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**EXAMINING THE IMPACT OF ATTITUDE, SUBJECTIVE
NORM, ENVIRONMENTAL AWARENESS AND
TECHNOLOGY TOWARDS GREEN TECHNOLOGY
IMPLEMENTATION AMONG MALAYSIAN UNIVERSITY
STAFF IN NORTHERN REGION**



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Universiti Utara Malaysia

**DOCTOR OF PHILOSOPHY
UNIVERSITI UTARA MALAYSIA
February 2018**

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TECHNOLOGY IMPLEMENTATION AMONG MALAYSIAN UNIVERSITY
STAFF IN NORTHERN REGION**

By



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UUM
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**Thesis Submitted to
School of Technology Management and Logistics,
Universiti Utara Malaysia,
in Fulfillment of the Requirement for the Degree of Doctor of Philosophy**



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ABSTRACT

Climate change has caused floods, droughts, raised the sea level, decreased the ecosystem and caused havoc to the weather system. Therefore, the implementation of green technology is desired to mitigate the climate change. The focus of prior studies has largely been on profit-making organizations and companies in the manufacturing sector contributing to the motivation of conducting this study. The objective of this study was to investigate the relationship between the independent variables and green technology implementation in the Malaysian Northern Region public universities. Besides, the study investigated the moderating effect of government support on the relationship between the independent variables and green technology implementation. This study integrated the theory of planned behavior (TPB) and the technology acceptance model (TAM) as its theoretical framework. The questionnaires were randomly distributed to six public universities in Malaysia, namely Universiti Sains Malaysia, Universiti Teknologi Mara Pulau Pinang, Universiti Utara Malaysia, Universiti Malaysia Perlis, Universiti Teknologi Mara Perlis and Universiti Teknologi Mara Kedah. 384 questionnaires were analyzed by using SPSS 20. Pearson correlation, multiple regression, hierarchical regression analysis, process macro and simple slope analysis were used to achieve the objectives. The result of this study revealed that all the independent variables (attitude, subjective norm, environmental awareness and technology) have positive relationships with green technology implementation. In addition, the independent variables collectively influence green technology implementation. Furthermore, this study proved that government support moderates the relationship between attitude, subjective norm, environmental awareness and technology towards green technology implementation. This means that government support could strengthen the positive relationship between the four independent variables and green technology implementation. Moreover, this study contributes to the body of knowledge in technology management (green technology), the universities and also the government.

Keywords: green technology, technology management, university, environmental problem, regression.

ABSTRAK

Perubahan iklim telah mengakibatkan berlakunya banjir, kemarau, peningkatan paras laut, pengurangan ekosistem dan menyebabkan malapetaka kepada sistem cuaca. Oleh itu, pelaksanaan teknologi hijau diperlukan untuk mengurangkan perubahan iklim. Kajian terdahulu sebahagian besarnya hanya tertumpu kepada organisasi yang membuat keuntungan dan syarikat-syarikat dalam sektor pembuatan telah menyumbang kepada motivasi untuk menjalankan kajian ini. Objektif kajian ini adalah untuk mengkaji hubungan antara pemboleh ubah bebas dan pelaksanaan teknologi hijau di universiti awam di wilayah utara Malaysia. Selain itu, kajian ini menyelidik kesan pemboleh ubah penyederhana sokongan kerajaan terhadap hubungan di antara pemboleh ubah bebas dan pelaksanaan teknologi hijau. Kajian ini menggabungkan teori tingkah laku yang dirancang (TPB) dan model penerimaan teknologi (TAM) sebagai satu rangka kerja teori. Soal selidik diedarkan secara rawak kepada enam buah universiti awam di Malaysia iaitu Universiti Sains Malaysia, Universiti Teknologi Mara Pulau Pinang, Universiti Utara Malaysia, Universiti Malaysia Perlis, Universiti Teknologi Mara Perlis dan Universiti Teknologi Mara Kedah. Sebanyak 384 soal selidik dianalisis dengan menggunakan SPSS 20. Di samping itu, korelasi Pearson, regresi berganda, analisis regresi hierarki, proses makro dan analisis cerun mudah digunakan untuk mencapai matlamat kajian. Hasil kajian ini menunjukkan bahawa semua pemboleh ubah bebas (sikap, norma subjektif, kesedaran alam sekitar dan teknologi) mempunyai hubungan positif kepada pelaksanaan teknologi hijau. Di samping itu, pemboleh ubah berpengaruh secara bersama ke atas pelaksanaan teknologi hijau. Tambahan pula, kajian ini membuktikan bahawa sokongan kerajaan menyederhanakan hubungan antara sikap, norma subjektif, kesedaran alam sekitar dan teknologi ke arah pelaksanaan teknologi hijau. Ini bermakna sokongan kerajaan dapat mengukuhkan hubungan positif antara empat pemboleh ubah bebas dan pelaksanaan teknologi hijau. Selain itu, kajian ini menyumbang kepada pengetahuan dalam pengurusan teknologi (teknologi hijau), universiti dan juga kerajaan.

Kata kunci: teknologi hijau, pengurusan teknologi, universiti, masalah alam sekitar, regresi

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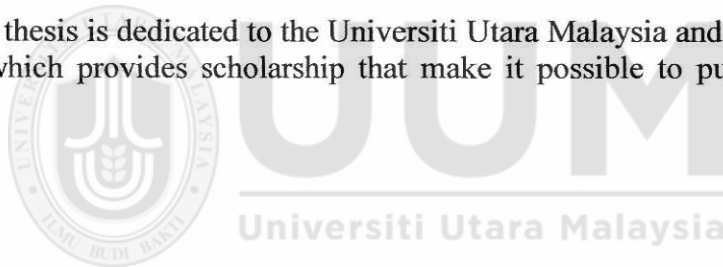
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PUBLICATIONS DERIVED FROM THE THESIS

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2. Jamaluddin, F. & Ibrahim, A. (2017). Exploring the Influence of Subjective Norm towards Green Technology Implementation among Malaysian University Staff: A Literature Review. *International Journal of Academic Research in Business and Social Sciences*, 7(2), 893-897.
3. Jamaluddin, F. & Ibrahim, A. (2016). Examining the Relationship between Environmental Awareness and Government Support towards Green Technology Implementation among Malaysian University Staff. *Journal of Global Business and Social Entrepreneurship (GBSE)*, 1(5), 196-204.
4. Jamaluddin, F. & Ibrahim, A. (2016). Examining the Relationship between Environmental Awareness and Government towards Green Technology Implementation among Malaysian University Staffs. In *Proceeding 4th International Conference on Global Social Entrepreneurship – ICGSE 2016*, 3-4, September 2016, Penang, Malaysia.



TABLE OF CONTENTS

TITLE PAGE	i
CERTIFICATION OF THESIS WORK	ii
PERMISSION TO USE	iii
ABSTRACT	iv
ABSTRAK	v
ACKNOWLEDGEMENT	vi
PUBLICATIONS DERIVED FROM THE THESIS	vii
TABLE OF CONTENTS	viii
LIST OF TABLES	xii
LIST OF FIGURES	xv
LIST OF APPENDIX	xvi
LIST OF ABBREVIATIONS	xvii
CHAPTER ONE INTRODUCTION	1
1.1 Introduction	1
1.2 Background of the Study	1
1.3 Problem Statement	9
1.4 Research Questions	14
1.5 Research Objectives	14
1.6 Scope of the Study	15
1.7 Significance of the Study	15
1.8 Operational Definition	17
1.9 Structure of the Thesis	18
CHAPTER TWO LITERATURE REVIEW	20
2.1 Introduction	20
2.2 Overview of Green Technology in Public Universities	20
2.3 Underpinning Theory in Green Technology Implementation	30
2.3.1 Theory of Planned Behavior (TPB)	31
2.3.2 Technology Acceptance Model (TAM)	42
2.4 Variables that Influence this Study	48
2.4.1 Attitude	48
2.4.1.1 Definition of attitude	48
2.4.1.2 Attitude is a Source of Green Technology Implementation	50
2.4.2 Subjective Norm	51
2.4.2.1 Definition of Subjective Norm	51
2.4.2.2 Subjective Norm is a Source of Green Technology Implementation	52
2.4.3 Environmental Awareness	53
2.4.3.1 Definition of Environmental Awareness	53
2.4.3.2 Environmental Awareness is a Source of Green Technology Implementation	54
2.4.4 Technology	54
2.4.4.1 Definition of Technology	55

2.4.1.2	Technology is a Source of Green Technology Implementation	56
2.4.5	Government Support	56
2.4.5.1	Definition of Government Support	57
2.4.5.2	Importance of Government Support for Green Technology Implementation	57
2.4.6	Green Technology Implementation	61
2.5	Types of Green Technology	63
2.5.1	Green Purchasing	64
2.5.2	Green Practices	67
2.5.3	Green Manufacturing	69
2.5.4	Green Building	71
2.6	Theoretical Framework	73
2.7	Research Hypotheses	74
2.7.1	Relationship between Independent Variables and Green Technology Implementation	74
2.7.1.1	The Relationship between Attitude and Green Technology Implementation	75
2.7.1.2	The Relationship between Subjective Norm and Green Technology	78
2.7.1.3	The Relationship between Environmental Awareness and Green Technology Implementation	82
2.7.1.4	The Relationship between Technology and Green Technology Implementation	84
2.7.2	Relationship between Attitude, Subjective Norms, Environmental Awareness Technology and Green Technology Implementation.	87
2.7.3	Relationship between Attitude, Subjective Norms, Environmental Awareness Technology and Green Technology Implementation on Government Support.	88
2.8	Summary of Chapter	92
CHAPTER THREE METHODOLOGY		93
3.1	Introduction	93
3.2	Research Design	93
3.2.1	Purpose of the Study	94
3.2.2	Time Dimension of the Study	94
3.2.3	Research Design Strategies	95
3.2.4	Unit of Analysis	95
3.3	Population and Sample Method	95
3.4	Data Collection	97
3.5	Questionnaires Design	97
3.5.1	Attitude	98
3.5.2	Subjective Norms	99
3.5.3	Environmental	100
3.5.4	Technology	101
3.5.5	Government Support	102
3.5.6	Green Technology Implementation	104
3.5.7	Reliability and Validity of the Instrument	105

3.5.8	Pilot Study	106
3.6	Method of Data Analysis	107
3.6.1	Pearson Correlation Analysis	107
3.6.2	Multiple Regression Analysis	108
3.6.3	Hierarchical Regression Analysis	108
3.6.4	Process Macro and Simple Slope	109
3.7	Summary of the Chapter	109
CHAPTER FOUR ANALYSIS AND FINDINGS		111
4.1	Introduction	111
4.2	Rate of Return	111
4.3	Respondent Profile	114
4.3.1	Type of Gender	114
4.3.2	Age of Respondents	115
4.3.3	Designation of Respondents' Position	115
4.3.4	Years of Working	116
4.4	Data Analysis	117
4.4.1	Test for Reliability	117
4.4.2	Test for Linearity	120
4.4.3	Test for Homoscedasticity	121
4.4.4	Test for Residual Normality	122
4.4.5	Test for Multicollinearity	127
4.5	Descriptive Analysis of Variables	129
4.6	Hypotheses Testing	131
4.6.1	Pearson Correlation Analysis	132
4.6.1.1	Testing of Hypothesis 1	133
4.6.1.2	Testing of Hypothesis 2	135
4.6.1.3	Testing of Hypothesis 3	136
4.6.1.4	Testing of Hypothesis 4	137
4.6.2	Multiple Regression Analysis	142
4.6.3	Hierarchical Regression Analysis	146
4.6.3.1	Moderator Test of Government Support on the Relationship between Attitude and Green Technology Implementation	146
4.6.3.2	Moderator Test of Government Support on the Relationship between Subjective Norm and Green Technology implementation	150
4.6.3.3	Moderator Test of Government Support on the Relationship between Environmental Awareness and Green Technology implementation	155
4.6.3.4	Moderator Test of Government Support on the Relationship between Technology and Green Technology implementation	159
4.7	Summary of Findings	164
4.8	Summary of Chapter	165
CHAPTER FIVE DISCUSSION AND CONCLUSION		166
5.1	Introduction	166
5.2	Summary of the Study	166

5.3	Relationship between Independent Variables and Green Technology Implementation	169
5.3.1	Relationship between Attitude and Green Technology Implementation	170
5.3.2	Relationship between Subjective Norm and Green Technology Implementation	172
5.3.3	Relationship between Environmental Awareness and Green Technology Implementation	173
5.3.4	Relationship between Technology and Green Technology Implementation	173
5.4	The Collective Influence of Independent Variables towards Green Technology Implementation	174
5.5	Effect of Moderating Variable (Government Support) on the Relationship between Each Independent Variables and Green Technology Implementation	176
5.5.1	Effect of Government Support as Moderating Variable on the Relationship between Attitude and Green Technology Implementation	177
5.5.2	Effect of Government Support as Moderating Variable on the Relationship between Subjective Norm and Green Technology Implementation	178
5.5.3	Effect of Government Support as Moderating Variable on the Relationship between Environmental Awareness and Green Technology Implementation	179
5.5.4	Effect of Government Support as Moderating Variable on the Relationship between Technology and Green Technology Implementation	180
5.6	Implications of the Study	181
5.6.1	Contribution to the Body of Knowledge in Technology Management	181
5.6.2	Benefit to the University and Government	183
5.7	Limitations of the Study	183
5.8	Suggestion for the Future Research	184
	REFERENCES	185
	Appendix A: Questionnaires for Green Technology Implementation	205

LIST OF TABLES

Table 2.1 World UI Green Metric Ranking 2017	24
Table 2.2 Summary of Universities' Green Technology Practices	28
Table 2.3 Summary of Previous Study that Used Theory of Planned Behavior (TPB)	35
Table 2.4 Summary of Previous Study that Used Technology Acceptance Model (TAM)	44
Table 2.5 Definitions of Attitude According to Previous Researchers	48
Table 2.6 Definition of Subjective Norm According to Previous Researchers	51
Table 2.7 Definitions of Environmental Awareness According to Previous Researcher	53
Table 2.8 Definitions of Technology according to Previous Researchers	55
Table 2.9 Measurements of Technology According to Previous Researchers	57
Table 2.10 Summary of Previous Study on Relationship between Government Support and Behavioral	61
Table 2.11 Green Purchasing Study	64
Table 2.12 Green Practices Study	67
Table 2.13 Green Manufacturing Study	70
Table 2.14 Green Building Study	71
Table 2.15 Summary of Previous on Relationship between Attitude and Green Behavior	77
Table 2.16 Summary of Previous Study on Relationship between Subjective Norm and Environmental Issues	80
Table 2.17 Summary of Previous Study on Relationship between Environmental Awareness and Environmental Issues	83
Table 2.18 Summary of Previous Study on Relationship between Technology and Environmental Issues	86
Table 2.19 The Connection of the Research Questions, Objectives, Hypotheses and Analyses	90
Table 3.1 Item Descriptions of Questionnaires Section	98
Table 3.2 Measures of Attitude	99
Table 3.3 Measures of Subjective Norm	100
Table 3.4 Measures of Environmental Awareness	101
Table 3.5 Measures of Technology	102
Table 3.6 Measures of Government Support	103
Table 3.7 Measures of Green Technology Implementation	104
Table 3.8 Pilot Test (N =30)	106
Table 4.1 Total Number of Questionnaires Distributed and Collected from Malaysian University Staff in Northern Region	112
Table 4.2 Response Rate from Previous Study	113
Table 4.3 Gender Respondents	114
Table 4.4 Age of respondents	115
Table 4.5 Respondents's Position	116
Table 4.6 Number of Working Years	116
Table 4.7 Reliability Analysis	119

Table 4.8 Test of Normality for Standardized Residual	123
Table 4.9 Test of Normality for Studentized Residual	123
Table 4.10 Intercorrelation Matrix for Success Factor Variables	128
Table 4.11 Testing Multicollinearity (Tolerance and VIF Values)	129
Table 4.12 Descriptive Statistics of Variables	130
Table 4.13 Correlation Values and the Strength of Relationship	133
Table 4.14 Correlation between Attitude and Green Technology Implementation	134
Table 4.15 Correlation between Subjective Norms and Green Technology Implementation	135
Table 4.16 Correlation between Environmental Awareness and Green Technology Implementation	136
Table 4.17 Correlation between Technology and Green Technology Implementation	137
Table 4.18 The Result of Hypotheses Testing on the Relationship between Attitude, Subjective Norm, Environmental Awareness, Technology, Government Support and Green Technology Implementation	138
Table 4.19 The Result of the Linear Regression Analysis on the Relationship between Attitude and Green Technology Implementation	138
Table 4.20 The Result of the Linear Regression Analysis on the Relationship between Subjective Norm and Green Technology Implementation	139
Table 4.21 The Result of the Linear Regression Analysis on the Relationship between Environmental Awareness and Green Technology Implementation	140
Table 4.22 The Result of the Linear Regression Analysis on the Relationship between Technology and Green Technology Implementation	141
Table 4.23 The Result of the Multiple Regression Analysis on the Relationship between Four Independent Variables and Dependent Variable	144
Table 4.24 The Result of Hypothesis 5	145
Table 4.25 Effect of Moderator Variable to the Relationship between Attitude and Green Technology Implementation	147
Table 4.26 Effect of Moderator Variable to the Relationship between Attitude and Green Technology Implementation (Process Macro)	148
Table 4.27 Effect of Moderator Variable to the Relationship between Subjective Norm and Green Technology Implementation	151
Table 4.28 Effect of Moderator Variable to the Relationship between Subjective Norm and Green Technology Implementation (Process Macro)	152
Table 4.29 Effect of Moderator Variable to the Relationship between Environmental Awareness and Green Technology Implementation	155
Table 4.30 Effect of Moderator Variable to the Relationship between Environmental Awareness and Green Technology Implementation (Process Macro)	156
Table 4.31 Effect of Moderator Variable to the Relationship between Technology and Green Technology Implementation	159
Table 4.32 Effect of Moderator Variable to the Relationship between Technology and Green Technology Implementation (Process Macro)	161
Table 4.33 The Result of Moderating Effect	163

Table 4.34 The Result of Hypotheses Testing on the Relationship between Attitude, Subjective Norm, Environmental Awareness, Technology, Government Support and Green Technology Implementation 164

Table 5.1 The Connection of the Hypothesis, Research Question, Discussion Sub-section and Findings 170

Table 5.2 Relationship between Research Question and Hypothesis 175

Table 5.3 Connection between Research Question and Hypothesis 176



LIST OF FIGURES

Figure 1.1 Energy Consumption of Fossil Fuels	3
Figure 1.2 Comparison Energy Consumption of year 1995 and 2015	3
Figure 1.3 Actual Malaysian CO2 Emissions per GDP with Trend	5
Figure 1.4 Trend in Annual Averaged Daily Mean Temperature at Subang Station during 1961 to 2015	7
Figure 1.5 Projected Temperature Relative to the Baseline (1961-1990) for the Peninsular Malaysia based on A1B Special Report on Emissions Scenario (SRES)	7
Figure 2.1 TPB Model	32
Figure 2.2 Technology Acceptance Model	43
Figure 2.3 Research Framework of Green Technology Implementation	74
Figure 4.1 Scatter Plot between Green Technology Implementation and Four Independent Variables	121
Figure 4.2 Scatter Plot between Green Technology Implementation and Four Independent Variables	122
Figure 4.3 Normal Q-Q Plot of Regression Standardized Residual	125
Figure 4.4 Normal Q-Q Plot of Regression Studentized Residual	125
Figure 4.5 Histogram for Standardized Residual	126
Figure 4.6 Histogram for Studentized Residual	127
Figure 4.7 Slope Analysis between Attitude, Government Support and Green Technology Implementation	149
Figure 4.8 Slope Analysis between Subjective Norm, Government Support and Green Technology Implementation	153
Figure 4.9 Slope Analysis between Environmental Awareness, Government Support and Green Technology Implementation	157
Figure 4.10 Slope Analysis between Technology, Government Support and Green Technology Implementation	162

LIST OF APPENDIX

Appendix A: Questionnaires for Green Technology Implementation

205



LIST OF ABBREVIATIONS

AT	Attitude
SN	Subjective Norm
EA	Environmental Awareness
TE	Technology
GS	Government Support
GTI	Green Technology Implementation
LR	Linear Regression
MRA	Multiple Regression Analysis
HRA	Hierarchical Regression Analysis
SPSS	Statistical Package for the Social Sciences
KETTHA	Ministry of Energy, Green Technology and Water
UN	United Nations
TPB	Theory of Planned Behavior
TAM	Technology Acceptance Model
UUM	Universiti Utara Malaysia
USM	Universiti Sains Malaysia
UniMAP	Universiti Malaysia Perlis
UiTM (Kedah)	Universiti Teknologi Mara (Kedah)
UiTM (Perlis)	Universiti Teknologi Mara (Perlis)
UiTM (Pulau Pinang)	Universiti Teknologi Mara (Pulau Pinang)
GHG	Greenhouse gasses
UPM	Universiti Putra Malaysia

UM	Universiti Malaya
UMS	Universiti Malaysia Sabah
UTM	Universiti Teknologi Malaysia
UMP	Universiti Malaysia Pahang
UTEM	Universiti Teknikal Malaysia Melaka
UKM	Universiti Kebangsaan Malaysia
USM	Universiti Sains Malaysia
UMT	Universiti Malaysia Terengganu
UTHM	Universiti Tun Hussein Onn Malaysia



CHAPTER ONE

INTRODUCTION

1.1 Introduction

This chapter comprises of several sections. It starts with background of study as in section 1.2. Section 1.3 then states the problems of the study. Next, section 1.4 presents research questions and followed by research objectives in section 1.5. Section 1.6 describes the scope of study and section 1.7 explains the significance of the study. Section 1.8 defines the terms used in the study before finally section 1.9 briefs on the structure of this thesis.

1.2 Background of the Study

Our world today faces various threats. Natural disasters can happen anywhere and at any time. The world is facing an increasing intensity of disasters from natural and man-made bringing devastating impacts. The consequence of inappropriately managed risk means disaster. As greenhouse gases were the highest contribution to disaster, therefore, they must be properly managed. There are five categories of sectors that drive greenhouse gases comprising of energy sector, agriculture, forests and other land uses, industry, transport and building sector. Among them, energy sector (energy production) remains the primary driver of greenhouse gases. It is about thirty five percent (35%) of greenhouse gases that comes from energy sector (Fredolin, 2014).

Globally, increasing human population had burdened global resources causing a rise in energy demand (Low, Mohammed, & Weng, 2012). The energy consumption in Malaysia from year 1978 to 2015 is illustrated in Figure 1.1. All fossil fuels sources exhibit growth in energy consumption. Figure 1.2 also show that energy consumption increased with rate 136.74% in 2015 compare to year 1995. In 1995 energy consumption was the highest for the petroleum products at 73.8%, followed by the electricity at 15.4%. These were followed by natural gas at 7.5%, the coal and coke at 3.3% and the biodiesel at 0.0%. However, in year 2015, petroleum products experienced a decrease by 18.4% (energy consumption 55.4%) but remained the highest consumption sources.

In fulfilling this rising situation, fossil fuels were used (IPCC, 2015). Fossil fuel may be defined as a natural fuel such as coal or gas formed in the geological past from the remains of living organisms. Based on the statistics produced by Malaysian Energy Commission, until end of December 2016, the reserves sources of fossil fuel decreased slightly (MEC, 2017). Referring to that statistics, reserves quantity for crude oil and condensates in year 2016 (5.028 billions of barrels) reduced at the rate of 14.88% compared to year 2015 (5.907 billions of barrels). However, the decreasing rate of reserves natural gas was recorded at 12.6% which were 87.762 trillion standard cubic feet in 2016 compared to 100.413 trillion standard cubic feet at year 2015. Besides crude oil and natural gas, reserves quantity for coal also decreased. With decreasing rate of 77.178%, coal reserves quantity reduced from 8493 millions tonnes in 2015 compared to the amount of 1938.37 millions tonnes emitted in year 2016 (MEC, 2017).

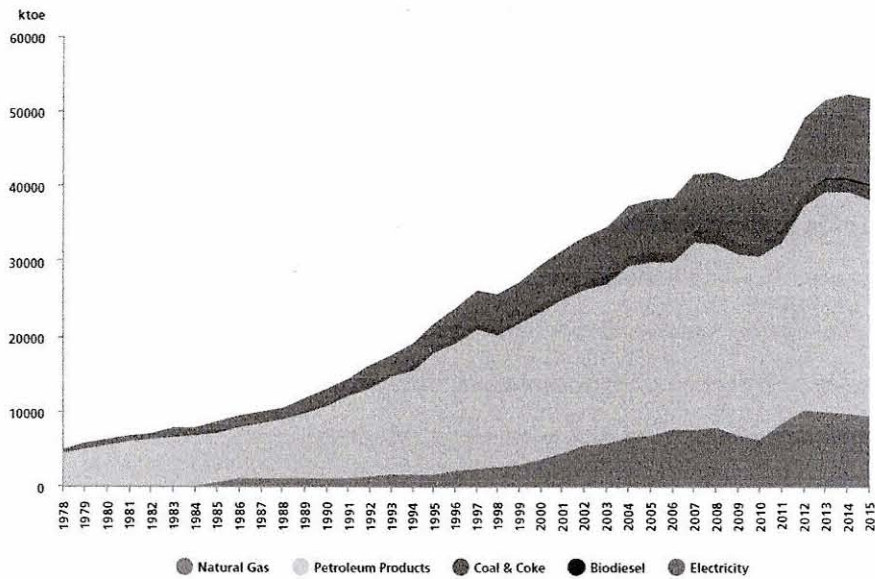


Figure 1.1
Energy Consumption of Fossil Fuels
 Sources: MEC (2015, 2017)

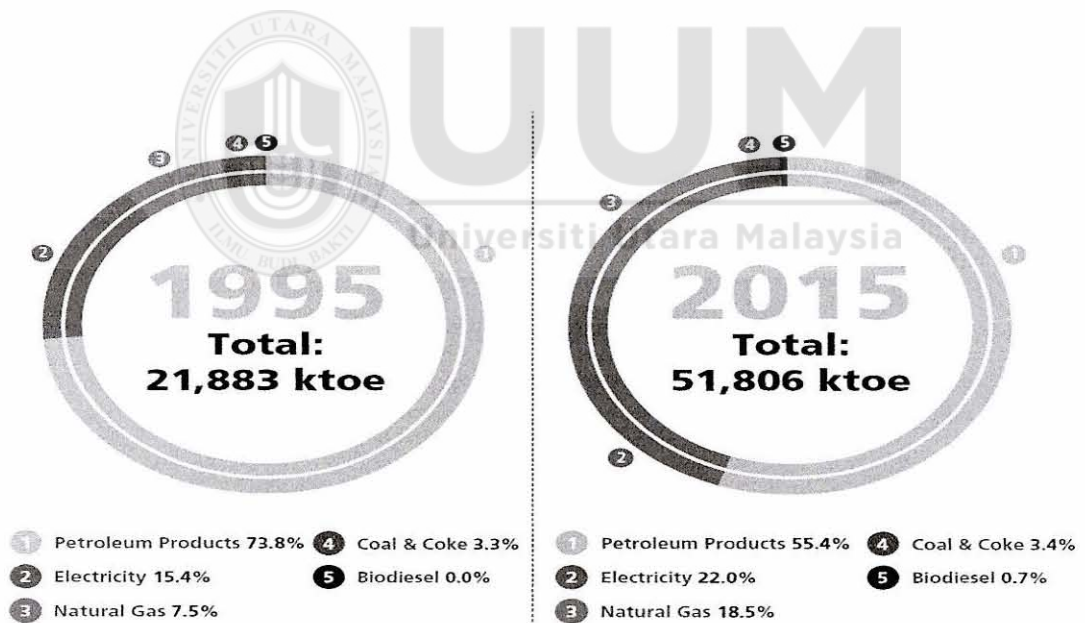


Figure 1.2
Comparison Energy Consumption of year 1995 and 2015
 Sources: MEC (2015, 2017)

The current scenario is worrying because more energy resources were extracted than found. It is in line with the prediction by Shafiee and Topal (2009), in another 40 to 200 years, reserves sources of fossil fuels will be depleted (Low *et al.*, 2012). Although fossil fuels are continuously formed through natural processes, they are generally considered to be non-renewable resources because they take millions of years to form and the known viable reserves deplete much faster than the formation of new ones. The explosion of demand in power usage had an impact to environmental problems. Rezai, Kit, Mohamed & Nasir, (2013) mentioned that environmental problems are caused by the excessive use of energy, environmentally unfriendly production processors, the emission of green gases, water and air pollution, climate change and the environment disasters.

These fossil fuels are not only unsustainable but also environmentally harmful. UNEP & UNFCCC (2001) found that human activities like burning fossils fuels, cutting and burning the trees in the forest are the main reasons for GHG emission (Ahmad & Hossain, 2015). Apart from the effect of fossil fuels, Danlami, Applanaidu, & Islam (2018) found that there is a strong relationship between the use of fossil fuels and lung cancer. Combustion of fossil fuels which consist of natural gas, oil and coal released billions tonnes of carbon dioxide (CO₂) gas per year. It is estimated that natural processes cannot absorb all the amount, so the balance were going to the atmosphere. Almost 30 billion tonnes of CO₂ gas enters the atmosphere as a result of human activities each year (Safaai, Noor, Hashim, Ujang, & Talib, 2010). This scenario caused cumulative emissions of carbon dioxide (CO₂) by increasing the concentration of greenhouse gases which caused global warming and climate change. The trend of actual

Malaysian CO₂ is illustrated in Figure 1.3. Inconsistent trend in CO₂ emissions depicted in Figure 1.3 reveals that we cannot expect the quantity of that emissions (CO₂ emissions) in the future.

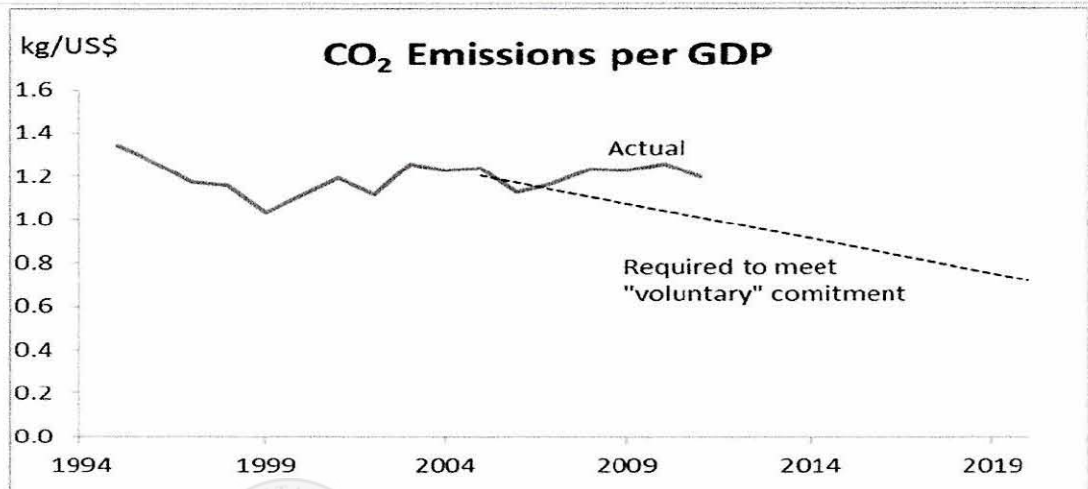


Figure 1.3
Actual Malaysian CO₂ Emissions per GDP with Trend
Source: Briggs & Leong (2016)

It is true that CO₂ is important to prevent the Earth from becoming frozen ball in the space but an increase of CO₂ had resulted in increasing greenhouse gasses concentrations. This happened when increasing of several gases like methane, carbon dioxide from different sources to atmosphere leads to Greenhouse Gases (GHG) emission.

During the COP 15 by the UNFCCC in December 2009 at Copenhagen, Denmark, the Prime Minister of Malaysia announced Malaysia's voluntary initiative to achieve up to 40% reduction in emissions intensity of Gross Domestic Product (GDP) by 2020 based

on 2005 level. IPCC (2015) mentioned that GHG emissions are mainly driven by economic activity, population size, land use patterns, energy use, technology and climate policy.

Continued emissions of greenhouse gases caused further global warming and change in climate system (IPCC, 2015). Climate change refers to a long-term changing trend of climate. These phenomena are believed to be the reason why natural disaster such as floods, droughts, hurricanes and rising of sea level are more frequent than previously. Climate change has effected the temperature. NAHRIM (2013) and Almassy (2014) reported that the annual mean surface temperature has increased by 0.6 to 1.2°C since 1969 and is projected to increase between 1.5°C to 2.0°C in 2050. Figure 1.4 shows the trends in annual averaged daily mean temperature at Subang (Malaysia) during 1961 to 2015. Moreover, Figure 1.5 illustrates the projected temperature relative to the baseline (1960-1990) for the Peninsular Malaysia. Based on the figure (see Figure 1.4 and Figure 1.5), the temperature shows an increase over the year.

