions and Intention to Adopt, the Pro-Environmental Scale and the Dispositional Resistance to Change scale, it was determined that the internal consistency reliability coefficients ranged from poor to acceptable levels of internal reliability (-0.27 to 0. 73) (Cramer, 2003; Field, 2009).

The scales and the subscales used in the study consisted of items that varied in number. Some of the subscales had a relatively low number of items such as that of Performance Expectancy with three items in the pilot study and six items in the main study, Effort Expectancy with five items in the pilot study and two items in the main study, Social Influence with six items in both studies, Facilitating Conditions with seven items in the pilot study and three items in the main study and Behavioural Intention with three items in the pilot study and two items in the main study. The PEB Scale consisted of eight items. A scale with less than ten items may be considered to be a short scale (Corbetta, 2003). Thus, the low number of items of the subscales and scales discussed may have contributed to their associated low internal consistency reliability coefficients.

Furthermore, the range evident in these internal reliability scores of the subscales and scales may arise due to the wording or phrasing of the items. If the wording or phrasing is unclear to the participants, then misinterpretation of the items may occur. Misinterpretation may result in discrepancies between the range of the reliability scores of the different scales and subscales. As such, this may have resulted in different answers being provided by the participants as the questions were not understood as they were intended by the researcher. The researcher did consider the wording and the phrasing of the items and ensure that they aligned with the participant's knowledge and experiences. However, given the large range discovered between the scales and subscales after the analysis, it is apparent that the participants misunderstood some of the items presented in the questionnaire. As a result of the time constraints of the research project undertaken, the researcher was unable to carry out a second pilot study in order to check the participants' understanding of the revised questionnaire. However, if there were more time available, the researcher would have completed a second pilot study on the revised questionnaire.

4.1.2.1 Independent Variables Predicting Intention to Adopt

The first research question was investigated through the use of multiple regression analyses as a means through which to determine whether the independent variables namely: Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions predicted the dependent variable of Intention to Adopt.

The regression analyses revealed that the two items of the Facilitating Conditions independent variable namely LIFESTYLE and TAXYLEVY were positive, significant predictors of Intention to Adopt HEVs. This result suggests the external factors in place that facilitate the use of the HEV technology include: the compatibility of the HEV with the lifestyle of the participant as well as the anticipated reduction in vehicle expenses as the HEV would contribute to a reduced Greenhouse Gas Tax Levy.

These findings are considered in line with the previous literature conducted within the realm of sustainable technologies utilising the UTAUT model. Cowan and Daim (2013) carried out research on the adoption and use of the sustainable technology of LED lighting according to the UTAUT model. The results of their study also illustrated that the construct of Facilitating Conditions was a significant predictor of user acceptance and use of the sustainable technology (Cowan & Daim, 2013). Lekitlane (2015) conducted research, which explored the participants' behavioural Intention to Adopt sustainable carpets according to the constructs of the UTAUT model. The results also revealed that the construct Facilitating Conditions predicted behavioural Intention to Adopt the sustainable carpets within the organisation (Lekitlane, 2015). More specifically, Riga (2015) conducted investigating behavioural Intention to Adopt Hybrid Electric Vehicles (HEVs) according to the constructs of the UTAUT model. The results of her study showed that the UTAUT model constructs, including that of Facilitating Conditions, were significant predictors of Intention to Adopt the HEVs (Riga, 2015).

As Riga (2015) conducted research that also explored the use and adoption of the sustainable technology of HEVs and also had similar sample characteristics of the sample that was utilised within the current research, it becomes necessary to explore the differences within the research findings between the two studies. Riga (2015) illustrated that all the UTAUT constructs predicted Intention to Adopt the HEV technology, whereas the current study found two items of the Facilitating Conditions construct as predicting the adoption of HEVs. The smaller sample size within the current research study may have contributed to the results found in the current study.

The regression analyses illustrated that the independent variables of Performance Expectancy, Effort Expectancy and Social Influence had no direct significant effect on the dependent variable Intention to Adopt. This result suggests that: the performance of the vehicle in terms of driving performance and personal performance objectives, as well as the perceived effort of the HEVs use and the availability of parts as well as the positive perceptions of the technology by others did not function in predicting the Intention to Adopt HEVs.

These results could be attributed to a number of conditions. The performance of the HEV (Performance Expectancy) including its driving performance has been perceived by potential users and adopters as producing a sub-standard driving experience, thus attributing to lower use and adoption rates (Graham-Rowe et al., 2012). With reference to the South Africa context, there are barriers preventing effective technological adoption within the country. The country is rife with poverty and there is limited education related to new sustainable technologies, which translates to low technological readiness, thereby preventing effective technological adoption (Jongh, et al., 2014). The widespread poverty and limited sustainable technology information within the country translates to reflect a small market for an expensive technology such as an HEV (Jongh, et al., 2014). The education provided is limited in terms of knowledge about such technologies. Consequently, these factors translate to mean that there is limited information available about the way the technology functions, providing limited accurate perceptions of: how the technology functions (Performance Expectancy), the perceived effort of the technology's use and its availability (Effort Expectancy) as well as the creation of associated low positive perceptions thereby attributing to low positive social perceptions of the technology (Social Influence).

Research previously undertaken supports this argument, as previous research illustrates how subjective psychological factors, including attitudes, influence vehicle adoption (Lane & Potter, 2007). Ozaki (2010) investigated the behaviours contributing to consumers' adoption of green electricity. The results illustrated that positive attitudes about green electricity aided in the intention to adopt it (Ozaki, 2011). Ozaki (2011) reveals how a positive attitude towards a technology may lead individuals to adopt the technology and thus illustrates the necessity of information and knowledge for users and adopters of a technology, as those individuals given

accurate information about a technology may form a positive attitude towards it, due to their being aware of its potential benefits and uses, which may in turn contribute to the technology's use and adoption.

