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# THE IMPACTS OF ATTITUDE, KNOWLEDGE, AND BELIEF ON CARBON NEUTRALITY: EVIDENCE FROM HONG KONG

**Ka Chun Fung**
*Hong Kong Metropolitan University,*
*Hong Kong, China*
*E-mail: afund@hkmu.edu.hk*
*ORCID 0009-0004-1468-8456*

**Kwok Yip Cheung**
*Hong Kong University of Science and Technology,*
*Hong Kong, China*
*E-mail: acstcheung@ust.hk*
*ORCID 0000-0003-4461-5579*

**Chung Yee Lai**
*Brittany Universite,*
*Paris, France*
*E-mail: tracyx4128@gmail.com*
*ORCID 0000-0002-6666-776X*

**Li Li Lily Pang**
*Brittany Universite,*
*Paris, France*
*E-mail: lilypang22@hotmail.com*

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**ABSTRACT**. This study employs the Theory of Planned Behavior and the Theory of Reasoned Action to investigate the relationships among belief, attitude, knowledge, and intention towards carbon neutrality. Structural equation modeling is used to analyze data from a sample of 392 respondents. The results indicate that knowledge and belief positively influence the intention to adopt carbon neutrality, which is consistent with previous research. However, contrary to expectations, the study does not find significant correlations between knowledge and attitude or between attitude and behavioral intention. Belief is found to play an important mediating role in the relationships between knowledge and intention, as well as between attitude and intention. The research highlights the importance of contextual variables in understanding the relationship between knowledge, belief, and attitude towards carbon neutrality. The findings have significant implications for policymakers and marketers who seek to promote carbon neutrality and emphasize the need to develop and promote belief systems that prioritize carbon neutrality. Overall, the study provides valuable insights into the factors which affect the intention to adopt carbon neutrality.

***Keywords***: carbon neutrality, attitude, knowledge, belief, Hong Kong

## Introduction

The increase in global temperature due to human activities has led to the worldwide challenge of climate change. In response, the Paris Agreement endeavors to prevent a global temperature rise beyond two degrees Celsius (Cherp et al., 2021). However, in the absence of supplementary measures, the global temperature could surge by four degrees Celsius by the year 2100 (Global IPCC, 2021). The concept of "carbon peak" signifies a pivotal moment in history when carbon dioxide emissions shift from an upward trajectory to a downward trend, indicating the decoupling of carbon emissions from economic growth. To achieve carbon peak across nations, it is crucial to improve carbon emission efficiency. The Paris Agreement also emphasizes the need for participating countries to transition their economies towards green growth and contribute to enhancing carbon production efficiency for sustainability. Nonetheless, significant diversity exists in the carbon emission performance across economies, attributable to the differing stages of development among nations (Furlan & Mariano, 2021). Developing countries exhibit relatively low carbon emission efficiency but possess substantial potential for reducing emissions, while developed countries are actively formulating their low-carbon development objectives and policies (Wang et al., 2021).

Carbon reduction strategies cannot consist of emission reduction alone to be entirely effective as $CO_2$ emissions cannot be reduced to absolute zero. Certain industries, such as cement production, face challenges in achieving zero emissions, even if the power industry undergoes a complete transition to renewable energy sources (Zhao et al., 2022). Requiring firms to completely halt their operations for zero emissions may not be a feasible solution to the climate change issue. Instead, individuals and organizations can strive for carbon neutrality by taking actions to offset the carbon they emit, resulting in a net impact of zero emissions. The European Parliament (2023) defines carbon neutrality as achieving a balance between carbon absorption in the atmosphere and carbon emissions. It is considered a key indicator for global commitment under the Sustainable Development Goal (SDG) 13 - Climate Change, which is derived from the goals set in the Paris Agreement to be achieved by 2050.

Since the introduction of the "sustainable development" concept in 1987, multiple international agreements and protocols have been established to demonstrate nations' commitment to addressing climate change and promoting environmental preservation. The Paris Agreement, signed in 2015, is a significant agreement related to carbon neutrality. It requires the 190 participating parties to take action for achieving four goals: limiting the global temperature increase on average to 1.5 degrees Celsius above pre-industrial levels, peaking global emissions, and rapidly reducing emissions to attain equilibrium between emissions and removal in the latter half of the 21st century (European Commission, 2018). Countries have the responsibility to design and implement plans to slow down carbon emissions based on their capabilities and emission contexts, with the targets and effectiveness of these plans reviewed every five years (Burleson, 2016).

Carbon neutrality can be accomplished through two main approaches: reducing carbon emissions and increasing carbon absorption. One method is carbon offsetting, achieved by transitioning to cleaner energy sources. World Nuclear Association (2022) emphasizes that a significant portion of annual CO2 emissions comes from electricity production using traditional fossil fuels, particularly coal and crude oil. Investing in new and cleaner forms of energy sources can help to minimize reliance on polluting fossil fuels and lead to lower carbon dioxide and greenhouse gas emissions, helping to restore the carbon cycle's balance (International Energy Agency, 2022).