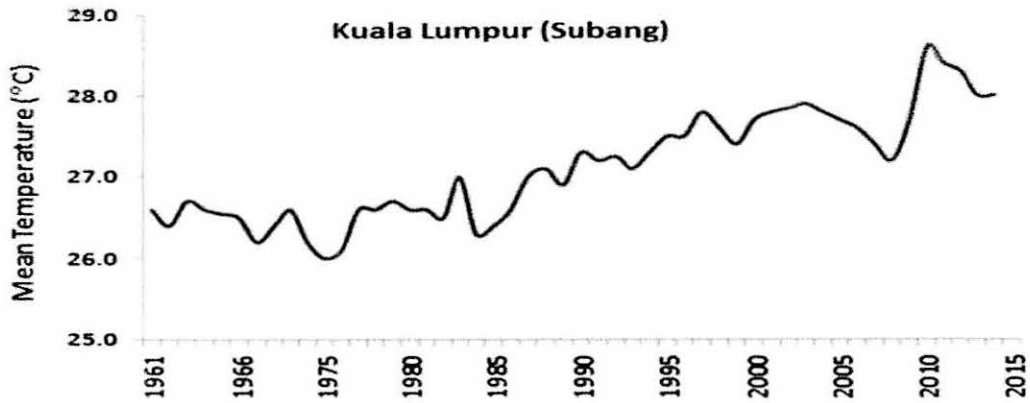


Figure 1.4
Trend in Annual Averaged Daily Mean Temperature at Subang Station during 1961 to 2015
 Source: Shahid *et al.* (2017)

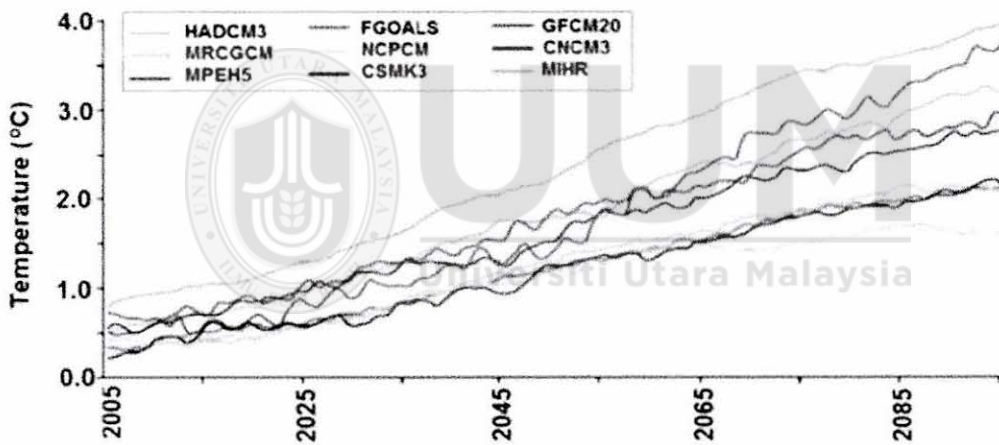


Figure 1.5
Projected Temperature Relative to the Baseline (1961-1990) for the Peninsular Malaysia based on A1B Special Report on Emissions Scenario (SRES)
 Source: Shahid *et al.* (2017)

These temperature changes will have many negative effects, including drought, floods, intensity of rainfall and rising sea level (Awang & Hamid, 2013). Due to increases in temperature, ice-packs have been shrinking in recent decades. These phenomena have several effects. First, it can reduce the available amount of freshwater for people living

in that areas where river flow and groundwater recharge will decrease due to less dilution of pollutants and higher concentration of pollutants in the water bodies. Moreover, increasing of ocean temperatures initially at the surface and over centuries at depth results in water expansion which finally contributes to rise of sea level. Although the global prediction for sea level rise is about 1.7 to 3.1 mm/year, the regional sea level rise in Malaysia is expected to be higher, owing to local climate and topographical conditions (Awang & Hamid, 2013).

Besides that, increasing temperature may lead to flash flood events by melting of these ice-packs into the rivers (Almassy, 2014). Moreover, increasing in sea levels are likely to expose the risk of flood to a million people in the region. This situation caused water excess. Malaysia is one of the countries that faces inland river flood risk due to climate change. Related to that situation, in year 2030, it is projected that around 85000 additional people may be at risk of river floods (WHO, 2015).

In addition to ecosystem, sea level rising caused destruction of assets and disruption to economic sectors, mental health effects, loss of human lives, loss on animals and plants (Awang & Hamid, 2013; IPCC, 2012). Besides that, sea level rise may reduce the size of an island or state, amount of frozen lands and its' infrastructure. Due to that impacts, ecosystem is worsened. As projected cause of climate change, oceans will continue to warm during the 21st century, global mean sea level will continue to rise during the 21st century, global glacier volume will further decrease and it is very likely that the Artic sea ice cover will continue to shrink and thin as global mean surface temperature rises

(Fredolin, 2014). This phenomenon gives havoc to weather system where inconsistent floods and drought affect the World economy especially Malaysia. In the future, the frequency and the intensity of weather which induced natural disasters is expected to increase (Almassy, 2014) affecting the weather system. Although risks cannot be fully eliminated, disaster risk management and mitigating climate change are very important to reduce climate change impacts. Therefore, green technology is introduced to mitigate climate change.

1.3 Problem Statement

Continued emissions of greenhouse gases cause global warming and climate change. Typically, global warming and climate change are two of world's most important issues that have now become the primary issues facing by people. Some examples of climate change that are caused by global warming are floods, droughts, rising of sea level, decreased ecosystem and havoc to weather system. For this reason, immediate and appropriate action is crucial to solve climate change issue before the world harmed. Therefore, the implementation of green technology is desired to mitigate the climate change. The Malaysian Government's commitment to green technology is clear. This is evident in the Commissioning of the Green Technology Policy 2009 and the establishment of the Green Technology Financing Scheme (GTFS) in the 2010 with a fund of RM 1.5 billion for three years ending December 31 2012.

Nowadays, green technology is the trending topic to discuss. Parallel with the objectives of Malaysian Government in reducing the pollution and emission to the environment, the

idea of green technology implementation should be considered as one of the appropriate solutions to the environmental problems occurred. Previous research on green technology implementation has addressed several sectors such as green technology in energy sector (Ahmad, Mat Tahar, Jack, & Liu, 2017; Low *et al.*, 2012). Other studies have focused on green technology implementation in transportation sector (Tiyarattanachai & Hollmann, 2016). Building is one of the sectors in green technology. Examples of green technology implementation in building sector are Jainudin, Jugah, Ali, & Tawie (2017) and Onuoha *et al.* (2017). In addition, waste and water is also one of the green technology sectors in Malaysia. Several authors who studied in this sector are Gan, Ahmad, & Boey (2013) and Murad, Molla, Mokhtar, & Raquib (2010)..

Recently, universities in Malaysia are interested to implement green technology in their campus. The first issue in green technology implementation is green attitude. As highlighted by Veer, Fleuren, Bekkema & Francke (2011), “it is widely recognized that one of the main problems with the introduction of innovation such as technologies or guidelines, professionals do not automatically use them as intended by the developers”. Therefore, the exact benefit from these green technologies cannot be received as planned. As a consequence, uncertain attitudes towards technology will cause a poor implementation (Winston & Delogite, 2002). Besides that, the attitudes strongly depend on individuals’ level of perceived importance of the environment (Han, Hsu, Lee, & Sheu, 2011). This means that, if staff has positive attitude towards green technology, the more likely would he or she intends to implement green technology.

The second issue in green technology is regarding the subjective norm or the strength of person's belief about the implementation of green technology. Many faculty members are slow to adopt new technologies although they are available in market because they deemed that it does not bring them any benefits (Gan *et al.*, 2013). It is difficult to alter mindsets of a person (Nicolaidis, 2006). As stated by Puvanasvaran, Yop Zain, Al-hayali, & Mukapit (2012), "the paradigm of mind set of Malaysian towards innovation and green technology must be changed to adopt all the opportunities and advantages from green technology". In addition, consumers who are environmentally conscious and who believe specific ecological activities can tackle environmental issues are more likely to perform green consumer behavior (Rezai *et al.*, 2013).

The third issue in green technology is environmental awareness. Lack of environmental awareness is detected as one of the barriers in implementing green technology at campus (Dahle & Neumeyer, 2001; Gan *et al.*, 2013; Velazquez, Munguia, & Sanchez, 2005). Therefore, many campaigns have been held by government agencies and private companies to foster environmental awareness within society and increase public participation in a variety of environmental preservation programs (Han, Hsu & Lee 2009). Besides that, research by Yaacob, Hameed, & Ismail (2003) found out the educated consumers in the East Coast of Peninsular Malaysia, possesses not or slightly awareness of green products. Despite the increasing rate of environmental awareness among societies, Ramayah, Lee, & Mohamad (2010) pointed out that the willingness to act towards saving the environment is low, especially in developing countries. To a certain extent, the findings should raise our concern regarding the major consequences

that the World will face if the community is still reluctant to commit to green practices, especially since the World is now struggling to curb the serious waste problem (Abdul Jalil, 2010).

Besides the issue environmental awareness in university, the fourth issue in green technology is government support. In this study, we use government support as moderating variable. As mentioned by Puvanasvaran *et al.* (2012), the strong support from the government enhances the development of green technology in Malaysia. Besides that, Effendi, Hadiwidjojo, Solimun, & Noermijati (2013), also use government role as the moderator variable between entrepreneurship orientation and business performance. Moreover, a research by Wabwoba, Wanyembi, & Omuterema (2012), also concluded that legislation plays an important role in technology innovations being implemented. The cost of buying green technology products is generally high depends on technology use. According to Mustapa, Peng, & Hashim, (2010), green technologies bring a certain amount of uncertainty which is high financing costs of research, development and deployment. This situation will cause a barrier for its development (Mustapa *et al.*, 2010). Many organizations opt for donations or low prices refurbished ones from the developed nations because of limited technical skills available in human personnel to green coupled with scarcity of funding, Wabwoba *et al.*, (2012). Lack of resources in smaller firms will create problem of green technology because the ability to adopt and use green technology may be limited (Chibelushi, 2008).

Based on previous literature and above discussion, researcher chooses to introduce moderating variable as part of the research gap in this study due to the inconsistent in previous findings. Besides that, there are inconsistent findings in the earlier studies, therefore, this study attempts to conduct a comprehensive study and fill the gap. Moreover, Malaysia still experiences a gap in understanding and implementing green technology into practice (Razak, 2010). Additionally, through the review of previous literature, even though green issues have received considerable attention, little is known regarding factors influence green technology in university which represents a research gap for this study. Consequently, the focus of prior studies has largely been on profit making organizations and companies in the manufacturing sector (Sulaiman & Rahman, 2013). Therefore, this study aims to fill the main gap in green technology implementation especially at university which has been rarely touched upon.

However, the issue that remains is that why higher education in Malaysia has not fully implemented green technology. Concerning the gaps mentioned above in the literature, therefore, in such situation, it is essential to conduct research to investigate the antecedents of green technology implementation among university staff in Malaysia. As a conclusion, this study identified the needs to include attitude, subjective norms, environmental awareness, technology, and also moderating effect which is government support in the framework.

1.4 Research Questions

This research is conducted to identifying the factors in implementing green technology. Based on the facts and issues from the problem statement, this study has structured several research questions:

1. What is the relationship between attitude, subjective norm, environmental awareness and technology towards green technology implementation?
2. Do variables of attitude, subjective norm, environmental awareness and technology collectively influence green technology implementation?
3. Is there a moderating effect of government support on the relationship between attitude, subjective norm, environmental awareness, technology and green technology implementation?

1.5 Research Objectives

In general, the objective of this study is to examine the relationship of attitude, subjective norms, environmental awareness, technology and green technology implementation which moderated by government support. Several specific objectives are:

1. To examine the relationship between attitude, subjective norm, environmental awareness and technology towards green technology implementation.
2. To examine the collective influence of attitude, subjective norm, environmental awareness and technology on green technology implementation.
3. To determine whether government support moderate the relationship between attitude, subjective norm, environmental awareness, technology and green technology implementation.

1.6 Scope of the Study

This study focused on determining the antecedents that influence green technology implementation. In this research, staff from public universities in northern region. Selected universities include Universiti Utara Malaysia (UUM), Universiti Teknologi Mara Kedah (UiTM Kedah), Universiti Malaysia Perlis (UniMAP), Universiti Teknologi Mara Perlis (UiTM Perlis), Universiti Sains Malaysia (USM) and Universiti Teknologi Mara Pulau Pinang (UiTM Pulau Pinang) to complete the study. Staff are chosen as respondents because they are internal agents of change at university campuses as their potential to change universities internally and their connection between institutional top and bottom (Brinkhurst, Rose, & Maurice, 2011).

Referring to KeTTHA's Green Technology Policy in Malaysia, there are four main sectors included which are energy, building, transportation, waste and water. However, this study only focused on energy, transportation, waste and water sector due to the limitation of the study. Furthermore, green technology implementation is considered as a dependent variable which refers to attitude, subjective norm, environmental awareness and technology. This study also included government support as a moderating variable.

1.7 Significance of the Study

Presently, there is very few information regarding green technology implementation especially in public universities. Most of the researchers only focused on profit making organizations and companies in manufacturing sector (Sulaiman & Abdul Rahman, 2013) rather than the implementation of green technology in universities. Therefore, this study

aims to provide information on the antecedents of green technology implementation especially in university. The result of the current study is expected to contribute to the body of knowledge of technology management, the universities and Malaysian Government. The research is significant in the following aspects:

- 1.7.1** Even though in the past studies there are studies on green technology, but most of them only focused on profit-making and companies in the manufacturing sector rather than university. Therefore, this study tends to find the relationship between independent variables towards green technology implementation in university. The proposed framework can be used as the foundation for future research in order to access the readiness of higher education institution (universities) in Malaysia to implement green technology. Other than that, academicians can enrich current global literature and regional literature concerning green technology. Besides that, new variables also added to current theory in framework like environmental awareness, technology and government support. Government support is chosen as moderating variable. The research enhances literature on green technology implementation and provides a foundation for further study on the progress and impact of green technology implementation. This research may benefit the body of knowledge of technology management.
- 1.7.2** The proposed framework can be used to solve green technology problem in university. By referring to the proposed framework, top management in university may identify the factors influencing green technology implementation

and try to focus on the recognized variables. Besides that, the outcomes of this study may assist the government in decision making and formulation of strategies to implement green technology approach in universities. This research is also beneficial to the universities as guidance.

1.8 Operational Definition

Green Technology Implementation: Green technology implementation is referring to the intention of green technology implementation (focused on energy, transportation, waste and water sector) in university.

Attitude: Attitude in this study refers to the staffs' evaluation towards green technology such as favorable or unfavorable to them.

Subjective Norm: Subjective norm in this study refers to the social pressures which influence staff to implement green technology such as family, media and friends.

Environmental Awareness: Environmental awareness in this study refers to staff's awareness on environmental problems.

Technology: Technology in this study refers to the technology of green product or green practices whether it is simple and easy to learn, use, helpful for improving environmental and it is compatible to existing operations or not.

Government Support: Government support in this study refers to the support from government to universities such as financial resources, technical assistance, training and skills, environmental guidance and policy.

1.9 Structure of the Thesis

This thesis is organized as follows:

Chapter One: This chapter consists of nine (9) sections. As an introduction to the thesis, this chapter provides the background of the research, problem statement, research questions, research objectives, scope of the study, operational definitions and the last section is an organization of the thesis.

Chapter Two: This chapter consists of seven (7) sections. It starts with the discussion on the overview of green technology implementation in public university in section 2.1, followed by previous literature on the underpinning theory in section 2.2 and section 2.3 describes about variables catered in this study. Moreover, section 2.4 discusses the types of green technology. Next, theoretical framework and research hypotheses are discussed in this chapter (section 2.5 and section 2.6). The last section is section 2.7 which discusses the summary of the chapter.

Chapter Three: This chapter describes the methodology of the study. It begins with section 3.1 (Introduction) and section 3.2 for research design which consists of purpose of the study, time dimension and unit of analysis. Besides that, population, sampling method and data collection are discussed in the next section. Moreover, questionnaire

design is presented in this chapter. Method of analysis is finally covered in the last section.

Chapter Four: This chapter demonstrates and discusses the results of primary data collection to address the objective of the study. It covers a detailed analysis, discussions and interpretation of data collected from respondents via questionnaires. This chapter starts with section 4.1 (introduction of the chapter), section 4.2 (rate return of questionnaires) and section 4.3 (profiles of the respondents). Besides that, this chapter also discussed on data analysis and descriptive analysis of the data. Main results of the hypotheses tests and discussion are covered in the last two sections.

Chapter Five: In this final chapter, summary of the study and discussion of the study are discussed. Moreover, implications and limitations of the study are discussed. Future research extension is suggested as well in section 5.8.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

For accurate and holistic conduct of study, previous related literatures have been reviewed thoroughly and the whole review is presented in this chapter. It starts with the overview of green technology at Malaysian public universities as in Section 2.1. Review on underpinning theory is then presented in Section 2.2. Next, Section 2.3 serves a review on variables catered in this study. Section 2.4 then presents a review on types of green technology. Theoretical framework is then covered in Section 2.6 while Section 2.7 presents the review on research hypothesis before finally the whole chapter is summarized in Section 2.8.

2.2 Overview of Green Technology in Public Universities

Malaysia is one of the earliest countries in the World that has serious consideration towards the environment by enacting the Environment Quality Act way back in 1974 (Cavana, Delahaye, & Sekaran, 2012). Besides the introduction of new legislation to protect the environment, the Malaysian government has recently formed Ministry of Energy, Green Technology and Water, a new ministry to cater the rising need and the importance of green technology (Cavana *et al.*, 2012).

Green is the traditional English word used to describe a color that is a mixture of yellow and blue. However, in the 21st century, green has evolved to have a deeper meaning

related to environmental issue. It is a common understanding that behaving in an environmentally sound way will be essential to our future. As found by scholars Chow and Chen (2009), in their research regarding intended belief and actual behavior in green at Hong Kong was stated that “the Earth may no longer be a sustainable living environment for any creature if we do not reduce the rate and amount of toxic waste such as carbon, nitrogen and sulfur dioxide”.

Malaysia still experiences a gap in understanding and implementing green technology into practice (Razak, 2010). Therefore, Malaysian government has played a strong role to ensure that the environmental problems have been solved by introducing necessary policies and implementing green technology (Abu Bakar, Mohd Sam, Tahir, Rajiani, & Muslan, 2011). Under the 10th Malaysia Plan, the Malaysian government has proposed a fund of RM 1.5 billion to promote green technology in 2010 through the National Green Technology Centre (Razak, 2010). The Government also restructured Ministry of Energy, Water and Communication and renamed it to Ministry of Energy, Green Technology and Water to support and enhance the implementation of green technology in Malaysia. Moreover, the National Auto Policy (NAP) promotes green technology by providing a duty exemption and a 50 percent excise tax reduction for manufacturer of hybrid electric vehicles.

Considering the unique mission of green campus, Green Metric World University Ranking deserves widespread attention and participation. The Green Metric World University Ranking is established by University of Indonesia in 2010 and is a university

ranking platform. This ranking aims to evaluate and rank universities all over the World according to their current condition (global climate change, energy and water conservation, waste recycling and green transportation) and policies related to green campus. Green metric evaluates universities based on six criteria which are setting and infrastructure, energy and climate change, waste, water, transportation and education.

Over 100% evaluation of UI Green Metric, fifteen percent (15%) is allocated for setting and infrastructure, twenty one percent (21%) for energy and climate change while eighteen percent (18%) for waste. Moreover, ten percent (10%) is considered for water, eighteen percent (18%) transportation and the balance of eighteen percent (18%) for education. The number of participating universities in Green Metric increasing rapidly each year even though the ranking is new. Initially, when the ranking is initiated, only ninety-five (95) universities participated. However, in 2016, the number of participating universities increased to five hundred and sixteen (516) from seventy-four (74) countries.

In Malaysia, there are several universities that participate in green metric ranking. They are Universiti Putra Malaysia (UPM), Universiti Malaya (UM), Universiti Malaysia Sabah (UMS), Universiti Teknologi Malaysia (UTM), Universiti Utara Malaysia (UUM), Universiti Malaysia Pahang (UMP), Universiti Teknikal Malaysia Melaka (UTEM), Universiti Kebangsaan Malaysia (UKM), Universiti Sains Malaysia (USM), Universiti Malaysia Terengganu (UMT), Universiti Tun Hussein Onn Malaysia (UTHM) and Universiti Malaysia Perlis (UniMAP).

Table 2.1 shows the World UI Green Metric Ranking based on year 2017. Based on the table (Table 2.1), Universiti Putra Malaysia (UPM) has the top rank of UI Green Metric, ranked the twenty-seven (27) for World's ranking and leads the ranking in Malaysia. Compared to UPM, Universiti Malaya (UM) ranked the thirty-fourth (34th) in the World and second (2nd) in Malaysia. Universiti Malaysia Sabah (UMS) ranked the thirty-seventh (37th) globally and third (3rd) in Malaysia.

Besides the three universities (UPM, UM and UMS), Universiti Teknologi Malaysia (UTM) ranked the sixty-sixth (66th) in the World and fourth (4th) among Malaysian universities. As one of the universities in Kedah, Universiti Utara Malaysia (UUM) managed to secure the eighty-third (83rd) rank in the World and fifth (5th) rank in Malaysia. Subsequently, it is followed by Universiti Malaysia Pahang (UMP) (107th in the World and 6th in Malaysia), Universiti Teknikal Malaysia Melaka (UTEM) (170th in the World and 7th in Malaysia), followed by Universiti Kebangsaan Malaysia (UKM), Universiti Sains Malaysia (USM), Universiti Tun Hussein Onn Malaysia (UTHM) and Universiti Malaysia Perlis (UniMAP).

Table 2.1

World UI Green Metric Ranking 2017

University	World's Ranking	Malaysian's Ranking
Universiti Putra Malaysia (UPM)	27	1
Universiti Malaya (UM)	34	2
Universiti Malaysia Sabah (UMS)	37	3
Universiti Teknologi Malaysia (UTM)	66	4
Universiti Utara Malaysia (UUM)	83	5
Universiti Malaysia Pahang (UMP)	107	6
Universiti Teknikal Malaysia Melaka (UTEM)	170	7
Universiti Kebangsaan Malaysia (UKM)	207	8
Universiti Sains Malaysia (USM)	260	9
Universiti Malaysia Terengganu (UMT)	430	10
Universiti Tun Hussein Onn Malaysia (UTHM)	477	11
Universiti Malaysia Perlis (UniMAP)	554	12

For UI Green Metric, many green practices have been employed by universities. Universiti Putra Malaysia (UPM) for example have implemented several practices like UPM Waste Bank where rewards are given for waste recycling. In addition, UPM also embarked on Green practice for tourism and villagers at Pulau Mabul by highlighting the importance of recycling empty bottles and containers. Besides that, Universiti Putra Malaysia (UPM) collaborated with Mitsubishi Corporation in planning trees to preserve the forest. In addition, UPM collaborated with a finance company to plant 1000 trees to turn campus green. Moreover, UPM has launched 'No Vehicle's Day in Campus'. Universiti Putra Malaysia has collaborated with One FM to organize 'OneFm go Green

Campaign' for supporting Earth Hour 2015. Continuing to green campus mission, UPM and Subang Jaya Municipal Council (MPSJ) co-organized Healthy Life Cycling Program in the university area.

Universiti Malaya (UM) also participated in green technology by introducing Rimba Project and Zero Wastes. In Zero Wastes program, students and staff were exposed to 3R concept which are Reduce, Reuse and Recycle. Moreover, top management of UM address water segment by introducing Water Warrior and Mytreevolution. Besides that, UM used Eco-Greenery Lamp and launched Green Low-Cost House.

To transform an institution into a green campus, various efforts have been taken by universities around the World. In Malaysia, Universiti Malaysia Sabah (UMS) has taken several initiatives like knowledge sharing with people surrounding by organized talk, campaign and so on. An example of knowledge sharing is giving talk on principles and practice of green cities. Besides that, as an initiative to reduce pollution and emissions, 200 electric bicycles were used for rental. All the bicycles were rent to staff and students around the campus to replace other vehicles.

As ranked the 66th in UI Green metric globally, Universiti Teknologi Malaysia (UTM) has encouraged the students to use bicycle instead of driving vehicles on campus. Besides that, to achieve the mission of reducing pollution and emission, management of UTM has scheduled buses for the members of the university. Moreover, to reduce solid waste, Universiti Teknologi Malaysia motivated the staff and students to avoid using

forbidden polystyrene and to recycle every waste accordingly. To efficiently use waste, energy and water, UTM has implemented green office campaign.

Besides UMS, Universiti Utara Malaysia received 200 electric pedal-assisted bicycles (EPAB) to promote green mobility in campus. UUM also received coveted recognition from Green World Awards. In addition, UUM has been chosen as Green World Ambassador on year 2016/2017. Other than that, in 2016, UUM won a global medal at the Green World Awards 2016 for education and training.

Moreover, Universiti Malaysia Pahang (UMP) has made wind turbine which can convert kinetic energy to electrical power as one of the green technology implementations. Other than that, UMP used solar energy by absorbing the sunlight and as a source of energy to generate electricity or heat. To successfully implement green technology, UMP has employed healthy lifestyle through night run, 3R principle practices (reduce, reuse and recycle), polystyrene free campus and solid waste management program. For flora and fauna, UMP has beautified the campus with flowers and herbal landscape around its lake for panoramic view. Moreover, Universiti Malaysia Pahang efficiently used water, provided shuttle bus services and implemented green policy.

UTM has introduced UTM Green Trishaws and Bicycles as an initiative for green technology practices. Gazetting policies for the use of energy and waste management was one of the green technology initiatives within the campus.

UKM has collaborate with PINTAR for sustainability and green technology by introducing IG-Home Modul Program. Other than that, UKM has set up Recycle Center to implement 3R principles (reduce, reuse and recycle). In addition, UKM's management set up a target of zero waste on campus.

As one of the northern public universities, Universiti Sains Malaysia (USM) implemented green technology on campus. Example of green technology practices were introducing green human resource management (Green HRM) and cementless concrete with low carbon footprint. Other than that, USM hold carnival to promote love for the environment by increasing awareness on environment. Moreover, a special talk on green technology has been organized where the concept of green technology was introduced as capable to convert food waste to energy. Establishment of center for education, training and research in renewable energy and energy efficiency hopefully for greener campus. Besides that, USM has promoted energy awareness weekly and waste minimization goals by recycling.

Universiti Malaysia Terengganu (UMT) has implemented several green practices like go green ride UMT and recycling activities. Universiti Tun Hussein Onn Malaysia (UTHM) has organized go green program and introduced a student society namely Green and Campus Sustainability Club. Other than that, UTHM organized International Conference on Civil and Environmental Engineering for Sustainability.

As like other universities, UniMAP also employed several green practices like switching off the light and air-conditioner when not in use. Other than that, UniMAP organized various workshops or campaigns like Green Campus Workshop, Earthday Campaign and Recycling. Table 2.2 showed summary of universities' green technology practices.

Table 2.2
Summary of Universities' Green Technology Practices

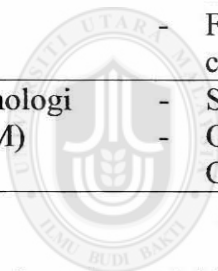
University	Green Technology Practices
Universiti Putra Malaysia (UPM)	<ul style="list-style-type: none"> - UPM waste bank - Embarks on Green practice for tourism and villagers at Pulau Mabul - (UPM) also collaborate with Mitsubishi Corporation in planning trees to preserve the forest. - UPM collaborate with Finance Company had planted 1000 trees to turn campus green. - 'No Vehicle's Day in Campus' - Universiti Putra Malaysia also had collaborated with One FM to organize 'OneFm go Green Campaign' for supporting Earth Hour 2015 - UPM and Subang Jaya Municipal Council (MPSJ) co-organized the Healthy Life Cycling Programme around the university area. - Build bio compost facility - UPM turns greener via coca cola-upm's recycle to cycle programme - UPM hosts ienforce 2015 on forensic environment preservation - Green Voice Programme - Green policy - UPM tree planting
Universiti Malaya (UM)	<ul style="list-style-type: none"> - Rimba project - Zero wastes - Water warrior - Mytreevolution - Use eco-greenery lamp - Launched green low cost house
Universiti Malaysia Sabah (UMS)	<ul style="list-style-type: none"> - Knowledge sharing with people surrounding - 200 electrics bicycle- electric bicycle rental - UMS aims to be country's first energy efficient campus - Talk on principles and practise of green cities

Table 2.2 (Continued)

Universiti Teknologi Malaysia (UTM)	<ul style="list-style-type: none"> - Encourage students to use bicycle - Schedule buses - Forbidden polystyrene use - Recycle- different box - Green office campaign
Universiti Utara Malaysia (UUM)	<ul style="list-style-type: none"> - Receive 200 electric pedal-assisted bicycle (EPAB) to promote green mobility in campus. - UUM receives coveted recognition from green world awards - UUM chosen as green world 2016/2017 ambassador - UUM win the global medal at the green world awards 2016 for education and training.
Universiti Malaysia Pahang (UMP)	<ul style="list-style-type: none"> - Wind turbine-convert kinetic energy to electrical power - Solar energy- absorb the sunlight as a source of energy to generate electricity or heat - 5s - Healthy lifestyle- night run, fun run, 10000 steps among staff n students - Waste-3R principle (reduce, reuse, recycle), polystyrene free campus, solid waste management programme - Flowers of UMP - Herbal landscape- to optimize the use of land - Green policy - Tranquility by the lake- panoramic view of very beautiful and quite peaceful - Efficiently using water (green lung) - Shuttle bus services
Universiti Teknikal Malaysia Melaka (UTEM)	<ul style="list-style-type: none"> - UTM green trishaws - Green city living- trishaws, bicycle - Gazetting policies for the use of energy, waste management, green technology initiatives within the campus
Universiti Kebangsaan Malaysia (UKM)	<ul style="list-style-type: none"> - Collaboration with PINTAR for sustainability & green technology ig-home module programme - <i>Pusat kitar semula</i> UKM- 3r- reduce, reuse & recycle - Zero waste target in campus
Universiti Sains Malaysia (USM)	<ul style="list-style-type: none"> - Introduced green human resource management (green HRM) - Introducing the cementless concrete with a low carbon footprint - Waste minimization goals by recycling - Hold carnival to promote love for the environment-increasing awareness on the environment

Table 2.2 (Continued)

	<ul style="list-style-type: none"> - Establishment of centre for education, training and research in renewable energy & energy efficiency (centre) - Organized a special talk on green technology- introduce a GT which is capable to convert food waste to energy - Energy Awareness Weekly (annually activities)
Universiti Malaysia Terengganu (UMT)	<ul style="list-style-type: none"> - Go green ride UMT - Save turtle - Recycling activities
Universiti Tun Hussein Onn Malaysia (UTHM)	<ul style="list-style-type: none"> - Organized go green Tun Fatimah programme - Student society- kelab green dan campus sustainability (gasca) - Organized International Conference on Civil & Environmental Engineering for Sustainability
Universiti Malaysia Perlis (UniMAP)	<ul style="list-style-type: none"> - Switching off the light and aircond when there is no one in the room - Organized green campus workshop - Organized ‘earthday’ campaign annually- purpose to inculcate the awareness amongst students and staff on the importance of environment - Furthermore, UniMAP also organizes recycling campaign.
Universiti Teknologi Mara (UiTM)	<ul style="list-style-type: none"> - Solar Photovoltaic Plant – big scale capacity 50mw - Organized Construction Management Recycle Community



Universiti Utara Malaysia

As green technology is an initiative to mitigate climate change, implementing green technology is an issue that needs to be addressed. Successfully implementing green technology is not easy because it depends on various factors like attitude, subjective norms, environmental awareness and technology. Therefore, underpinning theories that have been used for this study are discussed in the next section.

2.3 Underpinning Theory in Green Technology Implementation

This research uses variables included in Theory Planned Behavior (TPB) and also Theory Acceptance Model (TAM). Therefore, both theories need to discuss below.

2.3.1 Theory of Planned Behavior (TPB)

The theory used in this study is Theory Planned Behavior (TPB). The TPB model introduced by Ajzen (1991) serves as the basis in developing the theoretical framework to investigate staffs' behavioral intention towards green technology implementation. This theory was the extended version of Theory Reasoned Action (TRA). TRA by Ajzen & Fishbein (1980) only included two factors which were attitude and subjective norms.

The circumstances limit the sufficiency of the TRA in explaining an individual's behavior. Therefore, Theory of Planned Behavior (TPB) extended the TRA by including an additional variable namely Perceived Behavioral Control (PBC). TPB was amenable to the inclusion of additional components in order to better predicted variance in behavioral intention or actual behavior (Ajzen, 1991).

TPB had been widely adopted in attitude-behavior studies, such as electric vehicle usage (Sang & Bekhet, 2015a), intention to use technology (Teo, 2012), new technology implementation (Baker, Al-Gahtani, & Hubona, 2007), green consumption (Lien & Chen, 2010), green practices (Chen, Gregoire, Arendt, & Shelley, 2011; Siohong & Zainol, 2012; Wan, Cheung, & Shen, 2012; Yacob & Moorthy, 2012) green purchasing (Mahesh & Ganapathi, 2012; Moser, 2015; Teck, 2013). The whole set of variables in TPB is as follows.