In terms of the current research, this can be reflected in how the sample may perceive the technology negatively as they are unaware of how it functions (Performance Expectancy) and how it is used (Effort Expectancy). Previous research has reflected that a barrier to adoption of HEVs can manifest in the lack of knowledge regarding the performance of the vehicle in terms of the distance it is capable of travelling without the necessity of recharging the vehicle (Performance Expectancy) as well as the availability of places where the vehicle could be recharged on a journey (Effort Expectancy) (Haddadian & Khodayar, 2015). Also, a younger age and poorer socio-economic status have been found to be barriers of adoption of HEVs (Chekima, Wafa, Igau, Chekima & Sondoh, 2016; Nayum & Klöckner, 2014; Plötz, Schneider, Globisch & Dütschke, 2014). Given that this sample is comprised of youth in South Africa, that may also fall within a lower socio-economic bracket, given that the sample is from a public academic institution, it is possible that these factors prohibit adoption as the technology may be too expensive to afford due to it being a generally more expensive vehicle to purchase than a general combustion vehicle (Plötz, et al., 2014).

4.1.2.2. Moderating Effects of Pro-Environmental Behaviour and Dispositional Resistance to Change

The second and third research questions were investigated by the researcher through the use of multiple regression statistical analyses so as to determine whether the constructs of Pro-Environmental Behaviour and Dispositional Resistance to Change had a moderating impact on the causal relationship found between the independent variables namely Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions on the dependent variable of Intention to Adopt.

The regression analyses illustrated that there was no moderating effect present between the variables of PEB and DRC on the Intention to Adopt HEVs. Thus, these results show how neither the direct effects of the moderator variables nor the

interacting effect of the moderator variables with the independent variables were significant predictors of Intention to Adopt HEVs in Step 2 and Step 3 of the multiple regression moderated analyses. These results suggest that those individuals who exhibit PEB behaviours, which are those behaviours, which aim to create an improvement in the quality of the natural environment, do not influence individuals' purchase of a sustainable technology such as an HEV. Furthermore, these results also suggest that the personality construct of DRC, which describes those individuals who are adverse to initiating change and who also form negative attitudes towards situations of change such the use and adoption of a novel technology of an HEV, does not influence the use and adoption of HEVs.

The results found in this study, are contradictory to research previously conducted. In terms of the construct PEB previous research has illustrated how pro-environmental behaviour assists individuals in perceiving electric vehicles' attributes positively, which in turn contributes to their intention adopt the electric vehicles (Schuitema, et al., 2012). Another study supports these findings as it has also shown how pro-environmental attitudes have a direct, positive relationship to the intention to adopt electric vehicles (Noppers, et al., 2014). These contradictory findings may arise from students possibly not perceiving HEVs to be considered as a sustainable technology. Previous research has illustrated how individuals did not adopt HEVs as they were dubious of its sustainability benefits its terms of the vehicle's use of electricity as a power source (Haddadian & Khodayar, 2015). Perhaps these results also hold true for the current study as electricity is becoming scarcer within South Africa due to the country's limited coal stores.

Furthermore, these findings may also arise as this scale could perhaps be considered a poor measure of PEB, as the PEB scale is comprised of only eight items, which may be considered a short scale thereby influencing its internal reliability (Corbetta, 2003). Although this scale did exhibit acceptable internal reliability for use, its few items may have impinged on the scales' effectiveness in measuring this construct.

With reference to the DRC construct, research has illustrated how the personality trait of Dispositional Resistance to Change was a negative, significant predictor of ease of use and its related adoption of the technology (Nov & Ye, 2008). Nov and Schecter

(2012) carried out research which assessed electronic medical records (EMR) acceptance and adoption by physicians. The results also illustrated how the construct of Dispositional Resistance to Change negatively predicted constructs associated with the technology use and adoption (Nov & Schecter, 2012).

The contradictory findings of the moderator variables evident in the current study can be attributed to the small sample size, which in turn led to more non-significant results in the statistical analyses and thus no evident moderation effect.

These contradictory findings may also be attributed to the students not perceiving the HEV to be novel in nature as the technology was released in the country a decade ago (Dijk, Orsato & Kemp, 2013). The present results discovered could also arise from the participants' perception that the HEV technology did not present unconventional and novel ways of vehicle functioning thereby not hindering their resistance in intending to adopt it. This in turn could have attributed to their being no moderating effect in their Intention to Adopt HEVs.

The contradictory findings could also be attributed to the nature of the sample, the sample is comprised of 'Millennials', who tend to exhibit be open and accepting of new technologies (Corodeanu, 2015; Kanchanapibul, Lacka, Wang & Chan, 2014). In this way, the sample may be comprised of individuals who are low on the construct of DRC and thus no moderating effect was present in predicting Intention to Adopt HEVs.

4.3. Practical and Theoretical Implications

The results determined in the research study have a number of theoretical and practical implications. This study has implications for those who intend to replicate the study or expand on the research conducted in future research within the area of sustainable technology adoption as well as for the motor industry within South Africa as well as worldwide.

The findings of the current study provide support for the use of the UTAUT model in predicting Intention to Adopt sustainable technology. This has implications for future studies, as this model may be considered a viable means through which to predict

Intention to Adopt sustainable technologies. Thus, this model will allow for future research within the sustainable technology field to build on the current findings and explore adoption behaviours further. In terms of the current study, the results illustrated that the model predicted Intention to Adopt for two items of the Facilitating Conditions construct. Further research should utilise a larger sample size, in order to establish more significant results in the analyses.

In terms of the Intention to Adopt the sustainable HEV technology, the results of the this study revealed that individuals will adopt the technology if there are specific facilitating factors in place, specifically whether the technology is perceived to be compatible with the other aspects of the individuals' lives as well as whether the technology provides benefits in the form of a lowered Greenhouse Gas Levy. These results are beneficial for future researcher as well as for the motor industry within South Africa. Future researchers may be able to build on the current findings through exploring the Facilitating Conditions construct further. This could be achieved through the addition of several items that further explore the lifestyle factors that could specifically contribute to Intention to Adopt HEVs, as this current study utilised one general item about participant lifestyle to investigate this.

In terms of the motor industry in South Africa, the current findings are important as they reveal an avenue that can be utilised by the motor industry and government in aiding the adoption of sustainable technologies, which could in turn function as a possible means of aiding the global climate change issue. The benefits of sustainable technologies such as HEVs are evident, however this may not be reflected in the current marketplace as individuals exhibit reluctance in their Intention to Adopt such technologies. Within South Africa with poor education and low technological readiness prove to be inhibiting factors (Jongh, et al., 2014). The South African government can promote the adoption of sustainable technologies through spread of knowledge about the technology, perhaps through educational advertising programmes and incentives campaigns as well as fund greater research and development within the sustainable field (Kaggwa et al., 2014). This will allow for individuals within the country to perceive the benefits of the technology, determine the way that the technology is compatible with their lives as well as its Greenhouse

Gas Levy reduction benefits, thereby enhancing greater use and adoption of the technology.

