



**UNDERSTANDING PUBLIC INTENTION TO PAY CARBON TAX TO
REDUCE GREENHOUSE GAS EMISSIONS IN MALAYSIA**

By

GAI MEI YIN

**Thesis Submitted to the School of Graduate Studies, Universiti Putra
Malaysia, in Fulfilment of the Requirements for the Degree of Master of
Science**

October 2024

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October 2024

Chairman : Diana Emang, PhD
Faculty : Forestry and Environment

The idea of introducing tax on environmental externalities has been promoted for decades and can be traced back to the development of Pigouvian tax — a levy imposed on companies who caused harm to the environment or public health. This approach aims to internalise the cost of externalities to polluters and address climate change. Subsequently, the international community took a significant step towards combatting climate change by introducing carbon pricing mechanisms. The adoption of carbon pricing mechanisms has gain traction as a key climate policy tool to reduce greenhouse gas (GHG) emissions. Following this global trend, the Malaysian Government also plans to introduce a carbon tax to achieve its carbon-neutrality target by 2050. The idea of carbon tax has since sparked widespread discussion in Malaysia. Its implementation, however, requires extensive research to understand public behavioural intentions, enabling policymakers to design carbon tax policies that are both accepted and complied with by the public. This study aimed to understand Malaysians' perception of paying a carbon tax and determine the

potential factors that enhance their acceptance of such a policy. To achieve this, a well-established psychological theory known as the Theory of Planned Behaviour (TPB) was employed to investigate the complex psychological factors influencing public intention to pay carbon tax in Malaysia. This study extended the standard TPB model by adding a new variable which is environmental concern since it is recognised as a pivotal factor in pro-environmental decision-making processes and is hypothesised to significantly impact attitudes, social norms and perceived behavioural control. A structured questionnaire was developed for pilot study and subsequently refined for use in the final survey. The data was collected through online to reach out to potential respondents who are hard-to-reach from various location and face-to-face interview. A total of 404 responses collected between November 2023 and February 2024. Using Structural Equation Modelling (SEM) to gain a comprehensive path analysis, this study revealed that attitude, subjective norms and perceived behavioural control have significant positive relation with intention to pay carbon tax. The findings also suggested that environmental concern has a significant influence on the three TPB predictor which then led to a positive intention outcome. Among the three main TPB constructs, PBC emerged as the strongest predictor of intention to pay ($\beta = 0.425$, $p < 0.01$). This result suggested more transparency in the carbon taxation system and data that is publicly available which could empower public to pay carbon tax. The findings in this study provide an insight on public behavioural intention with regards to paying carbon tax in Malaysia and this can be a reference for policy makers to design a fair and acceptable carbon tax policy.

Keywords: Carbon tax, Structural Equation Modelling, Theory of Planned Behaviour

SDG: GOAL 4: Quality Education, GOAL 13: Climate Action



Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Master Sains

**MEMAHAMI NIAT MASYARAKAT UMUM UNTUK MEMBAYAR CUKAI
KARBON BAGI MENGURANGKAN PELEPASAN GAS RUMAH HIJAU DI
MALAYSIA**

Oleh

GAI MEI YIN

Oktober 2024

Pengerusi : Diana Emang, PhD
Fakulti : Perhutanan dan Alam Sekitar

Idea untuk memperkenalkan cukai ke atas kesan luaran alam sekitar telah dipromosikan sejak beberapa dekad lalu dan boleh dijejaki kembali kepada pembangunan cukai Pigouvian — cukai yang dikenakan ke atas syarikat yang melakukan pencemaran alam sekitar. Pendekatan ini bertujuan untuk menginternalisasikan kos kesan luaran kepada pencemar dan menangani perubahan iklim. Selepas itu, komuniti antarabangsa mengambil langkah penting dalam memerangi perubahan iklim dengan memperkenalkan mekanisme penetapan harga karbon. Penggunaan mekanisme penetapan harga karbon semakin mendapat perhatian sebagai alat dasar iklim utama untuk mengurangkan gas rumah hijau (GHG). Seiring dengan trend global ini, Kerajaan Malaysia juga merancang untuk memperkenalkan cukai karbon bagi mencapai sasaran neutral karbon menjelang tahun 2050. Cukai karbon menjadi topik hangat di Malaysia. Walau bagaimanapun, pelaksanaannya memerlukan kajian mendalam yang boleh memahami niat tingkah laku awam,

sekali gus membantu penggubal dasar merangka polisi cukai karbon yang lebih mudah diterima dan dipatuhi oleh masyarakat. Kajian ini bertujuan untuk memahami persepsi rakyat Malaysia terhadap pembayaran cukai karbon dan mengenal pasti faktor-faktor yang berpotensi meningkatkan penerimaan mereka terhadap dasar cukai karbon. Dengan itu, teori psikologi yang mantap dikenali sebagai Teori Tingkah laku Terancang (TPB) telah digunakan untuk mengkaji faktor psikologi kompleks yang mempengaruhi niat awam untuk membayar cukai karbon di Malaysia. Kajian ini telah mengubahsuai model TPB dengan menggabungkan factor keprihatinan terhadap alam sekitar kerana factor ini dilihat sebagai satu factor yang penting dalam proses membuat keputusan pro-alam sekitar dan dianggap mempunyai kesan yang signifikan terhadap sikap, norma social dan kawalan tingkah laku seseorang. Satu soal selidik berstruktur telah digunakan dalam kajian rintis, kemudian diperbaiki sebelum digunakan dalam tinjauan akhir untuk pengumpulan data. Data dikumpulkan secara dalam talian untuk mencapai responden yang sukar dihubungi dari pelbagai lokasi, dan melalui temu bual bersemuka untuk memastikan penyertaan daripada individu yang lebih memilih interaksi secara peribadi dan mudah dihubungi. Sebanyak 404 respons telah dikumpulkan antara November 2023 hingga Februari 2024. Dengan menggunakan Structural Equation Modelling (SEM), kajian ini mendedahkan bahawa sikap, norma subjektif, dan kawalan tingkah laku yang dirasakan mempunyai hubungan positif yang signifikan dengan niat untuk membayar cukai karbon. Kajian ini juga menunjukkan bahawa keprihatinan terhadap alam sekitar mempunyai pengaruh terhadap tiga pemboleh ubah ramalan TPB, yang kemudiannya membawa kepada hasil

niat yang positif. Antara tiga konstruk utama TPB, kawalan tingkah laku yang dirasakan (PBC) muncul sebagai peramal niat paling kuat untuk membayar ($\beta = 0.425, p < 0.01$). Hasil ini mencadangkan agar sistem percukaian karbon lebih telus dan data awam tersedia untuk memberi kuasa kepada masyarakat membayar cukai karbon. Penemuan dalam kajian ini memberikan pandangan mengenai niat tingkah laku awam terhadap pembayaran cukai karbon di Malaysia dan ini boleh dijadikan rujukan untuk pembuat dasar merangka polisi cukai karbon yang adil dan boleh diterima.

Kata kunci: Cukai karbon, Pemodelan Persamaan Struktur, Teori Perilaku Terancang

SDG: MATLAMAT 4: Pendidikan Berkualiti, MATLAMAT 13: Tindakan Iklim

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Diana Emang, PhD

Senior Lecturer
Faculty of Forestry and Environment
Universiti Putra Malaysia
(Chairman)

Sheena binti Bidin, PhD

Senior Lecturer
Faculty of Forestry and Environment
Universiti Putra Malaysia
(Member)

ZALILAH BINTI MOHD SHARIFF, PhD

Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

Date: 13 March 2025

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LIST OF ABBREVIATIONS

°C	degree Celsius
€	Pound sterling
°C	Degree Celsius
ADRC	Asian Disaster Reduction Centre
AMS	ASEAN Member States
ASEAN	Association of Southeast Asian Nations
AT	Attitude
AVE	Average variance extracted
CB	Covariance-based
CFA	Confirmatory factor analysis
CFI	Comparative fit index
CO ₂	Carbon Dioxide
COP	Conference of the Parties
CR	Composite reliability
CVM	Contingent valuation method
DOSM	Department of Statistics Malaysia
e	Error term
EC	Environmental concern
ETS	Emissions Trading System
EU	European Union
Gt	Gigatonne
GHG	Greenhouse gas
IEA	International Energy Agency

IEP	Institute for Economics and Piece
IP	Intention to pay
IPCC	Intergovernmental Panel on Climate Change
IPSOS	<i>Institut Public de Sondage d'Opinion Secteur</i>
NDCs	Nationally Determined Contributions
NFI	Normed fit index
OECD	Organization for Economic Cooperation and Development
PBC	Perceived behavioural control
PLS	Partial least square
RM	Ringgit Malaysia
RMSEA	Root mean square error of approximation
Rs	Indian Rupee
SDG	Sustainable Development Goal
SEM	Structural equation modelling
SN	Subjective norms
SPSS	Statistical Package for Social Science
SRMR	Standardised root mean squared residual
TPB	Theory of Planned Behaviour
TRA	Theory of reasoned action
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar
WTP	Willingness to Pay



CHAPTER 1

INTRODUCTION

1.1 Background of the Study

The world is facing a critical challenge: climate change. Extensive human activities, particularly the burning of fossil fuels and industrial processes, have led to a significant increase in anthropogenic greenhouse gas (GHG) emissions (IPCC, 2021). Carbon dioxide (CO₂) is the greatest GHG contributor, mainly produced from fossil fuel and industrial processes (EPA, 2023). The International Energy Agency (IEA) reported in its 2022 carbon emission report, seeing an alarming grow of global energy-related CO₂ emissions by 0.9%, reaching a record high of over 36.8 Gt in 2022 (Figure 1.1).

The rise in CO₂ emissions has triggered a climate crisis that is likely to delay the global agenda towards sustainable development goals (SDGs) (Kyte, 2014). Natural disaster has occurred more frequent and intense, with a tenfold increase compared to the 1960s (IEP, 2021). Floods and storms especially, are the most common types of disasters, accounting for 71% of those occurring between 1990 and 2019 based on the investigation by the Institute for Economics and Piece (IEP). Among all regions, Southeast Asia particularly is one of the most disaster-prone regions in the world (ADRC,

2023). In 2022, 12.72 million people in Southeast Asia was affected by natural disasters (ADRC, 2023).

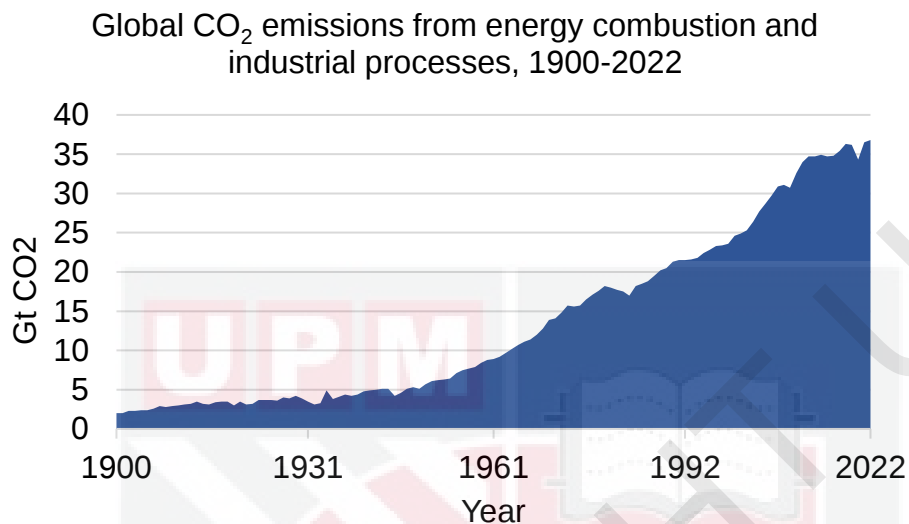


Figure 1.1: Global Carbon Dioxide (CO₂) Emissions from Energy Combustion and Industrial Processes between 1900 and 2022
(Source: International Energy Agency, 2023)

Mitigating climate change has become global leaders' top priority. Global leaders and experts have engaged in extensive negotiations to design effective mitigation efforts to stabilise the GHG emissions, yet still insufficient to curb the emissions in a favourable pattern (UNEP, 2013; IPCC, 2014; Parry, 2021). In light of the urgency to combat climate change, carbon pricing mechanisms have gained traction as a powerful policy instrument that helps to internalise the external costs of GHG emissions by putting a price on carbon emitted (World Bank, 2022). This approach aims to incentivise emitters to foster an environmentally friendly behaviour (Köppl & Schratzenstaller, 2021). Emitters can either invest in cleaner technologies or continue their business as usual but at a cost for the associated emissions.

1.1.1 The Development of Carbon Taxation Concept

The idea of introducing tax on environmental externalities has been promoted by economist decades ago as a key environmental policy instrument (Baumol & Oates, 1971; Pearce, 1991). Environmental taxes are recognised as an effective and efficient tool in the context of environmental economics (Tietenberg & Lewis, 2009). It can be achieved by pricing negative environmental implications through a tax rate that is set at the marginal cost of social damage.

The concept to use taxes to address negative environmental externalities can be traced back to Arthur Pigou in 1920 with his idea of Pigouvian tax – a levy imposed on companies who cause harm to the environment or public health (Pigou, 1920). Building on this idea, the Organization for Economic Cooperation and Development (OECD), in 1972, proposed the polluter pays principle as a solution to the 1960s environmental crisis, giving a theoretical basis for the introduction of environmental taxation (Tan et al., 2022). In 1980s, many environmental-related taxes such as emission tax, energy tax and carbon tax emerged (Tan et al., 2022). These initiatives aimed to achieve positive environmental impact by altering public consumption patterns and generating revenue for governments to invest in initiatives for environmental protection. In 1990s witnessed further developments with the introduction of green tax, ecological tax and environmental tax. All of these shared the same goal in promoting sustainable development. This kind of taxation suggested by OECD has then slowly been accepted by public and

applied in many countries. A few developed countries started to develop their own environmental taxation system while developing countries also started to look into the possible implementation of such tax (Tan et al., 2022).

The international community took a significant step towards addressing climate change. The establishment of Kyoto Protocol in 1997 marked a milestone in international environmental agreement that formed a legal binding commitment for countries to reduce anthropic emissions of GHG (UNFCCC, 1998). The Protocol provided a framework for countries to set their emission reduction targets and encouraged countries to set up cap-and-trade programmes and allow the world to trade carbon allowances (Stoft, 2009; UNFCCC, n.d.). Sweden became a pioneer to price carbon and established the first carbon tax in 1991. Shortly after, the European Union (EU) established the Emissions Trading System (ETS) which remains the world's largest carbon market to-date. The momentum of carbon pricing then continued to grow as more countries began to embrace the mechanisms.