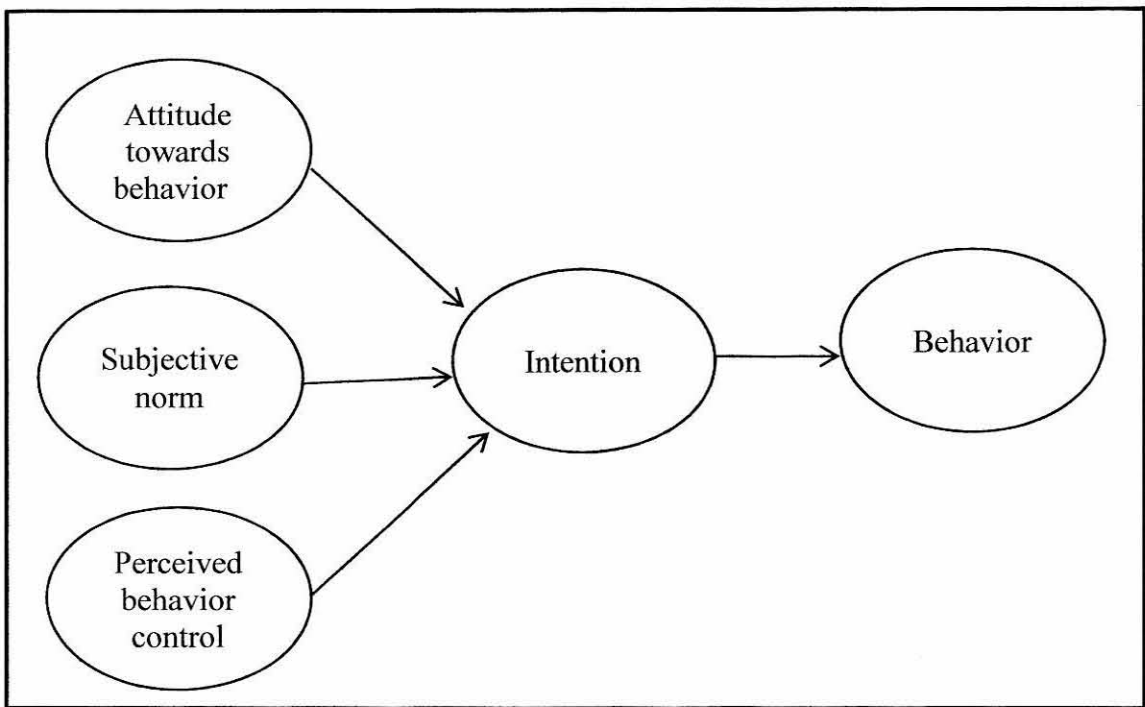


Figure 2. 1

TPB Model

Source: Adapted from Ajzen (1991).

A few studies demonstrated the value of the TPB in predicting environmental behaviors. TPB is considered as the most appropriate theory to study the drivers of green environment behavior and to investigate the owners' or managers' perception and attitude towards Malaysian organization green concept (Moorthy, Yacob, Chelliah, & Arokiasamy, 2012). It was hypothesized that attitude and subjective norms towards green technology implementation has a positive significant relationship towards green technology implementation.

Wan *et al.* (2012) had recently studied on recycling attitude and behavior in university campus by employing theory of planned behavior (TPB). They included three variables of TPB which were attitude (AT), subjective norm (SN) and perceived behavioral control

(PBC) to capture recycling attitude of 179 students and 26 staff members. Their study found that attitude, subjective norm and perceived behavioral control positively influenced recycling intention in Hong Kong university campus.

Similar to Wan *et al.* (2012), Siohong and Zainol (2012) in their research on 315 participants around Klang Valley also found that attitude, subjective norm and perceived behavioral control had a positive impact on recycling intention. Even though both studies by Wan *et al.* (2012), and Siohong and Zainol (2012) were conducted in different countries (Hong Kong and Malaysia), they still achieved the same results. It was proved that different countries did not affect the results of variables in TPB.

Besides recycle intention, TPB was to find the influence of attitude, subjective norm and perceived behavioral control towards green purchase intention. A study by Mahesh and Ganapathi (2012) showed that the intention of consumers to purchase green products is determined by having a positive attitude, subjective norm and perceived behavioral control. However, Moser (2015) who researched on green purchasing in Germany presented that willingness to pay and personal norm were the predictors of green purchasing compared to attitude. This may be due to the different consumers attitude in each country. Besides that, study of green purchasing in Malaysia by Teck (2013) also found that amongst the three variables (attitude, subjective norm and perceived behavioral control), only attitude and perceived behavioral control were predictors of green purchasing. This result suggested that family's and friend's opinions did not affect the prediction of green purchase intention.

In addition, a study by Wati, Koo, & Chung (2011) concluded that subjective norm proposed in Theory of Planned Behavior (TPB) was insufficient to capture the moral aspect of the ethical behavior. Subjective norm needs to be enforced by the threat of punishment or promise of reward. Table 2.3 (refer page 35) showed the summary of previous study which used Theory Planned Behavior (TPB) as their basic theory.



Table 2.3

Summary of Previous Study that used Theory of Planned Behavior (TPB)

Authors/Year	Title	Sample	Methods use	Item use in TPB	Result	Future research
Baker <i>et al.</i> (2007)	The Effects of Gender and Age on New Technology Implementation in a Developing Country: Testing the Theory of Planned Behavior (TPB)	1088 Knowledge Worker in Saudi Arabia	Questionnaires PLS	Attitude Subjective norm Perceived Behavioral Control	Attitude, subjective norm, and perceived behavioral control had significant relationship to new technology implementation	Add cognitive, social, demographic and cultural factors for further study on new technology implementation.
Lien & Chen (2010)	The Relationships between Green Consumption Cognition and Behavioral Intentions for Consumers in the Restaurant Industry	620 respondents in Taiwan	Questionnaires SEM	Attitude Subjective Norm Perceived Behavioral Control	Green consumption attitude, green subjective norm and perceived behavioral control positively effect behavioral intention	-

Table 2.3 (Continued)

Siohong & Zainol (2012)	Minimizing Waste and Encouraging Green Practices	315 responses were collected based on voluntary participation in the Klang Valley areas of Malaysia. A	Questionnaire Multiple Linear Regression	Green Attitude Subjective Norm Perceived Behavioral Control	Green attitude, subjective norms, perceived behavioral control had positive and significantly relationship towards green practice	1) Examine other behavioral intention measures or actual behaviors. 2) Provide further in-sight to examine indirect relationships or consider the moderating effects of demographic factor
Chen <i>et al.</i> (2011)	College and University Dining Services Administrators (CUDSAs) Intention to Adopt Sustainable Practices Results from US Institutions	555 persons of College and university dining services administrators in United State	Questionnaires SPSS-frequencies, Pearson correlations, exploratory factor analysis, and independent-sample's t-test and one-way analysis of variance.	Attitude (AT) Subjective Norm (SN) Perceived Behavioral Control (PBC)	1) AT and SN have positive relationship to adopt sustainable practices 2) PBC don't has positive relationship to adopt sustainable practices.	1) Future research could examine the effect of PBC and PN on specific sustainable behaviors (e.g. composting, farm to college, and trayless dining) 2) In addition, it would be valuable to do a two-step study: first, assess which specific sustainable

Table 2.3 (Continued)

			Confirmatory factor analysis (CFA), analysis of the measurement model, and structural equation modeling (SEM) analysis were conducted using the Analysis of Moment Structures (AMOS) version 16.0.			practices CUDSAs are intending to adopt in the future, then follow up to see what their actual behaviors.
Ahmad <i>et al.</i> (2017)	Public Acceptance of Residential Solar Photovoltaic Technology in Malaysia	780 respondents among the residents of peninsular Malaysia	Questionnaires - Non-probability convenience sampling	Attitude	Attitude to use significantly influenced behavioural intention to use solar PV technology.	1) Further study should address causal inferences and the cost of technology.

Table 2.3 (Continued)

					2) Further study should include organizations dealing with the technology, especially at the supply side. 3) Include government's perspective on technology adoption.
Yacob Moorthy (2012)	&	Green Practices: Perception of Malaysian SME Owners/Managers	-	Attitude towards environment Subjective norm (environmentalist & green movement) Perceived behavioral control (motivation)	-

Table 2.3 (Continued)

Wu & Teng (2011)	Applying the Extended Theory of Planned Behavior to Predict the Intention of Visiting a Green Hotel	400 respondents	Face-to-face surveys via convenience sampling	Attitude Subjective norm Perceived behavioral control	AT, SN and PBC - were significantly effect intention to visit green hotel
Teck (2013)	Use of Structural Equation Modeling to Predict the Intention to Purchase Green and Sustainable Homes in Malaysia	500 respondents Malaysia	Survey questionnaire SEM using AMOS	Attitude Subjective norm Perceived behavioral control	AT,SN and PBC - were significantly effect intention to purchase green house

Table 2.3 (Continued)

Moser (2015)	Thinking Green, Buying Green? Drivers of Pro-environmental Purchasing Behavior	12113 households in Germany	Survey questionnaires SEM using AMOS	Attitude	Attitude not significant to green purchasing behavior	Further research should scrutinize the attitude as behavior gap and identify major barriers that hinder consumers from translating their green attitudes into practice
Mahesh & Ganapathi (2012)	Influence of Consumers' Socio-Economic Characteristics and Attitude on Purchase Intention of Green Products	300 consumers Chennai City	-Survey Simple random -Descriptive statistics, ANOVA test, Chi-Square analysis and binary logit regression	Consumers' attitude	Consumers attitude had a positive relationship towards purchasing green products	-

Table 2.3 (Continued)

Teo (2012)	Examining the Intention to Use Technology among Pre-service Teachers : an Integration of the Technology Acceptance Model and Theory of Planned Behavior	157 service teachers in Singapore	pre- in	Survey questionnaire Descriptive statistics Validity	Attitude Subjective Norm	AT and SN had significant effects on BIU technology	Future research could include additional studies integrating the TAM and TPB with a view to examine their combined predictive abilities to explain the BIU among technology users in education.
Wan <i>et al.</i> (2012)	Recycling Attitude and Behaviour in University Campus: a Case Study in Hong Kong	179 students and 26 staff members in Hong Kong	students and staff in	Survey questionnaires	Attitude Subjective Norm	Attitude and subjective norm had significant relationship towards recycling.	Further studies were suggested to apply the model in different higher education institutions in different areas, and to include different campus users, such as administrative staff, and faculty members, etc., as samples.

To related with our framework, Theory Planned Behavior is used as the underlying theory because variables attitude and subjective norm involved in the study. Specifically, this study considers staff's attitude and subjective norm towards green technology as predictor for behavioral intention on green technology implementation. Besides TPB, this research includes another model which is Technology Acceptance Model (TAM). More explanation on Technology Acceptance Model (TAM) is presented in the next section.

2.3.2 Technology Acceptance Model (TAM)

Technology Acceptance Model is one of the well-known models related to technology acceptance and use is originally proposed by Davis in 1986. TAM has been proven to be a theoretical model in helping to explain and predict user intention of technology (Lu, Yu, Liu, & Yao, 2003; Park, Nam, & Cha, 2012). TAM is considered as an extension of Theory of Reasoned Action (TRA). TAM provides a basis with which one traces how external variables influence belief, attitude, and intention to use. Two cognitive beliefs posited by TAM are perceived usefulness and perceived ease of use.

According to TAM, one's actual use of a technology system is influenced directly or indirectly by the user's behavioral intentions, attitude, perceived usefulness of the system, and perceived ease of the system. TAM also proposes that external factors affect intention and actual use through mediated effects on perceived usefulness and perceived ease of use. Figure 2.2 depicts the original TAM.

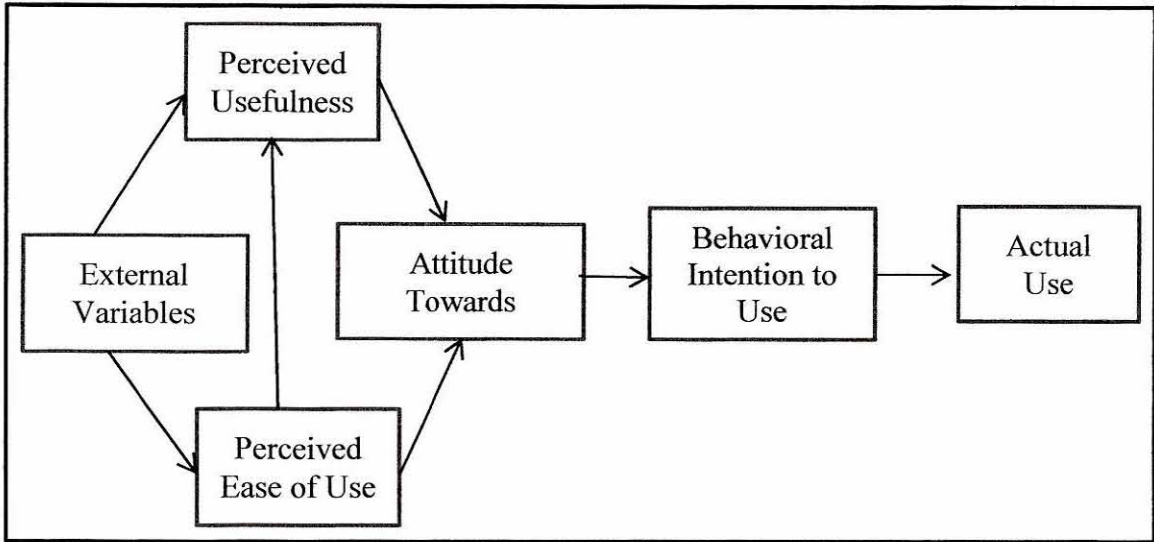


Figure 2. 2
 Technology Acceptance Model
 Source: Sung (2009)

As one of the popular models in technology field, various researchers had used this model to find the factors that affect behavioral intention. Some examples of previous study are Ahmad *et al.* (2017), Averdung & Wagenfuehrer (2011), Chang *et al.*, 2015, Park (2009), Park *et al.* (2012), Lu *et al.* (2003) and Teo (2012). Summary of previous study that used Technology Acceptance Model (TAM) as their guideline model is presented in the Table 2.4 (refer page 44).

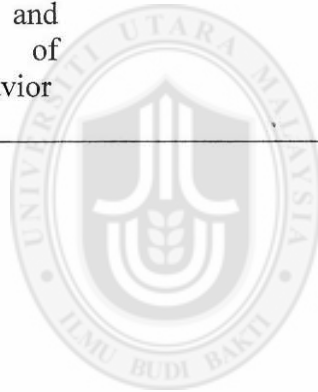
Table 2.4

Summary of Previous Study that used Technology Acceptance Model (TAM)

Authors/Year	Title	Sample	Methods use	Item use in TAM	Result	Future research
Ahmad <i>et al.</i> (2017)	Public Acceptance of Residential Solar Photovoltaic Technology in Malaysia	780 respondents - among the residents of peninsular Malaysia	Questionnaires Non-probability convenience sampling	Perceived usefulness Perceived ease of use	Perceived usefulness and perceived ease of use significantly influenced behavioural intention to use solar PV technology.	1) Further study should address causal inferences and the cost of technology. 2) Further study should include organizations dealing with the technology, especially at the supply side. 3) Include government's perspective on technology adoption.
Averdung & Wagenfuehrer (2011),	Consumers' Acceptance, Adoption and Behavioural Intentions Regarding Environmentally Sustainable Innovations	105 respondents in Germany	Questionnaires SEM	Perceived comfort of use Perceived usefulness	Perceived comfort of use is significant Perceived usefulness serves as mediator	-

Table 2.4 (Continued)

Teo (2012)	Examining the Intention to Use Technology among Pre-service Teachers : an Integration of the Technology Acceptance Model and Theory of Planned Behavior	157 service teachers in Singapore	pre- in	Survey questionnaire Descriptive statistics Validity	Perceived usefulness Perceived ease of use	Perceived usefulness and perceived ease of use had a significant influence on attitude towards use of technology	Future research could include additional studies integrating the TAM and TPB with a view to examine their combined predictive abilities to explain the BIU among technology users in education.
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Technology Acceptance Model (TAM) has been used to clarify the relationship between independent variables and dependent variable. For example, in the study of public acceptance regarding residential solar Photovoltaic (PV) technology in Malaysia, TAM has been used as factors that affect intention of public acceptance. In that study, perceived usefulness and perceived ease of use significantly and positively contributed to attitude towards using solar PV. However, as compared to both variables (perceived usefulness and perceived ease of use), the strength of perceived ease of use was stronger than perceived usefulness. It was confirmed that, TAM can be used as model to analyze the uptake of solar PV technology in Malaysian context.

Besides using TAM in solar Photovoltaic (PV) technology in Malaysia, it has been used in consumer's willingness to pay more for an environmentally sustainable innovation study by Averdung & Wagenfuehrer (2011). This study examined the perceived comfort of use increases the consumer's willingness to pay more for an environmentally sustainable innovation. Besides that, this study also presented that perceived usefulness in TAM can serve as a mediator for the effect of ecological attitude on consumer's willingness to pay more for an environmentally sustainable innovation.

Park (2009) stated that it needs to use TAM to understand university students' behavioral intention to use e-learning. The result from that study proved that TAM is the best theoretical tool to understand users' acceptance of e-learning. He tested the relationship between e-learning self-efficacy, subjective norm, system accessibility, perceived usefulness, perceived ease of use, attitude and behavioral intention to use e-learning.

Meanwhile, Park *et al.* (2012) used TAM in order to find the university students' behavioral intention to use mobile learning. The general structural model based on m-learning self-efficacy, relevance for students' major (MR), system accessibility, subjective norm, perceived usefulness, perceived ease of use, attitude and behavioral intention to use mobile learning. From the results, they confirmed that TAM was the model to explain students' acceptance of mobile learning.

Besides that, other scholars that used TAM as their model are Lu *et al.* (2003). In that study, variables used are technology complexity, individual differences, wireless trust environment, social influences and facilitating conditions. Twelve propositions were developed to facilitate future empirical research relating to wireless internet via mobile devices.

Moreover, TAM also may influence attitude towards use of technology. A study by Teo (2012) found that perceived usefulness and perceived ease of use has significantly influenced attitude towards use of technology. Therefore, this study concluded that TAM can be used to validate the relationship between independent variables and dependent variables.

Since in our framework employs technology as one of the variables, we can relate the underlying theory of Technology Acceptance Model to support this study. Furthermore, we used attitude and subjective norm as our independent variables.

2.4 Variables that Influence this Study

Four variables were chosen as factors influencing green technology implementation. They are attitude, subjective norms, environmental awareness and technology. Besides that, government support will be used as moderating variable. The explanations for all variables are presented in the following section.

2.4.1 Attitude

Attitude refers to the degree to which an individual has an unfavorable or favorable evaluation of the given behavior. Attitude is a variable that affects green technology implementation. Some of the attitude definitions quoted from previous researchers are presented subsequently.

2.4.1.1 Definition of Attitude

There are various forms of attitude definition. The definitions are shown in the Table 2.5.

Table 2.5

Definitions of Attitude According to Previous Researchers

Author and Year	Definition
Baker <i>et al.</i> (2007)	When investigating technology adoption in organizations, attitude toward using technology is an employee's evaluation of the costs and benefits of using the new technology.
Lien & Chen (2010)	The green consumption attitude in this study means the consumer attitude for the green consumer behavior is positive or negative to the restaurant.

Table 2.5 (Continued)

Mahesh & Ganapathi (2012)	The consumers' attitude towards environment, health, food safety and animal welfare are made up of their belief which they accumulate from their lifetime
Md Zain <i>et al.</i> (2012)	attitude toward sustainable behavior refer to an individual's responsibility in using the natural resources
Teck (2013)	Attitude refers to the degree to which an individual has an unfavorable or favorable evaluation of the given behavior
Massoules (2011)	Attitude is a psychological tendency that is expressed by evaluating a particular entity which some degree of favor or disfavor
Aman, Harun, & Hussein (2012)	Attitude is a person's feelings, consistently favorable or unfavorable evaluations, and tendencies toward an object or idea.
Chan (2013)	Attitudes of the consumers in relation to the environment protection.

Attitude as the first variable can be defined as a person's reaction through the soul, whose behavior can become a common habit while attitude toward sustainable behavior refer to an individual's responsibility in using the natural resources (Md Zain *et al.*, 2012). Attitude refers to the degree to which an individual has an unfavorable or favorable evaluation of the given behavior (Teck, 2013). It determines whether a person's actions are positive or negative. As coded by Chen, Gregoire, Arendt, & Shelley (2011), when a person has a more positive attitude towards a behavior, the person will want to engage in a certain behavior. It means that, if a person has a more positive attitude towards a behavior, the person will also intent to implement green technology. Furthermore, an attitude is a psychological tendency that is expressed by evaluating a particular entity which some degree of favor or disfavor (Massoules, 2011). According to Siohong & Zainol (2012), a positive attitude towards a behavior will more likely influence a person

to engage in the behavior; while a negative attitude towards an act will less likely influence a person engage in such behavior. According to Aman, Harun, & Hussein (2012), attitude is a person's feelings, consistently favorable or unfavorable evaluations, and tendencies towards an object or idea. The definition clearly indicates that staffs will have positive or negative attitudes towards green technology implementation.

This study basically focuses on the positive attitude of the staff. As discussed in the previous chapter, staff are the driving force behind the implementation of green technology in university. Staff are the driving force that may launch the implementation of green technology. In that regard, the study preferred to adopt the definitions set from Teck (2013) and Aman, Harun, & Hussein (2012) where they defined attitude as a degree to which an individual has an unfavorable or favorable evaluation of the given behavior. Therefore, attitude in this study refers to the staff 's evaluation towards green technology such as favorable or unfavorable for them.

2.4.1.2 Attitude is a Source of Green Technology Implementation

Esa *et al.* (2011) deduced that without a shift in mentality and habits, the advancements of green buildings in Malaysia will be a very difficult vision to achieve. Besides that, the movement of individuals toward positive attitudes and behaviors regarding sustainable practices can affect the success of recycling activities at UKM (Md Zain *et al.*, 2012). Not only that, Calvin *et al.* (2012) stated that behavioral intention especially recycling is influenced by attitude. In this study, 179 students and 26 staff from public university in Hong Kong were chosen as respondents. The result revealed that attitude was significant

to behavioral intention (recycling) with low impact which was $\beta = 0.19$. Consequently, in the context of Malaysia, Derahim *et al.*, (2011) indicated that the successful of sustainability in university need changing attitude from each individual in institution like faculty, staff and students. There are 2275 students who were involved in this study.

2.4.2 Subjective Norm

Subjective norm refers to the degree to which an individual has an unfavorable or favorable evaluation of the given behavior. Subjective norm is a variable that affects green technology implementation. Here are some definitions of subjective norm quoted from previous researchers.

2.4.2.1 Definition of Subjective Norm

There are various forms of attitude definition. The definitions are shown in the Table 2.6.

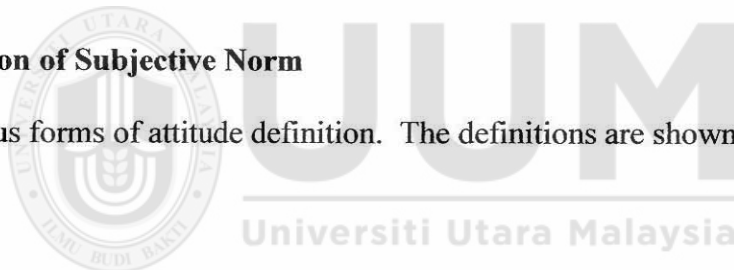


Table 2.6

Definitions of Subjective Norm According to Previous Researchers

Author & Year	Definition
Baker <i>et al.</i> (2007)	When applying TPB in the technology adoption context, subjective norm has been divided into two types of normative influence: (1) the influence of one's peers (e.g. peer influence) and (2) the influence of one's superiors (e.g. superior influence)
Mahesh & Ganapathi (2012)	Subjective norm of this study includes environmentalists and green movement. In other words, subject norm mean how others or people who are important to the consumers can influence their attitude towards green products.

Table 2.6 (Continued)

Teo (2012)	SN is the degree to which a person perceives the demands of the 'important' others on that individual to use technology
Chen <i>et al.</i> (2011)	SN measures the influence of social pressures on individuals to perform or not to perform a particular behavior.
Jyh (1998)	Subjective norm is a function of beliefs about the expecttaions of important referent others, and his or her motivation of complying with these referents.

This study basically focuses on the subjective norm of the staff. As discussed in the previous chapter, the staff are the driving force behind the implementation of green technology in university. Staff are the driving force that may launch the implementation of green technology. In that regard, the study has chosen to adopt the definitions set from Chen *et al.* (2011) where they defined subjective norm as to measure the influence of social pressures on individuals to perform or not to perform a particular behavior. Therefore, subjective norm in this study refers to the social pressures which influence staff to implement green technology such as family, media and friends.

2.4.2.2 Subjective Norm is a Source of Green Technology Implementation

Besides attitude, intent to implement green technology might be influenced by subjective norm. Subjective norm is a silent social context factor impacting individual behavior (Chen *et al.*, 2011). It measures the influence of social pressures on individuals to perform or not to perform a particular behavior. In order to learn any sustainable practices, most students often trust the people with “nothing to gain from their advocacy”, such as student leaders.

Moreover, the higher motivation from family, friends and others with whom the person shares a close personal relationship, the stronger the intention will be for that person to engage in a specific behavior. Therefore, subjective norm was important to implementing green technology.

2.4.3 Environmental Awareness

Environmental awareness refers to environmental knowledge and environmental concern regarding certain behavior. Environmental awareness is a variable that affects green technology implementation. Here are some definitions of environmental awareness quoted from previous researchers.

2.4.3.1 Definition of Environmental Awareness

There are various forms of environmental awareness definition. The definitions are shown in the Table 2.7.



Table 2.7
Definition of Environmental Awareness According to Previous Researcher

Author & Year	Definition
Sang & Bekhet (2015)	Environmental awareness is the degree to which people were aware of problems regarding the environment and support the effort to solve them or indicate the willingness to contribute personally to the solution.

This study basically focuses on the environmental awareness of the staff towards environmental problems. As discussed in the previous chapter, environmental awareness

is very important to successfully implement green technology. With that regard, this study preferred to adopt the definitions set from Sang and Bekhet (2015) where they defined environmental awareness as the degree to which people were aware of problems regarding the environment and support the effort to solve them or indicate the willingness to contribute personally to the solution. Therefore, environmental awareness in this study refers to the staff's awareness on environmental problem.

2.4.3.2 Environmental Awareness is a Source of Green Technology Implementation

Despite attitude and subjective norms, environmental awareness is another predictor of intention to implement green technology. Surveys by scholar Devine-wright (2007), have found that there was low level of awareness regarding energy consumption and climate change. An understanding in the concept of green technology was closely related to the how environmental consciousness in its implementation. As coded by Devine-wright (2007), although students may be aware of different energy sources, more in depth understanding of these sources vary markedly. Greater awareness on green technology in Malaysia may be instilled when higher education institutes offer mandatory courses (Bernama, 2012). Increasing the awareness of the seriousness of environmental problems has led to an increasing number of individuals to perform environmentally friendly behavior (Rezai *et al.*, 2013).

2.4.4 Technology

Technology refers to technology of green technology whether it is simple and easy to learn, use, helpful for improving environmental and it is compatible to existing operations

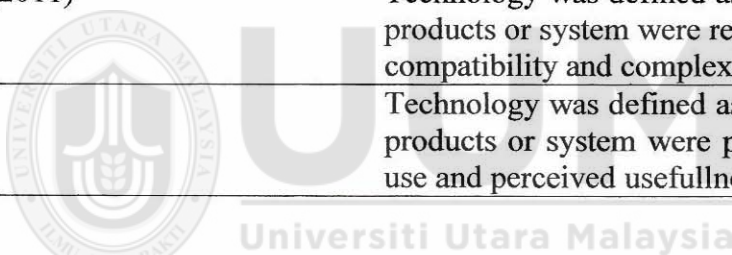
or not. Technology is a variable that gave effect to green technology implementation. Here are some definitions of technology quoted from previous researchers.

2.4.4.1 Definition of Technology

There are various forms of technology definition. The definitions are shown in the Table 2.8.

Table 2.8
Definitions of Technology According to Previous Researchers

Author & Year	Definition
Lin & Ho (2011)	Technology was defined as whether certain products or system were relative advantage, compatibility and complexity.
Ming & Chieh (2011)	Technology was defined as whether certain products or system were relative advantage, compatibility and complexity.
Sung (2009)	Technology was defined as whether certain products or system were perceived ease of use and perceived usefulness



This study basically focuses on the technology of the green technology products or system. As discussed in the previous chapter, technology of green products or system is very important to successfully implementing green technology. With that regard, the study had chosen to adopt the definitions set from Sung (2009) where he defined technology as whether certain products or system were perceived ease of use and perceived usefulness. Therefore, technology in this study refers to the technology of green product or green practices whether it is simple and easy to learn, use, helpful for improving environmental and it is compatible to existing operations or not.

2.4.1.2 Technology is a Source of Green Technology Implementation

Besides the three factors, technology may be one of the relevant factors affecting the implementation of new technologies (Lin & Ho, 2011). It is because technology can change depending on time. Moreover, different green technology applications use different technology.

Not all data are available to everyone because of certain reasons (Velazquez *et al.*, 2005). As mentioned by Velazquez *et al.* (2005), many companies are hesitance and scare to share information regarding sustainability practices with university community. Although technological factor has often been discussed in technical innovation, its influence on green technology implementation in university is scarcely analyzed. As suggested by Lin and Ho (2011) technology characteristics should be one of factors when analyzing the adoption of green practices. Besides that, as stated by Zimmerman and Halfacre (2006), if campus community does not agree with the changes or not familiar with the technology, the green technology implementation will fail.

2.4.5 Government Support

Government support in this study refers to the support from government that give to university such as financial resources, technical assistance, training and skills, environmental guidance and policy. Government support is a variable that affects green technology implementation. Here are some definitions of government support quoted from previous researchers.

2.4.5.1 Definition of Government Support

There are various forms of government support definition. The measurement of government support from previous studies are shown in the Table 2.9.

Table 2.9

Measurements of Technology According to Previous Researchers

Author & Year	Measurement
ElTayeb, Zailani & Jayaraman (2010)	Regulations
Velazquez <i>et al.</i> (2005)	Regulations, funding and policies
Amrina & Mohd Yusof (2012)	Government regulations
Moorthy <i>et al.</i> (2012)	Financial incentives and legislation

Based on the Table 2.9, authors measured government support from different perspectives. As this study tried to find the effect of government support on green technology implementation in university, hence, author has complied all the measurements from previous studies. Therefore, government support in this study refers to the support from government that give to university such as financial resources, technical assistance, training and skills, environmental guidance and policy.

2.4.5.2 Importance of Government Support for Green Technology Implementation

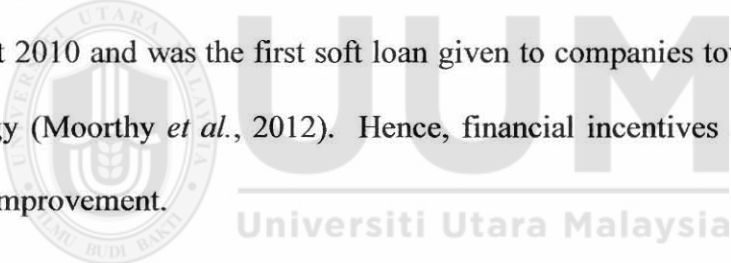
As a moderating variable, government support is also one of the important factors influencing green technology implementation. Since 2009, there are numerous initiatives as well as rules and regulations regarding green technology. Prof Dr Karl Wager said that, there was one regulation that was probably still missing which was the regulation on energy efficiency and would be implemented from 2014 onwards (Cool, 2012). On the

other hand, government may offer resource subsidies to levying text for green technology investment (Zhu, Sarkis, Cordeiro, & Lai, 2008). In Malaysia, the government offers various environmental incentives for the manufacturing sector such as capital rebate of up to 50 percent for purchase of recycling machineries and exemption on import duties and sales tax for such machines (ElTayeb *et al.*, 2010).

According to Velazquez *et al.* (2005), “lack of support is not only absence of funds but also the absence of leadership among university management”. There is a need for more government support for green technology implementation. As mention by Velazquez *et al.* (2005), more rigorous regulations are needed for sustainable development. Besides that, it is also necessary to put more emphasis in the enforcement of those regulations in order to effectively promote sustainability. They also observed that the existence of policies for backing sustainability initiatives was rarely found in universities and when they exist, policy enforcement was lacking and not truly effective in guiding daily campus activities. Besides that, the amount of funding and grant awards to implement sustainable projects on university are lower. The budgetary limits of projects ultimately force the participants to search for cheap products and donated items and affect other aspects to successful participation and perception of the green campaign (Zimmerman & Halfacre-hitchcock, 2006). They also stress that, in order to involve students in green technology implementation, a project budget must include sufficient funds for purchasing the new technology and devices for the building.

Amrina and Mohd Yusof (2012) has underlined the lack of top management commitment is also considered as the major obstacle in implementing sustainable manufacturing. They also suggest that in order to successfully implement sustainable manufacturing, top management must give their full commitment like support infrastructure and providing sufficient resources needed.

Financial incentives are also amongst the government supports. In SMEs, incentives related to finances are considered to be of great importance driver in environmental improvement (Moorthy *et al.*, 2012). This includes availability of public funding programs for green initiatives and tax, fee and subsidy system in the country. For example, in Malaysia, Green Technology Financing Scheme (GTFS) was announced in National Budget 2010 and was the first soft loan given to companies towards supporting green technology (Moorthy *et al.*, 2012). Hence, financial incentives are vital to drive environmental improvement.