4.4. Limitations

It is necessary to discuss the limitations of the research study conducted. The research design that was utilised within this study is non-experimental and cross-sectional in nature. Consequently, the researcher cannot determine causal conclusions from the results obtained in the study, as there is no random assignment nor random selection of the current sample from an entire population. Furthermore, the current sample does not contain a control group and the independent variables were not manipulated. As a consequence, causal conclusions cannot also be drawn as this study occurs at a specific point in time and investigates phenomena of HEV use that were currently occurring. In this way, this study might be improved upon through the carrying out of longitudinal studies, in which the independent variables can be measured over a period of time and causal relationships can be drawn from the results of the study, thereby providing greater support for use of technology as it is measured over an extended period of time. However, it should be mentioned in saying this that, the current research study specifically aimed to investigate the nature of the relationships between the different variables outlined and in this way, intended not to establish causal conclusions from the results.

The sample used in the study may pose several limitations. The sample size utilised for the statistical analyses was sufficient for the statistical analyses conducted. However, the sample sized utilised was a smaller sample than was initially proposed and expected. Consequently, the researcher decided to complete the study with the smaller sample size. This smaller sample size did impinge on the effectiveness of the statistical analyses, as some of the results were insignificant and perhaps could have shown stronger significant relationships if the sample size were to be larger. Consequently, the researcher could improve upon the study through further collecting a larger sample. However, due the time constraints of the completion of this research report, the researcher had to complete the study without the collection of new questionnaires and the rerunning of the analyses. Consequently, this research report could be carried out in the future by another researcher in order to investigate whether the relationships found hold true for a larger sample.

Also, the sample may provide a limitation in that it consisted of a convenience sample of students. This may be problematic, as the results drawn may not be considered generalizable to a broader population, in this case they may not be considerable generalizable to an actual workplace setting or to those individuals who are part of the real working world. The UTAUT Scale was specifically designed for application to a working class sample, however given this measure was acceptable for use in this study as this study specifically intended to investigate the factors influencing proposed usage of sustainable technology and not actual usage of the sustainable technology.

Furthermore, the sample utilised within this study may have other characteristics that are not generalizable and representative of broader populations. Specifically, volunteer sample candidates have the propensity to have personality characteristics that differ from the general population, as they tend to score highly on the traits of agreeableness and openness to experience (Dollinger & Leong, 1993). This may be problematic in terms of the current research study, which intended to determine factors that contribute to use and adoption of a sustainable technology. The personality characteristic of agreeableness may have led the participants to be more agreeable by stating their use and adoption of HEVs on the questionnaires. Furthermore, the personality trait of openness to experience may have led participants to be more open to adopting and using HEV on the questionnaires (Dollinger & Leong, 1993).

This sample is comprised of predominantly female, black participants from one academic course. This may also not provide a representative sample in the sense that female, black participants within this specific academic course may represent a specific class and hold a set of belief assumptions that may not be generalisable to a broader sample. Future research should thus ensure that the sample is more representative in terms of academic course, gender and race. Future research, should thus explore a broader range of students from a greater variety of academic courses. Furthermore, future research should also explore the broader population and move beyond students perhaps to organisations in order to measure a more representative sample in terms of gender and race. This is particularly necessary within the South

African context, as the South African society is diverse and thus a more representative sample is needed to more adequately express the beliefs and opinions of the population.

This study also made use of self-report questionnaires as the measure through which to determine HEV usage behaviour. This form of data collection presents a limitation in that it limits the participants to a fixed set of answers that is provided, which perhaps does not allow for usage behaviours to be fully understood. Thus, qualitative research could be a future means through which some of the results provided in this research report could be probed further to fully explore the factors underpinning potential usage behaviour of HEVs. Furthermore, this form of data collection method has the potential to change over time. Consequently, this future research conducted could perhaps make use of longitudinal studies with a more diverse sample population.

The scales utilised in this study including the scale and subscales of the UTAUT and the Pro-Environmental Behaviour Scale provide a limitation for this research study due to their low reliability coefficients found in the pilot study and for some of the subscales there are also low reliability coefficients evident in the main study. These poor reliability coefficients impinge on the consistency of measurement and the validity of associated results drawn from the study. Thus, these scales could be improved upon through revisions, perhaps making them more specific to the sample being assessed or alternatively a different scale should be utilised.

As this study specifically aimed to investigate the characteristics of existing phenomena in determining intention to use HEVs, the results drawn cannot be used to deduce causal conclusions. In this way, this study main need to be built upon in future research, in which causal conclusions can be deduced from the research conducted. In addition, this study is novel in the sense that it utilised the UTAUT Scale as a means to assess the intention of use of HEVs in particular, in this way it becomes challenging to situate this study within previous research and make conclusions based on the results drawn from the current study within a broader network of literature.

4.5. Directions for Future Research

The researcher would like to make recommendations for future research, which draws inspiration from the current research study. This study focussed on the investigation of HEV usage behaviour within a specific period of time which prevented causal conclusions being drawn from the result results. Future research should thus investigate HEV usage behaviours within longitudinal studies, so as to be able to deduce stronger support for actual usage and adoption behaviours from the results found. Consequently, this will in turn contribute to a broader body of literature considering sustainable technology usage and adoption.

A larger and more diverse sample would be beneficial to future research. This larger, more diverse sample could be comprised of a greater number of final year Law students as well as a sample those students from other academic spheres as well as non-students. This larger and more diverse sample could also extend to the workplace. This would allow for greater statistical validity through the meeting of the statistical criteria for sample size. Also, a more diverse sample would allow for a greater representation of the population and better generalizability of the results drawn.

Future research should improve upon the scales utilised in this study including the scale and subscales of the UTAUT and the Pro-Environmental Behaviour Scale, as these scales had low reliability coefficients, which impacted on the results drawn. Improvement to these scales could contribute to more reliable and valid results and perhaps greater relationships determined from the variables measures. These scales could be improved upon through certain revisions, which could involve making them more specific to the sample being assessed or perhaps a different scale should be utilised.