Another remarkable impetus for carbon pricing adoption was the Paris Agreement 2015 which established an ambitious framework to limit global temperature to well below 2°C above pre-industrial levels as well as to pursue efforts to limit the temperature increase even more ambitious at 1.5°C (Carbon Market Watch, 2017). The Paris Agreement has become one of the driving forces for countries to embrace carbon pricing as a key strategy to achieve these ambitious climate goals.

1.1.2 The Adoption of Carbon Pricing Policies Around the World

Carbon pricing has emerged as a major focus in national policy discussions (McKittrick, 2016). The High Level Commission on Carbon Pricing and Competitiveness emphasised that “Carbon pricing is an effective, flexible, and low-cost approach to reducing GHG” (CPLC, 2017). Carbon pricing uses taxes or tradable permits to assign a cost per tonnes of CO₂ emissions to fuel users, thereby forcing the emitter to pay for the social cost associated with their emitting activity (McKittrick, 2016). The World Bank’s 2023 State and Trends of Carbon Pricing report highlighted the growing adoption of carbon pricing at which about a quarter of global GHG emissions are currently covered by a carbon price (World Bank, 2023a). The coverage has increased tremendously compared to just 7% about 10 years ago.

There are two types of carbon pricing instruments, namely carbon tax and Emission Trading System (ETS). A carbon tax is a levy imposed on fossil fuels like coal, gas and natural gas, with the rate directly linked to their carbon content (Lin & Li, 2011). This taxation aims to discourage fossil fuel consumption and, consequently, reduce carbon emissions. It is said to be the most cost-effective way to internalise the environmental costs into the final prices of goods and services (Greaker et al., 2018). Carbon tax can be introduced in three possible forms which includes fuel tax, CO₂ tax and energy tax as identified by Baranzini et al. (2000). The early adopters were countries like Denmark, Finland, Sweden, New Zealand, Switzerland, Italy, Canada, etc (Lin & Li, 2011). The implementation of carbon tax presents both

advantages and disadvantages. As highlighted by Lin and Li (2011), carbon tax can decrease energy use, improve efficiency and foster the development of renewable energy sources. However, there are concerns regarding its potential impact on economic growth, social welfare and the competitiveness of carbon-intensive industries. It can potentially lead to leakage of carbon where businesses move their production plants to places with least stringent climate regulations to avoid being taxed. Nonetheless, Lin and Li (2011) concluded that a well-designed and scientifically sound carbon tax policy is crucial for countries seeking to reduce emissions.

An ETS, also referred as a cap-and-trade system, establishes a cap on the total amount of GHG emissions. Government would issue a limited number of tradable emission permits and the regulated firms are required to purchase and surrender a permit for every tonne of CO₂ they emit (Stavins, 2008). This system leverages market forces to determine the price of carbon. Firms that can reduce emissions in low cost can sell their surplus permits to firms that need to purchase more permits to sustain their operations. ETS is implemented in many countries and jurisdictions, including the EU, California, New Zealand and the Republic of Korea. The oldest cap-and-trade system, EU ETS, which was officially began operating in 2005, is currently in its fourth phase, running from 2021 to 2030 (International Carbon Action Partnership, 2024). The implementation of such system was meant to ensure EU achieve its emissions reduction targets under the Kyoto Protocol (European Commission, 2000).

As of April 2023, 73 national and sub-national jurisdictions have adopted a carbon pricing mechanism, representing 23% of global GHG emissions as shown in Figure 1.2 (World Bank, 2023b). Among them, 38 national and sub-national jurisdictions implemented or scheduled a carbon tax, covering approximately 5.62% of global GHG emissions (World Bank, 2023b). This widespread adoption of carbon pricing has contributed substantial revenue of about USD 95 billion collected from carbon taxes and ETS globally. Notably, governments have demonstrated a commitment to carbon pricing by maintaining or even strengthening these policies despite economic challenges and energy price shocks. This rapid growth underscores the increasing recognition of carbon pricing as a powerful strategy for combatting climate change. The trend is likely to continue as countries seek effective solutions to address the global climate crisis.

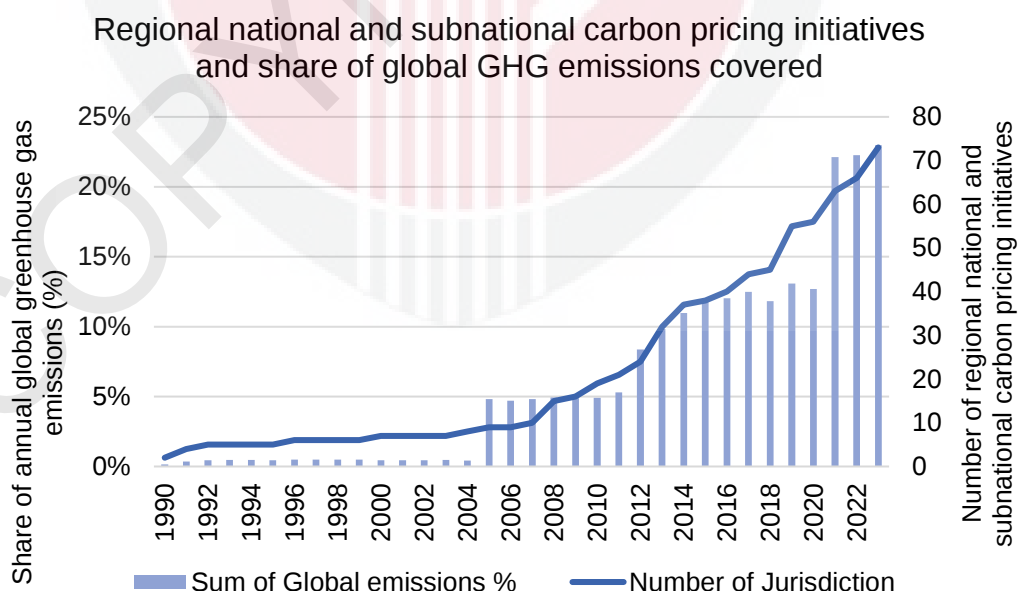


Figure 1.2: Regional National and Subnational Carbon Pricing Initiatives and Share of Global GHG Emissions Covered
(Source: World Bank, 2023b)

1.1.3 Introduction of Carbon Pricing Policies in Southeast Asia

Many countries have pledged to reduce at least half of their GHG emissions by 2030 and achieve net-zero latest by 2050, as per the Nationally Determined Contributions (NDCs). Eight out of 10 ASEAN Member States (AMS) have set a target to achieve net-zero emissions, by 2050 or later, including Malaysia (The Asia Foundation, 2023). Carbon crediting is currently an active or developing carbon pricing instrument among all 10 AMS. Among 10 of them, there are five AMS leaders considering the implementation of carbon tax, which are Brunei, Indonesia, Malaysia, the Philippines and Vietnam (The Asia Foundation, 2023). It is important for regional actors to build a deep understanding of carbon pricing instruments, including their rationale, potential risks and their role in driving climate change. This understanding will be essential for evaluating ongoing efforts across the region to introduce carbon pricing. As economic and climate policies evolve in the coming decades, carbon pricing is likely to take the centre stage (The Asia Foundation, 2023).

1.2 Problem Statement

According to Malaysia's latest 2021 amended NDCs, Malaysia pledged to reduce 45% of the carbon emissions by 2030 and committed to achieve net-zero earliest by 2050 (UNFCCC, 2022). In recognition of this challenge, the government announced, in the 12th Malaysia Plan, its intention to assess the feasibility of implementing carbon pricing instruments to support the

achievement of its domestic climate targets as well as its NDCs. A fixed charge might be imposed on the carbon content of fossil fuels which forces energy and fuel providers to increase prices (Muhammad, 2021). Another remarkable milestone by the Malaysian government was the establishment of voluntary carbon marketplace in March 2023, facilitated by Bursa Carbon Exchange. This marked the inaugural carbon market trading in Malaysia. The Government of Malaysia has then commenced preliminary work in 2023 to investigate the potential to introduce a carbon tax and intends to develop a policy, including designing a framework for a domestic ETS (World Bank, 2023a). This was the first public signal from the Government of Malaysia that such instrument is being considered (The Asia Foundation, 2023). While the effectiveness of carbon pricing in reducing emissions is well-established as stated by Green (2021), its successful implementation requires careful consideration of the social context. Recent studies have started exploring the public acceptability of carbon taxes, highlighting a series of important challenges such as distributional impacts on low-income households and fear of reducing market competitiveness (Zhang et al., 2021; Hammerle et al., 2021).

With evident findings that clearly demonstrated the effectiveness of carbon tax and the announcement that the Malaysian government intended to implement it, a significant gap exists in understanding its public acceptance or perception to pay carbon tax. Despite the government's environmental goals, a survey by *Institut Public de Sondage d'Opinion Secteur* (IPSOS) in 2021 revealed a low level of public concern about climate change in Malaysia

compared to other 26th Conference of the Parties (COP) participating countries. Malaysia also ranked forth from the last in terms of the percentage of worried about threats against the environment. While the best carbon tax rate in Malaysia is likely to be determined using a conventional economic model, studies have shown that public opinion significantly impacts the design and ultimate success of environmental policies, including carbon tax (Wong et al., 2019). Citizen support for climate policies is perceived as an important criterion in climate policy making (Rhodes et al., 2014). It is crucial to take into consideration political aspects and public acceptance to ensure a successful implementation of policy (Bhattacharyya, 1997). Although there is a growing body of research on public perceptions of climate policies, there is a critical knowledge gap in the context of Malaysia. The lack of study that examine psychosocial factors that lead to the willingness to pay carbon tax has motivated us to conduct this research and to contribute to existing literature related to environmental economics by predicting the factors that lead to their intention to pay carbon tax.

1.3 Research Questions

This study consists of four research questions:

1. What is the influence of attitude towards public intention to pay carbon tax to reduce GHG emissions?
2. What is the relationship between public subjective norms and intention to pay carbon tax?
3. What is the relationship between public perceived behavioural control and intention to pay carbon tax?
4. To what extent environmental concern will influence public attitude, subjective norms and perceived behavioural control?

1.4 Conceptual Framework and Development of Hypothesis

This study intended to adopt the Theory of Planned Behaviour (TPB) to study the willingness of Malaysian to pay carbon tax. As showed in Figure 1.3, the underlying conceptual framework will involve latent variables including environmental concern (EC), attitude (AT), subjective norms (SN) and perceived behavioural control (PBC), and an endogenous variable, intention to pay (IP). These determinants are expected to be significantly and positively influence the public's intention to pay carbon tax.

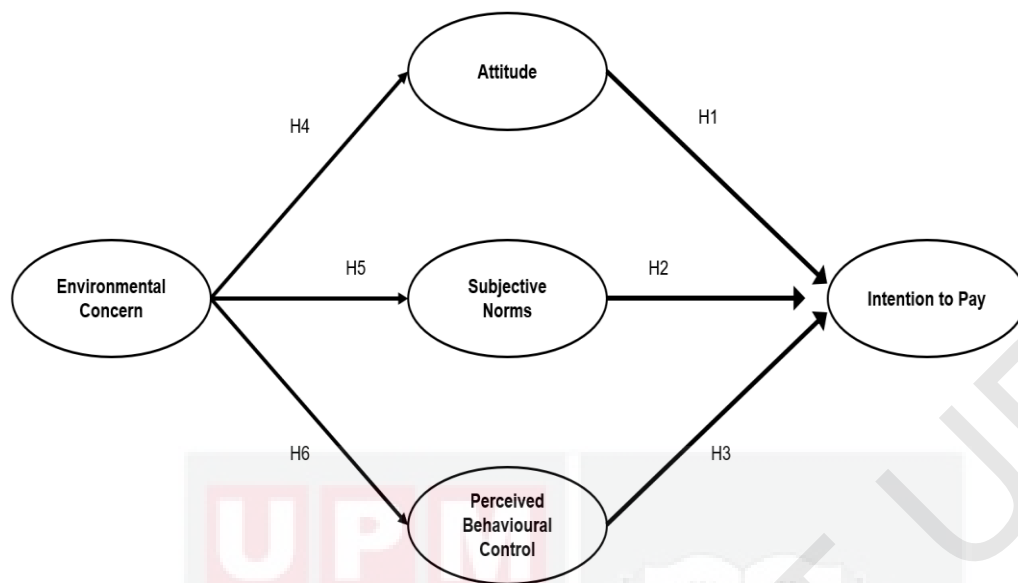


Figure 1.3: The extended TPB adopted in this research

AT is perceived as the psychological sentiment and the positive or negative judgement that arise as an individual participates in a particular behaviour (Fishbein & Ajzen, 1975). It is the extent to which an individual holds a positive or negative assessment of the behaviour in question (Ajzen, 1991). People with a more positive attitude are more likely to adopt the pro-environmental behaviour (Kaffashi & Shamsudin, 2019). Many studies have revealed a positive relationship between attitude and intention towards pro-environmental behaviour (Ghani et al., 2013; Pakpour et al., 2014; Donald et al., 2014; Zahedi et al., 2019; Fatoki, 2020).

The hypothesis is defined as:

H1: Attitude has a positive effect in predicting the person's intention to pay carbon tax.

SN is a product of the strength of normative beliefs and the motivation to comply with these beliefs (Ajzen, 1985). It refers to the degree of pressure an individual perceived from others to perform or not to perform a specific behaviour (Ajzen, 1991). SN is deemed positively influencing the intention (Karppinen, 2005; Ghani et al., 2013; Liobikienė et al., 2021).

The hypothesis is structured as follow:

H2: Subjective norms has a positive effect in predicting the person's intention to pay carbon tax.

PBC refers to the degree of control in performing the behaviour, whether it is easy or difficult. This construct has been included as a consideration that certain behaviour is not completely under volitional control. A person's control over other factors – perceived behavioural control – was deemed a crucial element in ensuring success of an attempt to achieve the behaviour (Ajzen, 1991) and these factors include time, resources, money, power, opportunity, and more.

The hypothesis is structured as follow:

H3: Perceived behavioural control has a positive effect in predicting a person's intention to pay carbon tax.

EC is adopted to determine its influence to attitude, subjective norms and perceived behavioural control. According to past literature such as Donald et al. (2014), Zahedi et al. (2019) and Kaffashi and Shamsuddin (2019), EC has

positive effect towards AT, SN and PBC. The hypotheses for H4 to H6 will be defined as follow:

H4: There is a positive effect between the individual's environmental concern and the attitude.

H5: There is a positive effect between the individual's environmental concern and the subjective norms.