Previous study by Gallagher and Muehlegger (2011) identified that variety incentives offered by the federal, state and local governments are the drive motivating consumers to adopt new hybrid vehicles. Another study by Zhu, Sarkis and Lai (2007) found that government support may also lessen barriers for organizations to embrace environment practices. Government policy (GP) can help higher education institution to obtain green technology by training and providing technologies (Zhu *et al.*, 2007).

From previous literature, it was found that government support was researched in various context of behavioral intention such as green purchase intention (Cavana *et al.*, 2012; ElTayeb *et al.*, 2010), green purchase (Min & Galle, 2001; Ramakrishnan, Haron, & Yen, 2015) and green practices adoption (Lin & Ho, 2011). A study by Mei *et al.* (2012) on 249 Malaysian consumers proved that government support was significantly effect green purchase intention. Similarly, ElTayeb *et al.*, 2010) also found that regulation has the most significant effect on green purchasing. Besides that, for green purchase practices, a study by Min and Galle (2001) found that there was a significant positive relationship between environmental regulatory and Green purchasing practices of US firms. Moreover, as similar to others study, Lin and Ho (2011) also affirmed that green practice adoption was significantly effect by government support. In this study around 353 respondents from Logistics Company in China were chosen as sample. Based on the previous relationship between government support and behavioral intention, Moorthy *et al.* (2012) also proposed theoretical framework where government support be part of independent variable. They have divided the government support into two contexts such as financial incentives and legislation. Other studies at Malaysia on green purchasing was done by Ramakrishnan *et al.* (2015) examines that government regulation influence employees green purchasing adoption. Government regulation was positively and significantly effect green purchasing adoption. Tan *et al.* (2014) investigated the factors which influence green purchasing in Kuala Lumpur, Malaysia. The results from the study affirmed that role of government was the strongest and positive predictor of green purchase intention.

Thus, considering dominance role of government support in prior literatures as an important factor of behavioral intention in green context, government support was considered in this research and it was expected that this variable would play important role on behavioral intention in the context green technology implementation in Malaysia. As government support was the strongest predictor to green behavior, therefore government support was chosen as moderating variable. The following table (Table 2.10) presents the summary of previous study on relationship between government support and behavioral intention.

Table 2.10

Summary of Previous Study on Relationship between Government Support and Behavioral Intention

Author & year	Area	Country	Respondent	Relationship
Ramakrishnan <i>et al.</i> (2015)	Green Purchasing Adoption	Malaysia	150 full time employees	Significant Positive
Min & Galle (2001)	Green Purchasing Practices	US	527 respondents	Significant Positive
Lin & Ho (2011)	Green Practices Adoption	China	322 respondents	Significant
ElTayeb <i>et al.</i> (2010)	Green Purchasing	Malaysia	132 firms	Significant
Tan <i>et al.</i> (2014)	Green Purchasing	Malaysia	458 respondents	Significant Positive

2.4.6 Green Technology Implementation

Green technology (GT) is defined as the development and application of products, equipment and systems used to conserve the natural environment and resources, which minimizes and reduces the negative impact of human activities. Aithal and Aithal (2016) implied green technology as environmental technologies that reduces and heals

environmental damages created by the products and technologies for the benefits and convenience of people. As mentioned by Chen *et al.* (2011), green technology implementation may be classified as successful when respondents intend to adopt, will to adopt and plan to adopt.

Besides that, other scholars which are Ivan *et al.* (2010) also measured successful green technology implementation when respondents intend to use green, plan to use green technology, will to use green technology, often use green technology to communicate university work and use green technology to plan for transportation in campus. They (Ivan *et al.* 2010), also found that other criteria to measure successful green technology are when organization would find the green technology useful in work, using the green technology enables us to accomplish tasks more quickly, using the green technology increase our productivity and using green technology promotes efficient utilization in our work. Besides that, the aim of green technology implementation is to meet the needs of community for a better quality of life by reducing the carbon footprint on the environment. Abu Bakar *et al.* (2011) observes that there are six business success factors of green technology to Malaysian entrepreneurs embark on that such as green nanotechnology, green chemistry, green supply chain, green purchasing, green building and green energy. The elaborations on types of green technology are discussed in the following section.

2.5 Types of Green Technology

Based on previous study, there are several types of green technology had been researched. The following are the some of the types of green technology investigated by previous studies. Table 2.11, Table 2.12, Table 2.13 and Table 2.14 show previous researches on green technology context.



2.5.1 Green Purchasing

Green purchasing refers to the purchase of green product. Summary of previous study on green purchasing is presented in Table 2.11 below. There were several authors that studied green purchasing like Chan (2013), Mei *et al.* (2012), Qader and Zainuddin (2011a), ElTayeb *et al.* (2010), Qader and Zainuddin (2011b), Aman *et al.* (2012), Ham *et al.* (2015), Joshi and Rahman (2016), and Teck (2013).

Table 2.11
Green Purchasing Study

Authors and Years	Sample size	Variables	Measurement of dependent variable	Findings
Chan (2013)	137 white collar employees	Environmental attitude Self-efficacy Store images Roles of sales person Willingness to pay more	Consumers' purchase intention on green personal care products.	Environmental attitude and self-efficacy are significant to green purchasing
Mei <i>et al.</i> (2012)	230 consumers	Environmental knowledge Environmental attitude Government initiatives Peer pressure Eco-label	Intention to purchase green products	Environmental knowledge, environmental attitude, government initiatives and peer pressure are positively related to green purchase intention, while eco-label is not

Table 2.11 (Continued)

Qader & Zainuddin (2011a)	175 academic staff	Media exposure	Intention to purchase green products - Intended to purchase a lead-free electronic product in future - Would try to purchase a lead-free electronic product in future	positively related. Media exposure significantly influence green purchasing
ElTayeb <i>et al.</i> (2010)	132 firms	Regulations (RG) Customer pressures (CP) Social responsibility (SR) Expected business benefits (EBB)	Green purchasing (GP) in the Malaysian manufacturing sector	GP is affected by the drivers namely RG, CP, EBB, and firm ownership. SR did not affect GP.
Qader & Zainuddin (2011b)		Media exposure Safety and health concern Self-efficacy	Consumers environmental attitude to buy green product	Safety and health concern and self-efficacy have a positive influence on environmental attitude to buy green product, while media exposure did not have positive influence on environmental attitude to buy green product.

Table 2.11 (Continued)

Aman <i>et al.</i> (2012)	384 Sabahan consumers	Environmental knowledge Environmental concern Attitude (mediator)	Green purchase intention	Environmental knowledge and environmental concern are significant to green purchase intention
Ham <i>et al.</i> (2015)	411 shoppers	Personal attitude Subjective norm (descriptive norm, social norm) Perceived behavioral control	Green purchase intention	Personal attitude, subjective norm and perceived behavioral intention have significant relationship to green purchase intention.
Joshi & Rahman (2016)	1502 college students in Delhi	Social influence Attitude towards green purchasing Perceived environmental knowledge Recycling participation Ecolabelling Exposure to environmental message through the media	Green purchase intention	Social influence, attitude towards green purchasing, perceived environmental knowledge, recycling participation, ecolabelling and exposure to environmental message through the media are significant predictors for green purchase intention
Teck (2013)	252 consumers	Attitude Social influence Perceived behavioral control Perceived self-identity	Green purchase intention	Attitude perceived behavioral control and perceived self-identity are significant predictor of green purchase.

2.5.2 Green Practices

Green practices involve the implementing new or modified processes, techniques and systems to reduce environmental harms. Example of green practices is recycling. Summary of previous study on green practices was presented in the Table 2.12 below. There were several authors that studied green practices like Calvin *et al.* (2012), Siohong and Zainol (2012), Royne *et al.* (2016), Lin and Ho (2011), and Sang and Bekhet (2015).

Table 2.12
Green Practices Study

Authors and Years	Sample size	Variables	Measurement of dependent variable	Findings
Calvin <i>et al.</i> (2012)	205 respondents	Attitude Subjective norm Perceived behavioral control Consequences awareness Moral norm Convenience	Intention to recycle	Attitude, subjective norm, perceived behavioral control, consequences awareness moral norm and convenience relates positively to recycle intention

Table 2.12 (Continued)

Siohong & Zainol (2012)	315 respondents	Green attitude Subjective norm Perceived behavioral control Green practices consequence	Intention to recycle	Green attitude, subjective norm, perceived behavioral control and green practices consequence have a positive effect on the recycle intention
Royne <i>et al.</i> (2016)	919 respondents	Environmental concern	Intention to recycle	Environmental concern was positively related to recycling behavior
Lin & Ho (2011)	353 respondents	Technological factors - Relative advantage - Compatibility - Complexity Organizational factors - Organizational support - Quality of human resources - Company size Environmental factors - Customer pressure - Regulatory pressure - Governmental support - Environmental uncertainty	Green practice adoption	All the organizational and environmental factors have a positive influence on green practices adoption. While on technological factors, only relative advantage and compatibility are positively influence green practices adoption

Table 2.12 (Continued)

Sang & Bekhet (2015)	751 respondents	Social influences Performance attributes Financial benefits Environmental concern Demographic Infrastructure readiness Government interventions	Usage intentions	Social influences, performance attributes, financial benefits, environmental concern, demographic, infrastructure readiness, government interventions are positively and significantly influence usage intention
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2.5.3 Green Manufacturing

Green manufacturing reflects the new manufacturing paradigm that employs various green strategies and techniques to become more eco-efficient. These strategies include creating products or systems that consumes less material and energy, substituting input materials (e.g. non-toxic for toxic), reducing unwanted outputs and converting outputs to inputs (recycling). Summary of previous study on green manufacturing was presented in the Table 2.13 below. There were several authors that studied green manufacturing like Ratnasingam and Wagner (2009), Chang, Kenzhekhanuly, and Park (2013), and Zhu, Sarkis, and Lai (2008).

Table 2.13

Green Manufacturing Study

Authors and Years	Sample size	Variables	Measurement of dependent variable	Findings
Ratnasingam & Wagner (2009)	250 of the largest wooden furniture manufacturers in Malaysia	Customer expectation, product design, strategic manufacturing initiatives, regulatory requirement, responsibility for the environment and shareholder	Green manufacturing practices among wooden furniture manufacturers in Malaysia.	Customer expectation, product design, strategic manufacturing initiatives, regulatory requirement, responsibility for the environment and shareholder value were reported as the contributing factors, in the order of decreasing importance, for the adoption of green manufacturing practices among wooden furniture manufacturers in Malaysia
Chang, Kenzhekhanuly, & Park (2013)	Companies in Korea	Internal Pressure External Pressure	Green supply chain management (GSCM)	Empirical research results revealed that both external and internal pressures have no influence on implementing GSCM
Zhu, Sarkis, & Lai (2008)	341 Chinese manufacturers	Internal environmental management (IEM), green purchasing (GP), cooperation with customers including environmental requirements (CC),	Green supply chain management practices implementation	IEM, GP, CC, ECO, and IR are positively highly correlated measurement factors for GSCM practices implementation

Table 2.13 (Continued)

eco-design practices (ECO), and
investment recovery (IR)

2.5.4 Green Building

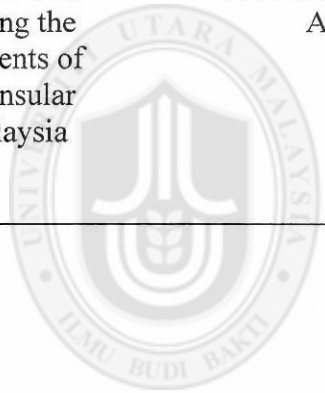
Green building can be defined as a practice of increasing efficiency of resources used, while at the same time reducing their impact on human health and environment. Green building concepts were designed to reduce the overall impact of the built environment. Summary of previous study on green building are presented in the Table 2.14 below. There were several authors that studied green building like Azis, Sipan, Sapri, Jalil, & Mohammad (2017) and Yasin, Abdullah, Yunus, Khalid, & Wahab (2016).

Table 2.14
Green Building Study

Authors and Years	Sample size	Variables	Measurement of dependent variable	Findings
Azis <i>et al.</i> (2017)	550 property valuation practitioners in Malaysia	Green envelope components	Green building	Only three green envelope components that can increase property values, specifically solar photovoltaic, green living wall and green roof

Table 2.14 (Continued)

Yasin <i>et al.</i> (2016)	100 respondents	Potential retrofit for green building	Green building	Installation of solar technology most priority step in the operation of green building Most potential criteria in green building is used renewable energy
Ahmad <i>et al.</i> (2017)	780 respondents - among the residents of peninsular Malaysia	Perceived ease of use Perceived usefulness Attitude	Public acceptance of residential solar photovoltaic technology in Malaysia	The analysis revealed that perceived ease of use, perceived usefulness and attitude to use significantly influenced behavioural intention to use solar PV technology



2.6 Theoretical Framework

The theoretical framework for this study was developed based on Theory Planned Behavior (TPB). This study was designed in order to investigate the antecedents of green technology implementation which has a relationship with attitude, subjective norm, environmental awareness and technology.

Based on the extensive literature on green technology implementation, attitude, subjective norm, environmental awareness, technology and government support with the problem statement presented in chapter one, as well as Theory Planned Behavior, an integrated framework is developed in order to investigate the factors of successful green technology implementation. Other than that, this study also tried to investigate the relationship between attitude, subjective norm, environmental awareness and technology on government support. The following Figure 2.3 shown the relationships between all proposed variables.

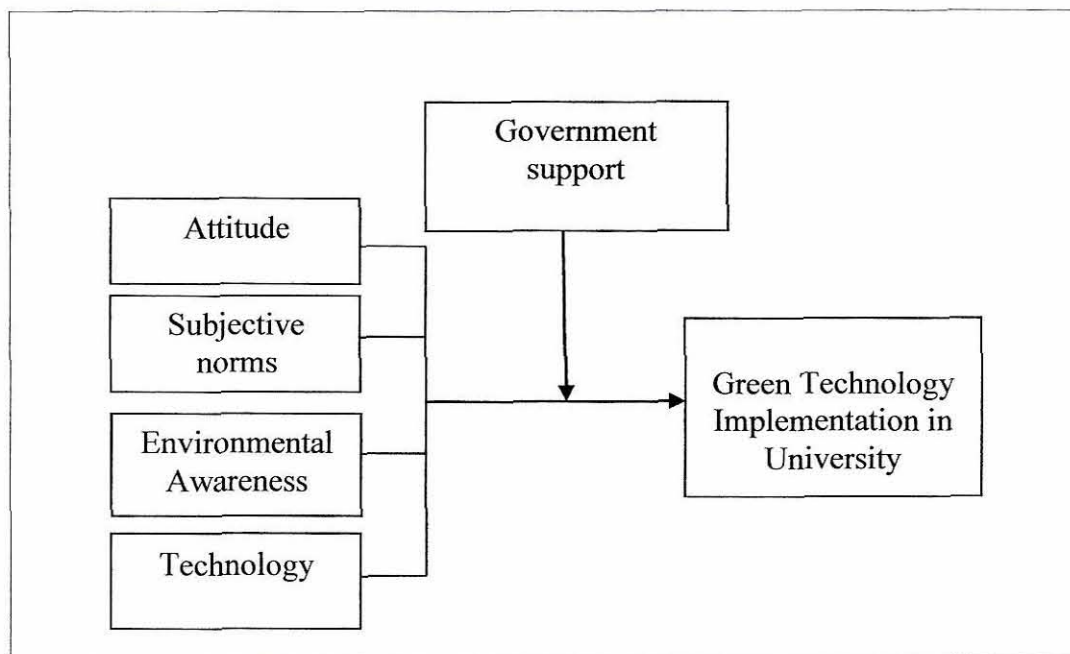


Figure 2.3
Research Framework of Green Technology Implementation

2.7 Research Hypotheses

Based on the theoretical framework, hypotheses for this research dimensions were formulated and developed in order to test the relationships among attitude, subjective norm, environmental awareness, technology and government support with green technology implementation and finally to achieve research objectives.

2.7.1 Relationship between Independent Variables and Green Technology Implementation

Independent variables refer to attitude, subjective norms, environmental awareness and technology. These lead the following hypotheses:

2.7.1.1 The Relationship between Attitude and Green Technology Implementation

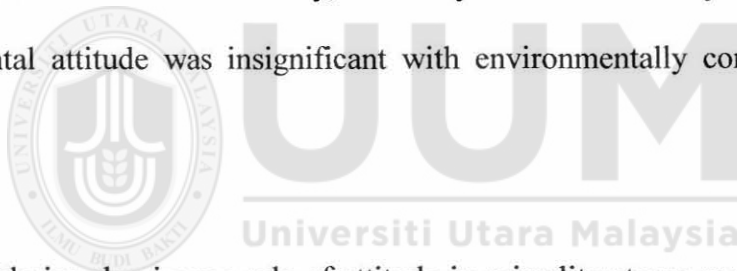
With regards to green studies, previous research findings indicated that green attitudes positively affected the intention to purchase green product (Cavana *et al.*, 2012; Chan, 2013). Chan (2013) examined green purchasing intention among 137 consumers and found that attitude positive and significant direct on green purchasing. The above author found that the direct effect had high impact ($\beta= 0.538$) on green purchasing. In addition, attitude had been found as the strongest predictors of behaviors compared to subjective norms and perceived behavioral control (Hung *et al.*, 2010). Moreover, as stated by Massoules (2011), attitude is strongly link with behavior. Besides that, others previous study also found that attitude had a positively and significantly influenced behavioral intention (Abd Hamid, 2011; Derahim *et al.*, 2011; Esa *et al.*, 2011; Md Zain *et al.*, 2012; Mohd Suki, 2016) .

Mohd Suki (2016) explore consumers' attitude towards green brands and green brand knowledge on behavioral intention of green purchasing in Malaysia and found that attitude towards green brands is positively and significantly effect green purchasing.

Though many findings highlight the direct relationship between attitude and behavioral intention, Han, Hsu, and Lee (2009) pointed out that attitude also has an indirect impact on the intention to visit, word-of-mouth communication and the willingness to pay more for green products and services, with overall image acting as a mediator between attitude and intention. In that study, the online survey was employed to collect data. Based on 3000 customers sent electronically, only 422 questionnaires were returned for

analysis. Similarly, Aman *et al.* (2012) investigated the influence of environmental knowledge and environmental concern on consumers green purchase and also the mediating effect of attitude. The findings confirmed that attitude mediated the relationship between environmental concern and green purchase intention.

However, even though attitude was considered as one of important and significant positive determinants of behavioral intention in most of the previous researches, some prior researchers also have found statistically insignificant influence of attitude on behavioral intention (Arslan, Yilmaz, & Aksoy, 2012). For example, Arslan *et al.* (2012) had included environmental attitude as one of the factors that influence purchasing behavior. Unfortunately, the study on 400 university students found that environmental attitude was insignificant with environmentally conscious purchasing behavior.



Thus, considering dominance role of attitude in prior literatures as an important factor of behavioral intention in green context, attitude is considered in this research and expects that this variable will play important role on behavioral intention in the context green technology implementation in Malaysia. Furthermore, due to inconsistency nature of the above findings of attitude on behavioral intention and the problem of generalize the results, attitude is considered in this study and expects that this variable will play important role on behavioral intention in the context of green technology implementation in Malaysia. The following table (Table 2.15) shows the summary of previous study on relationship between attitude and green behavior.

Table 2.15

Summary of Previous Study on the Relationship between Attitude and Green Behavior

Author & year	Area	Country	Respondent	Relationship
Moser (2015)	Green Purchasing	Germany	12113 households	Significant
Mohd Suki (2016)	Green Purchasing	Malaysia	300 respondents	Significant
Joshi & Rahman (2016)	Green Purchasing	Delhi, India	1502 college students	Significant Positive
Siohong & Zainol (2012)	Green Practices	Malaysia	315 Voluntary respondents	Significant
Calvin <i>et al.</i> (2012)	Green Practices (recycling)	Hong Kong	179 students 26 staff	Significant
Mahesh & Ganapathi (2012)	Green Products	Chennai	300 consumers	Significant
Chow & Chen (2009)	Green Computing	Hong Kong	267 University Students	Significant
Teck (2013)	Green Purchasing	Malaysia	252 respondents	Not Significant
Tan <i>et al.</i> (2014)	Green Purchasing	Kuala Lumpur, Malaysia	458 working adults	Not Significant
Chan (2013)	Green Purchasing	Penang, Malaysia	137 white collar employees	Not Significant
Moser (2015)	Green Purchasing	Germany	12 113 households	Not significant

Based on the discussion above, there were inconsistent findings between attitude and behavioral intention. There were some proving that there was positive significant relationship (Abd Hamid, 2011; Cavana *et al.*, 2012; Chan, 2013; Derahim *et al.*, 2011; Esa *et al.*, 2011; Massoules, 2011; Md Zain *et al.*, 2012; Qader & Zainuddin, 2011b; Wan *et al.*, 2012) and some with insignificant relationship (Han *et al.*, 2009; Aman *et al.* 2012).

Studies on the relationship between attitude and green technology have been executed by Abd Hamid (2011) in Malaysia. It was found that attitude has a positive influence

on the behavioral intention towards adopting green technology. However, only public consumers were chosen as the respondents. Researcher intended to examine the interest of staff in the university towards the implementation of green technology.

In addition, researchers wanted to test the extent of the attitude toward green technology implementation and comparison of those influences compared to other sources that were still an unanswered. Therefore, there was a need to include the attitude into this framework. Researcher tried to verify the relationship between attitude and green technology implementation therefore, the hypothesis needs to make as follow:

Hypothesis 1: There is a positive relationship between attitude and green technology implementation.



2.7.1.2 The Relationship between Subjective Norm and Green Technology

From previous literature, it was found that subjective norm are researched in various context of behavioral intention such as sustainable practice adoption (Chen *et al.*, 2011), consumer purchase intention (Jyh, 1998; Tarkiainen & Sundqvist, 2005), intention to properly prepare for exams Sommer & Haug (2012), green computing (Chow & Chen, 2009), green hotel (Wu & Teng, 2011), green purchasing (Ham, Jeger, & Ivković, 2015; Joshi & Rahman, 2016) and green practices (Siohong & Zainol, 2012). Previous findings on sustainable practice adoption in USA by Chen *et al.* (2011) concluded that subjective norm positively affect the intention to adopt

sustainable practices. Based on the distributed questionnaires to 535 college and university dining services administration staff, the authors found that subjective norm impacted the intention to adopt sustainable practices with $\beta=0.33$.

Besides that, a study by Jyh (1998) on 300 students in Taiwan revealed that subjective norm positively affected consumer purchase behavior. Similarly, Tarkiainen and Sundqvist (2005) in their study on purchase behavior affirms that subjective norm was positively influence purchasing organic food. Moreover, Wu and Teng (2011) investigated the factors influencing the intention to visit green hotel and revealed a positive relationship between subjective norm and intention to visit green hotel. Besides direct effect, the authors also found out that subjective norm has mediated the relationship between past behavior and the intention to visit green hotel.

Siohong and Zainol (2012) examined the intention on engage in green practices among 315 respondents and revealed that subjective norm positively affected intention to engage in green practices. Subjective norm impacted the intention to engage in green practices with $\beta = 0.184$. In the context of green purchase behavior, a study by (Joshi & Rahman, 2016) identified that social influence was positively predicted green purchasing behavior. Another study by Sommer and Haug (2012) summarized that subjective norm positively effect students' intention to properly prepared for exams. As pointed out by Chow and Chen (2009), subjective norm had a direct effect on green computing.

Even though subjective norm was considered as one of the important and significant positive determinants of behavioral intention in most of the previous researches, some prior researchers unveiled that there was a statistically insignificant influence of subjective norm on behavioral intention (Teck, 2013). For example, Teck (2013) explored subjective norm on behavioral intention of purchase green and sustainable homes in Malaysia found that subjective norm was insignificantly related to purchase behavior (p value = 0.318).

Thus, considering the dominant role of subjective norm in prior literatures as an important factor of behavioral intention in green context, subjective norm was considered in this research and it was expected that this variable would play an important role on behavioral intention in the context green technology implementation of Malaysia. Furthermore, due to inconsistent nature of the above findings of subjective norm on behavioral intention and the inconsistent results generalization, subjective norm was considered in this study and it was expected that this variable would play important role on behavioral intention in the context of green technology implementation in Malaysia. The following table (Table 2.16) shows the summary of previous studies on relationship between subjective norm and behavioral intention.

Table 2.16
Summary of Previous Study on Relationship between Subjective Norm and Environmental Issues

Author & year	Area	Country	Respondent	Relationship
Siohong & Zainol (2012).	Green Practices	Malaysia	315 Voluntary respondents	Significant

Table 2.16 (Continued)

Author & year	Area	Country	Respondent	Relationship
Joshi & Rahman (2016)	Green Purchasing	Delhi, India	1502 young educated consumers	Significant
Calvin <i>et al.</i> (2012)	Green Practices (recycling)	Hong Kong	179 students 26 staff University campus	Significant
Sang & Bekhet (2015)	Electric Vehicle Usage	Malaysia	751 drivers	Significant
Wu & Teng (2011)	Green hotel	Taiwan	250 respondents	Significant
Chen <i>et al.</i> (2011)	Sustainable practice adoption	USA	535 administrators	Significant
Teck (2013)	Green Purchasing	Malaysia	252 respondents	Not Significant

Based on the discussion above, there were inconsistent findings between subjective norm and behavioral intention. It was revealed that there were positive significant relationships (Chen *et al.*, 2011; Chow & Chen, 2009; Ham *et al.*, 2015; Joshi & Rahman, 2016; Jyh, 1998; Siohong & Zainol, 2012; Sommer & Haug, 2012; Tarkiainen & Sundqvist, 2005; Wu & Teng, 2011) and insignificant relationship (Teck, 2013).

Based on the importance of subjective norm towards green technology implementation, this study attempted to test whether there was a real relationship between subjective norms and green technology implementation. There was a need to address this doubt since there was no study that examined the relationship between the two variables.

As a contribution to the field of green technology in universities, this study tried to test the relationship between that variables. Based on the information obtained, this study

assumed that there was a possible relationship between subjective norm and green technology implementation, and the test was translated by the following hypothesis.

Hypothesis 2: There is a positive relationship between subjective norms and green technology implementation.

2.7.1.3 The Relationship between Environmental Awareness and Green Technology Implementation

A few previous studies revealed that environmental awareness was one of the important factors affecting behavioral intention such as green products usage (electric vehicle usage) (Sang & Bekhet, 2015b), green practices (Royne *et al.*, 2016), green purchasing (Aman *et al.*, 2012), green technology management (Mohd *et al.*, 2013).

Aman *et al.* (2012) conducted a study on green purchase behavior and they concluded that environmental knowledge and environmental concern affected the green purchase behavior. The study on 384 Sabahan consumers and observed that both drivers significantly influenced green purchase behavior. As observed by Royne *et al.* (2016) in their study on recycling behavior, concern for environmental technology positively influenced recycling behavior. A total of 919 respondents consisted of faculty, staff, students and community involved in this study. Sang and Bekhet (2015) studied on factor influencing the intention of consumers to use electric vehicle. In this study, a total of 1000 questionnaires were distributed to Malaysian drivers but only 751 questionnaires were used for data analysis because of the uncompleted responses. They observed that environmental concern positively and significantly impacted electric

vehicle usage. Similarly, previous study by Rezai *et al.* (2013) summarized an increase in the awareness of environmental problem would influence individuals to perform environmental behavior.

However, a study by Bokhari *et al.* (2014) recognized that environmental awareness was insignificant on green technology practices. A total of 384 respondents from Malacca, Malaysia were involved in this study.

Since environmental awareness was an important factor of green behavioral intention and due to inconsistency findings, this variable was included in this study. Moreover, hopefully this variable would play a strong role in the context of green technology implementation in Malaysia. The following table (Table 2.17) presents the summary of previous study on the relationship between environmental awareness and behavioral intention.

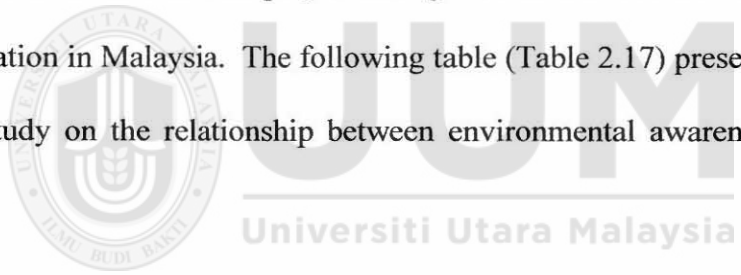


Table 2.17
Summary of Previous Study on Relationship between Environmental Awareness and Environmental Issues

Author & year	Area	Country	Respondent	Relationship
Royne <i>et al.</i> (2016)	Green Practice (recycling)	African America, Asian	919 respondents	Significant
Sang & Bekhet (2015)	Electric Vehicle Usage	Malaysia	751 drivers	Significant
Aman <i>et al.</i> , (2012)	Green Purchasing	Malaysia	384 respondents	Significant
Bokhari <i>et al.</i> , (2014)	Green Technology Practices	Malaysia	384 respondents	Not significant

By referring to the above discussion, there were inconsistent findings about environmental awareness and behavioral intention. There were positive significant relationships (Aman *et al.*, 2012; Bokhari *et al.*, 2014; Mohd *et al.*, 2013; Royne *et al.*, 2016; Sang & Bekhet, 2015b) and insignificant relationship (Bokhari *et al.*, 2014) revealed.

Due to the importance of environmental awareness towards green technology implementation, this study attempted to test whether there was a real relationship between environmental awareness and green technology implementation. This has not been addressed by previous studies.

As a contribution to the field of green technology at universities, this study tried to test the relationship between those variables. Based on the information obtained, this study assumed that there was a possible relationship between environmental awareness with green technology implementation and the test was translated by following hypothesis.

Hypothesis 3: There is a positive relationship between environmental awareness and green technology implementation.

2.7.1.4 The Relationship between Technology and Green Technology Implementation

Although there was a limited number of studies on the relationship between technology and green behavior, a few studies found out that technology was an important factor of behavioral intention such as intention to use technology (Teo, 2012), green practices

adoption (Lin & Ho, 2011; Yahya *et al.*, 2014) and green innovation adoption (Ming & Chieh, 2011). For example, Lin and Ho (2011) had execute a study on green practices adoption for Logistics Company in China and concluded that technological contexts affected green practices adoption. In this study, three contexts of technology were used which were relative advantage, compatibility and complexity. Relative advantage and compatibility have positive effect on green practices adoption while complexity negatively affected green practices adoption.

Similarly, Ming and Chieh (2011) noted that the result of their study also revealed that technology was a significant variable on green innovation adoption. With reference to Lin and Ho (2011), Ming and Chieh (2011) used the same three contexts of technology which were relative advantage, compatibility and complexity. Besides that, as proposed by Yahya *et al.* (2014), five contexts of technological were used namely relative advantage, complexity, compatibility, cost and company image. Teo (2012) conducted a study in Singapore to investigate the factors that affected intention to use technology. This study confirmed that perceived usefulness and perceived ease of use were significant towards the attitude towards usage.

Even though technology was considered as one of the important and significant positive determinants of behavioral intention in most of the previous researches, some prior researchers revealed a statistically insignificant influence of technology on behavioral intention (Sung, 2009). Sung (2009) through his research on 628 university students in

Korea, affirmed that perceived usefulness and perceived ease of use was insignificantly affecting the behavioral intention to use E-Learning.

Hence, considering the dominance role of technology in prior literatures as an important factor of green behavioral intention, technology was considered in this research. Furthermore, due to inconsistency nature of the technology findings and the results generalization, that variable is considered in this study and expected to play important role on green technology implementation in Malaysia. The following table (Table 2.18) presents the summary of previous study on relationship between technology and behavioral intention.

Table 2.18
Summary of Previous Study on Relationship between Technology and Environmental Issues

Author & year	Area	Country	Respondent	Relationship
Ming & Chieh (2011)	Green Innovation Adoption	China	244 respondents	Significant
Lin & Ho (2011)	Green Practices Adoption	China	322 respondents	Significant
Teo (2012)	Intention to use technology	Singapore	157 pre-service teachers	Significant
Sung (2009)	Intention to use E-Learning	Korea	628 university students	Not significant

Based on the discussion below, there were inconsistent findings between technology and behavioral intention. There are positive significant relationships (Lin & Ho, 2011;

Ming & Chieh, 2011; Teo, 2012; Yahya *et al.*, 2014) and insignificant relationship (Sung 2009).

Studies on the relationship between technology and green technology have been conducted in China (Lin & Ho, 2011). They found out that green practice's relative advantage and compatibility has a positive influence on green practice adoption for Chinese logistics companies. However, they only focused on logistics companies as their scope of the study. While this study intended to study the relationships among staff in Malaysian universities towards the implementation of green technology.

As a contribution to the field of green technology at universities, this study tried to test the relationship between those variables. Based on the information obtained, this study assumed that there was a possible relationship between technology towards green technology implementation and was translated by following hypothesis.

Hypothesis 4: There is a positive relationship between technology and green technology implementation.

2.7.2 Relationship between Attitude, Subjective Norms, Environmental Awareness Technology and Green Technology Implementation.