As the Facilitating Conditions subscale of the UTAUT Scale yielded significant results, it may be beneficial to revise this subscale of the UTAUT to include more items related to the specific lifestyle factors and the Carbon Dioxide Tax Emissions Levy, as future items within this construct may help to further explore reasons underpinning why consumers might choose to use a sustainable technology. In this instance, the use of an HEV would contribute to a lower Tax Levy and thus lead to a

lower accumulative cost of the vehicle. The use of the sustainable technology may also contribute to the purchase of the technology. Thus, the investigation into this construct, may contribute to the understanding of factors underpinning use and adoption of HEVs.

Also, the addition of other variables into the model may be useful in predicting Intention to Adopt HEVs. The variables of age, socio-economic status, education level, gender, driving experience and voluntariness of use, have previously moderated Intention to Adopt HEVs and thus may function as useful predictors that can be added to the model in future research (Chekima, et al., 2016; Nayum & Klöckner, 2014; Plötz, et al., 2014; Venkatesh, et al., 2003). This could be especially useful in future research consisting of a more heterogeneous sample. Given the poor internal reliabilities of the some of the subscales of the UTAUT Scale, another more robust scale might be a better option for use in future research.

Chapter 5

Conclusion

This research study aimed to investigate the relationship between the independent variables derived from the constructs of the UTAUT model namely: Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions and whether these variables were moderated by the variables of Pro-Environmental Behaviour and Dispositional Resistance to Change in the Intention to Adopt HEVs. This study provided a gap within the current literature as it sought to explore within the sphere of sustainable technologies, in which research within the South African context has been scarce. Furthermore, this research study also intended to determine the relationships between variables that have not yet been investigated in other research. Thus, this research was novel in nature and aimed to explore an understudied area, which can continue to build upon in future research.

The findings of this study revealed that two items of the Facilitating Conditions construct including: LIFESTYLE and TAXYLEVY were found to be positive, significant predictors of Intention to Adopt HEVs. Thus, the external factors that facilitate the use and adoption of the HEV technology include: the compatibility of the HEV with the lifestyle of the participant as well as the anticipated reduction in vehicle expenses due to a reduced Greenhouse Gas Tax Levy. Furthermore, the findings also show that there was no moderating effect present between the variables of PEB and DRC on the Intention to Adopt HEVs. This illustrates how high pro-environmental behaviours and high scores on the personality trait DRC, does not affect use and adoption of an HEV.

This research study intended to explore and explain the relationships between variables and was thus carried out at a single point in time. This does not allow for causal conclusions to be drawn from the results. Future research should thus build upon the current study and examine these variables over an extended period of time in a longitudinal analysis so that causal inferences can be drawn from the conclusions. Furthermore, future research should also adhere to the recommendations made by the researcher pertaining to the sample selected and the scales used. Also, as little previous research has been conducted within the sphere of the current study, it was

challenging to contextualize the current findings within a broader body of literature, thus impinging on the ability of the research to devise concise conclusions from the research study. This reflects on the necessity of future research to be conducted within the research area of the use and adoption of sustainable technologies, specifically HEVs, within the South African context.

Reference List

Abduljalil, K. M. & Zainuddin, Y. (2015). Integrating Technology Acceptance Model and Motivational Model towards intention to adopt accounting information system. *International Journal of Management, Accounting and Economics, 2,* 347-539.

Ackermann, C. L. & Palmer, A. (2014). The contribution of implicit cognition to the Theory of Reasoned Action Model: A study of food preferences. *Journal of Marketing Management, 30,* 529-550.

Alshare, K. A. & Alkhateeb, F. B. (2008). Predicting students usage of internet in two emerging economies using an extended Technology Acceptance Model (TAM). *Academy of Educational Leadership Journal, 12,* 109-128.

Alshehri, M., Drew, S., Alhussain, T. & Alghamdi, R. (2012, Dec). *The effects of website quality on adoption of e-government service: An empirical study applying UTAUT model using SEM*. Paper presented at the 23rd Australasian Conference on Information Systems, Deakin University, Australia.

Axsen, J., Bailey, J. & Castro, M. A. (2015). Preference and lifestyle heterogeneity among potential plug-in electric vehicle buyers. *Energy Economics, 50,* 190-201.

Bandura, A. (1977). Self-efficacy: Towards a unifying view of behavioral change. *Psychological Review, 84,* 191-215.

Baron, R. M. & Kenny, D. A. (1986). The moderator-mediator distinction in social psychological research: Conceptual, strategic and statistical considerations. *Journal of Personality and Social Psychology, 6,* 1173-1182.

Bayer, J. & Melone, N. (1989). A critique of diffusion theory as a managerial framework for understanding adoption of software engineering innovations. *The Journal of Systems and Software, 9,* 161-166.

Bradley, J. (2009). The Technology Acceptance Model and other user acceptance theories. In D. K. Yogesh, B. Lal, M. D. Williams, S. L. Schneberger & M. Wade (Eds.), *Handbook of research on contemporary theoretical models in information systems* (pp. 277-294). Hershey, PA: Information Science Reference.

Brown, S. A., Dennis, A. R. & Venkatesh, V. (2010). Predicting collaboration technology use: Integrating technology adoption and collaboration research. *Journal of Management Systems, 27,* 9-53.

Carlet, F. (2015). Understanding attitudes towards adoption of green infrastructure: A case study of US municipal officials. *Environmental Science & Policy, 51,* 65-76.

Chekima, B., Wafa, S. A.W. S.K., Igau, O. A., Chekima, S. & Sondoh, L. S. (2016). Examining green consumerism motivational drivers: Does premium price and demographics matter to green purchasing? *Journal of Cleaner Production, 112,* 3436-3450.

Choi, G. & Chung, H. (2013). Applying the Technology Acceptance Model to social networking sites (SNS): Impact of subjective norm and social capital on the acceptance of SNS. *Journal of Computer-Human Interaction, 29,*619-628.

Corbetta, P. (2003). *Social research: Theory, methods and techniques.* London, England: Sage.

Corodeanu, D. A. (2015). Consumer's protection from the generation Y's perspective. A review based on scenarios. *Procedia Economics and Finance, 20,* 8-18.