H6: There is a positive effect between the individual's environmental concern and the perceived behavioural control.

1.5 Objectives of the Study

The present research aimed to investigate the public intention to pay carbon tax to reduce GHG emissions. The specific objectives are:

1. To examine the influence of attitude towards public intention to pay carbon tax to reduce GHG emissions.
2. To examine the relationship between public subjective norms and intention to pay carbon tax.
3. To determine the relationship between public perceived behavioural control and intention to pay carbon tax.
4. To determine the extent of environmental concern in influencing public attitude, subjective norms and perceived behavioural control.

1.6 Significance of the Study

Public acceptance towards carbon policy is the key for its successful implementation. However, there is often a gap between environmental policy implementation and public acceptance. Thus, it is important to understand the extent of public to accept and willing to pay for better environmental outcomes (Zahedi et al., 2018) and support economic and environmental goals, as well as addressing social concerns. Therefore, this study helps to fill this gap by providing empirical data on public behaviour through their intentions, leading to more informed and effective carbon policy decisions. Additionally, understanding environmental attitudes, social norms, and ethical position are crucial as it provides perception of how public values the environment and direction in designing the environmental policy which best represent public opinion (Spash et al., 2006). As such, this study intended to understand the relationship between public behaviour from a psychological perspective, especially in identifying the motives behind their intention to support the carbon tax policy. This is important considering understanding what drives the public's intention to pay a carbon tax can encourage pro-environmental behaviours (i.e., pay carbon tax) and thus increase the overall effectiveness of the tax in reducing the GHG emissions. The study also provides insights for policymakers in establishing carbon tax policy which best accepted by the public in Malaysia. Specifically, it provides knowledge of public attitudes and intentions that could help in creating policies that align with public values and expectations, and ultimately help Malaysia mitigate climate change.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Climate is a critical global issue that urges nations to adopt strategies that mitigate GHG emissions because the uncontrolled release of GHG emissions is causing significant harm to the planet earth. Carbon tax policy has then emerged as a critical approach to tackle the problem as it incentivises polluters to reduce emissions. However, concern raise if public acceptance towards implementation of carbon tax policy is unknown, and this could hinder the success in implementing climate policies that are meant to tackle climate issues. This chapter provides a review of existing literature surrounding factors influencing public acceptance of carbon tax policies. Additionally, it will provide more context on the implementation of carbon tax in other countries and the design of policy that could better accepted by public.

2.2 Understanding Public Acceptance of Carbon Taxes

This section will present review of literature related to carbon tax, including the effectiveness of carbon tax and features or factors that lead to greater acceptance of carbon tax and the challenges to gain public support.

2.2.1 The Effectiveness of Carbon Tax

There is a growing belief that carbon pricing can effectively address climate change without harming the economy (Aldy, 2015; McKittrick, 2016, Schmalensee & Stavins, 2017). Carbon tax is one of the highly recommended policies instruments due to its cost-effective approach to mitigate climate change (European Environment Agency, 1996). Introducing a carbon tax discourages the use of carbon-intensive products and encourages a low carbon transition (Baranzini et al., 2000). This transition spur innovation in clean energy technologies and ultimately lead to lower GHG emissions.

The impact of implementing carbon tax has been long investigated by scholars since decades. Early research by Manne and Richels (1990) as well as Whalley and Wigle (1991) found significant GHG reductions across various carbon tax rates. This was further proven by Nakata and Lamont (2001), using a partial equilibrium approach, demonstrated that a carbon tax could decrease CO₂ emissions and encourage a shift from coal to gas which is a less carbon-intensive source of fuel. The effect of reduction was further proven by Grafström (2010) who revealed a potential reduction of up to 0.128% in household emissions in Sweden for every 1% increase in the carbon tax.

However, there are potential drawbacks of carbon taxes. Carbon tax is likely to halt the economic growth due to higher production cost for carbon

intensive businesses (Lin & Li, 2011). Furthermore, the carbon reduction effect is uncertain as businesses might simply pass on the cost of carbon tax by charging their customers a higher price, negating the obligation to reduce emissions (Lin & Li, 2011). This highlights the importance of designing carbon tax policies that address these potential shortcomings. Overall, the literature suggests that carbon taxes can be an effective tool for reducing GHG emissions. However, it requires careful design and considerations of potential drawbacks to maximise the effectiveness.

2.2.2 Factors Contributing to Public Acceptance of Carbon Tax

The urgency of climate change has propelled carbon taxes to the forefront of environmental policies. However, public acceptance of these taxes remains a significant hurdle to implementation. While some studies show public support for environmental policies, support for carbon taxes specifically remain indefinite and need more research to understand how public perceive such policies that aim to reduce GHG emissions (Fairbrother, 2022). This section will provide insights from past literature in the context of challenges to obtain public acceptance and factors leading to greater public acceptance to carbon tax.

Early in the 2000s, O'Connor et al. (2002) has investigated the factors that are likely to gain public support towards policy that aims to reduce GHG emissions. The study revealed a positive belief in environmental consequences and environmental knowledge has positive correlation to

support for carbon taxes. This is also proven by Gupta (2016) where the individuals' interest in environment and environmental activities play significant role in determining their willingness to pay. The study found the most important reason for individual willing to pay for carbon tax was due to the care for environment and want to protect for future generation. Besides caring the environment, the support from public could be related to the climate risk perception one believes. For example, American citizens who believe global warming happening were found 35-percentage point more likely to support the carbon tax compared to those who do not believe in global warming, with 25-percentage point less likely to support the policy (Kotchen et al., 2017).

Rotaris and Danielis (2019) further strengthen the point where attitude and belief factors were found to be positive and significant in affecting a person's stated willingness to pay for carbon tax, adding that environmental awareness tends to increase the willingness to pay for an annual fixed carbon tax. Their study emphasised the acceptance for carbon tax was influenced by the government credibility, perceived effectiveness of the tax through the available information about climate change. The study also revealed that public acceptance is higher when people believe human activity is the primary cause of climate change. These findings highlighted the need for transparent government communication and public education on climate change to enhance acceptance of carbon tax.

2.2.3 Challenges to Gain Public Support for Carbon Tax Policy

Although opposition to new taxes is common, the introduction of carbon tax seems to spark stronger opposition compared to other tax policies (Kim et al., 2024). The delay and hesitation to practice carbon taxation often reflect the failure to get support from the public (Hsu, 2012). Due to rising implementation of carbon pricing policies in recent years and the urgency to reduce GHG emissions to combat climate change, many studies were interested to investigate public's attitude toward reducing greenhouse gas emissions and supporting environmental policies, particularly carbon taxation.

Governments are facing challenges in raising public support for imposing carbon tax. Umit and Schaffer (2020) found 17 out of 23 countries in Europe were negative about government implementing carbon tax. In fact, they revealed that people's support for carbon tax decreases with their rising dependency on energy. Carbon tax has not been widely accepted in many countries. From the economic point of view, the major barrier to acceptance is the public's perception that carbon taxes will increase the cost of living (Eleazar et al., 2017; Carattini et al., 2018; Levi, 2021; Zhang et al., 2021). Philippines, for example, were against carbon taxation, claiming that carbon tax would increase their life burden by scarifying their basic expenses. Many were not ready for additional fees because they have yet to satisfy their basic needs (Eleazar et al., 2017). This finding is consistent with Zhang et al. (2021) where carbon tax tends to incur a cost to individual as a result of

paying greater taxes, this concern extended to potential negative impact on business profitability and competitiveness. It could also potentially lead to economic damages from the aspect of employability and job security (Carattini et al., 2018; Zhang et al., 2021).

Another reason for opposition to implementation of carbon tax related to fairness of the taxation ecosystem. Public perceived the nature of carbon tax to be regressive at which low-income households will likely be in a disadvantage position (Carattini et al., 2018; Savin et al., 2020). Besides, public remain sceptical on the effectiveness of carbon tax in changing public behaviour and reducing greenhouse gas emissions. The trust issue as well has become a resistance to implementing carbon taxation. People are sceptical that the environmental tax imposed might be for the purpose of raising government revenue rather than reducing greenhouse gas emissions (Klok et al., 2006). Trust issues are also said to be linked to a person's view with regards the tax in general or trust in the government itself (Baranzini & Carattini, 2016). Zhang et al. (2021) further strengthen the fact that trust has been a pivotal element for governments to gain support for their initiatives when it comes to addressing complex issues such as taxes to tackle climate change. This finding was consistent with the result showed in study from Umit and Schaffer (2020) where the lack of individual trust in political system has resulted in the opposition of carbon taxation. Carbon taxation needs to be designed to be more acceptable to the public to achieve effective greenhouse gas reduction (Carattini et al., 2018).

Despite all the challenges, a foundational study by O'Connor et al. (2002) explored nine factors that could lead to greater public support for climate policies and voluntary actions to reduce GHG emissions. These factors included belief in the reality of global warming, understanding the potential consequences of climate change and general knowledge about climate science. This finding aligned with the concept of awareness of consequences highlighted by Stern et al. (1999) where individuals who lack knowledge about climate change or fail to grasp the potential consequences are less likely to support climate policies. As such, there is evident that environmental awareness and climate change beliefs can play a crucial role in shaping public perceptions of carbon taxes.

2.3 Theoretical Framework

This section provides a review of literature about Theory of Planned Behaviour (TPB) and the application of this theoretical framework in the context of pro-environmental research.

2.3.1 Theory of Planned Behaviour

Human behaviour is a complex phenomenon influenced by behavioural dispositions such as social attitudes and personality traits (Campbell, 1963; Sherman & Fazio, 1983, Ajzen, 1998). This section will focus on the TPB, a widely used psychological theory to understand and predict pro-environmental behaviours.

The fundamental block of TPB was built upon Theory of Reasoned Action (TRA). TRA was developed by Ajzen and Fishbein, suggested that the prediction of an individual's intention to carry out a particular behaviour is determined by one's attitude and social influence (Ajzen, 1985). Attitude refers to a person's evaluation of the behaviour and subjective norm reflects the perceived social pressure to perform the behaviour. It is an expectancy-value model as stated by Fishbein and Ajzen (1975) that suggested an individual's attitude or intention toward a specific behaviour can be predicted based on the combination of their beliefs about the likely consequences (expectancies) of a behaviour and their evaluation of the desirability or importance of those outcomes (values).

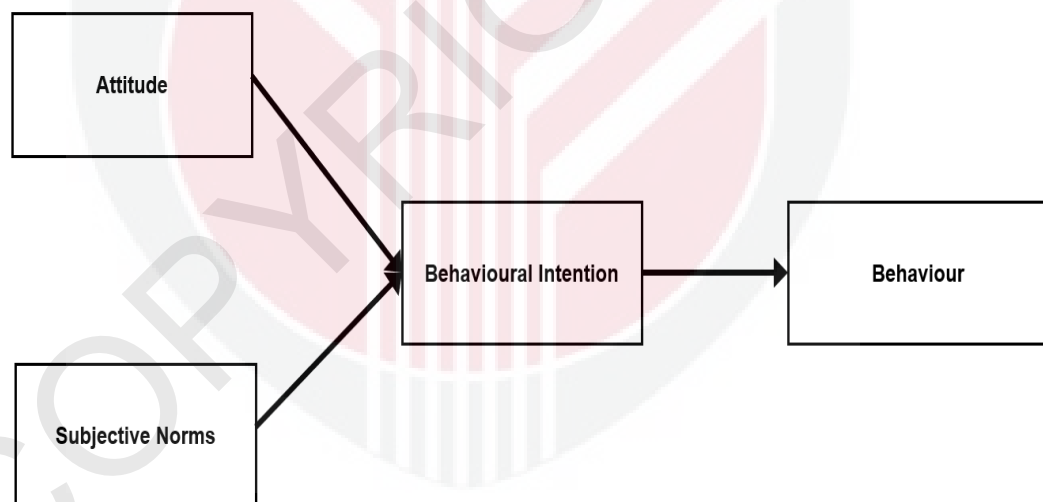


Figure 2.1: Theory of Reasoned Action (TRA)
(Source: Fishbein and Ajzen, 1975)

The TRA was then further extended into the TPB by incorporating a new antecedent of intention which is perceived behavioural control (PBC) (Ajzen, 1985). PBC reflects an individual's belief in their capability to perform the behaviour considering the potential obstacles and resources available (Ajzen,

1991). It formed from the person's perceptions about the factors that an influence their ability to perform the behaviour and the perceived power to control the factor. The inclusion of PBC made an important change to the original TRA model because certain performance of behaviour requires higher level of control or effort to perform and this perceived ease or difficulty is said to be related to the person's experience and ability to anticipate the potential challenges (Ajzen, 1985). The study suggested that PBC can be a more potent predictor of actual behaviour compared to attitude alone (Ajzen, 1985). This theory has been successfully applied in various domains, including the choice of forest planting method (Karppinen, 2005), behavioural intention to participate in kerbside recycling programme (Nigbur et al., 2010) and separate household food waste (Karim Ghani et al., 2013), solid waste management (He et al., 2021), and many more. The TPB offers a valuable framework for understanding and predicting pro-environmental behaviours, making it a powerful tool for researchers interested in promoting sustainable behaviours.

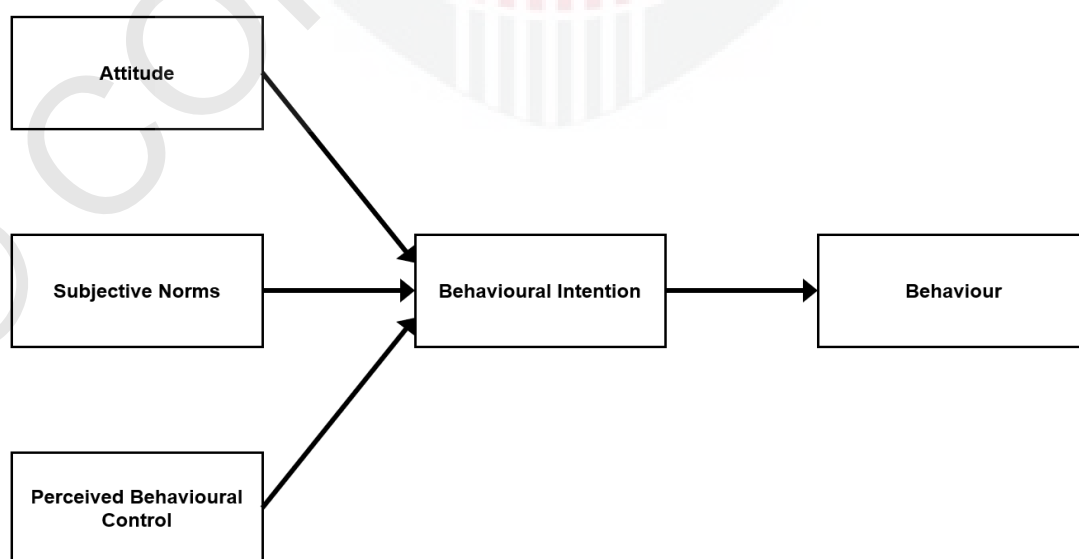


Figure 2.2: Theory of Planned Behaviour

2.3.2 The Application of Theory of Planned Behaviour in Pro-Environmental Research

The TPB is widely applied in understanding public behavioural intentions in environmental. This section provides an overview of studies that have applied TPB in determining one's pro-environmental behaviours.