The variables of attitude, subjective norm, environmental awareness and technology were examined collectively to determine the influence of each variable on green technology implementation. All the variables within the framework of this study were hypothesized as independent variables that have positive relationships with green

technology implementation. It may be concluded that all the independent variables of study collectively influenced green technology implementation in university. Hypothesis 5 was tested to examine the collective influence of attitude, subjective norm, environmental awareness and technology to green technology implementation. Hence, the proposed hypothesis is as below:

Hypothesis 5: Attitude, subjective norm, environmental awareness and technology are collectively influence Green Technology Implementation.

2.7.3 Relationship between Attitude, Subjective Norms, Environmental Awareness Technology and Green Technology Implementation on Government Support.

Moderation variable is a variable that acts to change the direction or strengthen the relationship between independent and dependent variable Baron and Kenny (1986). Based on the findings of previous studies, it was found that the relationship between independent variables like attitude, subjective norm, environmental awareness and technology towards green technology implementation were inconsistent. In addition to that, Baron and Kenny (1986) stated that moderator is likely to exist if the relationship between independent variable and dependent variable were not consistent, therefore, moderator is included in this study.

Based on the discussion in section 2.7.1.1 (page 99), there were inconsistent findings between attitude and behavioral intention. There were positive significant relationships (Abd Hamid, 2011; Cavana *et al.*, 2012; Chan, 2013; Derahim *et al.*, 2011; Esa *et al.*,

2011; Massoules, 2011; Md Zain *et al.*, 2012; Qader & Zainuddin, 2011b; Wan *et al.*, 2012) and insignificant relationship (Han *et al.*, 2009; Aman *et al.* 2012).

Moreover, there were inconsistent findings between environmental awareness and behavioral intention. There were positive significant relationships (Aman *et al.*, 2012; Bokhari *et al.*, 2014; Mohd *et al.*, 2013; Royne *et al.*, 2016; Sang & Bekhet, 2015b) and insignificant relationship (Bokhari *et al.*, 2014) revealed.

Besides that, there was inconsistent findings between technology and behavioral intention. There were positive significant (Lin & Ho, 2011; Ming & Chieh, 2011; Teo, 2012; Yahya *et al.*, 2014) and insignificant (Sung 2009) relationships revealed.

Based on the previous research, there was no studies on government support as moderating variable in testing the relationship between attitude, subjective norm, environmental awareness and technology with green technology implementation. It was inappropriate to adapt the study in other areas because of differences between university and a profit-based company. Therefore, researcher believed that by incorporating government support as moderating variable in the relationship between independent variable and green technology implementation, it would yield a different impact on each relationship. Since government support becomes the strongest predictor of green behavior, government support was selected as moderating variable. Therefore, this study proposed the following hypotheses:

Hypothesis 6: Government Support moderates the relationship between attitude and Green Technology Implementation.

Hypothesis 7: Government Support moderates the relationship between subjective norm and Green Technology Implementation.

Hypothesis 8: Government Support moderates the relationship between environmental awareness and Green Technology Implementation.

Hypothesis 9: Government Support moderates the relationship between technology and Green Technology Implementation.

The connection between the research questions, objectives, hypotheses and analyses are presented in the Table 2.19.

Table 2.19
The Connection of the Research Questions, Objectives, Hypotheses and Analyses

Research Questions	Research Objectives	Hypotheses	Analyses
What is the relationship between attitude towards green technology implementation?	To examine the relationship between attitude towards green technology implementation.	H1. There is a positive relationship between attitude and green technology implementation.	Pearson correlation and Linear Regression
What is the relationship between subjective norms towards green technology implementation?	To examine the relationship between subjective norms towards green technology implementation.	H2. There is a positive relationship between subjective norm and green technology implementation.	Pearson correlation and Linear Regression

Table 2.19 (Continued)

<p>What is the relationship between environmental awareness towards green technology implementation?</p>	<p>To examine the relationship between environmental awareness towards green technology implementation.</p>	<p>H3. There is a positive relationship between environmental awareness and green technology implementation.</p>	<p>Pearson correlation and Linear Regression</p>
<p>What is the relationship between technology towards green technology implementation?</p>	<p>To examine the relationship between technology towards green technology implementation.</p>	<p>H4. There is a positive relationship between technology and green technology implementation.</p>	<p>Pearson correlation and Linear Regression</p>
<p>Do variable of attitude, subjective norm, environmental awareness and technology collectively influence green technology implementation?</p>	<p>To examine the collective influence of four independent variables on green technology implementation.</p>	<p>H5: Attitude, subjective norm, environmental awareness and technology collectively influence green technology implementation.</p>	<p>Multiple Regression Analysis</p>
<p>Is there a moderating effect of government support on the relationship between attitude, subjective norm, environmental awareness, technology green technology implementation?</p>	<p>To determine whether government support moderate the relationship between attitude, subjective norm, environmental awareness, technology and green technology implementation.</p>	<p>H6: Government support moderates the relationship between attitude and green technology implementation. H7: Government support moderates the relationship between subjective norm and green technology implementation.</p>	<p>Hierarchical regression analyses, Process macro and simple slope analysis</p>

Table 2.19 (Continued)

H8: Government support moderates the relationship between environmental awareness and green technology implementation.
H9: Government support moderates the relationship between technology and green technology implementation

2.8 Summary of Chapter

This chapter starts with the overview of green technology in Malaysia, and followed by a review on independent variables attitude, subjective norm, environmental awareness and technology, government support as moderating variables, and green technology implementation as dependent variable. Past studies have been utilized and reviewed to enlighten on the relationships between attitude, subjective norm, environmental awareness, technology, government support and green technology implementation had relationship. Discussion on the methodology of this is presented in the next chapter.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

In the previous chapter, the factors influencing green technology implementation have been discussed. This chapter describes the research methodology of the study. It begins with research design, population and sampling, data collection and questionnaires design. Besides that, this chapter also discusses about method of data analysis and ends with the summary of the chapter.

3.2 Research Design

A research design can be used as guidance to researcher for data collection and data gathering. The main objective of this study is to investigate the relationship between attitude, subjective norm, environmental awareness, technology and green technology implementation and the moderating role on its relationship. This study employed a quantitative approach in order to answer the research questions. Creswell (2009) affirmed that quantitative approach has the following characteristics: pre-determined, instrument-based questions, performance data, attitude data, observational data, and census data, statistical analysis and statistical interpretation. The study was conducted in two phases, phase 1 is a pilot study to examine the reliability of the instrument and phase 2 is the main study using revised instrument to examine the relationships among the variables. For data collection, a survey method (questionnaires) is used. Descriptive study and hypothesis testing are used in this study. Since this study attempts to examine

the relationships between attitude, subjective norm, environmental awareness, technology, government support and green technology implementation, these two designs are suitable to implement. Descriptive study describes the characteristics of the respondent and university. Next, the relationships between independent variables, moderating variable and dependent variable are examined by hypothesis testing.

3.2.1 Purpose of the Study

The main objective of this study is to examine the relationship between independent variables and green technology implementation. In this study, elements of independent variables consist of attitude, subjective norm, environmental awareness and technology while government support is considered as moderating variable. This study is conducted to determine the relationship between each independent variable and green technology implementation and the effects of moderating variable on the relationships between independent variables and green technology implementation.

3.2.2 Time Dimension of the Study

There are two types of time period of the study which are longitudinal studies and cross-sectional study. As mentioned by Babbie (2010), longitudinal study refers to collection of data at different point of time. However, cross-sectional design is the study where data collection is conducted just once during the study to fulfill the objectives of the study (Cavana, Delahaye, & Sekaran, 2001). This study employed cross-sectional study, with consideration that it falls under correlational study and not under cause and effect study. Given that this study utilized cross-sectional study, data was collected just once.

3.2.3 Research Design Strategies

Employing quantitative method, survey method was used for data collection. Survey method is a commonly used method for quantitative study during data collection. A survey method is attempted to describe the phenomena or to learn the reasons for any particular activity (Zikmund, 1994). Subsequently, a survey method allows the researcher to collect data from many respondents, measure many variables and test multiple hypotheses (Neuman, 2006). In depth discussion on questionnaires design is presented in section 3.5 (refer page 97).

3.2.4 Unit of Analysis

In this study, the unit of analysis is individual staff at university. It involves administration staff like executive administrator, assistant registrar, secretary, admin assistant, executive officer, lab assistant, clerical officer and office assistant. Academic staff consist of professor, associate professor, senior lecturer, lecture and tutor. Respondents were chosen to represent their respective universities.

3.3 Population and Sample Method

This research focuses on six universities in northern region in Malaysia including Kedah, Perlis and Pulau Pinang. To complete the research, staff at Universiti Utara Malaysia (UUM), Universiti Teknologi Mara Kedah (UiTM Kedah), Universiti Malaysia Perlis (UniMAP), Universiti Teknologi Mara Perlis (UiTM Perlis), Universiti Sains Malaysia (USM) and Universiti Teknologi Mara Pulau Pinang (UiTM Pulau Pinang) were selected.

Since the unit of analysis in this study is individual staff, each staff chosen was to represent individual's university. The population for this six universities were 12,531 staff which consisted of administration and academic staff. It was too costly to study on the whole population, therefore sampling was needed.

Based on the table of determination sample by Krejcie & Morgan (1970), a number of 370 staff were needed and selected out of 12,531 staff. To efficiently get these 370 individuals, 600 set of questionnaires were distributed to 600 staff. After that, sampling technique for selecting sample was employed. For this study, simple random sampling was used to select the 600 individuals. Simple random sampling was chosen as compared to stratified random sampling due to the ease of securing the sample as much as needed and as soon as possible for smooth study. Besides, given that both sampling techniques yield representative sample, researcher opted for simple random sampling method for the ease of data collection. However, each university has its own representatives. To guarantee the representation of sample, fair allocation of questionnaires is practiced for each university whereby 100 questionnaires were distributed at each university to accomplish 600 questionnaire distribution. Random numbers were generated using random number function in Microsoft Excel. After that, the numbers were multiplied with the number of population. These numbers (numbers appeared in Microsoft Excel) were used to guide researcher for selecting sample. Based on the list of population acquired from university website and random number generated, the sample were chosen.

3.4 Data Collection

In this study, respondents reached the link of questionnaires through email. All respondents' emails were retrieved from universities' websites. This data collection method was easy and inexpensive as compared to mail survey. They may answer the questionnaires by a click on the link given. These questionnaires were shared through Google Drive software. After questionnaires were answered and submitted, responses were automatically sent to researcher's inbox through the same software. This study utilized 600 questionnaires and sent twice to each individual. A month after the first distribution, the return rate was low, therefore questionnaires were distributed again through email. Fortunately, the rate returns of questionnaires increased but was still under target. As an alternative way, hardcopies of the questionnaires in booklet format were distributed offline. Research assistants helped to distribute and collect the questionnaires aside from researcher's own effort. The study consumed approximately one year to accomplish data collection.

3.5 Questionnaires Design

The purpose of this study is to test the relationships between attitude, subjective norms, environmental awareness, and technology towards green technology implementation in university. Besides that, this study aims to investigate the impact of government support as moderating effect to green technology implementation in university. The questionnaires used were designed with reference to green technology literature and the Theory Planned Behavior (TPB) theoretical framework. Five points Likert scales was

used to measure the component of TPB, with five (5) indicating a positive view or strongly agree and one (1) a negative view or strongly disagree.

The questionnaire contained all four (4) major independent variables which are attitude, subjective norms, environmental awareness and technology. It also included government support as moderating variable and green technology implementation as dependent variable. Besides, the questionnaire catered questions for demographic information, such as gender, age, education level, courses and semester. The items indicated in the questionnaires are shown in Table 3.1.

Table 3.1
Item Descriptions of Questionnaires Section

Part	Measures	Number of items
Section A	Demographic Information	6
Section B	Attitude	8
	Subjective Norm	6
	Environmental Awareness	8
	Technology	6
	Government Support	8
	Green Technology Implementation	11

3.5.1 Attitude

Based on literature review, attitude is the measurement of positive or negative staff behavior towards green technology implementation. Eight items were used to measure this factor. Table 3.2 below shows the questions used to represents the variable with the sources and the previous research's Cronbach's Alpha values. As presented in Table 3.2, the questions for attitude were based on two different sources. The studies by Calvin, Ronnie, & Geoffrey (2012) and also Chen, Gregoire, Arendt & Shelly (2011) both yielded Cronbach's Alpha values of 0.77 and 0.84 respectively. Since the values of

Cronbach's Alpha were the highest, both sources were used as guidelines for questionnaire development.

Table 3. 2
Measures of Attitude

Factor	Questions	Source	Cronbach's Alpha
Attitude	1. Green technology/practices are good.	Calvin, Ronnie & Geoffrey (2012)	0.77
	2. Green technology/practices are useful.	Chen, Gregoire, Arendt & Shelly (2011)	0.84
	3. Green technology/ practices are sensible.		
	4. For me green technology/practice is reasonable.		
	5. I like to implement green technology/practice.		
	6. Implement green technology/practices is a pleasant idea.		
	7. I have favorable attitude towards green technology/practice.		
	8. The application of green technology practice makes work more interesting.		

3.5.2 Subjective Norms

The second factor of subjective norm measure addressed the effect of social influence on the behavior of staff towards green technology implementation. There were six items used to measure subjective norm. The items were developed from Calvin *et al.*, (2012), Koh, Prybutok, Ryan and Wu (2010) and Chen *et al.* (2011). Table 3.3 illustrates the questions used and adapted sources for variable subjective norms. In addition, the values of Cronbach's Alpha from previous study are provided in the same table (refer Table

3.3). Since all the sources achieved the highest Cronbach's Alpha value, therefore, those questions were used for this study.

Table 3.3
Measures of Subjective Norm

Factor	Questions	Source	Cronbach's alpha
Subjective norm	1. My friends expect me to implement green technology/practices.	Calvin <i>et al.</i> ,(2012)	0.70
	2. Media influence me to implement green technology/practices.	Koh, Prybutok, Ryan, & Wu, (2010)	0.8895
	3. Environmental groups influence me to implement green technology/practices.	Ivan, Connie, & Walter (2010)	0.80
	4. My parents influence me to implement green technology/practices.		
	5. People who influence my behavioral think that I should use the application of green technology practice.		
	6. People who are important to me think that I should use the application of green technology practice.		

3.5.3 Environmental

Environmental awareness was the third independent variable involved in this study. Based on the previous study, eight questions were chosen to represent environmental awareness variable. All the questions were adapted from several researchers. Based on Table 3.4, questions from two researches were used as guideline for environmental awareness variable. Since both Cronbach's Alpha values were greater than or equal to 0.60, therefore the questions were reliable to be used.

Table 3.4

Measures of Environmental Awareness

Factor	Questions	Source	Cronbach's alpha
Environmental Awareness	1. Green technology/practice is a major way to reduce pollution.	Calvin <i>et al.</i> , (2012)	0.68
	2. Green technology/practice is a major way to conserve natural resources.	Haron, Paim, & Yahaya, (2005)	0.60
	3. Green technology/practice improves environmental quality.		
	4. The green activist movement makes me aware of the green concept.		
	5. Green technology/practice can reduce global warming.		
	6. Alternative energy, e.g. solar energy can be utilized in place of electricity.		
	7. The natural environment should not be sacrificed in the name of development.		
	8. Usage of disposable goods should be encouraged as it provides convenience to consumers.		

3.5.4 Technology

Technology factor was measured by two criteria which were relative advantage and compatibility. There were six items included in this factor. All the items were adapted from Lin and Ho (2011) and Weng and Lin (2011). Item measurements for technology are presented in the Table 3.5. Based on Table 3.5, the Cronbach's Alpha for both sources are higher than 0.60, therefore the questions were reliable to represent technology variable.

Table 3.5
Measures of Technology

Factor	Questions	Source	Cronbach's alpha
Technology	1. The green practices can provide better environmental performance.	Lin & Ho (2011) Weng & Lin (2010)	0.8897
	2. The green practices can provide higher economic benefits.		0.8804
	3. The green practices can enhance my university's reputation.		
	4. The green technology/practices are compatible with our existing operations.		
	5. The green technology/practices are consistent with our university values.		
	6. Integrating the green technology / practices with university existing system is easy.		

3.5.5 Government Support

Besides attitude, subjective norm, environmental awareness and technology, a moderating variable was catered in this study. As the moderating variable, government support was measured by eight items. The items were adapted from Lin and Ho (2011), Ivan *et al.* (2010) and Weng & Lin (2011). Table 3.6 below shows the values of Cronbach's Alpha based on researches by Lin and Ho (2011) and Weng and Lin (2011).

Since the values of Cronbach's Alpha from both studies were greater than 0.60, the questions were reliable to represent the government support variable.

Table 3.6
Measures of Government Support

Factor	Questions	Source	Cronbach's alpha
Government support	1. Government in change to practice green technology.	Lin & Ho (2011)	0.8714
	2. Government support financial resources to practice green technology.	Weng & Lin (2011)	0.8718
	3. Government provides technical assistance for adopting green technology practice.		
	4. Government helps training manpower with green technology skills.		
	5. Government policy such as grants encourages us to use green technology practice.		
	6. Government has provided enough environmental guidance for university to comply with.		
	7. Government policy induces our university to use green technology.		
	8. Through using green technology, our university tries to reduce or avoid the threat of current or future government environment legislation.		

3.5.6 Green Technology Implementation

Green technology (GT) is defined as the development and application of products, equipment and systems used to conserve the natural environment and resources, which minimizes and reduces the negative impact of human activities. There were eleven items used to measure the green technology implementation. The items were adapted from Chen *et al.* (2011). Table 3.7 shows the measurement of green technology implementation based on previous research. The questions were used as guideline to represent green technology implementation since the Cronbach's alpha was greater than 0.60.

Table 3.7
Measures of Green Technology Implementation

Factor	Questions	Source	Cronbach's alpha
Green Technology Implementation	<ol style="list-style-type: none">1. I intend to use green technology in the next 6 months.2. I predict I would use green technology in the next 6 months.3. I am willing to use green technology in the next 6 months.4. I plan to use green technology in the next 6 months.5. I often use green technology/practice to manage tasks in my university.6. I often use green technology/practice to communicate at my university work.7. I often use green technology/practice to plan for transportation in campus.	Chen <i>et al.</i> (2011)	0.96

Table 3.7 (Continued)

8. I find green technology useful in my work.	Chen <i>et al.</i> (2011)
9. Using green technology enables me to accomplish tasks more quickly.	
10. Using green technology increase our productivity.	
11. Using green technology promotes efficient in my work.	

3.5.7 Reliability and Validity of the Instrument

To ensure that the measures developed are reasonably good, they need to meet two main criteria which are reliability and validity. Reliability of a measure is an indication of the stability and consistency with which the instrument measures the concept and help to access the goodness of a measure (Sekaran, 2003). The aim of pilot study was to test Cronbach's Alpha. A classical measure of reliability, Cronbach Alpha was used to examine the internal consistency and reliability of the items within each scale. The higher the coefficients, the better the measuring instrument (Sekaran, 2003).

Besides reliability, validity of an instrument needs appropriate attention. Validity refers to the extent which the instrument measures what it needs to, while reliability describes the consistency of this measurement instrument (Sekaran, 2003). There are two main types of validity: internal validity and external validity. Internal validity refers to the validity of measurement, whereas external validity refers to the ability to generalize the findings to the whole population. For content validity, a set of questionnaire was evaluated by a group of expert judges.

3.5.8 Pilot Study

Based on Sony, Ferguson, & Rian (2015), pilot test is important to ensure that the directions of the experiments and the wordings used correctly match. It means that, the respondents really understand the meaning of the questions hence answer the questions as they intend to. There were thirty (30) respondents selected for the purpose of pilot test. This effort was to make sure that the instrument was understandable enough by the respondents and to cater any ambiguous items for instrument's reliability enhancement. During pilot test, thirty (30) staff at Universiti Utara Malaysia (UUM) were required to completely answer all the questions. Only thirty (30) staff from UUM were chosen due to time constraints and the ease to obtain the sample. This questionnaire comprised of independent variables (attitude, subjective norm, environmental awareness, and technology), government support and green technology implementation. After that, internal validity was examined by measuring Cronbach's Alpha values. The value of Cronbach's alpha for each variable are presented in the Table 3.8.

Table 3.8
Pilot Test (N =30)

No	Variables	Number of items	Cronbach's alpha
1	Attitude	8	.942
2	Subjective Norm	6	.828
3	Environmental Awareness	8	.824
4	Technology	6	.731
5	Government Support	8	.878
6	Green Technology Implementation	11	.902

Based on the Table 3.8 above, it may be observed that all the values of Cronbach's Alpha are more than 0.60. As pointed out by Hair, Black, Babin and Anderson (2010) and

Sekaran (2003), if the value of Cronbach alpha is greater than 0.60, all variables are adequate or reliable enough to measure the specific factors. Therefore, no items were deleted. Since all the values of Cronbach's alpha were greater than 0.60, therefore the questionnaires were reliable and did not needed to change.

3.6 Method of Data Analysis

Several methods of data analysis were used to answer research questions for this study. Data collected through questionnaires were coded and analyzed using Statistical Package for the Social Science (SPSS) version 20.0. Preliminary test was executed to determine the response rate, descriptive statistics, validity and reliability of the study construct. Response rate was determined by computing frequency and percentage of response based on feedback received. Besides that, descriptive statistical analysis including frequencies and percentage were used to represent the main characteristics of sample. Detailed explanation of Pearson Correlation, Multiple Regression, Hierarchical Regression and also Process Macro analyses were discussed in the next sub-sections.

3.6.1 Pearson Correlation Analysis

Pearson correlation analysis was conducted to examine the relationship between independent variables (attitude, subjective norm, environmental awareness, technology) and green technology implementation. As mentioned by Sekaran (2003), the correlation analysis measures the direction, strength and significance of bivariate relationships of variables studied. The association analyzed in this study allowed the recognition of

relationship between independent and dependent variables. The correlation analysis was conducted to address the first four research questions.

3.6.2 Multiple Regression Analysis

Multiple regression analysis is a form of general linear modeling. A multivariate statistical technique was used to examine the relationship between a single dependent variable and a set of independent variables. This test was used to examine Hypothesis 5 (H5) for the significance of four independent variables (attitude, subjective norm, environmental awareness and technology) on a dependent variable (green technology implementation).

There were four assumptions of multiple regressions needed to be fulfilled before proceeding to multiple regression analysis. It needed to be assumed that the relationship between variables was linear, the values of the residuals were independent (multicollinearity), the variance of the residual was constant (homoscedasticity) and the values of the residuals were normally distributed.

3.6.3 Hierarchical Regression Analysis

Hierarchical multiple regression analysis is a statistical technique that can be used to analyze the relationship between a single dependent variable, moderator variables and several independent variables. Hierarchical Multiple Regression was utilized to test research Hypothesis 6 (H6) to Hypothesis 9 (H9) regarding the effect of moderating variable on the independent variables (attitude, subjective norm, environmental

awareness and technology) and dependent variable (green technology implementation) relationships.

The general procedures for testing moderating effects were to enter the sets of predictors into the regression equation in the following order. Step 1: the independent variables (Attitude, Subjective Norm, Environmental Awareness and Technology) were entered. Step 2: the moderator variable (Government Support) was entered into the equation. Step 3: the two-way interaction terms obtained by multiplying the moderator variable and independent variables were entered.

3.6.4 Process Macro and Simple Slope

Process macro is an observed variable path analysis modeling tool for SPSS. It can be used for estimating two or three ways interaction effect in moderation models along with simple slope. Besides that, process macro can be used for single or multiple moderators. Moreover, to clearly represent the effect of moderating variable, simple slope is used. In simple slope analysis, the effect of low and high moderator on the relationship between each independent variable and green technology implementation can be recognized.

3.7 Summary of the Chapter

In this chapter, discussion of the methodology of the study is presented. This research employed a survey method. Besides that, the respondents involved in this study were staff from public universities and data collection was conducted using questionnaires. This chapter comprises of five (5) main topics such as research design, population and

sampling, questionnaires design and method of data analysis. The next chapter presents the result of the main study and followed by some discussions.



CHAPTER FOUR

ANALYSIS AND FINDINGS

4.1 Introduction

This chapter aims to explain the findings of the study based on primary data collection in order to address the objectives of the study. It covers detailed analyses, discussions and interpretation of data collected from respondents through questionnaires. This chapter is divided into several sections. Section 4.1 starts with an introduction of the chapter. Section 4.2 explains the return rate of questionnaires. Section 4.3 profiles the respondent based on gender, age of respondents, designations of respondent's position and years of working. Subsequently followed by section 4.4 which discusses the findings. Before proceeding to the main analysis, reliability analysis was conducted to assess the goodness of the measurement. There were several assumptions needed for the study such as linearity, multicollinearity, homoscedasticity and residual normality. Section 4.5 discusses the descriptive analysis of the data. Furthermore, in section 4.6 and 4.7, the main results of the hypotheses testing and its discussions are presented respectively. Lastly, section 4.8 summarizes the whole chapter.

4.2 Rate of Return

As mentioned in section 3.4 (refer page 97), this study used questionnaires as data collection instrument. In November 2016, questionnaires were distributed to 600 staff in northern region universities through email. After a month, the rate of return was low and therefore the questionnaires were redistributed through email. Fortunately, the rate return

of questionnaires increased but still does not achieve study's target. Therefore, alternatively the questionnaires were again distributed in booklet form manually. Besides researcher, research assistants also helped to distribute and collect the questionnaires. At the end of data collection period (around one year needed), a total of 384 sets of questionnaires were accepted which were usable in this study.

Table 4.1 below shows the total number of questionnaires distributed and collected for this study. Six public universities in Malaysian northern region involved in the data collection procedures were UUM, UiTM (Kedah), UniMAP, UiTM (Perlis), USM and UiTM (Pulau Pinang). The population size was 12531 staff and because of the big population, only 600 set of questionnaires were given to sample the staff.

Table 4.1
Total Number of Questionnaires Distributed and Collected from Malaysian University Staff in Northern Region

University	Population size	Number of Questionnaires sent	Completed respond	Non Respond	Percentages responses
UUM	3418	100	67	33	67%
UiTM (Kedah)	658	100	70	30	70%
UniMAP	1987	100	61	39	61%
UiTM(Perlis)	826	100	57	43	57%
USM	5283	100	60	40	60%
UiTM (Pulau Pinang)	359	100	69	31	69%
Overall	12531	600	384	216	64%

The response rate from UiTM (Perlis) was the lowest of 57% whilst UiTM (Kedah) had the highest of 90%. USM, UniMAP, UUM and UiTM (Pulau Pinang) were almost

around 60% to 70% which were 60%, 61%, 67% and 69% respectively. Based on the data in Table 4.1, around 67 respondents from Universiti Utara Malaysia (UUM) answered the questionnaires while other 33 staff did not respond. Moreover, in UiTM (Kedah), only 30 respondents did not answer the questionnaires while 70 staff answered. 31 staff at UniMAP did not answer the questionnaires while 69 respondents answered. For UiTM (Perlis), only 43 respondents did not answer the questionnaires which represents 43%. For USM, around 60 staff completed the questionnaires while 40 did not answered. In UiTM (Pulau Pinang), only 31 respondents did not completely answer the questionnaires. The overall response rate was 64% and it was considered good as compared to previous study. A total of 216 staffs did not respond to the questionnaires which represents 36% of the whole distributed questionnaires. Based on previous study related to this field, the response rate were 67% (Veer *et al.*, 2011), 34% (Ahadiat, 2005), 20% (Bressler & Oklahoma, 2011) and 50.4% (Teck, 2013). The response rates from the previous studies is shown in Table 4.2 below.

Table 4.2
Response Rate from Previous Study

No	Authors	Tittles	Level of Response Rate
1	Veer <i>et al.</i> , (2011)	Successful implementation of new technologies in nursing care: a questionnaire survey of nurse-users.	Potential respondents 1018 Nursing Staff in Dutch Hospitals, 685 (67%) completed a survey questionnaire.
2	Ahadiat, (2005)	Factors that may influence or hinder use of instructional technology among accounting faculty.	271 faculties involve which participated 34% response rate.

Table 4.2 (Continued)

3	Bressler & Oklahoma, (2011)	A study of Small Business Technology Adoption and Utilization	Four hundred and fifty returned from 2000. Only 397 usable which give 20% response rate.
4	Teck, (2013)	Use of Structural Equation Modeling to Predict the Intention to Purchase Green and Sustainable Homes in Malaysia	Received 500 surveys, only 252 were used, so the response rate was 50.4 %.

4.3 Respondent Profile

This section provides background information of the respondents who participated in the survey. The section consists of gender, age of respondents, designation of the respondent's position and years of working. Moreover, a total of 384 respondents participated in this study. Besides that, the general information of the sample was explained in the next subsection.

4.3.1 Type of Gender

Table 4.3 shows the gender of the respondents based on 384 respondents. In overall, most of the respondents were female (59.38% or 228 respondents) while 40.62% (156 respondents) were male. It means that, female was more interested to answer the questionnaires compared to male. The percentage for both genders were quite same because the questionnaires were equally distributed.

Table 4.3
Gender of Respondents

Gender	Frequency	Percentage (%)
Female	228	59.38
Male	156	40.62
Total	384	100

4.3.2 Age of Respondents

Distribution of respondent's age is shown in Table 4.4 (refer page 114). The table shows that 46.09 % of the respondents (177 respondents) were in between 25 to 35 years old followed by 36 to 45 years which was 37.24% (143 respondents) and respondents of age above 45 years old of 11.72% of the whole sample. The least respondents were below 25 years old which was 4.95% (19 respondents). This may be due to the majority of staff were started working at age 25 years old. It was observed that majority of respondents that answer the questionnaires were in 25 to 35 years old. Finally, the least respondents were from age below than 25 years old due to the quiet number of staff in that year.

Table 4. 4
Age of Respondents

Age	Frequency	Percentage (%)
Below 25 years old	19	4.95
25-35 years old	177	46.09
36-45 years old	143	37.24
Above 45 years old	45	11.72
Total	384	100

4.3.3 Designation of Respondents' Position

Table 4.5 shows the frequency and percentage of respondent's position. Most of the respondents were academic staff that constituted to 51.30% (197 respondents) while 48.70% (187 respondents) were administrative staff. Consequently, based on percentage, it depicted that academic staff were more interested in answering the questionnaire due to their understanding of questions. Besides that, the percentage for both positions (academic staff and administrative staff) were similar since researcher has divided the samples equally. Moreover, in this study, administration staff represented by executive

administrator, assistant registrar, secretary, admin assistant, executive officer, lab assistant, clerical officer and office assistant. The academic staff consisted of professor, associate professor, senior lecturer, lecturer and also tutor.

Table 4.5
Respondents's Position

Position	Frequency	Percentage (%)
Academic Staff	197	51.30
Administrative Staff	187	48.70
Total	384	100

4.3.4 Years of Working

Table 4.6 (refer page 115) presents the number of working years of the staff. Most of the respondents have worked for 1 to 5 years in the university (45.57 % or 175 respondents), followed by respondents that worked more than 10 years (28.39% or 109 respondents). Due to the results, it is meant that most of the respondents which have worked for 1 to 5 years, were easy to understand and answer the questionnaire. Finally, the least portion of respondents worked between 6 to 10 years (26.04% or 100 respondents).

Table 4.6
Number of Working Years

Year of Designation	Frequency	Percentage (%)
1-5 Years	175	45.57
6-10 Years	100	26.04
More than 10 years	109	28.39
Total	384	100

4.4 Data Analysis

The data was analyzed using SPSS (version 20) statistical software. Before the data analysis was conducted, goodness of the measurements of the data was needed to be assessed. Since questionnaire was used, it was essential to ensure that every variable in the questionnaires measured the concept it was supposed to measure, so that the relevant concepts were measured accurately. Thus, reliability test was done. As the requirements of data analysis, some assumptions were needed to be fulfilled. Several tests were conducted to assure its linearity, homoscedasticity, residual normality and multicollinearity assumptions were satisfied in order to use correlation and regression techniques. All the assumptions were examined using mathematical and graphical approach. The test for reliability, linearity, homoscedasticity, residual normality and multicollinearity are discussed in the next section.

4.4.1 Test for Reliability

Reliability is an assessment of the degree of consistency between measurements of variables (Hair *et al.*, 2010). Specifically, reliability is how well a test measures what it should. The most common reliability measure is using Cronbach's alpha (α). Reliability analysis is measured via Cronbach's alpha to check for internal consistency of the constructs. Moreover, high reliability (high value of Cronbach's alpha) means that the questions being asked accurately measure the variable needed. However, when the value of Cronbach's alpha was low, it is represented that questions asking not measures the related variable but something else. In reliability test, all the items tapping in the independents variables, moderator variable and independent variable are included to test.

Therefore, the reliability tests were conducted based on the data collected from 384 respondents.

The reliability coefficient alpha of the four independent variables, a moderator variable and dependent variable were obtained. Table 4.7 illustrates the grouping of items for the variables and its reliability scores based on 384 sets of questionnaires. As pointed out by Sekaran & Bougie (2010), all constructs are reliable if the Cronbach's alpha values are greater than 0.60. Based on Table 4.7, the highest value of Cronbach's alpha was green technology implementation (dependent variable) which is 0.936. This value represented that 93.6% questions given measures green technology implementation variable. Follows with government support as moderating variable and the value was 0.932. This meant that around 93.2 % of government support questions illustrated that variable. Moreover, 92.2 % (0.929) of green technology implementation questions interpret that variable. Other than that, around 90.1% of the questions given measures technology variable. For subjective norm, 86% of the questions accurately measures that variable. The lowest value of Cronbach's alpha is 0.747 which represented that 74.7% of technology questions measures that variable. Since Cronbach's alpha values were above 0.60, thus, it can be concluded that this instrument is reliable to measure all the constructs and they are free of random error. Therefore, no item are deleted.