Cowan, K. & Daim, T. (2013). Adoption of energy efficient technologies: A review of behavioural theories for the case of LED lighting. In T. Daim, T. Oliver & J. Kim (Eds.), *Green Energy and Technology: Research and Technology Management in the Electricity Industry* (pp. 214-229). London: Springer.

Cramer, D. (2003). *Advanced quantitative data analysis*. Maidenhead, PA: Open University Press.

Daim, T., Oliver, T. & Kim, J. (2013). Adoption of energy efficient technologies: A review of behavioural theories for the case of LED lighting. In T. Daim & J. Kim (Eds.), *Research and Technology Management in the Electricity Industry: Methods, Tools and Case Studies*. (pp.229-249). London: Springer.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13,* 319-340.

Davis, F. D., Bagozzi, R. P. & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science, 35,* 982-1003.

De Jong, R., Ahman, M., Jacobs, R. & Dumitrescu, E. (2009). *Hybrid electric vehicles: An overview of current technology and its application in developing and transitional countries.* Report produced for United Nations Environment Programme (UNEP). Retrieved from: http://www.unep.org/transport/pcfv/pdf/hev_report.pdf.

Dijk, M., Orsato, R. J. & Kemp, R. (2013). The emergence of an electric mobile trajectory. *Energy Policy, 52,* 135-145.

Dollinger, S. J. & Leong, F. T. L. (1993). Volunteer bias and the five-factor model. *The Journal of Psychology, 127,* 29-36.

Draft Carbon Tax Law Bill for public comment. (2015). November 2, 2015. Pretoria: National Treasury. Retrieved, 1 December 2015, from http://www.treasury.gov.za/comm_media/press/2015/2015110201%20-%20Media%20Statement%20Carbon%20Tax%20Bill.pdf.

Egbue, O. & Long, S. (2012). Barriers to widespread adoption of electric vehicles: An analysis of consumer attitudes and perceptions. *Energy Policy, 48*, 717-729.

Field, A. (2009). *Discovering statistics using SPSS (3rd ed.)*. London, England: Sage.

Fishbein, M. & Ajzen, I. (1975). *Belief, attitude, intention and behavior: An introduction to theory and research.* Reading, MA: Addison-Wesley.

Frymier, A. B. & Nadler, M. K. (2013). *Persuasion: Integrating theory, research and practice (3rd ed.)*. Dubuque, IA: Kendall Hunt.

Garg, A. K. & Garg, D. (2013). An assessment of 3G internet service in Botswana: Technology Acceptance Model with social influence and price perception. *Pakistan Journal of Social Sciences, 33,* 47-60.

Gauthier, J. & Wooldridge, B. (2012). Influences on sustainable innovation adoption: Evidence from leadership in energy and environmental design. *Business Strategy and the Environment, 21,* 98-110.

Graham-Rowe, E., Gardner, B., Abraham, C., Skippon, S., Dittmar, H., Hutchins, R. & Stannard, J. (2012). Mainstream consumers driving plug-in battery-electric and plug-in hybrid electric cars: A qualitative analysis of responses and evaluations. *Transport Research Part A, 46,* 140-153.

Gravetter, F. J. & Forzano, L. B. (2003). *Research methods for the behavioural sciences.* Belmont, California: Wadsworth.

Guagnano, G., Hawkes, G. R., Acredolo, C. & White, N. (1986). Innovation perception and adoption of solar heating technology. *The Journal of Consumer Affairs, 20,* 48-64.

Guilbert, E. R., Robitaille, A. C., Guilbert, A. C. & Morin, D. (2014). Determinants of the implementation of a new practice in hormonal contraception by Quebec nurses. *Canadian Journal of Human Sexuality, 23,* 34-48.

Haddadian, G. & Khodayar, M. E. (2015). Accelerating the global adoption of electric vehicles: Barriers and drivers. *The Electricity Journal, 28,* 53-68.

Hannan, M. A., Azidin, F. A. & Mohamed, A. (2014). Hybrid electric vehicles and their challenges: A review. *Renewable and Sustainable Energy Reviews, 29*, 135-150.

Harich, J. (2010). Change resistance as the crux of the environmental sustainability problem. *System Dynamics Review, 26,* 35-72.

Hosun, Y., Namyeon, L., & Ohbyung, K. (2015). The role of digital knowledge richness in green technology adoption: A digital option theory perspective. *The Journal of Information Systems, 24,* 23-52.

Huck, S. W. (2012). *Reading statistics and research (6th ed.).* Boston, MA: Pearson.

Jacobsson, S. & Bergek, A. (2011). Innovation system analyses and sustainability transitions: Contributions and suggestions for research. *Environmental Innovation and Societal Transitions, 1,* 41-57.

Jongh, D., Ghoorah, D. & Makina, A. (2014). South African renewable investment barriers: An investor perspective. *Journal of Energy in South Africa, 25,* 15-27.

Kaggwa, M., Mutanga, S. S., Nhamo, G. & Simelane, T. (2014). *South Africa's green economy transition: Implications for re-orientating the economy towards a low-carbon growth trajectory.* Report produced for South African Institute of International Affiairs. Retrieved from: http://www.greengrowthknowledge.org/sites/default/files/downloads/resource/south_africas_green_economy_transition_implications_for_reorienting_the_economy_towards_a_low_carbon_growth_trajectory_SAII.pdf.

Kanchanapibul, M., Lacka, E., Wang, X. & Chan, H. K. (2014). An empirical investigation of green purchase behaviour among the young generation. *Journal of Cleaner Production, 66*, 528-536.

Kiddie, T. J. (2014). Text (ing) in context: The future of workplace communication in the United States. *Business and Professional Communication Quarterly, 77,* 65-88.

Kinnunen, J. (1996). Gabriel Tarde as a founding father of innovation diffusion research. *Acta Sociologica, 39,* 431-442.

Kitchener, K. S. (2000). *Foundations of ethical practice, research, and teaching in psychology.* Mahwah, New Jersey: Lawrence Erlbaum Associates, Inc.

Kollmuss, A. & Agyeman, J. (2002). Mind the gap: Why do people act environmentally and what are the barriers to pro-environmental behaviour? *Environmental Education Research, 8,* 239-259.

Kurland, N. B. (1995). Ethical intentions and the theory of reasoned action and planned behaviour. *Applied Journal of Psychology, 4,* 297-313.