Many studies have highlighted the important role of attitude in shaping intention to perform a pro-environmental behaviour (Karppinen, 2005; Ghani et al., 2013; Zahedi et al., 2013; Pakpour et al., 2014; Fatoki, 2020). Karppinen (2005) found that forest owners' attitudes toward different forest planting method were the strongest predictor, followed by PBC and SN. Similarly, Pakpour et al. (2014) revealed a significant relationship between attitude and household waste management intention in Iran. Similar result was also presented by Ghani et al. (2013) which has applied TPB to identify the factors contributed to public's behavioural intention to separate household food waste, denoting AT had the strongest influence, followed by PBC and SN.

Different from the literature that found attitude as a predominant factor of intention, Donald et al. (2014) when studying the preferred transport mode using TPB has drawn into a conclusion that PBC was the most significant factor compared to influence of AT and SN in travelling by public transport than travelling by private car. However, Schniederjans and Starkey (2014) found that PBC was not a significant factor to determine the intention to purchase the "green transportation t-shirt". It is interesting that this study

revealed a high PBC among respondents but did not lead to greater actual intention. The study concluded that this might be due to low level of knowledge with regards to the contribution of green transportation towards better environmental protection or the fact that people did not find buying such t-shirt could bring an environmental impact.

Scholars also found social perceptions, also referred as subjective norms, plays a pivotal role in affecting a person's behaviour to travel by personal car. Liobikienė et al. (2021) in applying TPB to investigate the intention of Lithuania's residents in adopting renewable energy found different degree of significance on subjective norms and attitude. The result showed subjective norms was a significant factor in affecting the intention to use renewable energy, but attitude was not the impactful factor leading to the behavioural intention.

Zahedi et al. (2019) and Fatoki (2020) both found that AT and PBC played a critical role in influencing the intention to perform a pro-environmental activity. In the context which aligns with our study, the investigation by Zahedi et al. (2019) proved that AT and PBC were among the three attitudinal factors that positively influence the public's intention and willingness to pay to reduce environmental pollution from private road transport. The study also revealed that AT encompassed the greatest impact towards public's willingness to pay carbon tax, compared to PBC. Meanwhile, Fatoki (2020) has applied the extended TPB to understand hotel employees' intention to save electricity and concluded that both attitude and PBC were significantly positively related

to the employees' electricity saving intention. Subjective norm was proven to be insignificant in determining the electricity saving intention.

2.3.3 The Incorporation of Environmental Concern in Extended Theory of Planned Behaviour

The TPB model received several critics in lacking considerations on general attitude which could strengthen the TPB model in studying intentions. The limitation has led to the development of extended TPB that incorporate other factors. The extended TPB has formed and is applied in many studies to identify the intentions towards sustainable practices (Kaffashi & Shamsuddin, 2019).

Environmental concern is defined as an Individual's awareness of environmental problems. Several studies have added environmental concern as the factor assessing pro-environmental behavioural intention. In regards with the study from Donald et al. (2014) found an indirect effect of environmental concern on the intention to switch to public transport, suggesting that environmental awareness can motivate pro-environmental choices, resulting in the person's willingness to pay.

There are two ways environmental concern can be incorporated into the TPB model. Environmental concern can act as a latent variable that influence AT, SN and PBC directly in the model as shown in Figure 2.3. This model was applied by Zahedi et al. (2019) and Kaffashi and Shamsuddin (2019). Zahedi et al. (2019) found environmental concern has significant positive relationship

with the three original factors in TPB. The study thus concluded that the willingness of public to pay for reducing GHG emissions can be enhanced by improving their awareness to climate change. Kaffashi and Shamsuddin (2019) also found that environmental concerns had significant impact on residents' intention on transitioning to low carbon society. They also found individuals with greater environmental concern have better sustainable and environmentally friendly lifestyle.

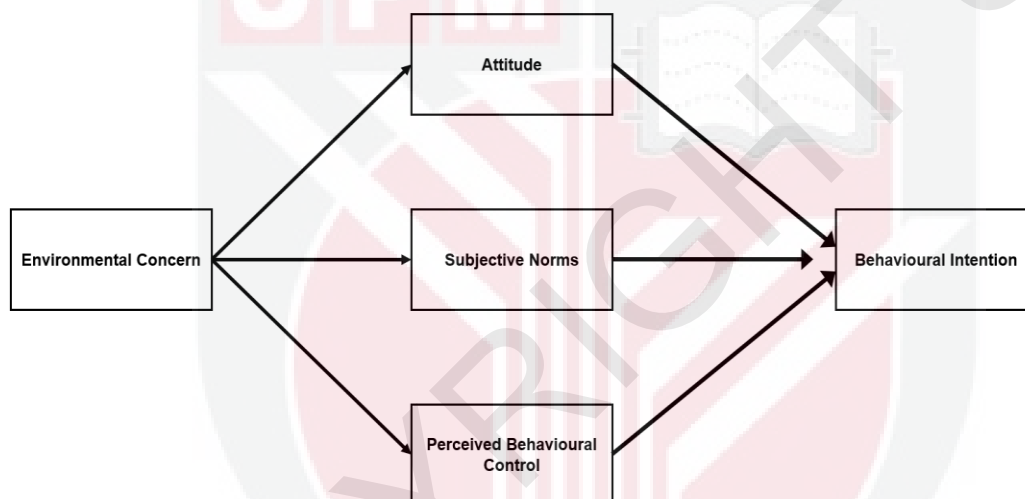


Figure 2.3: Illustration of the Integration of Environmental Concern as Variable that has Direct Influence on AT, SN and PBC

Another case of extended TPB model is integrating environmental concern as a direct factor that affect behavioural intention (Figure 2.4) which was adopted by Fatoki (2020). In order to understand hotel employees' intention to save electricity, study from Fatoki (2020) by adding the environmental concern as a determinant, found a significant positive relationship between environmental concern with the intention outcome. There is study that only predict the impact of environmental concern on AT and excluded SN and PBC like Liobikienė et al. (2021). This study has an interesting finding where

the attitude affecting intention to use renewable energy turned significant after integrated environmental concern with attitude, which showed a positive attitude of people with greater awareness toward environmental issues are likely to adopt renewable energy.

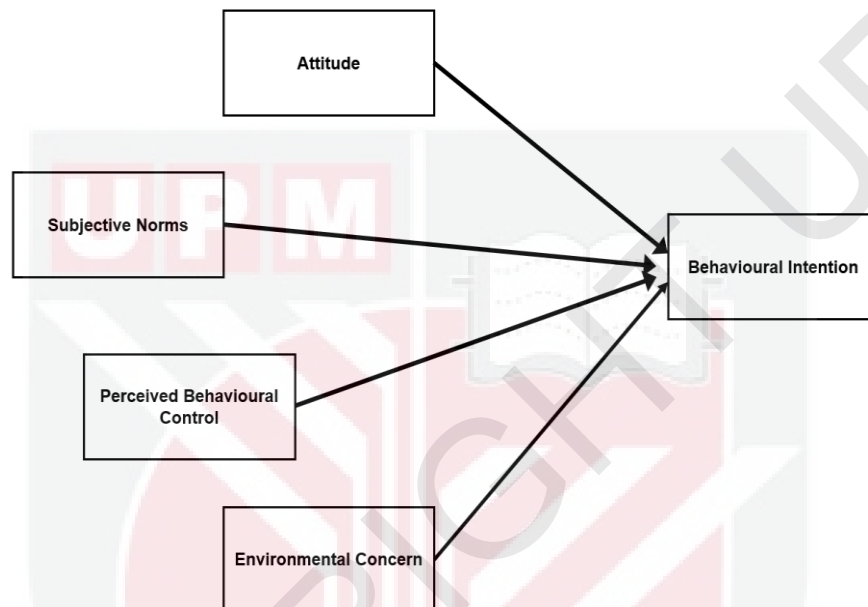


Figure 2.4: Illustration of the Integration of Environmental Concern as Variable That Has Direct Influence on Behavioural Intention

In investigating the relationship between environmental variables and attitude formation, study from Liu et al. (2022) found a significant positive relationship between environmental concern and attitude in terms of consumers' intention to purchase greener restaurant products. In accordance with their finding, the authors suggested to provide information such as carbon emissions contributed by consuming meat, to enhance consumers' awareness in making decisions for their purchases as well as a motivating factor to practice greener consumption.

Environmental concern plays a crucial role in shaping pro-environmental intentions and behaviours. By incorporating this factor into models like the TPB, researchers can gain a more comprehensive understanding of how individuals make choices that impact the environment. Furthermore, interventions designed to raise environmental awareness can be effective in promoting sustainable practices.

2.4 Summary of Literature Review and Research Gap

In the context of evaluating pro-environmental behaviour, the TPB has always been one of the most applied theories in social science. Many literatures have proven the significant role of AT, SN and PBC in predicting behavioural intention. This study also extended the TPB model to allow for a more comprehensive examination of behavioural motives impacting the pro-environmental behaviour (Ajzen, 1991). This study has, by referencing Zahedi et al. (2019) and Kaffashi and Shamsuddin (2019), integrated EC as a factor that is predicted to directly affect AT, SN and PBC. EC is expected to positively influence AT, SN and PBC as proven from previous literatures.

Studies related to willingness to pay often assessed using economic models such as contingent valuation method, choice experiment modelling and others. However, a growing recognition exists that effective climate policies require more than just economic considerations, also an understanding of public behaviour and acceptance. In the context of evaluating pro-environmental behaviour, the TPB has always been one of the most applied

theories in social science. The TPB, particularly with its extended model, allows for more comprehensive examination of behavioural motives impacting pro-environmental behaviour (Ajzen, 1991). Despite this growing body of research on public perceptions of climate policies, there is a critical knowledge gap in the context of Malaysia. This study is motivated by the lack of study that has examined the psychological factors that lead to the intention to pay carbon tax, especially in the context of Malaysia. As the Malaysian government plans to introduce carbon tax, research like this could contribute valuable insights to policymakers throughout the design of policy and campaign that can consequently heighten public support on such policy. Thereby, fill up the knowledge gap. Additionally, this TPB will be extended by incorporating environmental concern (EC) to obtain a more robust analysis. This study aims to lay a foundation for understanding public perceptions of carbon tax in the Malaysian context.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

Chapter Three delves into the methodology employed to investigate the psychological factors affecting the intention to pay carbon tax. It outlines the conceptual framework guiding the analysis and details of research design, data collection and analysis approaches. This research has also taken necessary measures to ensure data validity and reliability as outlined in this chapter.

3.2 Research Design

This research adopted a quantitative approach to assess individuals' behavioural intentions and their willingness to pay carbon tax. This method, which relies on numerical data analysis through statistical techniques, is suitable for this research to generalise the findings to a larger population compared to a qualitative method that is mainly used to delve deeper into the motivations of a smaller sample. The strategy to collect quantitative data was through administration of survey through both online and face-to-face interview. The online method can help to reach to larger population effectively and collect a significant number of data required for this research while face-to-face interview method helps to easily reach out to people who

prefer personal interaction. Prior to the actual administration of the survey, a pilot study is conducted using to test for the reliability of questionnaire. Figure 3.1 shows the flow of research process. Started with reviewing literature to adapt the questions and designing the questionnaire for pilot research, the data collected was then tested for its reliability and revised to ensure clarity of questions. By the time the questionnaire is finalised, target population, suitable sample size and technique to use were determined. Data for actual analysis is collected via online and face-to-face interview. The data has undergone reliability and validity check through Cronbach's Alpha and Confirmatory Factor Analysis before it is analysed using Structural Equation Modelling and ready for report writing.

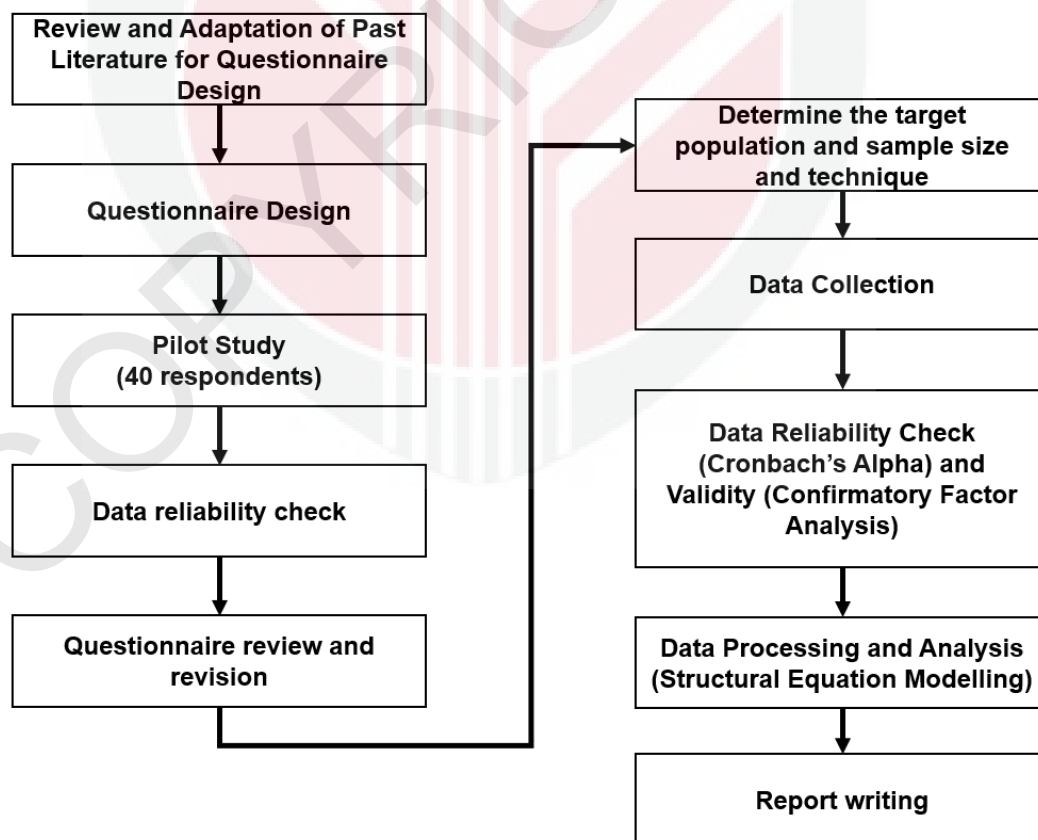


Figure 3.1: Flow Chart of Research Design

3.3 Questionnaire Design

The empirical data was collected through structured questionnaire. It was designed in English language as it is an appropriate language to communicate with the respondents of diverse background. The questionnaire was structured into six sections as shown in Table 3.1 below.