Table 4.7
Reliability Analysis

Variables	No. of Item	Cronbach's Alpha
<p style="text-align: center;">Attitude</p> <p>Green technology/practices are good. Green technology/practices are useful. Green technology/ practices are sensible. For me green technology/practice is reasonable. I like to implement green technology/practice. Implement green technology/practice is a pleasant idea. I have favorable attitude towards green technology/ practice. The application of green technology practice makes work more interesting.</p>	8	0.936
<p style="text-align: center;">Subjective Norm</p> <p>My friends expect me to implement green technology/practices. My classmates/colleagues expect me to implement green technology/practices. Media influence me to implement green technology/practices. Environmental groups influence me to implement green technology/practices. My parents influence me to implement green technology/practices. People who influence my behavioral think that I should use the application of green technology practice. People who are important to me think that I should use the</p>	6	0.860
<p style="text-align: center;">Environmental Awareness</p> <p>Green technology/practice is a major way to reduce pollution. Green technology/practice is a major way to conserve natural resources. Green technology/practice improves environmental quality. The green activist movement makes me aware of the green concept. Green /practice can reduce global warming. Alternative energy, e.g. solar energy can be utilized in place of electricity. The natural environment should not be sacrificed in the name of development. Usage of disposable goods should be encouraged as it provides convenience to consumer.</p>	8	0.901

Table 4.7 (Continued)

Variables	No. of Item	Cronbach's Alpha
<p style="text-align: center;">Technology</p> <p>The green technology can provide better environmental performance.</p> <p>The green technology can provide higher economic benefits.</p> <p>The green technology can enhance my university's reputation.</p> <p>The green technology is compatible with our existing operations.</p> <p>The green technology is consistent with our university values.</p> <p>Integrating the green technology with university existing system is easy.</p>	6	0.747
<p style="text-align: center;">Green technology implementation</p> <p>I intend to use green technology in the next 6 months.</p> <p>I predict I would use green technology in the next 6 months.</p> <p>I am willing to use green technology in the next 6 months.</p> <p>I plan to use green technology in the next 6 months.</p> <p>I often use green technology/practice to manage tasks in my university.</p> <p>I often use green technology/practice to communicate attitude my university work.</p> <p>I often use green technology/practice to plan for transportation in campus.</p> <p>I find green technology useful in my work.</p> <p>Using green technology enables me to accomplish tasks more quickly.</p> <p>Using green technology increase our productivity.</p>	11	0.929

4.4.2 Test for Linearity

The first assumption needed to be met was linearity. The linearity of the relationship between dependent and independent variables represented the degree to which the change in the dependent variable associated with independent variables. In this case, a scatter plot was a good approach for judging how well a straight line fitted the data.

The scatter plot in Figure 4.1 below displays visible relationships between green technology implementation (dependent variable) with four independent variables namely attitude, subjective norm, environmental awareness and technology. The residual plot indicates that there was random distribution for positive and negative residual values crossed into range X and Y axis. In addition, the figure shows that the residuals were randomly distributed in a band clustered around the horizontal line through zero (0). Therefore, this plot supported the assumptions of linearity between variables.

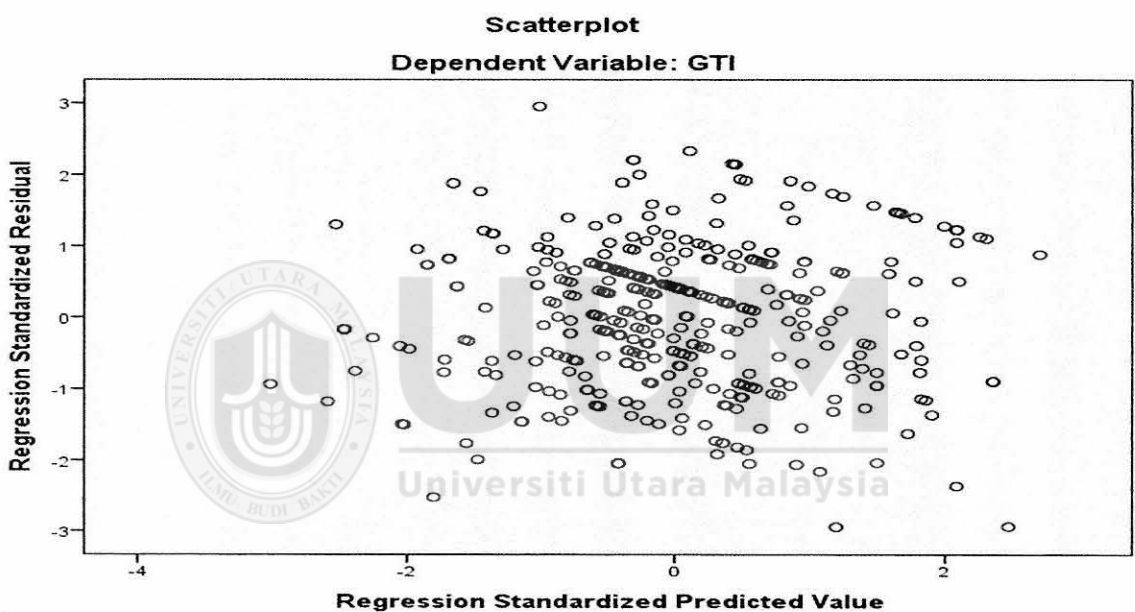


Figure 4. 1
Scatter Plot between Green Technology Implementation and Four Independent Variables

4.4.3 Test for Homoscedasticity

Another assumption needed to be satisfied was homoscedasticity. Homoscedasticity refers to the condition where the dependent variable being explained in the dependence relationship should not be concentrated in only a limited range of the independent values. Homoscedasticity was verified through the scatter plot of the regression standardized residual versus regression standardized predicted values.

Figure 4.2 below exhibits the plot of the residuals against the predicted values for independent variables and green technology implementation. The figure shows that the residuals were scattered. In addition, the figure indicates that there was no pattern of increasing and decreasing of residuals. This suggests that the homoscedasticity assumption was satisfied.

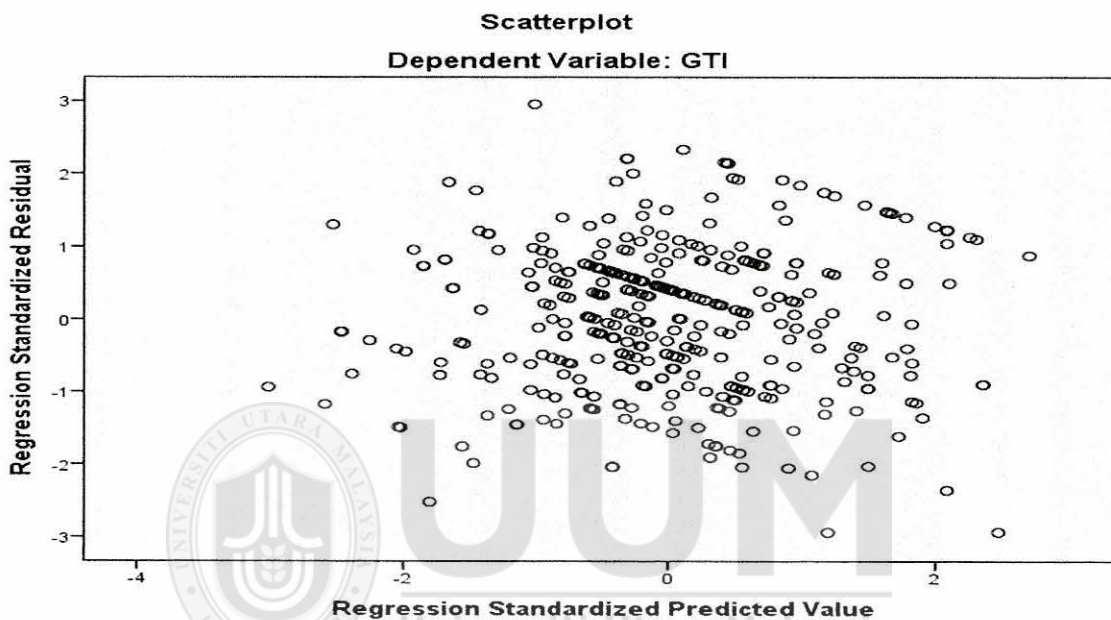


Figure 4.2
Scatter Plot between Green Technology Implementation and Four Independent Variables

4.4.4 Test for Residual Normality

The fourth assumption of multiple regressions was normality of residuals. A residual is the difference between the actual value of Y and the predicted value of Y. Two types of residuals were used which were standardized and studentized. The residual normality was checked using two types of approach which were mathematical and graphical approach. For mathematical approach, the result is based on Kolmogorov-Smirnov test and Shapiro-Wilk test.

Table 4. 8
Tests of Normality for Standardized Residual

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual	0.059	384	0.003	0.995	384	0.257

Table 4.9
Tests of Normality for Studentized Residual

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Studentized Residual	0.059	384	0.003	0.995	384	0.267

For checking normality of residuals, two hypotheses were considered. Null hypothesis states that residuals were normally distributed, while alternative hypothesis stated that residuals were not normally distributed.

H_0 : Residuals are normally distributed

H_1 : Residuals are not normally distributed

Based on Kolmogorov-Smirnov test in Table 4.8 and Table 4.9 (refer page 122), the p-values for standardized and studentized residual were 0.003 and 0.003. In order to reject the null hypothesis, the p-value of Kolmogorov-Smirnov must be lower than 0.05. Based on p-values above, they were all less than 0.05. Therefore, the null hypothesis was rejected meaning that residuals were non-normally distributed.

However, when referred to both Table 4.8 and Table 4.9, the values of Shapiro-Wilk are 0.257 and 0.267. Compared to Kolmogorov-Smirnov values, the Shapiro-Wilk values are greater than 0.05. Therefore, based on Kolmogorov-Wilk test, the test failed to reject the null hypothesis. In checking normality, there are contradicting findings acquired. By using Kolmogorov-Smirnov test, the residuals were not normally distributed while residuals were normally distributed when using Shapiro-Wilk test. As identified by Mohd Razali & Yap (2011), Shapiro-Wilk test is the most powerful normality test compared to Kolmogorov-Smirnov test. Based on that point, conclusion was made that residuals were normally distributed by referring to Shapiro-Wilk test.

Besides mathematical approach, residual normality also was checked using graphical approach. There were several ways to show graphically such as Q-Q plot and histogram. Figure 4.3 and Figure 4.4 (refer page 124) display the Q-Q plots for both standardized and studentized residual. Furthermore, histograms for both types of residual are presented in Figure 4.5 and Figure 4.6. By referring to Figure 4.3 and Figure 4.4, almost all points fall on the normal line and some are near to that line. It was found that both Q-Q plots support the residual normality assumption.

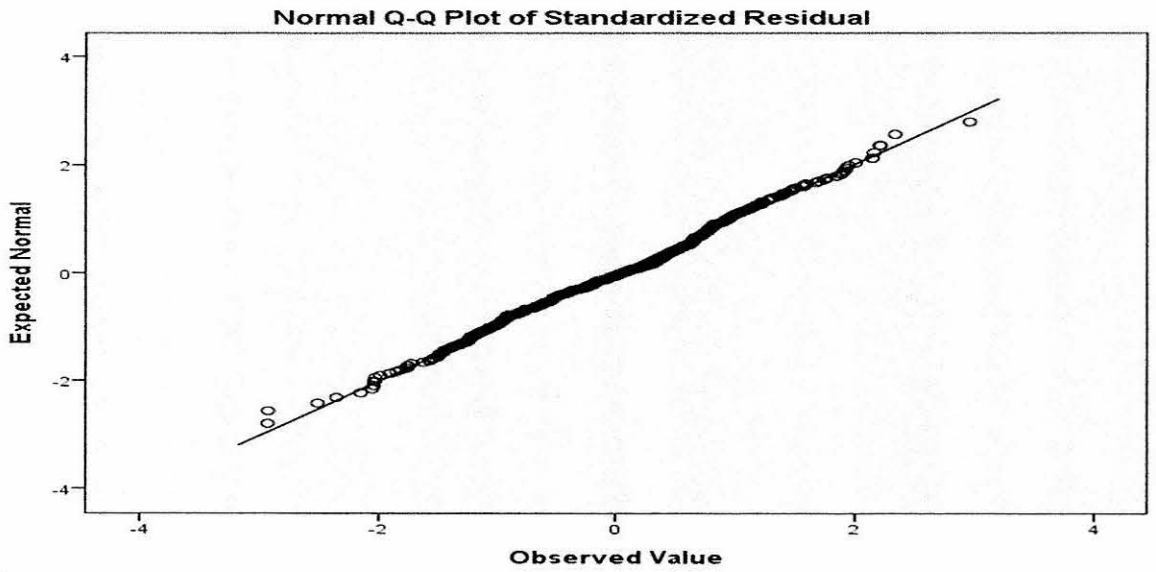


Figure 4.3
Normal Q-Q Plot of Regression Standardized Residual

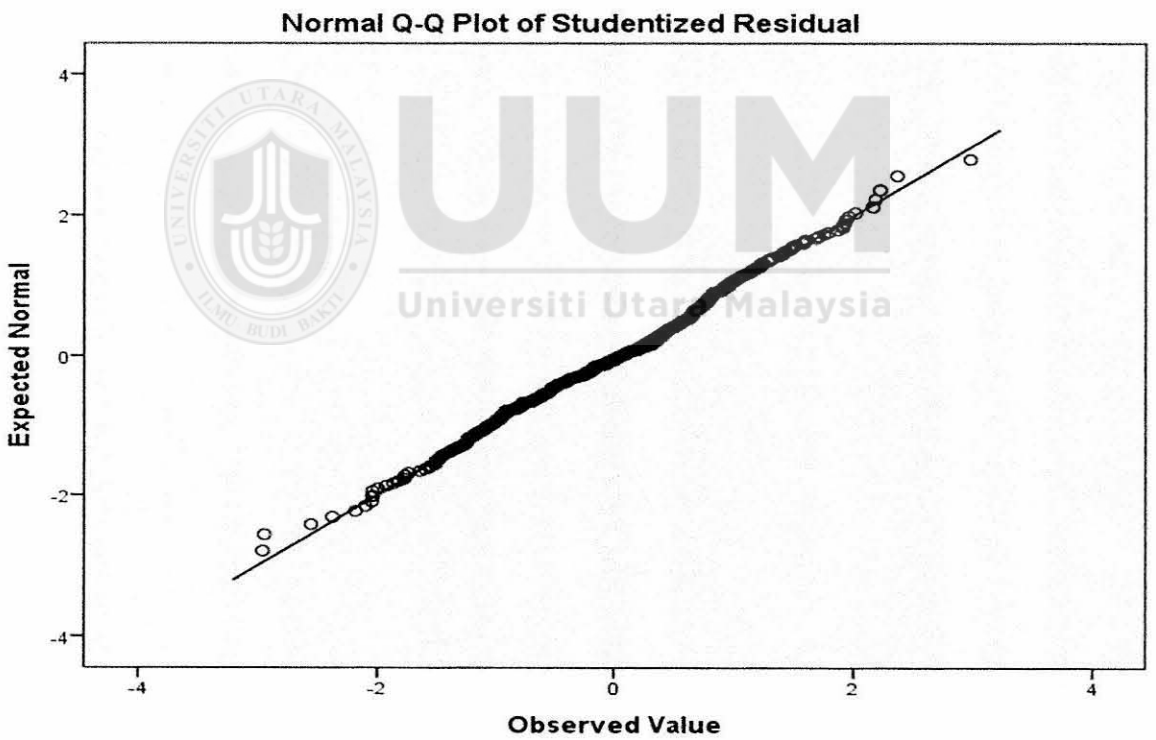


Figure 4.4
Normal Q-Q Plot of Regression Studentized Residual

Besides Q-Q plot, histogram was used for residual normality assessment. Based on Figure 4.5 and 4.6 (refer page 125 and 126), both histograms followed the normal curve. It was found that both histograms supported the normality assumption. Therefore, Shapiro-Wilk test, Q-Q plot and histogram provided sufficient evidence to conclude that the residual data was approximately normally distributed.

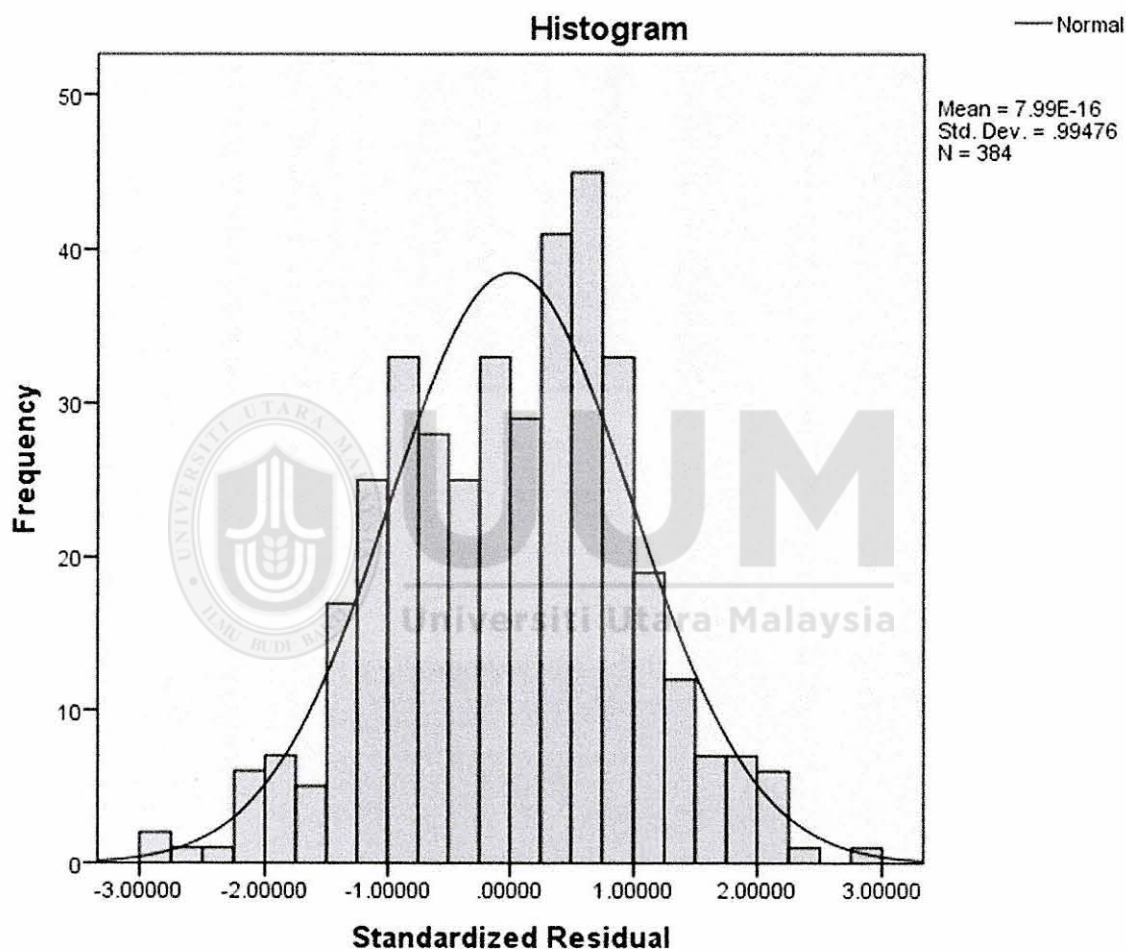


Figure 4.5
Histogram for Standardized Residual

attitude, subjective norm, environmental awareness, technology and government support were not greater than 0.469. These correlation coefficients were not high based on a statement by Hair *et al.* (2010), where high correlation 0.90 and above was the first indication of substantial collinearity. From Table 4.10, it is observed that all five variables were correlated with each other without showing collinearity problem.

Table 4.10
Intercorrelation Matrix for Success Factor Variables

Variable	Correlations				
	AT	SN	EA	TE	GS
Attitude (AT)	1.000				
Subjective Norms (SN)	.380**	1.000			
Environmental Awareness (EA)	.469**	.310**	1.000		
Technology (TE)	.337**	.129**	.412**	1.000	
Government Support (GS)	.224**	.483**	.255**	0.102**	1.000

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

Besides referring to intercorrelation matrix, the multicollinearity was checked based on the value of tolerance and variance inflation factor (VIF). Based on the results illustrated in Table 4.11 (refer page 128), the tolerance value for attitude, subjective norm, environmental awareness, technology and government support are in range 0.640 to 0.712. While 1.404 to 1.562 are the values for VIF. Multicollinearity is encountered when tolerance value is less than 0.10 while VIF value is greater than 10 (Farooq, 2016; Harindranath & Jacob, 2017). Based on the results in Table 4.11 (refer page 128), it was

found that the values of tolerance were in the range of 0.640 to 0.7012 whilst 1.404 to 1.562 for variance inflation factor. Since the value of tolerance was greater than 0.10 and variance inflation factor less than 10, no significant multicollinearity was detected.

Table 4.11
Testing Multicollinearity (Tolerance and VIF Values)

Independent Variables	Tolerance	Variance Inflation Factor (VIF)
Attitude (AT)	0.677	1.478
Subjective Norms (SN)	0.661	1.512
Environmental Awareness (EA)	0.653	1.530
Technology (TE)	0.712	1.404
Government Support (GS)	0.640	1.562

4.5 Descriptive Analysis of Variables

This section presents the descriptive statistics of the dependent, moderator and independent variables used in this study. Descriptive analysis examines statistical description of variables in the study. Statistics such as mean and standard deviations were used as descriptive statistics for independent variables, moderating variable and dependent variable. These scores highlight the respondent's feedback obtained from the questionnaires. As mentioned in Chapter Three (3) (refer Section 3.3 page 116), staff at public universities in Northern Region of Malaysia were the participants of this research. This study employed a dependent variable which was green technology implementation and a moderator namely government support. Apart from that, there were four independent variables involved which were attitude, subjective norm, environmental awareness and technology.

Table 4.12
Descriptive Statistics of Variables

Variable	N	Min	Max	Mean	Std. Deviation
Attitude	384	3	5.00	4.3600	0.5020
Subjective Norm	384	3	5.00	3.7700	0.5500
Environmental Awareness	384	3	5.00	4.3500	0.4980
Technology	384	2.60	5.00	3.5404	0.4606
Government Support	384	3.54	5.00	3.8021	0.6440
Green Technology Implementation	384	3.54	5.00	3.79	0.578

Table 4.12 illustrates that the mean value for the attitude was 4.3600 which was the highest mean whilst the mean value for the technology has the lowest value of 2.60. The lowest mean was due to the position of respondents answering the questionnaire like administrative staff for example officer clerk where they felt that green technology was difficult. Moreover, this means that majority of respondents indicated that attitude plays an important role towards green technology implementation. Environmental awareness and subjective norm have mean values of 4.3500 and 3.7700 respectively. Government support as a moderating variable has a mean value of 3.8021 while the mean value of green technology implementation was 3.7900.

In order to measure the dispersion of data from the mean, standard deviation was computed. Based on the results in Table 4.12 above, environmental awareness has the lowest standard deviation of 0.4606 whilst government support has the highest standard deviation of 0.6440.

4.6 Hypotheses Testing

This part explains the hypothesis testing conducted. Hypothesis is a statement that the researcher sets out whether to accept or reject based on data collection method. Nine (9) hypotheses were formulated and tested in this study. Hypotheses 1 to 4 (H1 to H4) were formulated to test the relationship between each of the independent variables and Green Technology Implementation. While hypothesis 5 (H5) was formulated to test whether the four independent variables collectively influenced the variance of Green Technology Implementation. Furthermore, Hierarchical Regression analysis, Process macro and Simple slope were used to test the effect of moderator variable to each of the independent variables as in Hypotheses 6 to 9 (H6-H9). The hypotheses used in this study are stated below.

Hypothesis 1 (H1)

H1 There is a positive relationship between attitude and green technology implementation.

Hypothesis 2 (H2)

H2 There is a positive relationship between subjective norm and green technology implementation.

Hypothesis 3 (H3)

H3 There is a positive relationship between environmental awareness and green technology implementation.

Hypothesis 4 (H4)

H4 There is a positive relationship between technology and green technology implementation.

Hypothesis 5 (H5)

H5 Attitude, subjective norm, environmental awareness and technology are collectively influence green technology implementation.

Hypothesis 6 (H6)

H6 Government support moderate the relationship between attitude and green technology implementation

Hypothesis 7 (H7)

H7 Government support moderate the relationship between subjective norm and green technology implementation

Hypothesis 8 (H8)

H8 Government support moderate the relationship between environmental awareness and green technology implementation

Hypothesis 9 (H9)

H9 Government support moderate the relationship between technology and green technology implementation

4.6.1 Pearson Correlation Analysis

As the levels of measurement of the variables concerned are interval and all the assumptions are satisfied, the parametric correlation technique was used to test the hypotheses. In order to test the Hypothesis 1 (one) to 4 (four), a Pearson correlation

analysis was conducted to access the nature of relationship between the two variables, independent and dependent variables. Correlation coefficient was used to determine the strength of the linear relationship between two variables (Bluman, 2014). The significant level was 0.05, as a percent 95% confident level was desired. As concluded by Bluman (2014), the range of linear correlation coefficient (r) is from -1 to +1. Value of r close to -1 implies strong negative linear relationship. Strong positive linear relationship exists when the value of r is close to +1. However, when the value of r is 0, there is no linear relationship found between variables. Table 4.13 below as affirmed by Wong & Hiew (2005), mentioned the guidelines for the strength of relationship between variables.

Based on hypothesis testing of Hypothesis 1(H1) to Hypothesis 4 (H4), Attitude, Subjective Norms, Environmental Awareness and Technology were positively and significantly related to Green Technology Implementation. The results of correlation analysis are shown in Table 4.14 to Table 4.17 (refer page 133 until 136).

Table 4.13
Correlation Value and the Strength of Relationship

Correlation Value	The Strength of the Relationship
$r = 0.10$ to 0.29 / $r = -0.10$ to -0.29	Weak
$r = 0.30$ to 0.49 / $r = -0.30$ to -0.49	Medium
$r = 0.50$ to 1.00 / $r = -0.50$ to -1.00	Strong

4.6.1.1 Testing of Hypothesis 1

Hypothesis 1 concerns about the relationship between attitude and green technology implementation. As shown in the Table 4.14, attitude has a positive and significant

relationship with green technology implementation. The positive direction indicated that if the value of the attitude increased, it would lead to an increase of green technology implementation level. In terms of the strength of the relationship, the results indicated that the strength of attitude and green technology implementation was considered as strong. This reflected that the intention towards implement green technology was likely to increase when attitude increased.

Table 4.14 below exhibits the results of Pearson correlation in identifying the relationship between attitude and green technology implementation. The relationship between attitude and green technology implementation obtained were positive relationship with correlation coefficient of $r = 0.550$, $p\text{-value} < 0.01$. Therefore, the hypothesis proposed for the variables (there is a positive relationship between attitude and green technology implementation) was supported.

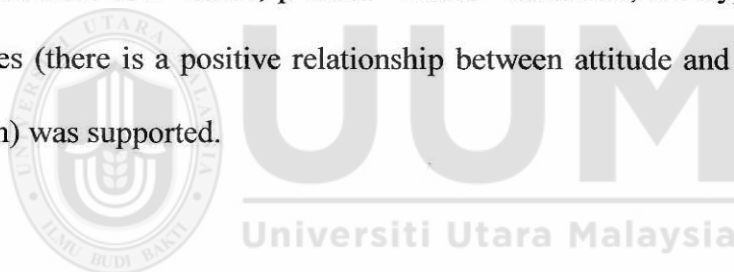


Table 4.14
Correlation between Attitude and Green Technology Implementation

Variable		AT	GTI
Attitude (AT)	Pearson Correlation	1	.550**
	Sig. (2-tailed)		.000
Green Technology Implementation (GTI)	Pearson Correlation	.550**	1
	Sig. (2-tailed)	.000	

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

4.6.1.2 Testing of Hypothesis 2

The relationship between subjective norm and green technology implementation is as Hypothesis 2 (H2). According to Table 4.15 (refer page 134), subjective norm was positively related to green technology implementation.

The value of Pearson Correlation between subjective norm and green technology implementation is presented in Table 4.15 below. Based on the table, subjective norm has a significant relationship with green technology implementation. It shows that subjective norm has a positive correlation with green technology implementation. The strength of the relationship between subjective norm and green technology implementation was 0.620. Since the p-value was less than 0.01, therefore the test failed to reject H2. As a conclusion, subjective norm has a positive relationship with green technology implementation. In terms of the strength of the relationship, the results indicated that the strength of subjective norm and green technology implementation was considered as strong. This implied that the intention to implement green technology was likely to increase if environmental awareness increased.

Table 4.15
Correlation between Subjective Norms and Green Technology Implementation

Variable		SN	GTI
Subjective Norms (SN)	Pearson Correlation	1	.620**
	Sig. (2-tailed)		.000
Green Technology Implementation (GTI)	Pearson Correlation	.620**	1
	Sig. (2-tailed)	.000	

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

4.6.1.3 Testing of Hypothesis 3

Another test was conducted to test the relationship between environmental awareness and green technology implementation. Table 4.16 (refer page 135) shows the correlation analysis between environmental awareness and green technology implementation. The result indicated that there was a positive relationship between environmental awareness and green technology implementation with a p-value of 0.000. Hence H3 (there is a positive relationship between environmental awareness and green technology implementation) was accepted. Therefore, the relationship between environmental awareness and green technology implementation was positive with $r = 0.521$. In terms of the strength of the relationship, the results indicated that the strength of environmental awareness and green technology implementation was considered as strong. This reflected that the intention towards implement green technology was likely to increase when environmental awareness increased.

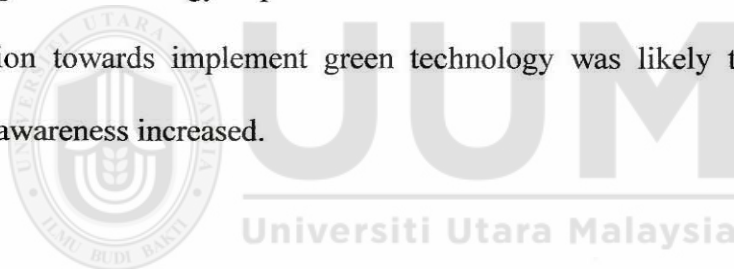


Table 4.16

Correlation between Environmental Awareness and Green Technology Implementation

Variable		EA	GTI
Environmental Awareness (EA)	Pearson Correlation	1	.521**
	Sig. (2-tailed)		.000
Green Technology Implementation (GTI)	Pearson Correlation	.521**	1
	Sig. (2-tailed)	.000	

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

4.6.1.4 Testing of Hypothesis 4

Hypothesis 4 concerns about the relationship between technology and green technology implementation. As shown in Table 4.17 (refer page 136), technology has a positive relationship with green technology implementation. The positive direction of correlation coefficient indicated that if the value of the technology increased, it would lead to an increase in the level of green technology implementation. In terms of the strength of relationship, the results indicated that the strength of technology and green technology implementation was considered as strong. This implied that the intention to implement green technology was likely to increase if technology increased.

Table 4.17 below shows the results of Pearson correlation analysis in order to identify the relationship between technology and green technology implementation. The relationship between technology and green technology implementation was positive with correlation coefficient of $r = 0.637$, $p\text{-value} < 0.01$. Therefore, the hypothesis proposed for the variables was supported.

Table 4.17
Correlation between Technology and Green Technology Implementation

Variable		TE	GTI
Technology (TE)	Pearson Correlation	1	.637**
	Sig. (2-tailed)		.000
Green Technology Implementation (GTI)	Pearson Correlation	.637**	1
	Sig. (2-tailed)	.000	

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

Table 4.18

The Result of Hypotheses Testing on the Relationship between Attitude, Subjective Norm, Environmental Awareness, Technology, Government Support and Green Technology Implementation.

Hypotheses	Description	Result of Hypothesis Testing
H1	There is a positive relationship between attitude and green technology implementation.	Accepted
H2	There is a positive relationship between subjective norm and green technology implementation.	Accepted
H3	There is a positive relationship between environmental awareness and green technology implementation.	Accepted
H4	There is a positive relationship between technology and green technology implementation.	Accepted

All four hypotheses were accepted through hypothesis testing as stated in Table 4.18 (refer page 137). Going further, this study attempted to look at the extent to which each independent variable influenced green technology implementation. This could be ascertained by linear regression test for each independent variable with green technology implementation. The linear regression test is discussed in the next section.