Labay, D. G. & Kinnear, T. C. (1981). Exploring the consumer decision process in the adoption of solar energy systems. *Journal of Consumer Research, 8,* 271-278.

Lane, B. & Potter, S. (2007). The adoption of cleaner vehicles in the UK: Exploring the consumer attitude-action gap. *Journal of Cleaner Production, 15,* 1085-1092.

Larsen, G. D. (2005). Horses for courses: Relating innovation diffusion concepts to the stages of the diffusion process. *Construction Management and Economics, 23,* 787-792.

Laughton, C. (2010). *Solar domestic water heating: The Earthscan expert handbook for planning, design and installation*. London: UK.

Lei, Z., Jingxiao, J. & Ruyang, L. (2011). Research on the consumption model of green electricity in China- based on Theory of Reasoned Action. *Energy Procedia, 5,* 938-944.

Lekitlane, M. (2015). *UTAUT, green values and affective factors that lead to the intention to adopt the Urban Retreat carpet in employees* (Unpublished master's thesis). University of the Witwatersrand, Johannesburg.

Lewis, K. & Cassells, S. (2010). Barriers and drivers for environmental practice uptake in SMEs: A New Zealand perspective. *International Journal of Business Studies, 18,* 7-21.

Lin, J., Jan, H & Jin, Y. (2014, December). *Instant messaging use and acceptance among college students*. Paper presented at Pacific Asia Conference of Information Systems, Southwestern University of Finance and Economics, Chengdu, China.

Luqman, A. & Abdullah, N. K. (2011). E-business adoption amongst SMEs: A structural equation modelling approach. *Journal of Internet Banking and Commerce, 16,* 1-19.

Magsamen-Conrad, K., Upadhyaya, S., C. Y. Joa & Dowd, J. (2015). Bridging the divide: Using the UTAUT to predict multigenerational adoption practices. *Computers in Human Behaviour, 50,* 186-196.

Malkani, A. & Starik, M. (2013). The green building technology model: An approach to understanding the adoption of green office buildings. *Jorse, 5,* 71-85.

Milfont, T., Duckitt, J. & Cameron, L. D. (2006). A cross-cultural study of environmental motive concerns and their implications for proenvironmental behavior. *Environment and Behavior, 38,* 745-767.

Milfont, T., Duckitt, J. & Wagner, C. (2010). A cross-cultural test of the value-attitude- behavior hierarchy . *Journal of Applied Psychology, 40,* 2791-2813.

Morelli, J. (2011). Environmental sustainability: A definition for environmental professionals. *Journal of Environmental Sustainability, 1,* 1-9.

Nayum, A. & Klöckner, C. A. (2014). A comprehensive socio-psychological approach to car type choice. *Journal of Environmental Psychology, 40,* 401-411.

Niemeyer, S. (2010). Consumer voices: Adoption of residential energy-efficient practices. *International Journal of Consumer Studies, 34,* 140-145.

Noppers, E. H., Keizer, K., Bolderijk, J. W. & Steg, L. (2014). The adoption of sustainable technologies: Driven by symbolic and environmental motives. *Global Environmental Change, 25,* 52-62.

Nov, O. & Schecter, W. (2012). Dispositional Resistance to Change and hospital physician's use of electronic medical records: A multidimensional perspective. *Journal of the American Society for Information Science and Technology, 63,* 648-656.

Nov, O. & Ye, C. (2008). Users' personality and perceived ease of use of digital libraries: The case for Resistance to Change. *Journal of the American Society for Information Science and Technology, 59,* 845-851.

Olatokun, W. M. & Igbinedion, L. J. (2009). The adoption of automatic teller machines in Nigeria: An application of the theory of diffusion of innovation. *Informing Science and Information Technology, 6,* 373-393.

Oreg, S., Vakola, M., Armenakis, A., Bozionelos, N., Gonza´lez , L., H˘reb´ıc˘kova, M., Kordac˘ova´,J., Mlac˘ic´,B., Feric´,I., Topic, M.K., Saksvik, P.O., Bayazit, M., Arciniega , L., Barkauskiene, R., Fujimoto, Y., Han, J., Jimmieson, N., Mitsuhashi, H., Ohly, S., Hetland, H., Saksvik, I., van Dam, K. (2008). Dispositional resistance to change: Measurement equivalence and the link to personal values across 17 nations. *American Psychological Association, 93,* 935-944.

Ozaki, R. (2011). Adopting sustainable innovation: what makes consumers sign up to green electricity? *Business Strategy and the Environment, 20,* 1-17.

Paul, J., Modi, A. & Patel, J. (2016). Predicting green product behavior using Theory of Planned Behavior and Reasoned Action. *Journal of Retailing and Consumer Services, 29,* 123-134.

Phichitchaisopa, N. & Naenna, T. (2012). Factors affecting the adoption of healthcare information technology. *EXCI Journal, 12,* 413-436.

Plötz, P., Schneider, U., Globisch, J. & Dütschke, E. (2014). Who will buy electric vehicles? Identifying early adopters in Germany. *Transportation Research Part A, 67,* 96-109.

Poullikkas, A. (2014). Sustainable options for electric vehicle technologies. *Renewable and Sustainable Energy Reviews, 41*, 1277-1287.

Rauschnabel, P. A., Brem, A. & Ivens B. S. (2015). Who will buy smart glasses? Empirical results of two pre-market-entry studies on the role of personality in individual awareness and intended adoption of Google Glass wearables. *Computers in Human Behavior, 49,* 635-647.

Riga, D. (2015). *Hybrid electric vehicles: driving towards sustainability* (Unpublished master's thesis). University of the Witwatersrand, Johannesburg.

Rogers, E. M. (1971). *Communication of innovations.* New York: The Free Press.

Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). New York: The Free Press.

Rosnes, O. & Vennemo, H. (2012). The cost of providing electricity to South Africa. *Energy Economics, 4*, 1318-1328.

Sanford, C. & Oh, H. (2010). The role of user resistance in the adoption of mobile data service. *Cyberpsychology, Behavior & Social Networking, 13,* 663-672.

Sawang, S., Newton, C. & Jamieson, K. (2012). Increasing learners' satisfaction/intention to adopt more e-learning. *Education and Training, 55,* 83-105.