Table 3.1: Questionnaire Sections

Section	Focus
Section A	Environmental Concern
Section B	Attitude
Section C	Subjective Norm
Section D	Perceived Behavioural Control
Section E	Intention to Pay
Section F	Socio-economic Characteristics

Section A to E addressed the constructs of extended Theory of Planned Behaviour employed in this research, which are EC, AT, SN, PBC and IP. These sections consist of close-ended questions assessed through Likert scale items abstracted from established literature. Section F collected socio-demographic data such as age, occupation, monthly income, educational level, and other relevant information. This section provides context for understanding the variations in responses across different population segments. The sub-sections 3.3.1 to 3.3.5 will justify and detail the variables assessed in each section. Afterwards, these variables were assessed using Likert scale. The scales were developed with references from existing literature and tested for its reliability using Cronbach's alpha. The study employed a mixed Likert scale approach that balances capturing the full range of respondents' opinions and minimising their burden. The original TPB

variables were assessed through a 7-point Likert scale which offers granularity and allow for a more comprehensive and accurate understanding of respondents' TPB-related constructs. This can enhance the accuracy in capturing the intensity of these constructs. Meanwhile, the newly introduced variable which is environmental concern was assessed using a simpler 5-point scale to reduce respondents' burden. This type of mixed Likert scale points, although uncommon, was found in Koufteros (1999) and Song et al. (2020) applied in structural equation modelling.

3.3.1 Attitude towards Carbon Tax

Within the TPB framework, attitude refers to an individual's overall evaluation of a specific behaviour (Ajzen, 1991). Individuals with a favourable attitude might believe a carbon tax will effectively reduce greenhouse gas emissions and mitigate climate change, thus contribute to a positive pro-environmental action. The constructs to assess this variable is outlined in Table 3.2. These items intended to capture respondents' beliefs about the consequences of implementing carbon tax policy. This construct is measured using 7-point Likert Scale from "Extremely Disagree" to "Extremely Agree".

Table 3.2: Measurement Items for Attitude.

Measurement Items	Reference
I feel positive to support carbon tax in Malaysia if the government has implemented. (AT1)	López-Mosquera et al., 2014; Karppinen, 2005; Zahedi et al., 2019
The idea of paying to reduce GHG emissions is very reasonable. (AT2)	
Carbon tax is the best method to reduce GHG emissions. (AT3)	

3.3.2 Subjective Norms

Subjective norm refers to a person's perception of pressures given by the social and people around them to behave in a certain way (Ajzen, 1991). Past literature has proven that Individuals are more likely to comply with a behaviour if they perceive important social circles supporting it. Conversely, if significant others are perceived to disapprove, individuals may be less inclined to engage in that behaviour. This construct is assessed with 7-point Likert Scale from "Extremely Disagree" to "Extremely Agree". The items used to measure SN are presented in Table 3.3 below.

Table 3.3: Measurement Items for Subjective Norms

Measurement Items	Reference
People whose opinions I value think I should pay carbon tax. (SN1)	López-Mosquera et al., 2014; Iranmanesh et al., 2019; Liu et al., 2022
My family think I should pay carbon tax. (SN2)	
My close friends think I should pay carbon tax. (SN3)	

3.3.3 Perceived Behavioural Control

Perceived behavioural control is defined as the confidence of an individual on their ability to perform a specific behaviour. It also considers the external factors perceived to help to successfully execute the behaviour (Ajzen, 1991). In this research, the items to measure perceived behavioural control involves the individuals' perceived financial means and necessary resources to pay carbon tax. Individuals who perceive financial constraints or lack of supporting infrastructure might be less willing to pay, regardless to their

environmental attitudes or social pressures. This variable is assessed with 7-point Likert Scale from “Extremely Disagree” to “Extremely Agree”. The items used to measure PBC are presented in Table 3.4 below.

Table 3.4: Measurement Items for Perceived Behavioural Control

Measurement Items	Reference
If I wanted to, I could pay carbon tax. (PBC1)	Karim Ghani et al. 2013; Iranmanesh et al., 2019; Zahedi et al., 2019
If I have the resources, money, time and opportunity, I will pay carbon tax. (PBC2)	
If I do not have financial pressure, it would be easy for me to pay carbon tax. (PBC3)	

3.3.4 Intention to Pay Carbon Tax

Understanding behavioural intentions is crucial as they serve as a proxy for actual behaviour (Ajzen, 1991). By examining intentions to pay a carbon tax, this research gain valuable insights into the likelihood of policy acceptance and compliance. In this context, a strong behavioural intention to pay a carbon tax indicates an individual’s readiness to comply with the policy. This section of questionnaire has directly assessed the respondents’ intention to pay carbon tax as shown in Table 3.5. The items were assessed using 7-point Likert Scale from “Extremely Disagree” to “Extremely Agree”.

Table 3.5: Measurement Items for Intention to Pay Carbon Tax

Measurement Items	Reference
I am willing to make an effort to reduce GHG emissions. (IP1)	Zahedi et al., 2019
I am willing to pay carbon tax to reduce GHG emissions. (IP2)	
How willing am I to pay carbon tax to reduce GHG emissions? (IP3)	

3.3.5 Environmental Concern

Environmental concern is a complex concept that includes an individual's cognitive evaluation, emotional connections and behavioural intentions on environmental issues (Fransson & Garling, 1999). It is an individual's sentiment towards environment-related matters (Zimmer et al., 1994). Ahmad and Thyagaraj (2015) deemed environmental concern as a willingness to engage in behaviours that benefit the environment. Individual with high environmental concern may experience feelings of concern, worry or even anger about environmental degradation, which in turn motivates their pro-environmental behaviours. In this study, environmental concern is operationalised within the context of the TPB, treated as an additional variable for extended TPB. The respondents' concern toward environmental was measured by assessing their perceptions of the severity of environmental problems. This variable is assessed using 5-point Likert scale, denoted as "Not at all concern" to "Extremely concern". This section has taken references from Zahedi et al. (2019) which has applied a 5-point Likert scale for environmental concern. The items used to measure EC are presented in Table 3.6 below.

Table 3.6: Measurement Items for Environmental Concern

Measurement Items	Reference
I think climate change impacts are becoming serious in recent years. (EC1)	Zahedi et al., 2019; Fatoki, 2020
My level of concern about the effect of climate change on my health and well-being. (EC2)	
My level of concern about the state of the world's environment and what it means for the future. (EC3)	

3.4 Pilot Study

A pilot test is a crucial step in questionnaire development, ensuring the instrument's effectiveness before main survey for data collection (Van Teijlingen & Hundley, 2002). The pilot test played a vital role in refining the questionnaire, ensuring clarity, comprehensiveness, and reliability. Pilot test with 40 respondents collected via face-to-face interview in March 2023 was conducted to identify and address potential issues within the questionnaire and data collection process. Since pilot study is a preliminary investigation helps to test the suitability of observing measurements, a relatively small sample size of around 30 is said to be sufficient (Bujang et al., 2024).

Questionnaire bias can arise from the way every question is designed and administered (Choi & Pak, 2005). To address potential bias such as improper wording and the length of questions being too long, this questionnaire was improved by:

1. Providing a brief introduction of carbon tax to ensure the respondents were provided with sufficient information that enable them to answer the questions.
2. Reworded some questions to ensure consistency and better clarity.
3. Avoid lengthy questions to be asked.
4. Avoid ambiguous questions by providing choices of answer that can be clearly understood such as “No, I am not aware” instead of “No.”
5. Be vague with choices of answers such as “1-3 times in a year” instead of “occasionally”.
6. Remove unnecessary questions to avoid response fatigue.

The pilot test assessed the questionnaire's internal consistency using Cronbach's alpha coefficient generated through IBM Statistical Package for Social Science (SPSS) version 29.0. All the constructs showed alpha values exceeded 0.70, indicating high internal reliability and suitable to be used for this research purpose.

3.5 Sampling Design

This section details the employed sampling design by outlining the specific sampling technique chosen, the sample size determined and the justification for this selection.

3.5.1 Sampling Population

The survey was opened to Malaysian aged 18 and above to reflect the potential nationwide impact of a carbon tax policy. This is to ensure the sample is representative of the wider Malaysian adult population of diverse demographics, similar to the sampling method employed by Hammerle et al. (2021) in understanding the Australian's acceptance of carbon taxes. This approach is crucial for generalising the findings to the national context, considering the implementation of carbon tax by the Malaysian government is a nationwide impact. Socioeconomic characteristics of the respondents is presented in Chapter 4. The total population in Malaysia as stated by Department of Statistics Malaysia (DOSM), updated in 2023, consists of 33,400,000 (DOSM, 2023). This figure is used as a baseline for the

determination of the significant number of respondents required for this research.

3.5.2 Sampling Size

This section addresses the process of determining an appropriate sample size for this research. As suggested by Roscoe (1975), an appropriate sample size should be at least 30 and below 500 to maintain the sample error at an acceptable level. For Structural Equation Modelling (SEM) which will be employed in this study, it is usually with sample size of not less than 100 and recommended to obtain sample of more than 200 (Kline, 2016; Hair et al., 2019).

The few scholars who have applied TPB collected responses of more than 100. For instance, Kaffashi and Shamsudin (2019) with 680 completed responses, and Empidi and Emang (2021) which has gathered a total of 143 valid responses for TPB study. The sample size required for this research is determined using the Cochran (1977) method stated as follow:

$$n_0 = \frac{t^2 (p)(q)}{d^2}$$

$$n_0 = \frac{1.96^2 (0.5)(0.5)}{0.05^2} \approx 384.16$$

Where n_0 = sample size, t = desired confidence interval, pq = variance estimation and d = acceptable margin of error. In this research, $t = 1.96$ for a 95% confidence level for sample size above 120 (Bartlett et al., 2001), pq is

the variance estimation where p is assumed as 0.5 and $q = 1-p = 0.5$. Finally, the acceptable margin of error is maintained at 0.05. The minimum returned sample size for this research was 384 respondents.

3.5.3 Sampling Technique

Sampling techniques consist of two approaches, namely probability and non-probability (Saunders et al., 2000). This research employed a snowball sampling technique to recruit participants. Snowball sampling, or chain referral sampling, is a non-probability survey selection method that is frequently used to identify populations that are rare and hard-to-find (Biernacki & Waldorf, 1981). This method is widely applied in biomedical, social and behavioural research domains (Johnson, 2014). Snowball sampling leverages existing social networks to identify potential respondents. Began by identifying a small group of initial contacts who met the eligibility criteria (age 18 and above, Malaysian) and were willing to participate. These initial participants were then asked to refer others within their social circles who also fit the criteria and might be interested in participating. Snowball sampling technique is a cost-effective approach and enhance efficiency by saving time (Johnson, 2014). This technique has helped to ensure the completion of data collection within research timeframe.

3.6 Data Collection

A self-administered questionnaire was developed to gather data required for this research. The questionnaire was available both online and offline to maximise the accessibility and reach a wider range of participants across Malaysia. This questionnaire was provided in English language. A significant challenge encountered during data collection was the reluctance of potential participants to engage in face-to-face interviews. Many respondents declined due to time constraints and other commitments. To overcome this hurdle, the study transitioned to online survey platforms. This approach offered several advantages:

- a. **Convenience:** Respondent could complete the survey at their own pace and from any location.
- b. **Anonymity:** The online format provided a more private and less intimidating environment, encouraging participation.
- c. **Scalability:** Online platforms able to reach a larger and more diverse audience.

The entire online process was facilitated through *WhatsApp* and *LinkedIn*. This allowed us to reach a wider geographical range of participants across Malaysia compared to solely relying on face-to-face interview in public locations. To further enhance the recruitment process, four enumerators were engaged to assist in survey administration using both online and face-to-face interview method with their personal networks. The initial participants were requested to refer others within their social circles to participate in the

survey. The study aimed to explore the perceptions of Malaysian citizens regarding the payment of carbon tax.

While efforts were made to ensure a diverse sample, practical limitations and time constraints introduced potential biases that influenced the final sample composition. The snowball sampling technique, while effective for reaching participants from various places in Malaysia, may not be accurately representing the target population. To minimise bias in collecting samples, background of participants would be assessed to ensure the sample collected have a mix of diverse background. Participants would be asked the current place of residence and their occupation. The snowball sampling process continued until a sufficient sample size of 404 completed questionnaires. These 404 participants comprised a younger demographic, particularly students who were more responsive and willing to complete the questionnaire compared to the working adults. Although the demographic is primarily younger participants, their perspectives are important as they are likely be the most affected by climate change in the future. While the study acknowledges the limitations of the sample, it aims to lay a foundation for understanding public perceptions of carbon tax in the Malaysian context and provide valuable insights into the factors influencing their intention to pay carbon tax. Future research can extend the sample size and diversify the sample to obtain more comprehensive understanding of public opinion.

3.7 Data Analysis

This section presents the mode of analysis applied in this research. The focus for analysis is the application of Structural Equation Modelling (SEM) which would be used to perform path analysis for the extended TPB. The analyses were performed using IBM SPSS 29.0 and AMOS 26.0 which is an application designed to analyse SEM.

3.7.1 Structural Equation Modelling

Structural equation modelling (SEM) has been employed instead multiple regression analysis as it provides estimations regarding the magnitude of hypothesised relationships among variables within a theoretical framework. It provides statistical analysis about the direct effect of hypothesised relationships and indirectly effect under circumstance where there are other variables, also known as intervening or mediating variables, positioned between the other two (Maruyama, 1998). Analysis techniques such as multiple regression and logistic regression which are categorised as first-generation techniques have some limitations which led to the increasing adoption of second-generation technique which is SEM (Maruyama, 1998).