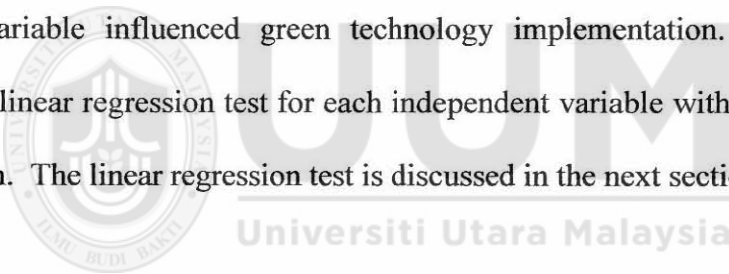


Table 4.19

The Result of the Linear Regression Analysis on the Relationship between Attitude and Green Technology Implementation

Variables	B	SE _B	β	t	p
Dependent Variable: Green Technology Implementation (GTI)					
Constant	2.204	.245		10.991	.000
Predictors: Attitude (AT)	.600	.056	.550	8.499	.000
R	.550				
R ²	.303				
Adjusted R ²	.297				
F	70.240	p = .000			

Linear regression test has been executed to study the influence of attitude on green technology implementation. The results in the Table 4.19 above, shows that $R^2 = 0.303$, Adjusted $R^2 = 0.297$, $F = 70.240$, $p\text{-value} < 0.000$. This means that the effect of attitude towards green technology implementation was 30.3%. Meanwhile, the remaining was influenced by other factors. The regression equation for this model is as follows:

$$\text{Green technology implementation} = 2.204 + 0.600AT$$

Results also showed a constant of 2.204 explains that in the absence of attitude, the green technology implementation was 2.204. Meanwhile, the regression coefficient of 0.600 also meant that if there were any additions (because positive relationship) in attitude, then this would improve the green technology implementation. The test results found that attitude has a significant effect on green technology implementation at since $p\text{-value} < 0.000$.



Table 4.20

The Result of the Linear Regression Analysis on the Relationship between Subjective Norm and Green Technology Implementation

Variables	B	SE _B	β	t	p
Dependent Variable: Green Technology Implementation (GTI)					
Constant	2.119	.245		11.386	.000
Predictors: Subjective norm (SN)	.649	.049	.620	9.055	.000
R	.620				
R ²	.384				
Adjusted R ²	.380				
F	80.988				p = .000

Linear regression test has been executed to study the influence of subjective norm on green technology implementation. The results in Table 4.20 above, shows $R^2 = 0.384$,

Adjusted $R^2 = 0.380$, $F = 80.988$, $p\text{-value} < 0.000$. This meant that the effect of subjective norm towards green technology implementation was 38.4%. Meanwhile, the remaining was influenced by other factors. The regression equation for this model is as follows:

$$\text{Green technology implementation} = 2.119 + 0.649\text{SN}$$

Results also showed a constant of 2.119 explains that in the absence of subjective norm, the green technology implementation was 2.119. Meanwhile, the regression coefficient of 0.649 also meant that if there were any additions (because positive relationship) in subjective norm, then this would improve the green technology implementation. The test results found that subjective norm has a significant effect on green technology implementation at since $p\text{-value} < 0.000$.

Table 4.21
The Result of the Linear Regression Analysis on the Relationship between Environmental Awareness and Green Technology Implementation

Variables	B	SE _B	β	t	p
Dependent Variable: Green Technology Implementation (GTI)					
Constant	2.792	.244		8.243	.000
Predictors: Environmental awareness (EA)	.565	.056	.521	7.487	.000
R	.521				
R ²	.271				
Adjusted R ²	.269				
F	62.867	p = .000			

Linear regression test has been executed to study the influence of environmental awareness on green technology implementation. The results in Table 4.21 above, shows $R^2 = 0.271$, Adjusted $R^2 = 0.269$, $F = 62.867$, $p\text{-value} < 0.000$. This meant that the effect

of environmental awareness towards green technology implementation was 27.1%. Meanwhile, the remaining was influenced by other factors. The regression equation for this model is as follows:

$$\text{Green technology implementation} = 2.009 + 0.565EA$$

Results also showed a constant of 2.792 meaning that in the absence of environmental awareness, the green technology implementation was 2.792. Meanwhile, the regression coefficient of 0.565 also meant that if there were any additions (because positive relationship) in environmental awareness, then this would improve the green technology implementation. The test results found that environmental awareness has a significant effect on green technology implementation at since $p\text{-value} < 0.000$.

Table 4.22
The Result of the Linear Regression Analysis on the Relationship between Technology and Green Technology Implementation

Variables	B	SE_B	β	t	p
Dependent Variable: Green Technology Implementation (GTI)					
Constant	2.009	.224		11.386	.000
Predictors: Technology (TE)	.682	.063	.637	9.055	.000
R	.637				
R ²	.406				
Adjusted R ²	.404				
F	95.988				p = .000

Linear regression test has been executed to study the influence of technology on green technology implementation. The results in the Table 4.22 above, shows $R^2 = 0.406$, Adjusted $R^2 = 0.404$, $F = 95.988$, $p\text{-value} < 0.000$. This meant that the effect of technology towards green technology implementation was 40.6%. Meanwhile, the

remaining was influenced by other factors. The regression equation for this model is as follows:

$$\text{Green technology implementation} = 2.792 + 0.682TE$$

Results also showed a constant of 2.009 explains that in the absence of technology, the green technology implementation was 2.009. Meanwhile, the regression coefficient of 0.682 also meant that if there were any additions (because positive relationship) in technology, then this would improve the green technology implementation. The test results found that technology has a significant effect on green technology implementation at since $p\text{-value} < 0.000$.

4.6.2 Multiple Regression Analysis

Multiple regression analysis was used to evaluate the simultaneous effects of independent variables towards green technology implementation. The test of these hypotheses led to the accomplishment of fifth objective in this study; that is to determine the effect of independent variables (attitude, subjective norm, environmental awareness and technology) towards green technology implementation. There were four assumptions that were needed to be fulfilled before proceeding to multiple regression analysis which were linearity, homoscedasticity, normality and multicollinearity. All the assumptions have been satisfied in the previous section (refer page 116-128). Thus, multiple regression analysis could be carried out consequently.

Multiple regression analysis was used to evaluate the simultaneous effect of independent variables (attitude, subjective norm, environmental awareness and technology) on the

green technology implementation (dependent variable). Equation below implies the general multiple regression model for the study.

$$Y_{GTI} = b_0 + b_1V_1 + b_2V_2 + b_3V_3 + b_4V_4 + e$$

Where,

- b Constant level of green technology implementation
- b₁ Change in green technology implementation achieved associated with unit change in attitude.
- b₂ Change in green technology implementation achieved associated with unit change in subjective norm.
- b₃ Change in green technology implementation achieved associated with unit change in environmental awareness.
- b₄ Change in green technology implementation achieved associated with unit change in technology.
- V₁ Attitude
- V₂ Subjective norm
- V₃ Environmental awareness
- V₄ Technology

Hypothesis 5 (H5) sought to determine whether the four independent variables (attitude, subjective norm, environmental awareness and technology) collectively influenced the

variance of green technology implementation. Multiple regression analysis was used to test this hypothesis. All the four independent variables were tested simultaneously. The result is shown in Table 4.23 below.

Table 4.23
The Result of the Multiple Regression Analysis on the Relationship between Four Independent Variables and Dependent Variables

Variables	B	SE _B	β	t	p
Dependent Variable: Green Technology Implementation					
Constant	.609	.289		2.054	.002
Predictors:					
Attitude (AT)	.259	.053	.225	2.958	.001
Subjective Norm (SN)	.328	.051	.311	3.141	.000
Environmental Awareness (EA)	.229	.056	.195	2.141	.002
Technology (TE)	.348	.048	.331	3.790	.000
R ²	.443				
Adjusted R ²	.423				
F	60.373	p = .000			

Note: *Significant level is $p < .05$, ** Significant level is $p > .01$, *** Significant level is $p < 0.001$.

Multiple regression analysis has been executed on all of four independent variables which were attitude, subjective norms, environmental awareness and technology. The result showed that the model has $R^2 = 0.443$ and adjusted $R^2 = 0.423$. The results suggested that 44.3% of the variance of green technology implementation has been significantly explained by the all four independent variables. With F value of 60.373 and p-value < 0.001, the model was said to be fit significantly. With regards to the value of R^2 , it meant that 55.7% of green technology implementation was explained by another independent

variable which was not covered in this study. The multiple regression equation is shown below:

$$\text{Green technology implementation} = 0.609 + 0.259\text{AT} + 0.328\text{SN} + 0.209\text{EA} + 0.348\text{TE}$$

According to the constant result of 0.609, it meant that the value of green technology implementation was 0.609 if all the independent variables which were attitude, subjective norm, environmental awareness and technology did not exist. Meanwhile, according to the analysis on the multiple regressions it could be deduced that the value of coefficient regression was 0.259 for attitude, 0.328 for subjective norm, 0.209 for environmental awareness and 0.348 for technology. This simply meant that if there was an increase in any of the independent variables, the value of green technology implementation also increased. From the results obtained, it showed that all the independent variables (attitude, subjective norm, environmental awareness and technology) were significantly contribute to green technology implementation at p-value < 0.05. Therefore, Hypothesis 5 (attitude, subjective norm, environmental awareness and technology are collectively influence green technology implementation) was accepted. Table 4.24 shows the result of the test for Hypothesis 5.

Table 4.24
The Result of Hypothesis 5

Hypothesis	Description	Result of Hypothesis
H5	Attitude, subjective norm, environmental awareness and technology are collectively influence green technology implementation.	Accepted

4.6.3 Hierarchical Regression Analysis

This section describes the findings with respect to government support as a moderator in the relationship between each independent variable with green technology implementation (Hypothesis 6 to Hypothesis 9). In order to test the moderating effect of government support on the relationship between independent variables and green technology implementation, hierarchical regression analysis has been carried out. Based on section 3.6.3 (refer page 108), there were three steps involve testing using hierarchical regression analysis. Step 1 implied the effect of each independent variable (attitude, subjective norm, environmental awareness and technology) on dependent variable (green technology implementation). Step 2 involved the inclusion of moderating variable (government support) to test the effect of moderating variable on the relationship between independent variable and dependent variable. For Step 3, the two-way interaction terms (independent multiplying with moderating variable) were included to test the effect of interaction on dependent variable. As a means of doing this, the hierarchical regression analysis output was coupled with the process macro in SPSS. Process Macro is a computational procedure for SPSS that implements moderation analysis. Furthermore, test using simple slope analysis was conducted. The slope was built base on coefficient values in process macro.

4.6.3.1 Moderator Test of Government Support on the Relationship between Attitude and Green Technology Implementation

The regression analysis conducted focused on the interaction (moderation) between government support and the relationship between attitude and green technology

implementation. Three tests consisting of hierarchical regression analysis, process macro and simple slope analysis were presented in the proceeding sub-sections below.

Table 4.25

Effect of Moderator Variable to the Relationship between Attitude and Green Technology Implementation

Predictors variables	Beta	P	R ²	ΔR ²	t	Durbin-Watson
Step 1- Main effect						
Attitude	0.550***	0.000	0.303	0.297	8.499	2.371
Model Fit (F-value)	F= 70.240					
Step 2- Moderating effect						
Attitude	0.491***				5.143	
Government Support	0.153***	0.000	0.323	0.303	9.763	2.371
Model Fit (F-value)	F= 45.081					
Step 3- Interaction effect						
Attitude	0.497***				3.510	
Government Support	0.202***				3.745	
Attitude*Government Support	0.197***	0.011	0.376	0.331	2.647	2.371
Model Fit (F-value)	F= 35.136					

Note: *Significant level is $p < .05$, ** Significant level is $p < .01$, *** Significant level is $p < .001$

Table 4.25 above illustrates the result of moderator effect towards the relationship between attitude and green technology implementation. Step 1 showed the effect of attitude to green technology implementation. By referring to Step 1, it could be seen that the relationship between attitude and green technology implementation was significant with $R^2 = 0.303$ and $p\text{-value} < 0.001$.

Moderating variable namely government support was introduced in the Step 2. However, in Step 2, it was found that the strength of the relationship between attitude and green technology implementation by introducing government support as a moderating variable

was significant. It was found that the attitude has a significant relationship with green technology implementation ($R^2 = 0.323$, $F = 45.081$ and $p\text{-value} < 0.05$).

In the Step 3, it was found that the interaction between government support and attitude was positive and significant with $R^2 = 0.376$, F value = 35.136 and $p\text{-value}$ less than 0.05. Hence, according to the result, it could be concluded that the government support has acted as moderating variable in the relationship between attitude and green technology implementation.

Besides Hierarchical Regression Analysis, Process Macro has been used to examine the effect of government support towards the relationship between attitude and green technology implementation. The result of Process Macro is shown in Table 4.26 below.

Table 4.26
Effect of Moderator Variable to the Relationship between Attitude and Green Technology Implementation (Process Macro)

Model Summary						
R	R²	MSE	F	df1	df2	p
.613	.376	.421	35.136	3.000	380.00	.000

Model Coefficient	
Constant	4.138
Government Support	.318
Attitude	.556
Interaction	.430

R² Increase Due to Interaction					
	Adjusted R²	F	df1	df2	p
Interaction	.053	7.945	1.000	380.00	.011

Table 4.26 (Continued)

Johnson –Neyman Technique		
Value	% Below	% Above
.749	7.407	92.593

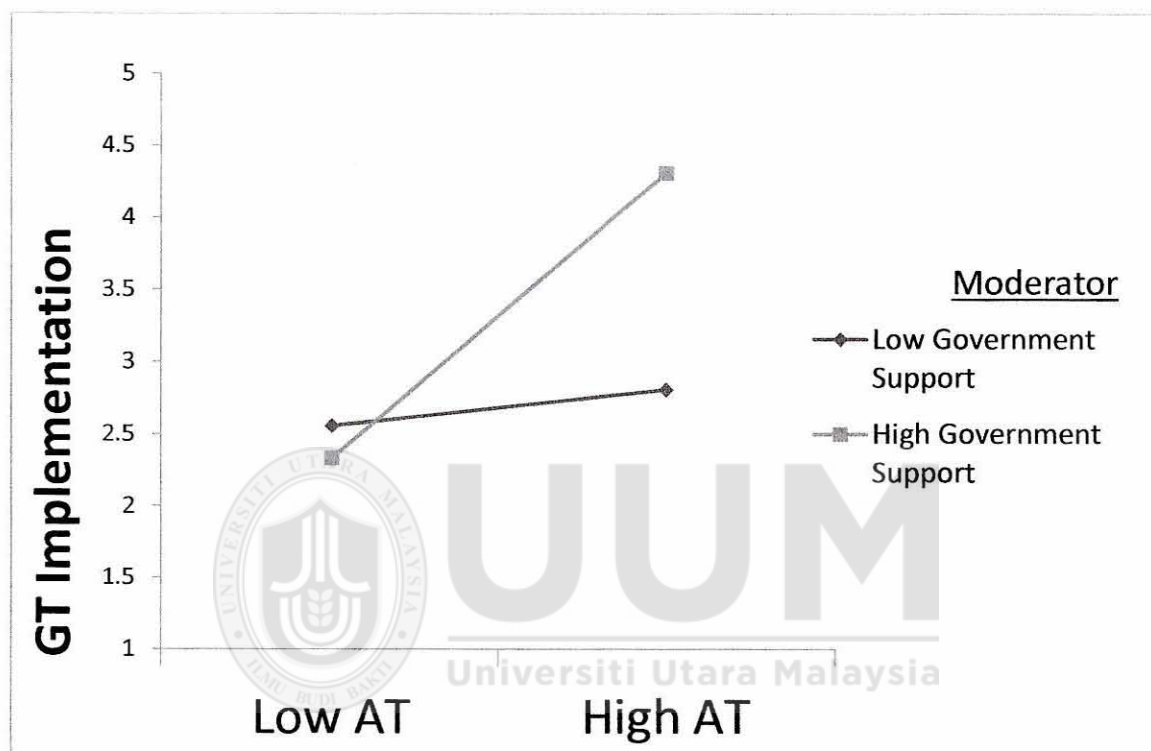


Figure 4.7
Slope Analysis between Attitude, Government Support and Green Technology Implementation

Table 4.26 (refer page 147 and 148) illustrates the effect of moderator government support using Macro Process. By referring to Table 4.26, the model and overall result was acceptable because $p\text{-value} < 0.05$. Based on that result, it was found that moderator government support has changed the effect of attitude towards green technology implementation by 5.3% ($\text{Adjusted } R^2 = 0.053$). Since the value of $p\text{-value}$ was less than 0.05, therefore the effect of moderator was significant.

Additionally, the output of slope analysis is presented in Figure 4.7 (refer page 148). Based on slope analysis test (refer to Figure 4.7), it indicated that the government support strengthened the positive relationship between attitude and green technology implementation. Besides that, the two nonparallel lines implied that the combination of attitude and government support results in higher green technology implementation. Additionally, high government support strengthened the effect of staff green technology implementation when attitude was high. Input for slope analysis was based on the output of Process Macro presented in Table 4.26 (refer page 147 and 148).

Besides that, moderator effect could be explained by looking at the effect of moderator conditional on the independent variables in the different values of moderator too. By referring to the Johnson-Neyman value, around 7.407% of the cases have a moderator value below 0.749, whereas 92.593% have a moderator value above 0.749.

Based on the three types of tests conducted, this study concluded that the impact of moderator government support towards the relationship between attitude and green technology implementation is significant. Therefore, H6 (government support moderates the relationship between attitude and green technology implementation) was accepted.

4.6.3.2 Moderator Test of Government Support on the Relationship between Subjective Norm and Green Technology implementation

Regression analysis conducted focused on the interaction (moderation) between government support and the relationship between subjective norm and green technology implementation. The analysis was conducted using three modes namely SPSS, Process

Macro and simple slope analysis. It is presented in the proceeding page (refer page 150-153).

Table 4.27

Effect of Moderator Variable to the Relationship between Subjective Norm and Green Technology Implementation

Predictors variables	Beta	P	R ²	ΔR ²	t	Durbin-Watson
Step 1- Main effect						
Subjective Norm	.62***	.000	.384	.380	8.480	1.791
Model Fit (F-value)	F= 80.988					
Step 2- Moderating effect						
Subjective Norm	.39***				7.775	
Government Support	.172***	.000	.437	.273	4.790	1.791
Model Fit (F-value)	F= 50.975					
Step 3- Interaction effect						
Subjective Norm	.41***				2.602	
Government Support	.362***				2.358	
Subjective Norm *Government Support	.420***	.04	.489	.371	2.868	1.791
Model Fit (F-value)	F= 48.76					

Note: *Significant level is $p < .05$, ** Significant level is $p < .01$, *** Significant level is $p < .001$

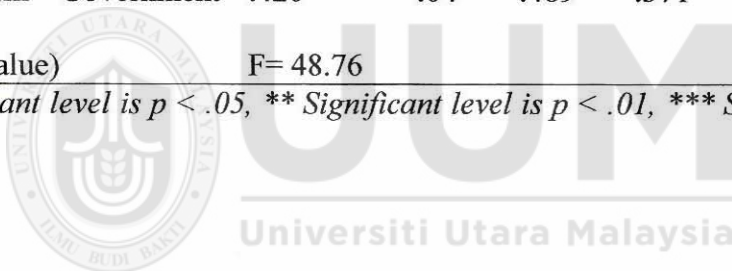


Table 4.27 illustrates the result of moderator effect towards relationship between subjective norm and green technology implementation. Step 1 showed the effect of subjective norm to green technology implementation. By referring to Step 1, the relationship between subjective norm and green technology implementation was significant, which $R^2 = 0.384$ and $p\text{-value} < 0.001$.

Moderating variable namely government support was introduced in the Step 2. However, in the Step 2, it was found that the strength of the relationship between subjective norm and green technology implementation by introducing government support as a

moderating variable was significant. It was found that the subjective norm has a significant relationship with green technology implementation ($R^2 = 0.437$, $F = 50.975$ and $p\text{-value} < 0.05$).

In the Step 3, it was found that the interaction between government support and subjective norm was significant with $R^2 = 0.489$, F value = 48.76 and $p\text{-value}$ less than 0.05. Hence, according to the result, it could be concluded that the government support act as a moderating variable in the relationship between subjective norm and green technology implementation.

Besides Hierarchical Regression Analysis, Process Macro has been used to examine the effect of government support towards the relationship between subjective norm and green technology implementation. The result of Process Macro is shown in Table 4.28 below.

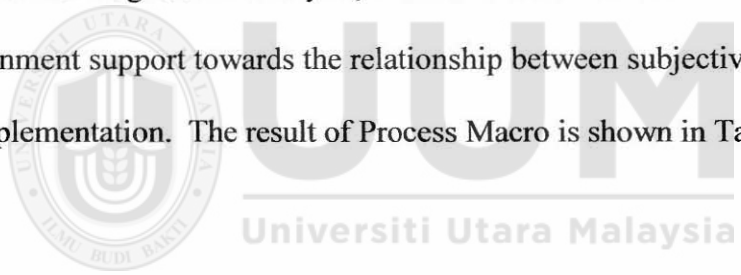


Table 4.28

Effect of Moderator Variable to the Relationship between Subjective Norm and Green Technology Implementation (Process Macro)

Model Summary						
R	R²	MSE	F	df1	df2	p
.6994	.4891	.2434	48.7604	3.000	380.00	.000

Model Coefficient	
Constant	3.7785
Government Support	.375
Subjective Norm	.397
Interaction	.440

Table 4.28 (Continued)

R² Increase Due to Interaction					
	R² Change	F	df1	df2	p
Interaction	.052	6.663	1.000	380.00	.04

Johnson –Neyman Technique		
Value	% Below	% Above
2.6161	5.9063	94.0937

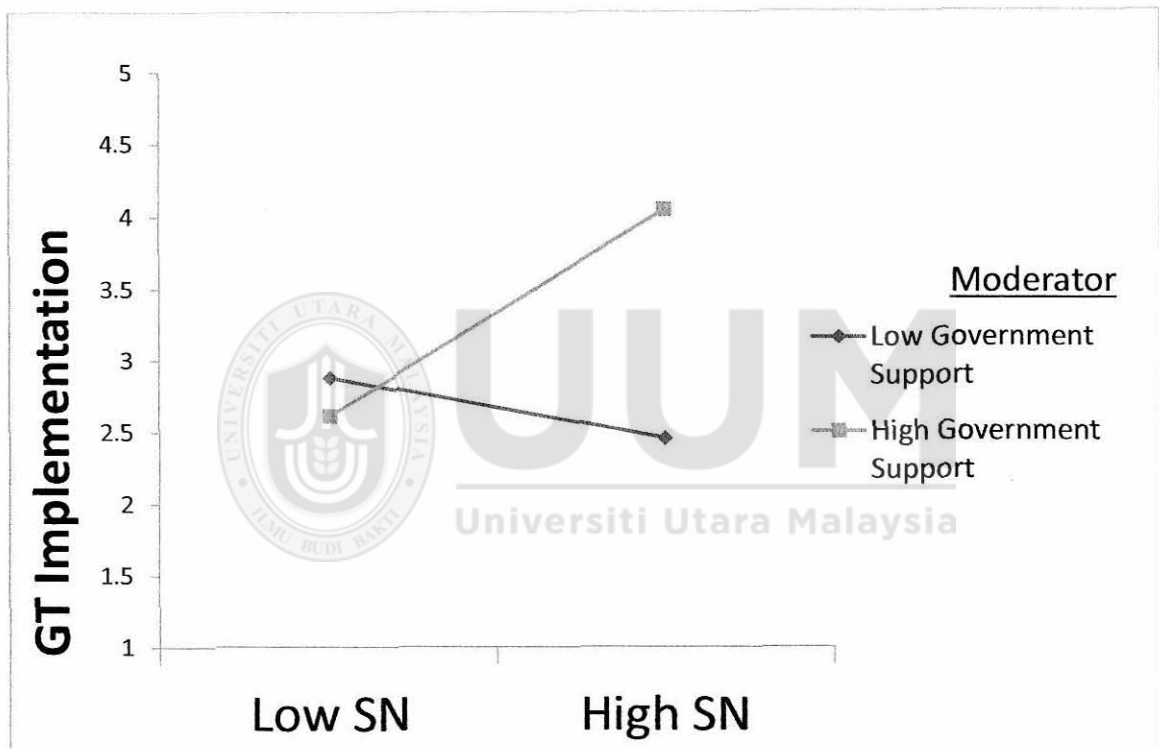


Figure 4.8

Slope Analysis between Subjective Norm, Government Support and Green Technology Implementation

Based on Table 4.28 (refer page 151 and 152), the model and overall result was acceptable because $p\text{-value} < 0.05$. Table 4.28 illustrates the effect of moderator government support. Based on the result, it could be seen that moderator government support has changed the effect of subjective norm towards green technology

implementation by 5.2% (R^2 Change = 0.052). Since the value of p-value was less than 0.05, therefore the effect of moderator was significant.

Additionally, the interaction output between subjective norm and government support was positive. Figure 4.8 (refer page 152) shows two nonparallel lines which implied that the combination of subjective norm and government support increased green technology implementation. Therefore, it indicated that the government support strengthened the positive relationship between subjective norm and green technology implementation. Additionally, high government support strengthened the effect of staff green technology implementation when subjective norm was high. Input for slope analysis was based on the output of Process Macro presented in Table 4.28 (refer page 151-152).

Besides that, moderator effect could be explained by looking at the effect of moderator conditional on the independent variables in the different values of moderator too. By referring to the Johnson-Neyman value, around 5.9063% of the cases have a moderator value below 2.6161, whereas 94.0937% have a moderator value above 2.6161.

Based on the three types of tests conducted, this study concluded that the impact of moderator government support towards the relationship between subjective norm and green technology implementation was significant. Therefore, H7 (government support moderates the relationship between subjective norm and green technology implementation) was accepted.

4.6.3.3 Moderator Test of Government Support on the Relationship between Environmental Awareness and Green Technology implementation

The effect of government support as moderator among relationship between independent variables and green technology implementation is explained in this section. In order to test the moderating effect, the hierarchical regression has been conducted.

Table 4.29

Effect of Moderator Variable to the Relationship between Environmental Awareness and Green Technology Implementation

Predictors variables	Beta	P	R ²	ΔR ²	t	Durbin-Watson
Step 1- Main effect						
Environmental Awareness	.521***	.000	.271	.265	8.480	1.767
Model Fit (F-value)	F= 44.240					
Step 2- Moderating effect						
Environmental Awareness	.354***				7.775	
Government Support	.256***	.000	.350	.346	4.790	1.767
Model Fit (F-value)	F= 35.975					
Step 3- Interaction effect						
Environmental Awareness	.229***				2.918	
Government Support	.408***				2.987	
Subjective Norm *Government Support	0.170***	0.04	0.398	0.395	2.037	1.767
Model Fit (F-value)	F= 30.76					

Note: *Significant level is $p < .05$, ** Significant level is $p < .01$, *** Significant level is $p < .001$

Table 4.29 above illustrates the result of moderator effect towards relationship between environmental awareness and green technology implementation. Step 1 showed the effect of environmental awareness to green technology implementation. By referring to Step 1, it could be seen that the relationship between environmental awareness and green technology implementation was significant, which $R^2 = 0.271$ and $p\text{-value} < 0.001$.

Moderating variable namely government support was introduced in the Step 2. However, in the Step 2, it was found that the strength of the relationship between attitude and green technology implementation by introducing government support as a moderating variable was significant. It was found that the attitude was having a significant relationship with green technology implementation ($R^2 = 0.350$, $F = 35.975$ and $p\text{-value} < 0.05$).

In the Step 3, it was found that the interaction between government support and environmental awareness was positive and significant with $R^2 = 0.398$, F value = 30.76 and $p\text{-value}$ less than 0.05. Hence, according to the result, it could be concluded that the government support has acted as moderating variable in the relationship between environmental awareness and green technology implementation.

Besides Hierarchical Regression Analysis, Process Macro has been used to examine the effect of government support towards the relationship between environmental awareness and green technology implementation. The result of Process Macro is shown in Table 4.30 (refer page 155-156).

Table 4.30
Effect of Moderator Variable to the Relationship between Environmental Awareness and Green Technology Implementation (Process Macro)

Model Summary						
R	R²	MSE	F	df1	df2	p
.6270	.3980	.2379	30.760	3.000	380.00	.042

Model	Coefficient
Constant	1.7261
Government	.3820

Support	
Attitude	.2510
Interaction	.1742

R² Increase Due to Interaction					
	Adjusted R²	F	df1	df2	p
Interaction	.048	3.9760	1.000	380.00	.0369

Johnson –Neyman Technique		
Value	% Below	% Above
.5006	16.4063	83.5938

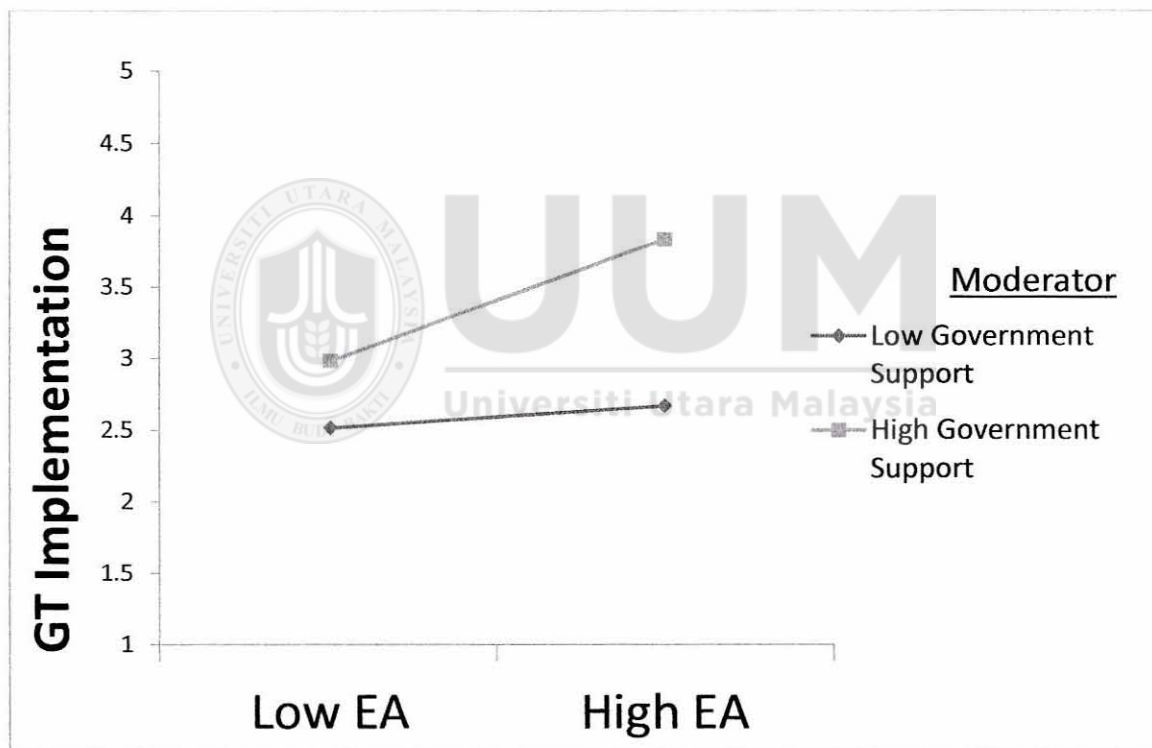


Figure 4.9
Slope Analysis between Environmental Awareness, Government Support and Green Technology Implementation

Referring to the Table 4.30 (refer page 155 and 156), the model and overall result could be acceptable because the value of p-value < 0.05. Table 4.30 illustrates the effect of moderator government support. Based on the result, it could be seen that moderator

government support had changed the effect of environmental awareness towards green technology implementation by 4.8% (Adjusted $R^2 = 0.048$). Since the value of p-value was less than 0.05, therefore the effect of moderator was significant.

Additionally, the output of slope analysis is presented in Figure 4.9 above. Based on slope analysis test (refer to Figure 4.9), it indicated that the government support strengthened the positive relationship between environmental awareness and green technology implementation. Besides that, the two nonparallel lines implied that the combination of environmental awareness and government support resulted in higher green technology implementation. Additionally, high government support strengthened the effect of staff green technology implementation when environmental awareness was high. Input for slope analysis was based on the output of Process Macro presented in Table 4.30 (refer page 155 and 156).

Besides that, moderator effect could be explained by looking at the effect of moderator conditional on the independent variables in the different values of moderator too. By referring to the Johnson-Neyman value, around 16.4063% of the cases have a moderator value below 0.5006, whereas 83.5938 % have a moderator value above 0.5006.

Based on the three types of tests that have been used, this study concluded that the impact of moderator government support towards the relationship between environmental awareness and green technology implementation was significant. Therefore, H8

(government support moderates the relationship between environmental awareness and green technology implementation) was accepted.

4.6.3.4 Moderator Test of Government Support on the Relationship between Technology and Green Technology implementation

The effect of government support as moderator among relationship between independent variables and green technology implementation is explained in this section. In order to test the moderating effect, the hierarchical regression has been used.

Table 4.31

Effect of Moderator Variable to the Relationship between Technology and Green Technology Implementation

Predictors variables	Beta	P	R ²	ΔR ²	t	Durbin-Watson
Step 1- Main effect						
Technology	0.637***	0.000	0.406	0.402	6.536	2.371
Model Fit (F-value)	F= 95.988					
Step 2- Moderating effect						
Technology	0.588***				9.763	
Government Support	0.362***	0.000	0.426	0.422	5.143	2.371
Model Fit (F-value)	F= 60.767					
Step 3- Interaction effect						
Technology	0.323***				3.510	
Government Support	0.212***				2.647	
Technology*Government Support	0.325***	0.000	0.501	0.496	3.745	2.371
Model Fit (F-value)	F= 55.357					

*Note: *Significant level is $p < .05$, ** Significant level is $p < .01$, *** Significant level is $p < .001$*

Table 4.31 above illustrates the result of moderator effect towards relationship between technology and green technology implementation. Step 1 showed the effect of technology on green technology implementation. By referring to Step 1, it could be seen

that the relationship between technology and green technology implementation was significant, which $R^2 = 0.406$ and $p\text{-value} < 0.001$.