Sawitri, D. R., Hadiyanto, H. & Hadi, S. P. (2015). Pro-environmental behavior from a social cognitive theory perspective. *Procedia Environmental Sciences, 23,* 27-33.

Schuitema, G., Anable, J.,Skippon, S. & Kinnear, N. (2012). The role of instrumental, hedonic and symbolic attitudes in the intention to adopt electric vehicles. *Transport Research Part A, 48,*39-49.

Schultz, P. W., Zelezny, L. & Dalrymple, N. J. (2000). A multinational perspective on the relation between Judeo-Christian religious beliefs and attitudes of environmental concern. *Environment and Behavior, 32,* 567-591.

Schultz, P. W., Milfont, T. L., Chance, R. C., Tronu, G., Luís, S., Ando, K., Rasool, F., Roose, P. M., Ogunbode, C. A., Castro, J. & Gouveia, V. V. (2014). Cross-cultural evidence for spatial bias in in beliefs about the severity of environmental problems. *Environment and Behavior, 46,* 267-302.

Sonnenberg, N. C., Erasmus, A. C., Donoghue, S. (2011). Significance of environmental sustainability issues in consumers' choice of major household appliances in South Africa. *International Journal of Consumer Studies, 35,* 153-163.

Southey, G. (2011). The theories of Reasoned Action and Planned Behavior applied to business decisions: A selective annotated biography. *Journal of Business Ideas and Trends, 9,* 43-50.

Stangor, C. (2011). *Research methods for the behavioral sciences (4th ed.)*. Belmont, CA: Wadsworth.

Stein, R. S. & Powers, J. (2011). *The energy problem.* Toh Tuck Link, Singapore: World Scientific Publishing Co. Pte. Ltd.

Straub, E. T. (2009). Understanding technology adoption: Theory and future directions for informal learning. *Review of Educational Research, 79,* 625-649.

Sulak, T. N., Saxon, T. F. & Fearon, D. (2014). Applying the theory of Reasoned Action to domestic violence reporting behavior: The role of sex and victimization. *Journal of Family Violence, 29,* 165-173.

Sutton, P. (2004). *A Perspective on environmental sustainability? Report produced for the Victorian Commissioner for Environmental Sustainability*. Retrieved from: http://www.green-innovations.asn.au/A-Perspective-on-Environmental-Sustainability.pdf

Thrasher, R. G., Andrew, D. P. S & Mahony, D. F. (2011). The efficacy of a modified Theory of Reasoned Action to explain gambling behavior in college students. *Journal of Gambling Studies, 27,* 499-516.

Tran:SIT (2007). *Energy, climate change and transport.* Report produced for The Energy, Climate Change and Transport Nexus. Retrieved from: http://planning.cityenergy.org.za/Pdf_files/planning/sustainable_transport/Energy%20Climate%20Change%20and%20Transport.pdf.

Ul-Haque, M., Azhar, S. M. & Ur-Rehman, M. (2014). Incorporating emotions as antecedents and mediators in Theory of Reasoned Action model. *Business Review, 9,* 40-47.

Vasseur, V. & Kemp, R. (2015). The adoption of PV in the Netherlands: A statistical analysis of adoption factors. *Renewable and Sustainable Energy Reviews, 41,* 483-494.

Venkatesh, V. & Davis, F. D. (2000). A theoretical explanation of the Technology Acceptance Model: Four longitudinal field studies. *Management Science, 46,* 186-204.

Venkatesh, V., Morris, M. G., Davis, G. B. & Davis, F. D. (2003). User acceptance of information technology: toward a unified view. *MIS Quarterly, 27*, 424-478.

Wang, Y. S., Wu, S. C., Lin, H. H., Wang, Y. M. & He, T. R. (2012). Determinants of user adoption of web ATM: An integrated model of TCT and IDT. *The Service Industries Journal, 32,* 9, 1505-1525.

Weir, S. & Knight, J. (2004). Externality effects of education: Dynamics of the adoption and diffusion of an innovation in rural Ethiopia. *Economic Development and Cultural Change, 53,* 93-113.

Wentzel, J. P., Diatha, K. S. & Yadavalli, V. (2013). An application of the extended Technology Acceptance Model in understanding technology-enabled financial service production in South Africa. *Development Southern Africa, 30,* 659-673.

Wolf, A. & Seebauer, S. (2014).Technology adoption of electric bicycles: A survey among early adopters. *Transportation Research Part A, 69,* 196-211.

Zhu, D. S., Lin, T. C. T. & Hsu, Y. C. (2012). Using the Technology Acceptance Model to evaluate user attitude and intention for online games. *Total Quality Management, 23,* 965-980.

Appendix 1

Participant Information Sheet

Psychology

School of Human & Community Development

University of the Witwatersrand

Private Bag 3, Wits, 2050

Tel: 011 717 4503 Fax: 011 717 4559

To Whom It May Concern:

Dear Sir/Madam,

My name is Kelli-Paige Preston. I am currently an Organisational Psychology Masters student at the University of Witwatersrand. I am conducting research for the purpose of obtaining this degree. The purpose of my research is to explore the factors that influence technology adoption and the subsequent consequences for the environment. This research will specifically investigate the factors that influence the adoption of Hybrid Electric Vehicles (HEVs).

I would like to invite you to participate in this study. Participation in this study will involve completion of a questionnaire, which should take you no longer than twenty minutes to complete. I understand that this is a substantial investment of your time. However, your response is valuable, as it will contribute towards a broader understanding of technology adoption and its subsequent environmental consequences within a South African context, in addition to having an impact on research both nationally and internationally.

Participation in this research is voluntary, and you will not be advantaged or disadvantaged in any way for choosing to complete the questionnaire or not. Your responses will remain confidential and anonymity is guaranteed. At no time will I know who you are, since the questionnaire requests no identifying information. The data obtained from the questionnaire will only be seen by my supervisor and I and the results will be reported in the form of a research report. Furthermore, the data collected may be used for future publication purposes or in conference presentations. There are no foreseeable risks for participation in this study. Completion of the questionnaire will be considered to indicate permission for your responses to be used for the research project.

A feedback sheet in the form of a one to two page summary of the study and its findings will be provided to you upon request. You may e-mail or phone my supervisor or myself if you would like to receive this. Our contact details appear below the signature. The feedback will be available approximately 6 months after the collection of the data. If you have any further questions or require feedback on the progress of the research, please feel free to contact my supervisor or I on the details provided below.