Limitations of First-Generation Data Analysis Techniques includes:

1. **Unable to handle complex model structure:** These techniques can only analyse simple causal relationships, making it difficult to explore intricate causal relationships with multiple variables influencing each other. This led to estimation that can only be achieved piecewise

rather than simultaneously, potentially affecting the quality of result (Sarstedt et al., 2019)

2. **Observable variables requirement:** The first-generation techniques have limitation in terms of handling observable variables, thus overlooking theoretical concepts that are abstract and unobservable. This can be overcome through validation such as a confirmatory factor analysis (CFA).
3. **Absence of measurement error:** The first-generation techniques hardly consider the error measurement, which is quite unrealistic, particularly when estimating relationships among measures of theoretical concepts.

As stated by Musil et al. (1998), SEM able to assess the conceptual and measurement model simultaneously and allow adjustments for measurement error. Therefore, SEM is suitable for this research to analyse various latent variables to obtain better insights from this study. However, there are several limitations in adopting SEM:

1. **Assumptions of normality:** SEM relies on the assumption that the data follows a multivariate normal distribution, which means the relationships among variables are captured entirely by means and covariance. However, real-world data often deviates from this assumption, potentially leading to biased or inaccurate results. This can be a limitation when dealing with highly skewed or non-normal data (Ramlall, 2017).
2. **Relatively large samples required:** SEM is generally a large-sample technique. Certain types of estimates in SEM, such as standard errors for effects of latent variables, may be inaccurate when the sample size is not large. The risk for technical problems in the analysis is greater too. More complex models or those with more parameters require bigger sample sizes because it requires more estimates (Kline, 2023).
3. **Latent variable challenges:** Latent variables, which are theoretical constructs not directly observed, have no inherent scale and require arbitrary units. This issue, known as factor indeterminacy, can make interpretation challenging. To address this, researchers may normalize the data, fix certain coefficients to a standard value, or choose robust indicators that represent the latent construct effectively (Ramlall, 2017).

- 4. Model fit and parameter issues:** SEM models may indicate a good overall fit to the data, but individual parameter estimates can sometimes be illogical or unrealistic. This disconnect can complicate the interpretation and practical application of the findings, as researchers need to ensure both model fit and parameter estimates are reliable (Ramlall, 2017).
- 5. Chi-Square statistic limitations:** The chi-square statistic, commonly used in SEM to assess model fit, is highly sensitive to sample size. In large samples, even small deviations from the hypothesized model can lead to significant chi-square values, suggesting poor fit, while smaller samples may fail to detect issues (Ramlall, 2017).
- 6. Measurement issues:** SEM is highly sensitive to measurement scales, nonlinearity, and non-normality in the data. Additionally, missing data and restricted ranges of variables can exacerbate these issues, making it difficult to generate robust and reliable models without extensive data preparation and testing (Ramlall, 2017).
- 7. Error propagation:** SEM uses a full-information estimation technique, such as maximum likelihood, which assumes all parameters are estimated simultaneously. An error in one part of the model can propagate to other parameters, compounding the impact and potentially distorting the entire model's results (Ramlall, 2017).

To mitigate these limitations, the study has employed rigorous methodological practices, including careful model specification, the use of well-validated and reliable measurement instruments, and a sufficient large sample size. Additionally, the model fitness was assessed through other fitness of indices as proposed in other scholarly works.

SEM method can be performed in two ways, namely covariance-based SEM (CB-SEM) and partial least square SEM (PLS-SEM). This research has adopted CB-SEM technique which is suitable approach that focuses on estimating the path in a model by considering constructs as common factors and this approach is more appropriate for research that meant to test and confirm a theoretical model compared to PLS-SEM that is more commonly

used for theory development (Mohamad et al., 2019). The CB-SEM estimates the model using the maximum likelihood (ML) approach. It is followed by a two-step approach as outline by Anderson and Gerbing (1988), which consist of a measurement model and structural model. A measurement model will first be assessed through Confirmatory Factor Analysis (CFA) to check its validity, while the structural model will present the hypothesised causal relationships between the latent variables.

The first step involves establishing a measurement model. This model specifies how the constructs within the framework, so called latent variables, are operationalised through observed measures (Hair et al., 2021). In this research, the latent variables include environmental concerns, attitude, subjective norms, perceived behavioural control and behavioural intention toward paying carbon tax. Observed measures are the items captured through the administered survey. Measurement model is assessed through CFA which determines the construct validity, ensure the measurement model is well-fitted. The results of measurement model will be presented in Chapter 4.

Second step, which is also the final step is the structural model where causal relationships between latent variables are determined. Path analysis is performed in this stage to estimate the strength and significance of the hypothesised relationships (Hair et al., 2021). Path coefficients indicate the direct impact of one latent variable on another. This model can also determine the indirect effects mediated by other latent variables and provide

more insights on how the intervening variable contributed to the causal relationships. The structural model is evaluated based on goodness-of-fit indices which includes some commonly seen indices such as comparative fit index (CFI) and the normed fit index (NFI). The model is considered acceptable if the indices met the criteria.

3.7.2 Data Validity and Reliability

Testing the data validity and reliability is important to ensure good quality of the study (Heale & Twycross, 2015). To ensure the good interpretation of research findings, researchers must test the validity and reliability of observation variables and ensure that it satisfy the two conditions (Sürücü & Maslakci, 2020). The results are displayed in Chapter Four.

Data validity ensures the measuring instrument accurately captures the intended construct (Anastasi & Urbina, 1997). CFA is performed to measure the validity of data. The analysis provides both convergent and divergent validity. The definitions of validity and reliability test has been perfectly outlines in Sürücü and Maslakci (2020). Convergent validity assesses how well the designed measures able to capture the latent constructs (Hair et al., 1998). It confirms if the different elements of measuring instrument are effectively measuring the intended concept. Higher convergent validity indicates the measures are internally consistent and collectively capture the essence of the construct. For convergent validity, AVE values must be lower than composite reliability (CR) and greater than 0.5 and CR value to be

greater than 0.7 (Sürücü & Maslakci, 2020). Discriminant validity determines whether the observed variables used in the measurement model measures the latent variable (Sürücü & Maslakci, 2020).

As for reliability which focuses on the consistency and stability of the measuring instrument (Hair et al., 1998). In this research, Cronbach's alpha coefficient, which is the most popular method in determining internal consistency (Sürücü & Maslakci, 2020), is used. The Cronbach's alpha coefficient ranged between 0 and 1, where the value closer to 1 indicating higher internal consistency. Table 3.7 below shows the classification of Cronbach's alpha coefficient. The alpha value should be greater than 0.7 to indicate good internal consistency (Sürücü & Maslakci, 2020).

Table 3.7: Classification of Cronbach's Alpha Coefficient

Cronbach's Alpha	Interpretation of Cronbach's Alpha Coefficient
≥ 0.9	The internal consistency of the scale is high
$0.7 \leq \alpha < 0.9$	The scale has internal consistency
$0.6 \leq \alpha < 0.7$	The internal consistency of the scale is acceptable
$0.5 \leq \alpha < 0.6$	The internal consistency of the scale is weak
$\alpha \leq 0.5$	The scale has no internal consistency

(Source: Sürücü and Maslakci, 2020)

CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter presents the findings analysed from the data collected. Begin by presenting descriptive statistics of the data collected and summary of respondents' responses, and then delve into the SEM analysis. The last section of this chapter will further discuss the findings and compare to existing literature.

4.2 Respondents' Socio-demographic

Table 4.1 shows the descriptive statistics of respondents' demographic which includes gender, race, marital status, age and educational attainment. Occupation and monthly income level of respondents are shown in Figure 4.1 and Figure 4.2 in charts. Total 404 respondents have participated this survey, comprised of mainly female respondents, accounted for 58.9%. Majority of the respondents were not married (87.6%) and age between 19 and 28. Up to 73.0% of the respondents were bachelor's degree holder. The survey participants consisted of a quite balanced proportion of student and working adult, 55.4% and 44.6% respectively (Figure 4.1). Many of them earned a monthly income of below RM1000 (USD212.34) as they are mostly students (Figure 4.2). These demographic characteristics have shown that most of the

respondents are highly educated where they are a tertiary education degree holder or are still studying in a university.

Table 4.1: Socio-demographic of Respondents (n=404)

Characteristics		<i>n</i>	Percentage (%)
Gender	Male	166	41.1
	Female	238	58.9
Race	Malay	230	56.9
	Chinese	119	29.5
	Indian	45	11.1
	Other	10	2.5
Marital Status	Married	50	12.4
	Single	354	87.6
Age	19 - 23	196	48.5
	24 - 28	140	34.7
	29 – 34	29	7.2
	35 and above	39	9.7
Education Attainment	Secondary school	12	3.0
	Diploma	41	10.1
	Bachelor's degree	295	73.0
	Master's degree	43	10.6
	PhD/Doctorate degree	6	1.5
	Professional certificate	7	1.7

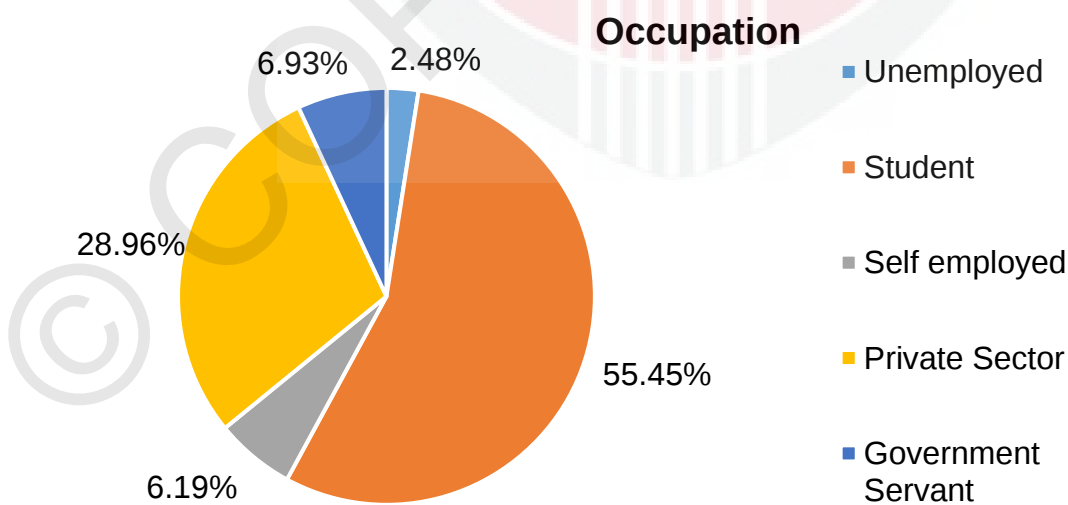


Figure 4.1: Chart of occupation of respondents (n=404)

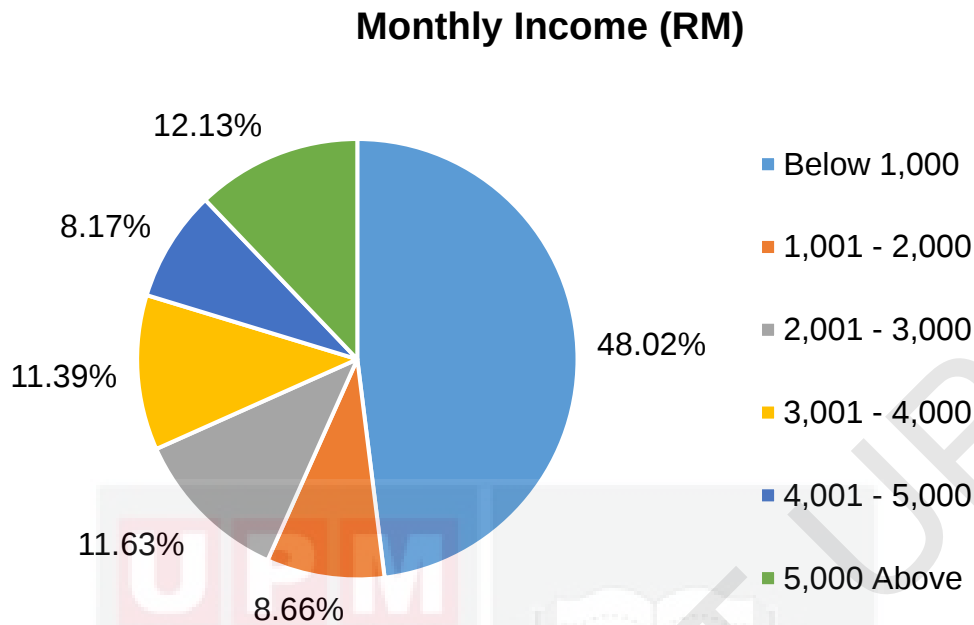


Figure 4.2: Chart of monthly income (RM) of respondents (n=404)

4.3 Descriptive Statistics of Variables

The descriptive statistics under sub-sections 4.3.1 to 4.3.5 showed that most of the respondents have provided positive perceptions on the observed items. The result implied that the respondents were highly concern or agree with the questions asked, therefore translates into having positive environmental concern, attitude, social pressure, perceived behavioural control and intention towards carbon tax payment.

4.3.1 Respondents' Attitude towards Paying Carbon Tax

An individual with positive attitude or thoughts toward the carbon tax is more likely to support it. This study found high levels of agreement with statements regarding support to reduce GHG emissions. Over 70% of respondents

indicated positive attitudes through their agreement with the measurement items as shown in Table 4.2. Specifically, 73.50% agreed that they felt positive to support the implementation of carbon tax and a significant majority (87.13%) agreed that paying a carbon tax is very reasonable. Furthermore, nearly 80% (79.46%) thought carbon tax is the best method to reduce GHG.

Table 4.2: Percentage distributions of respondents' attitude towards paying carbon tax

Items	Somewhat disagree to Strongly disagree	Neither	Somewhat agree to Strongly agree
AT1	9.60	16.80	73.50
AT2	5.70	7.18	87.13
AT3	8.90	11.63	79.46

4.3.2 Subjective Norms towards Implementation of Carbon Tax

This study examined the influence of perceived social pressure on willingness to pay a carbon tax. This variable helps to understand the impact of social pressure to an individual, whether the individuals' decision is made by following perceptions from people around them. The result showed in Table 4.3 suggest that social pressure from close relationships plays a somewhat lesser role compared to other factors. While an average of 61% of respondents indicated a likelihood to follow the opinions of people who they valued and close family or friends regarding the carbon tax, many also did not perceive social pressure would influence their decisions.