Moderating variable namely government support was introduced in the Step 2. However, in the Step 2, it was found that the strength of the relationship between technology and green technology implementation by introducing government support as a moderating variable was significant. It was found that the technology was having a significant relationship with green technology implementation ($R^2 = 0.426$, $F = 60.767$ and $p\text{-value} < 0.05$).

In the Step 3 (refer Table 4.31), it was found that the interaction between government support and technology was positive and significant with $R^2 = 0.501$, F value = 55.357 and $p\text{-value}$ less than 0.05. Hence, according to the result, it could be concluded that the government support has acted as moderating variable in the relationship between technology and green technology implementation.

Besides Hierarchical Regression Analysis, Process Macro has been used to examine the effect of government support towards the relationship between technology and green technology implementation. The result of Process Macro is shown in Table 4.32 below.

Table 4.32

Effect of Moderator Variable to the Relationship between Technology and Green Technology Implementation (Process Macro)

Model Summary						
R	R²	MSE	F	df1	df2	p
.7078	.501	.2419	55.357	3.000	380.00	.000

Model	Coefficient
Constant	3.7945
Government Support Technology Interaction	.2150
	.3261
	.3291

R² Increase Due to Interaction					
	Adjusted R²	F	df1	df2	p
Interaction	.075	4.008	1.000	380.00	.000

Johnson –Neyman Technique		
Value	% Below	% Above
.3255	11.8750	88.1250

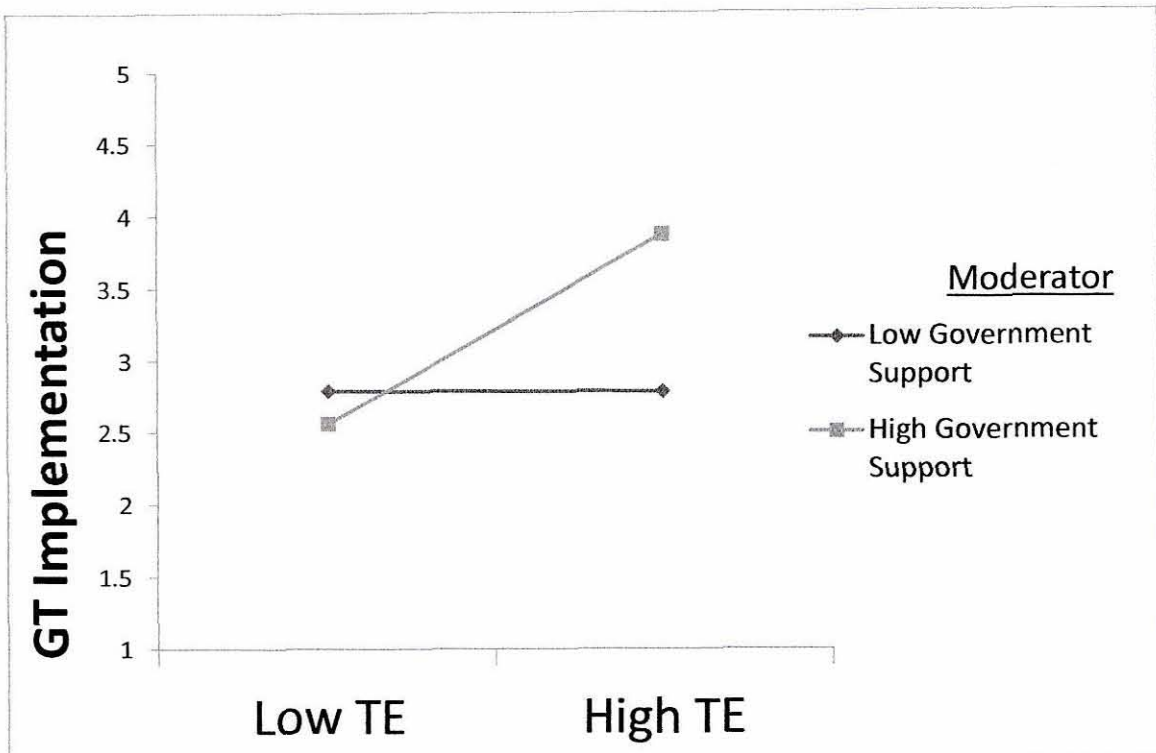


Figure 4.10

Slope Analysis between Technology, Government Support and Green Technology Implementation

By referring to Table 4.32, the model and overall result could be acceptable because the value of p-value < 0.05. Table 4.32 (refer page 160) illustrated the effect of moderator government support. Based on the result, it could be seen that moderator government support has changed the effect of technology towards green technology implementation by 7.5% (Adjusted $R^2 = .075$). Since the value of p-value was less than 0.05, therefore the effect of moderator was significant.

Additionally, the output of slope analysis is presented in Figure 4.10 above. Based on slope analysis test (refer to Figure 4.10), the result indicated that the government support strengthened the positive relationship between technology and green technology

implementation. Input for slope analysis was based on the output of Process Macro presented in Table 4.32 (refer page 160).

Besides that, moderator effect also could be explained by looking at the effect of moderator conditional on the independent variables in the different values of moderator. By referring to the Johnson-Neyman value, around 11.8750% of the cases have a moderator value below 0.3255, whereas 88.1250% have a moderator value above 0.3255.

Based on the three types of tests that have been used, this study concluded that the impact of moderator government support towards the relationship between technology and green technology implementation was significant. Therefore, H9 (government support moderates the relationship between technology and green technology implementation) was accepted. Table 4.33 (refer page 162) presented the result of hypothesis 6 until hypothesis 9. From that table, all the hypotheses (H6, H7, H8, and H9) were accepted.

Table 4.33
The Result of Moderating Effect

Hypothesis	Description	Result of Hypothesis
H6	Government support moderate the relationship between attitude and green technology implementation	Accepted
H7	Government support moderate the relationship between subjective norm and green technology implementation	Accepted
H8	Government support moderate the relationship between environmental awareness and green technology implementation	Accepted
H9	Government support moderate the relationship between technology and green technology implementation	Accepted

4.7 Summary of Findings

Having presented all the results including main and moderating effects in the preceding sections, next, the summary of the results of all hypotheses tested are presented as shown in Table 4.34 below. The result in Table 4.34 shows that all the hypotheses were accepted, therefore these analyses were answered the objectives and hypotheses of this study. In addition, it meant that all the independent variables (attitude, subjective norm, environmental awareness and technology) and moderating variable (government support) were related to green technology implementation.

Table 4.34

The Result of Hypotheses Testing on the Relationship between Attitude, Subjective Norm, Environmental Awareness, Technology, Government Support and Green Technology Implementation

Hypotheses	Description	Result of Hypothesis
H1	There is a positive and significant relationship between attitude and green technology implementation.	Accepted
H2	There is a positive and significant relationship between subjective norm and green technology implementation.	Accepted
H3	There is a positive and significant relationship between environmental awareness and green technology implementation.	Accepted
H4	There is a positive and significant relationship between technology and green technology implementation.	Accepted
H5	Attitude, subjective norm, environmental awareness and technology are collectively influence Green Technology Implementation.	Accepted
H6	Government Support moderates the relationship between attitude and green technology implementation.	Accepted
H7	Government Support moderates the relationship between subjective norm and green technology implementation.	Accepted
H8	Government Support moderates the relationship between environmental awareness and green technology implementation.	Accepted
H9	Government Support moderates the relationship between technology and green technology implementation.	Accepted

4.8 Summary of Chapter

This chapter presents the basic profile of the survey respondents such as type of gender, age of respondents, designation of the respondents' position and years of working. Several assumptions were examined in this study such as linearity, homoscedasticity, normality and multicollinearity. Based on the results in step 1 (main effect), four independent variables which are attitude, subjective norm, environmental awareness and technology have positive relationship with green technology implementation. Specifically, the study found that all variables namely attitude, subjective norm, environmental awareness and technology has positive impact on green technology implementation. Based on multiple regression analysis, all the independent variables (attitude, subjective norm, environmental awareness and technology) explained the criterion of green technology implementation. Finally, this study established that government support has an interaction effect with attitude, subjective norm, environmental awareness and technology in predicting green technology implementation. In the next chapter (Chapter Five), concluding remarks of the study are offered.

CHAPTER FIVE

DISCUSSION AND CONCLUSION

5.1 Introduction

This final chapter consists of eight (8) sections which starts with the introduction of the chapter in section 5.1. The following section is a summary of the study (as in section 5.2). Next, the findings of the study presented in Chapter Four are discussed. Section 5.3 discusses the relationships between independent variables (IVs) towards dependent variable (DV) while section 5.4 discusses the collective influence of IVs on DV. Section 5.5 discusses the moderating role of government support on the relationship between independent variable (attitude, subjective norm, environmental awareness and technology) and green technology implementation. It is followed by the discussion on the implications of the study (as in section 5.6). Review is made upon the contribution of this study to the body of knowledge in technology management, benefits to universities and government (as in section 5.6.1 and section 5.6.2). Limitations of the study and suggestions for the future research are then discussed (as in section 5.7 and section 5.8).

5.2 Summary of the Study

The study has achieved its objectives and has answered the research questions. Therefore, this research has filled the first research gap which is to integrate moderating variable in the study due to inconsistency in previous findings. The study investigated the effects of independent variables comprising of attitude, subjective norm,

environmental awareness and technology while considering government supports as the moderator towards green technology implementation.

Besides that, this study has filled the main research gap which is to provide comprehensive study on green technology implementation especially in university perspective which has been rarely studied. Moreover, the study yielded concrete contribution to the body of knowledge (in technology management) since previous studies focused largely on profit making organizations and companies in the manufacturing sector as compared to green technology implementation especially at universities. This study is vital since Malaysian government aims to reduce pollution, emission and environmental problems in Malaysia. A clear understanding of factors influencing green technology implementation would assist respective entities to better appreciate their shortcomings and to inspire new ways in improving green technology implementation especially at universities.

In order to achieve the first specific objective which is to examine the relationship between attitude and green technology implementation, Pearson correlation analysis was applied in this study. The result is presented in Chapter 4, section 4.6.1.1 (refer page 132) with further explanation in Chapter 5, section 5.3.1 (refer page 169). Based on that test, it was found that attitude positively affected green technology implementation. Therefore, first specific objective was achieved.

Next, the second specific objective is to examine the relationship between subjective norm and green technology implementation. In order to examine the relationship, again

Pearson correlation analysis was used. The finding revealed that subjective norm positively affected green technology implementation. Detailed result and discussion are presented in section 4.6.1.2 (refer page 134) and 5.3.2 (refer page 171). Hence, second objective was achieved.

The third specific objective which is to examine the relationship between environmental awareness and green technology implementation was achieved by Pearson correlation analysis test. From the result, it was confirmed that environmental awareness positively affected green technology implementation. Section 4.6.1.3 (refer page 135) and section 5.3.3 (refer page 172) show detailed result and explanation of this relationship.

Pearson correlation analysis was used to examine the relationship between technology and green technology implementation which is fourth objective. Based on the result presented in section 4.6.1.4 (refer page 136) and detailed explanation in section 5.3.4 (refer page 172), technology has positively affected green technology implementation. Therefore, fourth objective (there is a positive relationship between technology and green technology implementation) was achieved.

Next, multiple regression analysis was conducted to achieve fifth objective which is to examine the collective influence of four independent variables towards green technology implementation. The results from the analysis indicated that four independent variables collectively influenced green technology implementation. Detailed result and explanation are shown in section 4.6.2 (refer page 144) and section 5.4 (refer page 173).

Besides that, the sixth objective was achieved through hierarchical regression analysis test, process macro and simple slope analysis. In addressing this objective, the effect of moderating effect government support towards the relationship between each independent variable such as attitude, subjective norm, environmental awareness and technology was examined. Results (refer page 145 until 162) revealed that government support acted as a moderator to the relationship of all independent variables (attitude, subjective norm, environmental awareness and technology) towards green technology implementation. Summary of data analysis and findings are presented below (section 5.3 to section 5.5).

5.3 Relationship between Independent Variables and Green Technology Implementation

The objective of the study is to examine the relationship and influence of independent variables consisting of attitude, subjective norm, environmental awareness and technology towards green technology implementation. Through a series of hypotheses, research questions of the relationship have been obtained. Table 5.1 (refer page 169) shows the relationship between hypothesis, research questions, discussion sub-section and findings. Based on Table 5.1, all the hypotheses were accepted which indicated that attitude, subjective norm, environmental awareness and technology have positive relationship towards green technology implementation.

Table 5.1

The Connection of the Hypothesis, Research Question, Discussion Sub-section and Findings

Hypothesis	Description	Research Question	Discussion Sub-section	Hypothesis Result
H1	There is a positive relationship between attitude and green technology implementation.	What is the relationship between attitude towards green technology implementation.	5.3.1. Relationship between attitude and green technology implementation.	Accepted
H2	There is a positive relationship between subjective norm and green technology implementation.	What is the relationship between subjective norm towards green technology implementation.	5.3.2 Relationship between subjective norm and green technology implementation.	Accepted
H3	There is a positive relationship between environmental awareness and green technology implementation.	What is the relationship between environmental awareness towards green technology implementation.	5.3.3 Relationship between environmental awareness and green technology implementation.	Accepted
H4	There is a positive relationship between technology and green technology implementation.	What is the relationship between technology towards green technology implementation.	5.3.4 Relationship between technology and green technology implementation.	Accepted

5.3.1 Relationship between Attitude and Green Technology Implementation

The first hypothesis (H1) of the study is to examine the direct relationship between attitude and green technology implementation. In this study, attitude referred to the

university staff's attitude. Results (refer page 133) showed that there was a strong positive relationship between attitude and green technology implementation ($r = .550$, $p\text{-value} < 0.000$). The findings also indicated that attitude affected 30.3% of green technology implementation ($R^2 = .303$). Meanwhile, the remaining 69.7% was influenced by other factors.

The findings were also in line with the findings of previous scholars which found that there were positive significant relationship between attitude and green behavior (Teck, 2013; Siohong & Zainol, 2012). This highlighted that the importance of having green attitude has a significant role in determining the level of green technology implementation. Based on this positive relationship, the intention to implement green technology would increase if green attitude was increased.

From the results of the study, it could be observed that green attitude was one of the important factors that influenced implementation of green technology. Attitude would make people like or dislike something and move towards or away from certain things. Staff that have more positive or more favorable attitude towards green technology have a higher interest to implement green technology. Besides that, staff who have more positive attitude towards green technology are easier to accept green technology.

Additionally, the positive effect of green attitude on the intention to implement green technology explained that the more positive the person's evaluation or belief of the consequences of engaging with green technology, the higher the possibility for him or her to implement green technology.

5.3.2 Relationship between Subjective Norm and Green Technology Implementation

The second hypothesis (H2) of the study is to examine the direct relationship between subjective norm and green technology implementation. In this study, subjective norm referred to the university staff's subjective norm. Results (refer page 134) showed that there was a strong positive relationship between subjective norm and green technology implementation ($r = .620$, $p\text{-value} < 0.000$). The findings also indicated that attitude affected 38.4% of green technology implementation ($R^2 = .384$). Meanwhile, the remaining 61.6% is influenced by other factors.

The study finding is consistent with the findings of previous scholar which found that there was positive significant relationship between subjective norm and green behavior (Chow & Chen, 2009; Janmaimool, 2017; Mohd Suki, 2016; Seung & Byoungho, 2017; Siohong & Zainol, 2012). This result confirmed that subjective norm acted as a crucial factor to implement green technology. Additionally, the findings revealed that family members, friends and media were the three most important motivation sources for staff to implement green technology because someone close to a staff may affect the staff's choice of action on green technology implementation.

This result affirmed that descriptive social norm exposed by important people such as members, friends and media have strong effect on staff's intention to implement green technology. It means that opinions from members, friends and media could affect the implementation of green technology. Therefore, encouraging important people of staff could catalyze the staff's intention to engage in green technology implementation too.

5.3.3 Relationship between Environmental Awareness and Green Technology Implementation

The third hypothesis (H3) of the study is to examine the direct relationship between environmental awareness and green technology implementation. In this study, environmental awareness referred to the university staff's environmental awareness. Results (refer page 135) showed that there was a strong positive relationship between environmental awareness and green technology implementation ($r = .521$, $p\text{-value} < 0.000$). The findings also indicated that environmental awareness affect 27.1% of green technology implementation ($R^2 = .271$). Meanwhile, the remaining 72.9% is influenced by other factors.

The results seem to be consistent with past studies which revealed that there was significant positive relationship between environmental awareness and green behavior (Bokhari *et al.*, 2014; Teck, 2013; Royne *et al.*, 2016; Aman *et al.*, 2012). This result unveils that environmental awareness was one of the factors that impacted green technology implementation. Additionally, individuals (staff) who are concerned about environment have a contribution to implement green technology. In short, individuals (staff) who were aware about environmental problems were more likely to translate their awareness into action which is to implement green technology.

5.3.4 Relationship between Technology and Green Technology Implementation

The fourth hypothesis (H4) of the study is to examine the direct relationship between technology and green technology implementation. In this study, technology referred to the technology of green technology. Results (refer page 136) showed that there was a

strong positive relationship between technology and green technology implementation ($r = .637$, $p\text{-value} < 0.000$). The findings also indicated that technology affected the implementation of green technology by 40.6% ($R^2 = .406$). Meanwhile, the remaining 59.4% was influenced by other factors.

In line with the findings of Lin & Ho (2011) and Weng & Lin (2011), technology was a significant predictor of green behavior. This result proved that compatibility and benefits of green technology affected the implementation behavior. Staff would implement green technology if they thought green technology was simple and easy to learn and use, helpful for improving environmental and it was compatible to the existing operations. In short, with more relative advantage and more compatibility of green technology, staff are more motivated to implement green technology.

Besides Pearson correlation analysis, multiple regression analysis was used to examine the collective influence of four independent variables on green technology implementation. Next, the collectively influence of four independent variables to green technology implementation are discussed (refer section 5.4).

5.4 The Collective Influence of Independent Variables towards Green Technology Implementation

This section discusses the effects of four independent variables such as attitude, subjective norm, environmental awareness and technology to dependent variable. Descriptions of the case are as follows.

Table 5.2
Relationship between Research Question and Hypothesis

Hypothesis	Description	Research Question	Hypothesis Result
H5	Attitude, subjective norm, environmental awareness and technology are collectively influence green technology implementation.	Do variables of attitude, subjective norm, environmental awareness and technology collectively influence green technology implementation?	Accepted

Based on the finding in section 4.6.2, the result revealed that the independent variables for this research namely attitude, subjective norm, environmental awareness and technology affect 44.3% of green technology implementation. Meanwhile, the remaining balance of 55.7% was influenced by other factors. The result also indicated that attitude, subjective norm, environmental awareness and technology have significant effect on green technology implementation with p-value < 0.05.

Besides direct relationship, indirect relationship also has been discussed in this study. Indirect relationship referred to the moderator effect which is, government support towards relationship between independent and dependent variables. The effect of moderating variables government support towards the relationship of independent variables attitude, subjective norm, environmental awareness and technology on green technology implementation are discussed in the next section (refer section 5.5).

5.5 Effect of Moderating Variable (Government Support) on the Relationship between Each Independent Variables and Green Technology Implementation

This section discusses the next research questions. Through a series of tests, the results of hypotheses testing were obtained. According to Baron & Kenny (1986), the moderator is likely to exist if the relationship between independent variable and dependents variables are not consistent. Table 5.3 (refer page 175 and 176) shows the connection between the research questions and hypothesis for this study.

Table 5.3
Connection between Research Question and Hypothesis

Hypothesis	Description	Research Question	Discussion Sub-section	Hypothesis Result
H6	Government supports moderate the relationship between attitude and green technology implementation.	Is there a moderating effect of government support on the relationship between attitude, subjective norm, environmental awareness, technology and green technology implementation?	5.5.1 Effect of Government Support as Moderating Variable on the Relationship between Attitude and Green Technology Implementation.	Accepted
H7	Government supports moderate the relationship between subjective norm and green technology implementation.	Is there a moderating effect of government support on the relationship between attitude, subjective norm, environmental awareness, technology and green technology implementation?	5.5.2 Effect of Government Support as Moderating Variable on the Relationship between Subjective Norm and Green Technology Implementation.	Accepted
H8	Government supports moderate the relationship between environmental awareness and green technology implementation.	Is there a moderating effect of government support on the relationship between attitude, subjective norm, environmental awareness, technology and green technology implementation?	5.5.3 Effect of Government Support as Moderating Variable on the Relationship between Environmental Awareness and Green Technology Implementation.	Accepted

Table 5.3 (Continued)

H9	Government supports moderate the relationship between technology and green technology implementation.	5.5.4 Effect of Government Support as Moderating Variable on the Relationship between Technology and Green Technology Implementation.	Accepted
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5.5.1 Effect of Government Support as Moderating Variable on the Relationship between Attitude and Green Technology Implementation

Based on the findings of three types of tests that has been conducted, H6 (government support moderates the relationship between attitude and green technology implementation) was accepted. The findings showed that the interaction between attitude and government support on the implementation of green technology was significant and positive. This meant that government support could strengthen the positive relationship between attitude and green technology implementation. Unfortunately, if attitude was not enhanced in accordance with the government support, attitude would not give a positive contribution to the implementation of green technology.

The result in section 4.6.3.1 (refer page 146) was consistent with previous findings (Adebayo, 2005; Alajmi & Ahmad, 2016; Alajmi, Ahmad, Al-ansi, & Gorondutse, 2017; Soch & Kaushik, 2016). Even though, there were previous studies on effect of government support as moderating variable, but none of them cater green technology implementation at universities. Based on the discussion in Chapter 2 (literature review), researcher has not found any research to prove that moderator variable of government support affected the relationship between attitude and green technology implementation

especially in university perspective. Therefore, researcher believes that researches on that effect have not yet been conducted by other researchers. The finding implied that the existence of any changes in government support would affect the relationship between attitude and green technology implementation.

5.5.2 Effect of Government Support as Moderating Variable on the Relationship between Subjective Norm and Green Technology Implementation

The findings based on the series of tests conducted have found that H7 (government support moderate the relationship between subjective norm and green technology implementation) was accepted. The study found that the presence of government support affected the relationship between subjective norm and green technology implementation.

In other words, government support did act as a moderating variable in the relationship between subjective norm and green technology implementation.

The result was in line with previous study like Alajmi & Ahmad (2016), Alajmi *et al.* (2017) and Soch & Kaushik (2016). Although the result was in line with previous studies, but all the studies did not research about green technology implementation at university. Based on the discussion in the Chapter 2 (literature review), research to prove the effect of moderator variable of government support on the relationship between subjective norm and implementation of green technology in Malaysia has not been found by researcher and it was believed nobody has addressed it. The findings implied that the existence of any changes in government support would affect the relationship between subjective norm and green technology implementation.

5.5.3 Effect of Government Support as Moderating Variable on the Relationship between Environmental Awareness and Green Technology Implementation

Based on the findings of three types of tests that has been conducted, H8 (government support moderates the relationship between environmental awareness and green technology implementation) was accepted. The findings showed that the interaction between environmental awareness and government support on the implementation of green technology was significant and positive. This meant that government support could strengthen the positive relationship between environmental awareness and green technology implementation. Unfortunately, if environmental awareness was not enhanced in accordance with the government support, environmental awareness would not be able to significantly contribute to the implementation of green technology.

The result is also consistent with previous findings by Kim, Kim, Suh, & Zheng (2016) and Liu, Li, Zhu, Cai, & Wang (2014). However, both studies did not cater green technology implementation especially at university. Based on the discussion in Chapter 2 (literature review), researcher has not found any research to prove that moderator variable of government support affected the relationship between environmental awareness and green technology implementation in Malaysia. Therefore, researcher believed that researches on that effect have not yet been conducted by other researchers. The finding implies that the existence of any changes in government support would affect the relationship between environmental awareness and green technology implementation. In order to make staff more aware of the environmental problem in Malaysia, government may enforce the use of environmental logo on all products. Besides that, government

may organize more green campaigns in order to increase staff's intention towards green technology.

5.5.4 Effect of Government Support as Moderating Variable on the Relationship between Technology and Green Technology Implementation

The findings based on a series of tests indicated that H9 (government support moderate the relationship between technology and green technology implementation) was accepted. The findings showed that the interaction between technology and government support on the implementation of green technology was significant and positive. This meant that government support could strengthen the positive relationship between technology and green technology implementation. Unfortunately, if technology is not enhanced in accordance with the government support, technology would not be able to give a positive contribution to the implementation of green technology.

Even though the result supported previous studies by Sandhu, Iqbal, Ali, & Tufail (2017), Oyelakin & Kandi (2017) and Bamgbade, Kamaruddeen, Nawi, & Aziz (2015), all of the researches did not focus on green technology implementation especially at university. Based on the discussion in Chapter 2 (literature review), researcher has not found any research to prove that moderator variable of government support affected the relationship between technology and green technology implementation in Malaysia. Therefore, researcher believed that researches on that effect have not yet been executed by other researchers. The finding implied that the existence of any changes in government support would affect the relationship between technology and green technology implementation.

5.6 Implications of the Study

This study was conducted to find the relationship between independent variables (attitude, subjective norm, environmental awareness and technology) and green technology implementation (green technology implementation). There were five direct relationships and four indirect relationships. There were some contributions from this study.

In this section, the implications of the research towards the body of knowledge of technology management and the university and government are presented. Contribution to the body of knowledge focused on research area chosen, methodology adopted, solving trending issue and developing new framework. In addition, this section also discusses on the benefits of the findings to management (university and government).

5.6.1 Contribution to the Body of Knowledge in Technology Management

The main contribution of the research is to the body of knowledge in technology management. This study has enhanced trending issue which is green technology implementation problem especially in university. The study of green technology implementation at university is novel because previous researches only focused on green technology implementation for organization and manufacturing sector. Besides that, very few researches discussed this topic.

In addition, this study affirmed the importance of four independent variables namely attitude, subjective norm, environmental awareness and technology toward green

technology implementation. Based on the previous studies, there were inconsistent findings regarding these four independent variables and green behavior relationship and further study on this topic is needed. This study reconfirmed this relationship and the findings proved that these four independent variables (attitude, subjective norm, environmental awareness and technology) contributed to the green technology implementation. Therefore, the main gap which is inconsistent in findings was filled.

Another contribution of this study is the introduction of moderating variable. In this study, government support was chosen as the moderating variable. The results revealed that government support only moderated the relationship between attitude, subjective norm, environmental awareness and technology towards green technology implementation. It means that, if there were any changes in government support, it only affected the relationship of attitude, subjective norm, environmental awareness and technology towards green technology implementation. This study has confirmed that government support could be used as a moderator variable and could be applied in green behavior context.

In addition, this study has used the integrated mode of analysis to solve the problem. In this study, SPSS output consisted of Pearson correlation, multiple regression analysis and hierarchical regression analysis was coupled with SPSS Process Macro output. Besides that, in order to reconfirm the interaction effect, simple slope analysis has been used.

5.6.2 Benefit to the University and Government

Besides contributing to the body of knowledge, this study has benefited university and government managements. The findings of this study can be very informative and useful to universities and government. This is because, these four variables which are attitude, subjective norm, environmental awareness and technology have been proven to have significant positive relationship with green technology, therefore Management University should ensure that all the variables are well managed. Besides that, the proposed framework could be used as a guideline for the university and government to plan for successful implementing green technology. Since Malaysian government aims to reduce pollution, emission and environmental problem, therefore this framework is very important.

5.7 Limitations of the Study

There were several of limitations of this study. The study may be limited because of variable types. In this study, only four variables were included which are attitude, subjective norm, environmental awareness and technology. There are several intangible variables (variables that cannot be touched or not having physical presence) that were not included in this study due to limited scope of the study like culture, religion and others. This study attempts to limit the scope to make the study not too wide and difficult to implement. As the scope of study is to study green technology implementation at university, it is uncertain if the findings can be applied to other sectors such as manufacturing or others green behavior like green purchasing. The next constraint is population of the study. The study population is limited to public universities in

Northern Region of Malaysia only. This is due to the cost and time constraint. To overcome these limitations, the suggestions for future research are proposed in the following section.

5.8 Suggestion for the Future Research

Constraints faced by this study could be used as a guidance for studies in the future. Thus, future studies should include other variables especially intangible ones which can motivate staff to implement green technology such as culture, religion, lifestyle, knowledge and organizations pressure. Subjective norm also may be divided into social norm and personal norm. Besides government support as moderating variable, future research may try to examine demographic factors, technology or other variables as moderating variable.

Furthermore, future studies may replicate this study using larger population and sample in different contexts such as different sectors, university or state. Besides public university, private university and college may be the population of the study. Other than that, future research may focus on the specific green technology like green products, green purchasing, green manufacturing and green practices.

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Appendix A: Questionnaires for Green Technology Implementation



**THE RELATIONSHIP OF ATTITUDE,
SUBJECTIVE NORM, ENVIRONMENTAL AWARENESS AND
TECHNOLOGY TOWARDS GREEN TECHNOLOGY
IMPLEMENTATION: MODERATING EFFECT OF
GOVERNMENT SUPPORT IN NORTHERN REGION OF
MALAYSIA UNIVERSITIES**

Set of Questionnaires

The purpose of this questionnaire is to find factors influence implementation of green technology practice among university staffs. Green technology is the development and application of products, equipment and system used to conserve the natural environment and resources, which minimize and reduce the negative impact of human activities. I am very pleased to have you as my respondent and really appreciate your contribution to this academic exercise. Your inputs will provide the most valuable information to disseminating my findings. The information given will be treated as private and confidential and will be only be used for the purpose of this research only. Your cooperation is highly appreciated.

University : _____

FAATHIRAH BINTI JAMALUDDIN

UNIVERSITI UTARA MALAYSIA

Section A: Demographic

Please tick (/) one answer only

1) Gender :

- Female
 Male

2) Age : _____

3) Position :

- Academic staff
 Administrative staff

4) Department: _____

5) Work experience: _____

6) What kind of green technology/ practices do you implement?

- Reduce using plastic that can effect environment.
- Collect the vast amounts of white paper (e.g. tests, memos, etc.) used in daily activities.
- Recycle the things that can be used again.
- Water and electrical saving practice.
- Buy product that can be reuse.
- Bring your own tupperware when buying food.
- Use public transport or alternative fuel.
- Produce friendly environmental product without misspend water and energy resources.
- Bring your own bag when go to shopping.

Section B

Please tick (/) appropriately in the box that best explains your opinion.

Strongly disagree	Disagree	Uncertain	Agree	Strongly agree
1	2	3	4	5

No	Attitude (AT)	1	2	3	4	5
1	Green technology practices are good.					
2	Green technology practices are useful.					
3	Green technology practices are sensible.					
4	For me green technology practice is reasonable.					
5	I like to implement green technology practice.					
6	Implement green technology practices are a pleasant idea.					
7	I have favorable attitude towards green technology practice.					
8	The application of green technology practice makes work more interesting.					
	Subjective Norms (SN)					
1	My friends expect me to implement green technology practices.					
2	Media influence me to implement green technology practices.					
3	Environmental groups influence me to implement green technology practices.					
4	My parents influence me to implement green technology practices.					

	Subjective Norms (SN)	1	2	3	4	5
5	People who influence my behavioral think that I should use the application of green technology practice.					
6	People who are important to me think that I should use the application of green technology practice.					
	Environmental Awareness (EA)					
1	Green technology practice is a major way to reduce pollution.					
2	Green technology practice is a major way to conserve natural resources.					
3	Green technology practice improves environmental quality.					
4	The green activist movement makes me aware of the green concept.					
5	Green technology practice can reduce global warming.					
6	Alternative energy, e.g. solar energy can be utilized in place of electricity					
7	The natural environment should not be sacrificed in the name of development					
8	Usage of disposable goods should be encouraged as it provides convenience to consumers					
	Technology (TE)					
1	The green practices can provide better environmental performance.					
2	The green practices can provide higher economic benefits.					
3	The green practices can enhance my university's reputation.					
4	The green technology/practices are compatible with our existing operations					
5	The green technology/practices are consistent with our university values					
6	Integrating the green technology/practices with university existing system is easy					

No	Government Support (GS)	1	2	3	4	5
1	Government in change to practice green technology.					
2	Government support financial resources to practice green technology.					
3	Government provides technical assistance for adopting green technology practice.					
4	Government helps training manpower with green technology skills.					
5	Government policy such as grants encourages us to use green technology practice.					
6	Government has provided enough environmental guidance for university to comply with.					
7	Government policy induces our university to use green technology.					
8	Through using green technology, our university tries to reduce or avoid the threat of current or future government environment legislation					
	Green Technology Implementation					
1	I intend to use green technology in the next 6 months.					
2	I predict I would use green technology in the next 6 months.					
3	I am willing to use green technology in the next 6 months.					
4	I plan to use green technology in the next 6 months.					
5	I often use green technology/practice to manage tasks in my university.					
6	I often use green technology/practice to communicate at my university work.					
7	I often use green technology/practice to plan for transportation in campus.					
8	I find green technology useful in my work.					
9	Using the green technology enables us to accomplish tasks more quickly.					
10	Using the green technology increase our productivity					
11	Using green technology promotes efficient utilization in my work.					

**Thank you very much for your participation in this survey.
Your time and opinions are deeply appreciated**