Thank you for considering taking part in this research. Please complete the following questionnaire, if you are willing to participate in the study. Please print this sheet for future reference.

Kind Regards,

Kelli-Paige Preston
kellipaigepreston@gmail.com

Andrew.Thatcher (Supervisor)
011 717 4533
Andrew.Thatcher@wits.ac.za

Appendix 2

Demographic Questionnaire

1. What is your gender?

Male	Female

2. What is your race?

Black	Coloured	Asian	Indian	White	Other

3. What is your age? _____

4. Do you own a car?

Yes	No

5. Do you drive a car owned by your family?

Yes	No

6. Do you have access to a car?

Yes	No

7. If you have access to a car, what type of car? (You may choose more than 1)

Petrol	Diesel	HEV

Appendix 3

Adapted UTAUT Scale

What are Hybrid Electric Vehicles (HEVs)?

HEVs are vehicles powered by a combination of both a combustion engine and an electric motor. These combined vehicle features are aimed at helping HEVs reduce fuel consumption in comparison to conventional combustion vehicles, as well as reduce the vehicles' air pollution emissions.

Popular HEVs include: Toyota Prius, Honda CR-Z, Lexus CT200h.

Suppose that you have R500 000 to purchase a new vehicle…

Performance Expectancy Subscale

I expect that...

Questionnaire Item	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Using a Hybrid Electric Vehicle will help me get to my destination on time					
Using a Hybrid Electric Vehicle will lower my fuel consumption					
Using a Hybrid Electric Vehicle will help reduce my travelling costs over time					
Using a Hybrid Electric Vehicle will reduce my impact on the environment					
Using a Hybrid Electric Vehicle will reduce toxic emissions to the environment					
Using a Hybrid Electric Vehicle will give me similar driving power performance to a conventional combustion vehicle					

Effort Expectancy Subscale

I expect that...

Questionnaire item	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
It would be as easy to use a Hybrid Electric Vehicle as using a general combustion vehicle					
Learning to use a Hybrid Electric Vehicle would be difficult for me					
Hybrid Electric Vehicles are not as					

readily available in the market as combustion vehicles					
It would be easy to maintain a Hybrid Electric Vehicle					
My interaction with a Hybrid Electric Vehicle would complex and difficult to understand					

Social Influence Subscale

I believe that...

Questionnaire Item	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
People who influence my behaviour think that I should use a Hybrid Electric Vehicle					
People who are important to me would think that I should use a Hybrid Electric Vehicle					
I would use a Hybrid Electric Vehicle if a number of other students use it					
My friends and family would be upset if I did not adopt a Hybrid Electric Vehicle					
I would receive recognition from others if I adopted a Hybrid Electric Vehicle					
I would use a Hybrid Electric Vehicle if celebrities I admire use it					

Facilitating Conditions Subscale

I believe that...

Questionnaire Item	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I will have control over whether or not I choose to get a Hybrid Electric Vehicle					
I will have the resources necessary to purchase a Hybrid Electric Vehicle					
Using a Hybrid Electric Vehicle will not be compatible with other aspects of my life					
Using a Hybrid Electric Vehicle fits in well with my lifestyle					
I would not adopt a Hybrid Electric Vehicle because it is expensive					
I would not adopt a Hybrid Electric Vehicle due to the unavailability of spare parts					
I would adopt a Hybrid Electric Vehicle due to a reduction in my Greenhouse Gas Tax Levy					

Behavioural Intention to Adopt Subscale

Questionnaire Item	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I like the idea of using a Hybrid Electric Vehicle					
Using a Hybrid Electric Vehicle will					

make driving pleasant					

Appendix 4

Pro-Environmental Behaviour Scale

Please rate the extent to which you engaged in these behaviours **in the last year** by selecting the answer that best reflects your degree of action of that response.

Questionnaire Item	Never	Rarely	Sometimes	Often	Very Often
Looked for ways to reuse things.					
Did not recycle newspapers.					
Recycled cans or bottles.					
Encouraged friends or family to recycle.					
Did not purchase products in reusable or recyclable containers.					
Picked up litter that was not my own.					
Composted food scraps.					
Conserved petrol by walking or bicycling.					

Appendix 5

Dispositional Resistance to Change Scale

Indicate the **extent to which you agree or disagree** with each of the listed responses by selecting the answer that best reflects your feelings of agreement or disagreement toward that specific response.

Routine Seeking Subscale

Questionnaire Item	Not Like Me At All	Not Like Me	Somewhat Not Like Me	Somewhat Like Me	Like Me	Very Much Like Me
I generally consider changes to be a negative thing.						
I'll take a routine day over a day full of unexpected events any time.						
I like to do the same old things rather than try new and different ones.						
Whenever my life forms a stable routine, I look for ways to change it.						
I'd rather be bored than surprised.						

Emotional Reaction Subscale

Questionnaire Item	Not Like Me At All	Not Like Me	Somewhat Not Like Me	Somewhat Like Me	Like Me	Very Much Like Me
If I were to be informed that there's going to be a significant change regarding the way things are done at school, I would probably feel stressed.						
When I am informed of a change of plans, I tense up a bit.						
When things don't go according to plans, it stresses me out.						
If one of my professors changed the grading criteria, it would probably						

make me feel uncomfortable even if I thought I'd do just as well without having to do any extra work.						

Short-Term Focus Subscale

Questionnaire Item	Not Like Me At All	Not Like Me	Somewhat Not Like Me	Somewhat Like Me	Like Me	Very Much Like Me
Changing plans seems like a real hassle to me.						
Often, I feel a bit uncomfortable even about changes that may potentially improve my life.						
When someone pressures me to change something, I tend to resist it even if I think the change may ultimately benefit me.						
I sometimes find myself avoiding changes that I know will be good for me.						

Cognitive Rigidity Subscale

Questionnaire Item	Not Like Me At All	Not Like Me	Somewhat Not Like Me	Somewhat Like Me	Like Me	Very Much Like Me
I often change my mind.						
I don't change my mind easily.						
When someone pressures me to change something, I tend to resist it even if I think the change may ultimately benefit me.						
Once I've come to a conclusion, I'm not likely to change my mind.						
My views are very consistent over time.						

Appendix 6

Ethical Clearance Certificate