Table 4.3: Percentage distribution of respondents perceived social pressure

Items	Somewhat disagree to Strongly disagree	Neither	Somewhat agree to Strongly agree
SN1	14.36	24.50	61.14
SN2	13.37	24.26	62.38
SN3	13.12	26.24	60.64

4.3.3 Perceived Behavioural Control towards Paying Carbon Tax

There were high levels of PBC among respondents regarding their ability to pay a carbon tax (Table 4.4). Over 75% (75.25%) expressed confidence in their control over the decision to pay the tax. Additionally, a strong majority (81.93%) indicated they would pay if they had the necessary resources, suggesting a high level of PBC over external factors like finance and time. Furthermore, a significant portion (83.91%) believed paying the tax would be easy in the absence of financial pressure, highlighting their confidence in paying the tax without the external barriers. His result suggests that individuals possess a strong belief in their ability to control external factors that could facilitate successful carbon tax payment.

Table 4.4: Percentage distribution of respondents perceived behavioural control

Items	Somewhat disagree to Strongly disagree	Neither	Somewhat agree to Strongly agree
PBC1	9.65	15.10	75.25
PBC2	6.68	11.39	81.93
PBC3	7.67	8.42	83.91

4.3.4 Intention to Pay Carbon Tax

There is a high willingness among respondents to contribute to GHG reduction efforts. A significant majority (85.89%) expressed a willingness to make an effort to reduce GHG emissions as shown in Table 4.5. Furthermore, 77.72% indicated they were willing to pay carbon tax to reduce GHG emissions. In terms of to what extent they were willing, 11.88% expressed unwillingness, and some (14.11%) remained unsure. The overall sentiment leaned towards positive intention to pay a carbon tax.

Table 4.5: Percentage distribution of intention to pay. (n=404)

Items	Somewhat disagree to Strongly disagree	Neither	Somewhat agree to Strongly agree
IP1	6.19	7.92	85.89
IP2	8.17	14.11	77.72
Items	Slightly unwilling to extremely unwilling	Neither	Slightly willing to extremely willing
IP3	11.88	14.11	74.01

4.3.5 Environmental concern

This research attempted to understand the level of concern the public perceived towards climate change and carbon tax. The results in Table 4.6 revealed a high level of concern about climate change, with an accumulated percentage greater than 80% of respondents have answered “Moderately concern” and “Extremely Concern”. The public’s level of concern towards climate change seems increasing compared to the year where Masud et al. (2016) has conducted their research, where up to 67% to 72% of their

respondents from Selangor were aware of climate change and acknowledge the potential affect that climate change has toward human life. While this comparison is extremely important to observe the extent that public acknowledge the impact of climate change to their life and that high level of concern or awareness indicating a good sign that the public would have a positive environmental behaviour.

Table 4.6: Percentage distribution of environmental concern

Items	Not at all concern	Slightly concern	Somewhat concern	Moderately concern	Extremely concern
EC1	1.24	3.47	5.45	33.91	55.94
EC2	1.49	4.70	9.90	38.12	45.79
EC3	1.49	4.46	10.89	41.58	41.58

4.4 Data Validity and Reliability

This section presents the result of measures taken to establish the validity and reliability of the data used in this research. Techniques to ensure data validity and reliability has been presented in previous chapter. Table 4.7 shows the benchmark value for reliability and validity test. For reliability, Cronbach's alpha coefficient is observed, at which the observed variables will only be accepted with value greater than 0.70. Table 4.8 shows the value of Cronbach's alpha obtained through IBM SPSS application. All the variables consist of alpha coefficient greater than 0.7, indicating good internal consistency and reliability of the items measured.

Table 4.7: Benchmarking of reliability and validity test

Reliability Test	Benchmark
Cronbach's alpha (α)	>0.70 (Sürücü & Maslakci, 2020)
Validity Test (CFA)	Benchmark
Factor loadings (λ)	>0.60 (Hair et al., 2014)
Average Variance Extracted (AVE)	>0.50 (Sürücü & Maslakci, 2020)
Composite reliability (CR)	>0.70 (Sürücü & Maslakci, 2020)
The Discriminant validity	<0.90 (Henseler et al., 2015)

CFA was employed to assess the construct validity of the measurement model. The final CFA results, including factor loadings (λ), composite reliability (CR) and average variance extracted (AVE) are presented in Table 4.8. The AVE values are all greater than 0.5 and CR with values greater than 0.7 have shown great consistency among the variables (Sürücü & Maslakci, 2020). These results provide evidence for the convergent validity of the measurement model.

Table 4.8: Reliability and confirmatory factor analysis for the extended TPB model.

Item	Mean	λ	α	CR	AVE
EC1	4.4	0.636	0.761	0.766	0.525
EC2	4.22	0.726			
EC3	4.17	0.800			
AT1	5.14	0.783	0.869	0.834	0.625
AT2	5.67	0.777			
AT3	5.4	0.812			
SN1	4.8	0.873	0.904	0.931	0.817
SN2	4.86	0.908			
SN3	4.8	0.930			
PBC1	5.17	0.766	0.856	0.862	0.676
PBC2	5.48	0.899			
PBC3	5.58	0.796			
IP1	5.54	0.806	0.857	0.889	0.728
IP2	5.22	0.865			
IP3	5.04	0.886			

Table 4.9 shows discriminant validity checking using square root of AVE for each construct in this model, denoting the discriminant validity is established as suggested in Fornell-Larcker criterion (Fornell & Larcker, 1981). This criterion has implied that the square-root of AVE of a construct needs to be greater than all the correlations between that construct and the rest in the model.

Table 4.9: Discriminant validity

Construct	EC	AT	SN	PBC	IP
EC	0.724				
AT	0.709***	0.791			
SN	0.414***	0.625***	0.904		
PBC	0.426***	0.588***	0.567***	0.822	
IP	0.410***	0.627***	0.560***	0.679***	0.853

4.5 Results of Structural Model Analysis

After performing measurement model, model fit needs to be assessed to determine whether the proposed model adequately represents the relationships between the observed data and the underlying theoretical constructs (Hu & Bentler, 1999). Obtaining a well-fitting model is crucial as it indicates that the theoretical framework is supported by the data and is suitable for explaining the observed relationships. The model fit indices assessed in this research are presented in table below.

Evaluating the model fit of proposed SEM is crucial in ensuring the validity and interpretability of the results. There are two categories of fit indices used

in SEM analysis, namely absolute fit and incremental fit. Absolute fit refers to indices assess how well the model, on its own, reproduces the discrepancy between the model-implied covariance matrix and the observed covariance matrix. Examples of absolute fit indices include chi-square (χ^2), root mean square error of approximation (RMSEA) and standardised root mean squared residual (SRMR). As for incremental fit indices, it provides a comparison of the fit of the proposed model to a baseline model. In this study, the incremental fit indices assessed are comparative fit index (CFI) and normed fit index (NFI). Table 4.10 showed the results of model fit indices.

Table 4.10: Model fit indices for structural equation modelling

Model Fit Indices	Value	Model Fitness
χ^2 (df)	273.574 (80)	$P < 0.05$, poor model fit
CMIN/DF	3.420	< 5.0 , for $n > 200$ (Marsh & Hocevar, 1985)
CFI	0.950	> 0.90 (Hatcher, 1994)
NFI	0.931	> 0.90 (Bentler & Bonett, 1980)
RMSEA	0.077	< 0.08 (MacCallum et al., 1996)
SRMR	0.0588	< 0.09 (Hair et al., 2009)

The chi-square statistic ($\chi^2=273.574$, $df=80$) is statistically significant ($p < 0.05$), indicating a poor model fit. However, chi-squared test alone unable to provide a good oversight of fitness of model as it is sensitive towards the size of sample (Hu & Bentler, 1999). In fact, it is not considered to be very a very useful fit index by most researchers because it is affected by several factors (Newsom, 2023). For example:

1. **Sample size:** models with >400 cases will mostly get statistically significant chi square (Kenny, 2024)
2. **Model size:** more variables tend to have larger chi-square (Newsom, 2023)

Therefore, additional fit indices are considered to provide a more comprehensive assessment. The Normed Chi-square (CMIN/DF) consist value of 3.420 is well below the acceptable threshold of 5.0 (Marsh & Hocevar, 1985), indicating a reasonable fit between the model and the data. Root mean square error of approximation (RMSEA) is 0.077 implies good model fit at which the value should be well below 0.08 as suggested by Meyers et al. (2005). For the standardised root mean square residual (SRMR), its value (SRMR=0.0588) is well below the 0.09 threshold for good fit suggested by Hair et al. (2009). The comparative fit index (CFI=0.950), indicating good model fit since the value is greater than 0.90 (Hatcher, 1994). Finally, normed fit indices showed good fit (NFI=0.931) with value greater than 0.90 (Bentler & Bonett, 1980). These model fit evaluations have led to the conclusion where the model fit for this extended model can be accepted and subsequently, interpretation of estimates is followed by this section.

4.6 Path Analysis

This research presents the adoption of extended TPB framework, by adding environmental concern, to investigate the intention to pay carbon tax and the amount the public is willing to pay in the context of Malaysia. The following sections will provide results and discussion on estimation of mean willingness

to pay carbon tax and path analysis of the latent variables employed in the extended TPB framework.

The path coefficient analysis from the structural model as shown in Table 4.11 revealed significant positive relationships between all three hypothesised determinants (AT, SN and PBC) and the IP. These results support H1, H2 and H3 as shown in Figure 4.1. This finding is consistent with Donald et al. (2014) and Tommasetti et al. (2018) who also found significant role of AT, SN and PBC in determining pro-environmental behaviour.

Among the three main TPB constructs, PBC emerged as the strongest predictor of intention to pay ($\beta = 0.425$, $p < 0.01$), followed by attitude ($\beta = 0.282$, $p < 0.01$) and then subjective norms ($\beta = 0.149$, $p < 0.01$). Interestingly, the result revealed that an individual's perceived ability to pay played a more prominent role in forming the intention to pay compared to social pressures and attitude. This highlights the importance of individuals feeling empowered and capable of paying the tax, similar to findings from Donald et al. (2014). Compared to AT, which reflects general feelings about the policy and action to reduce GHG emissions, PBC taps into a sense of control that might be particularly crucial for a new policy like a carbon tax. SN focuses on social pressure, but PBC emphasises individual agency. In this study, PBC were assessed through the level of confidence of respondents to pay carbon tax based on their ability, and the perceived ease to act with all the necessary resources equipped. In other words, provided with necessary information and support, public are more willing to pay carbon tax and are

confident that they can do so. Their perceived feasibility of the action, which in this case is paying the tax, could strengthen the role of PBC in predicting the intention (Donald et al., 2014).

Information asymmetry was one of the underlying factors outlined by Vermier and Verbeke (2006), as a key reason for low PBC due to lack of clear information would lead to feeling of uncertainty about the contribution of their pro-environmental choices. The appearance of PBC as the strongest predictor in this study thus indicated that a successful implementation of carbon tax policy that gain higher public acceptance is very much related to the availability and transparency of information to ensure the public understands how carbon tax could effectively reduce GHG emissions in Malaysia. This in fact provided a good insight to policy maker in designing, executing and monitoring the carbon tax policy. It is imperative to build trust and be transparent with the policy execution as highlighted by Klok et al. (2006), Gupta (2016), Umit and Schaffer (2020) and Zhang et al. (2021).

While subjective norm had a statistically significant effect, its influence was relatively weaker than AT and PBC, implying social pressure contributed the least among the three variables to affect the intention to pay carbon tax. Although not as predominant as the other two variable, social pressure still plays significant role in estimating intention to perform certain action. As stated by Górecki and Letki (2020), an individual's decisions are shaped by the social environment that one live in, where our act is influenced based on the extent of acceptance within our social group. Overall, these three

constructs (AT, SN and PBC) predict 54.3% of the variance in intention to pay carbon tax (Table 4.11). Figure 4.1 has shown the illustration of relationship between all latent variables and observed variable which explains the path analysis formed from the extended TPB model.

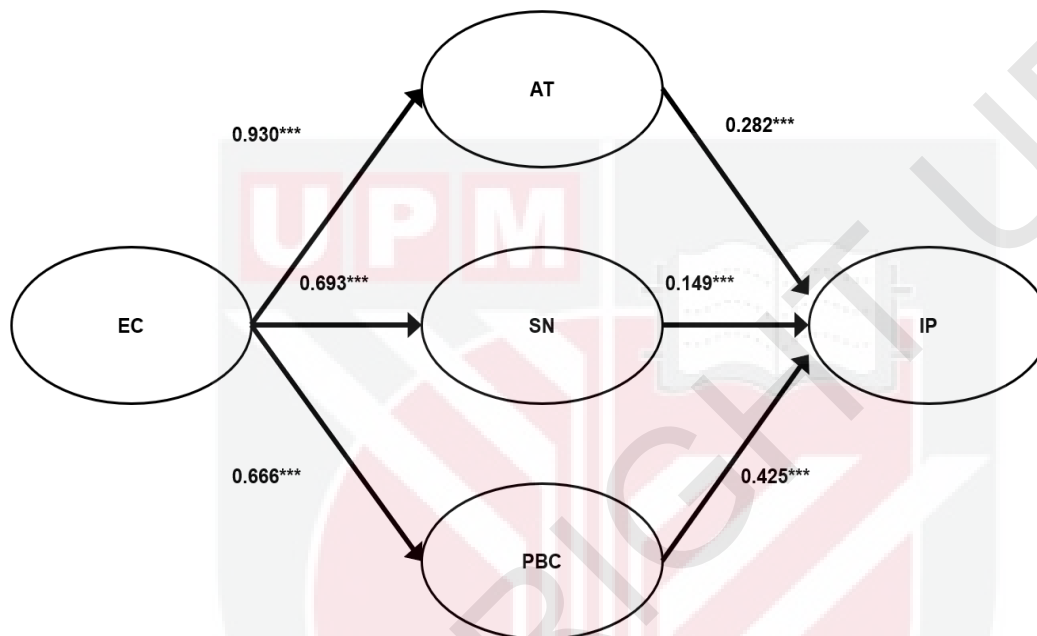


Figure 4.3: The structural model of intention to pay based on the extended TPB model

Note: *** significant at $p < 0.01$

Table 4.11: Results of path analysis

Path	Unstandardised Coefficient	Path coefficient	p-level	R ²
AT <--- EC	2.200	0.930	<.001	0.865
SN <--- EC	1.871	0.693	<.001	0.480
PBC <--- EC	1.527	0.666	<.001	0.444
BI <--- AT	0.311	0.282	<.001	0.543
BI <--- SN	0.144	0.149	0.006	
BI <--- PBC	0.485	0.425	<.001	

In the extended framework, environmental concern (EC) has significant affect towards attitude ($\beta = 0.930$, $p < 0.01$), subjective norm ($\beta = 0.693$, $p < 0.01$) and perceived behavioural control ($\beta = 0.666$, $p < 0.01$). The finding aligns with He et al. (2021), revealed a positive influence of EC to AT, SN and PBC. According to He et al. (2021), the extended TPB model provides a more explanatory model for predicting intention to pay, also improved the algorithm on determining the WTP for pro-environmental behaviour, in their case related to municipal solid waste management. The extended model provided a robust framework for predicting intention to pay carbon tax in this study. H5 to H7 are accepted. As we delve into the detail, EC has the greatest affect to AT compared to SN and PBC, implying that this result aligns to findings from Zahedi et al. (2019) and Kaffashi and Shamsuddin (2019) where EC has greatly contributed to predicting the AT.

CHAPTER 5

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary and Conclusion

The body of research in carbon tax has been long established. However, there is a lack in understanding factors that contributed to the willingness to pay carbon tax. This research has filled up the gap by integrating an extended Theory of Planned Behaviour to investigate psychological factors contributing to intention to pay carbon tax.

Using SEM, the result revealed that environmental concern significantly influences all three core psychological factors in TPB, which are AT, SN and PBC. The finding revealed that people who have more concern to environmental issues possessed more positive attitude to the implementation of carbon tax policy. However, attitude is not the predominant factor in predicting intention to pay. Perceived behavioural control plays the most important role in predicting the intention. This finding implied the importance of how the individuals perceived their ability to perform the action led to the actual intention. Overall, the study confirms the applicability of the TPB model in understanding the psychological factors that shape individuals' willingness to engage in pro-environmental behaviours, in this case, to pay for carbon tax.

5.2 Recommendations

Given the recent global climate challenges, the implementation of carbon tax policy in Malaysia can be deemed a starting point that fosters an appropriate behavioural change for national fiscal and climate policy reforms in the future (Wong et al., 2019). TPB framework in this study has revealed the underlying factors that potentially lead to willingness to pay carbon tax. This study has proven the significant and positive role of attitude, subjective norms and perceived behavioural control in predicting intention to pay carbon. Perceived behavioural control plays a more prominent role in predicting the intention to pay carbon tax. In addition to this, the introduction of environmental concern as an extended variable in the TPB model has proven to be crucial in influencing attitude, subjective norms and perceived behavioural control.

As a suggestion to enhance public support, policymakers should focus on public education campaigns that could enhance public awareness and knowledge regarding climate change as highlighted by Zahedi et al. (2019). The government can invest in public education and awareness campaign that highlight benefits of carbon taxes and the creation of green jobs. The programmes should also emphasis the individual's role in mitigating climate change and the ways in which paying carbon tax contributes to environmental protection.

This study also found perceived behavioural control as the strongest factor contributing to intention compared to attitude and subjective norms, indicating

individuals are more likely to support carbon tax policy if they feel confident in their ability to pay. In fact, their decision making is influenced by the availability of information to perform the behaviour (Vermier & Verbeka, 2006). This encourage policymakers to take into consideration the level of transparency and support to be provided to enhance the acceptance of carbon tax policy and ensure successful implementation of carbon tax in Malaysia. The policymakers should clearly outline the design and use of revenue from carbon tax to better convince public to support such initiative. Policymakers should also provide financial and other support to ensure fair contribution of low- and high-income individuals. Building trust as well, is important as this has been one of the factors that led to low public support for policy implementation (OECD, 2022). For instance, the British Columbian government clearly communicate their purpose of tax and how the revenue will be used. The British Columbian government also introduced the climate action tax credit programme to ensure the tax is implemented fairly and equitably. British Columbia is well-known for its transparent carbon taxation and revenue neutrality where the government return the revenue generated from carbon tax to households and businesses through tax deductions and credits. These transparencies are crucial to ensure public acceptance on carbon tax. In conclusion, the implementation of carbon tax policy requires robust analysis from various aspects other than determining the appropriate tax rate. Policymakers should take into consideration the aspects to designing an effective policy and external factors like increasing positive attitudes and environmental concern to enhance public support to such implementation.

5.3 Limitation of the Study

Several limitations of this study should be acknowledged. The current study's sample size consists of only 404. It is recommended to increase the sample size up to 500 for a more robust analysis that can better capture the opinion from a more diverse and bias-less population in Malaysia. Beside sample size, future study is also recommended to apply other sampling technique such as cluster sampling or random sampling to ensure least bias and good representative of sample from each subgroup.

To better capture the relationship between behavioural intention and actual intention, future study is recommended to integrate willingness to pay. Willingness to pay (WTP) can serve as a critical behavioural measure that offers insights into individuals' preferences for non-priced environmental goods (Hanley & Spash, 1993). This environmental valuation can be elicited using stated preference method such as Contingent Valuation Method (CVM) by presenting a hypothetical scenario that provide context of method that carbon tax will be introduced and ask the amount the respondents are willing to pay (Hanley & Spash, 1993).

Finally, it is recommended to expand the framework by including other possible factors as suggested by Kaffashi and Shamsuddin (2019) for a better understanding of factors affecting behavioural intention. The future inclusion could be the integration of socio-demographic factors (age, income, education level) or other psychological constructs such as environmental risk

perception as adopted by Maartensson and Loi (2021) to form a more comprehensive analysis. Future research that focuses on carbon tax implementation in Malaysia does not only provide valuable insights for policy design, but it also spread awareness to the public and enhance knowledge and awareness in this topic.



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APPENDIX



Understanding Public Intention to Pay Carbon Tax to Reduce Greenhouse Gas Emissions in Malaysia

Dear respondents,

Greenhouse gas (GHG) emissions caused global warming, thus significantly increase climate change impact. Both present and future generations are expected to experience adverse climate change impacts in the coming decades. Thus, this study aims to examine the intention of Malaysian to pay for a carbon tax to reduce GHG emissions.

Your participation in this study will provide behavioural information on carbon tax. The information could be used in shaping carbon tax policy and climate change mitigation strategies in Malaysia.

This research is conducted with support from Universiti Putra Malaysia. All information will be treated with confidentiality and used only for scientific research.

Thank you for your time and cooperation.

For any queries, please contact:

Gai Mei Yin
Department of Forestry Science and Biodiversity
Faculty of Forestry and Environment
Universiti Putra Malaysia (UPM)
43400 UPM Serdang, Selangor
Phone : +60-1135366219/ Email: gmeiyin98@gmail.com

What is greenhouse gas (GHG)?

Greenhouse gas (GHG) refers to gases (carbon dioxide, methane, etc.) that trap heat in the atmosphere, causing the rise in temperature, which is commonly known as global warming. It has led to catastrophic climate events (e.g., prolonged droughts, extreme heat, frequent floods) that affect the safety and security of livelihoods.

What is carbon tax?

The severity of climate change impacts has urged global leaders to curb carbon emissions (e.g., by promoting renewable energy, increasing production efficiency, reducing emissions from transportation, etc.). Carbon tax is one of the pricing tools that have been implemented by many countries (e.g., Canada, China, Japan, the European Union) to reduce GHG emissions. It places a monetary value on every tonne of GHG emitted and requires the emitters (individuals and businesses) to pay the cost of their pollution (carbon footprint).

Does carbon tax exist in Malaysia?

In March 2023, Malaysia established the Voluntary Carbon Market (VCM) which is facilitated by the Bursa Carbon Exchange to allow a voluntary carbon offset by large corporations and other individuals (<https://bcx.bursamalaysia.com/web>). The Malaysian government currently does not impose carbon tax but in order to achieve Malaysia's 2050 net-zero emission pledge, there is a possibility where carbon tax will be applied nationally in the future.

Part A: How concern are you on climate change impacts?

Please choose **ONE NUMBER** for each statement to indicate your level of awareness.

		Not At All Aware	Slightly Aware	Somewhat Aware	Moderately Aware	Extremely Aware
1	I think climate change impacts are becoming serious in recent years.	1	2	3	4	5
2	My level of concern about the effect of climate change on my health and well-being (e.g., mental health, deaths due to extreme weather, food insecurity).	1	2	3	4	5
3	My level of concern about the state of the world's environment and what it means for the future.	1	2	3	4	5

Part B: What is your attitude towards paying the carbon tax?

Please choose **ONE NUMBER** for each statement to indicate your agreement.

Level of Agreement		Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
1	I feel positive to support carbon tax in Malaysia, if the government has implemented.	1	2	3	4	5	6	7
2	The idea of paying to reduce GHG emissions is very reasonable.	1	2	3	4	5	6	7
3	Carbon tax is the best method to reduce GHG emissions.	1	2	3	4	5	6	7

Part C: To what extent your closest person (i.e., family members, friends, colleague, government, and environmental agencies) will affect your decision to pay carbon tax?

Please choose **ONE NUMBER** for each statement to indicate your agreement.

Level of Agreement	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
1 People whose opinions I value think I should pay carbon tax.	1	2	3	4	5	6	7
2 My family think I should pay carbon tax.	1	2	3	4	5	6	7
3 My close friends think I should to pay carbon tax.	1	2	3	4	5	6	7

Part D: How is your control over the decision to pay carbon tax?

Please choose **ONE NUMBER** for each statement/question to indicate your agreement.

Level of Agreement	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
1 I have control to decide if I want to pay carbon tax (If I want, I will pay carbon tax). [change to: I am confident that if I want, I can pay for reducing emissions]	1	2	3	4	5	6	7
2 If I have the resources, money, time and opportunity, I will pay carbon tax.	1	2	3	4	5	6	7
3 If I do not have financial pressure, it would be easy for me to pay carbon tax.	1	2	3	4	5	6	7

Part E: How willing are you to pay a carbon tax?

Please choose ONE NUMBER for each statement/question to indicate your agreement.

Level of Agreement	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
I am willing to make an effort to reduce GHG emissions.	1	2	3	4	5	6	7
I am willing to pay carbon tax to reduce GHG emission.	1	2	3	4	5	6	7
Level of Willingness	Extremely Unwilling	Quite Unwilling	Slightly Unwilling	Neither Willing nor Unwilling	Slightly Willing	Quite Willing	Extremely Willing
How willing are you in paying carbon tax to reduce GHG emission?	1	2	3	4	5	6	7

Part F: Respondent's Demographic

1. Gender : ☐ Male
☐ Female
2. Race : ☐ Malay
☐ Chinese
☐ Indian
☐ Other:
3. Marital Status : ☐ Married
☐ Single
☐ Others:
4. Age (years old) : ☐ 35 and above ☐ 19 - 23
☐ 29 – 34 ☐ 19 and below
☐ 24 - 28
5. Education Attainment : ☐ No Formal Education ☐ Bachelor's Degree
☐ Primary School ☐ Master's Degree
☐ Secondary School ☐ PhD/Doctorate Degree
☐ Diploma ☐ Professional Certificate
6. Occupation : ☐ Student ☐ Private sector
☐ Self-employed ☐ Unemployed
☐ Government servant ☐ Other:
7. Monthly Income (RM) : ☐ 5,000 above ☐ 2,001 – 3,000
☐ 4,001 – 5,000 ☐ 1,001 – 2,000
☐ 3,001 – 4,000 ☐ Below 1,000

8. Do you aware of any type of carbon tax?
- ☐ No, I am not aware
 - ☐ Yes, I am aware.
 - ☐ Somewhat aware.
9. Do you use car/motorcycle in everyday life?
- ☐ Yes, I always drive car/motorcycle.
 - ☐ Yes, I occasionally drive car/motorcycle.
 - ☐ No, I don't use car/motorcycle, but I use other mode of transportation (bus/train/Grab/taxi etc).
 - ☐ No, I walk everyday.
10. Have there been any extreme climate phenomena (e.g., prolong draught, severe flooding, extreme rain) in your area?
- ☐ Not at all
 - ☐ Yes, the extreme climate phenomena frequently occur
 - ☐ Yes, and somewhat become regular in comparison to the previous years
 - ☐ I don't know
11. How many times you have experienced meteorological events that are believed to be caused by climate change?
- ☐ 1 – 3 times in a year
 - ☐ 4 – 6 times in a year
 - ☐ 7 – 10 times in a year
 - ☐ More than 10 times in a year
 - ☐ None
12. How many times have you attended seminar / workshop / conference pertaining to climate change issues?
- ☐ 1 – 3 times in a year
 - ☐ 4 – 6 times in a year
 - ☐ 7 – 10 times in a year
 - ☐ More than 10 times in a year
 - ☐ None
13. Do you think that the current national policy and strategy on disaster management are adequate to address climate change and manage the associated risks?
- ☐ No
 - ☐ Yes
 - ☐ To some extent
 - ☐ I don't know

14. As Malaysian, do you think your input should be considered in the formulation of our national climate policy?

- ☐ No
- ☐ Yes
- ☐ To some extent
- ☐ I don't know

15. Are you currently involved in any climate-related work / activities / policymaking / advocacy etc.?

- ☐ No
- ☐ Yes
- ☐ Somewhat

16. What are your TOP 3 climate concerns?

- ☐ Extreme (high and low) temperatures
- ☐ Drought and wildfires
- ☐ Availability of fresh water (decrease in water quality and quantity)
- ☐ Natural events (floods, landslides, storms)
- ☐ Rising sea level and coastal areas flooding
- ☐ Biodiversity loss
- ☐ Soil erosion
- ☐ Destroy coastal and marine ecosystem
- ☐ Health (mortality, illness, spread of diseases)
- ☐ Vulnerable population (low-income group, women, unemployed, socially marginalised people)
- ☐ Employment (businesses exposed to climate risks)
- ☐ Food insecurity
- ☐ Infrastructure disruptions

17. Who do you think is primarily responsible for the reduction of climate change impacts?

- ☐ Government
- ☐ Non-profit organisations (World Wildlife Fund, Greenpeace, etc)
- ☐ Businesses and Corporations
- ☐ Citizens
- ☐ All of above

BIODATA OF STUDENT

Gai Mei Yin was born in 1998 at Kuala Lumpur, Malaysia. She received her Bachelor of Economics from Universiti Putra Malaysia in 2022 and enrolled as a master student in Environmental Economics, Planning and Management programme in the same year under Faculty of Forestry and Environment. Her research interests include sustainable development, carbon pricing policies, and Environmental, Social and Governance (ESG). The recent establishment of Voluntary Carbon Market (VCM) marketplace in Malaysia has sparked her interest to research carbon pricing policies and delve into it from the social science angle.

LIST OF PUBLICATIONS

Gai, M. Y., Hassan, M. L., Anak Empidi, A. V., Juraimi, U. F., Mohd Noorazman, N., & Emang, D. (2024). Public Perceptions on the Importance of Ecosystem Services from Vulnerable Forest: A Case Study of Ampang Forest Reserve, Selangor, Malaysia. *Journal Manajemen Hutan Tropika*, 30(1), 61-69. <https://doi.org/10.7226/jtfm.30.1.61>