Achieving carbon neutrality requires proactive measures, such as constructing facilities to absorb carbon emissions, while carbon emission reduction involves limiting emissions

through passive means. Carbon neutrality demands greater commitment in terms of time and cost compared to carbon emission reduction, as it requires not only reducing emissions but also implementing strategies to actively absorb carbon. This is because carbon neutrality requires completely offsetting all carbon emissions, which can be a complex and costly process. In contrast, carbon reduction involves gradually reducing emissions over time, which can be implemented more easily and with less disruption. Moreover, achieving carbon neutrality may require significant changes to a company's operations and supply chain (Zhang et al. 2022). Therefore, it is important to investigate the inherent traits of management in Hong Kong companies to determine their ability to implement carbon neutrality.

The study makes five key contributions as below:

i) it enhances our understanding of the psychological and behavioural factors related to the adoption of carbon neutrality. By investigating these factors, the study addresses the issue of why companies in Hong Kong have been slower to embrace carbon neutrality compared to other regions;

ii) it extends established theoretical frameworks, such as the Theory of Planned Behaviour (TPB) and Theory of Reasoned Action (TRA), to analyze the behavioural intention and influencing factors related to carbon neutrality. This offers a solid theoretical foundation for predicting and understanding behaviours in the context of carbon neutrality;

iii) it offers policy implications and recommendations to promote carbon neutrality in Hong Kong. These recommendations may involve strategies to improve knowledge dissemination and foster stronger belief in the concept of carbon neutrality, thereby encouraging greater participation and adoption of sustainable practices. For example, the government could focus on providing education to senior management to enhance their knowledge of carbon neutrality, which could, in turn, influence their decisions to adopt carbon neutrality. Additionally, since knowledge positively influences belief, which subsequently affects intention, the government could design promotional strategies aimed at improving the knowledge of senior management towards carbon neutrality;

iv) it identifies belief as a significant mediator in the relationship between knowledge and intention, as well as between attitude and intention. This helps better understand the complex interplay between these factors in shaping managers' intentions towards embracing carbon neutrality;

v) it identifies areas for future research, particularly in investigating any context-specific factors that result in insignificant relationships between knowledge and attitude as well as between attitude and intention. These gaps in understandings provide opportunities for further exploration and analysis in the field.

## 1. Literature review and hypotheses development

### *Background for the study*

This study was conducted in Hong Kong. The Chinese central government has committed to the goals outlined in the Paris Agreement, specifically aiming to reach carbon peak by 2030 and achieve carbon neutrality by 2060. As the largest carbon emitter, China accounts for 28% of carbon gas emissions worldwide in 2019 (Friedlingstein et al., 2020). The goals set by the central government also apply to Hong Kong, and the Hong Kong government established the “Climate Action Plan 2030+” to reduce carbon emissions by 50% by 2035 and achieve carbon neutrality by 2050 (Environment Bureau, 2017). To support decarbonization efforts, carbon trading is becoming more common in Hong Kong. The Hong Kong Exchange and Clearing Limited collaborated with the Financial Services Development Council to

introduce a voluntary carbon market in 2022. This initiative aims to provide quality carbon credits for companies to trade and facilitate cooperation and cross-border carbon trading with Mainland China's financial markets (Hong Kong Financial Services Development Council, 2023).

Understanding knowledge, attitudes, and behaviors related to carbon neutrality is important. According to a study conducted in the building industry, stakeholders exhibit a negative attitude and lack proper implementation of zero carbon building practices due to inconsistent understanding of the concept. Adequate knowledge exposure is identified as essential for fostering positive attitudes and behavioural change (Pan & Pan, 2020). From a policy and market perspective, the progression of carbon neutrality in Hong Kong lags behind other Asian financial hubs. The government focuses on fiscal mechanisms and direct investment in green initiatives to promote carbon emission reduction but there is a lack of strong positive responses. For instance, the government provides incentives such as tax waivers and subsidies for electric vehicles, but without these extrinsic incentives, new adoption of electric vehicles decreases significantly. Extra efforts are essential for creating a sustained trend of change (Liu et al., 2022; Zhu et al., 2021). Given the current development and characteristics in Hong Kong, it is important to examine how intrinsic characteristics of individuals impact carbon neutrality. Therefore, it is crucial to comprehend how individuals' beliefs, attitudes, and knowledge influence their intention to embrace carbon neutrality in the city.

### *Theoretical framework*

Theory of Planned Behavior (TPB) was developed by Ajzen in 1991 as a framework to explain decision-making processes in specific situations, including health, learning, and protective behaviors. The TPB emphasizes the role of behavioral intention, which is affected by three factors: subjective norm, behavioral attitude, and perceived behavioral control. Previous studies have applied the TPB to examine behavioral intentions associated with air pollution control, afforestation, carbon reduction, and community governance (Ajzen, 1991; Lin et al., 2012; Xu et al., 2020). Nevertheless, there is currently a lack of research utilizing this theory to investigate the factors which drive individual adoption of carbon neutrality.

Theory of Reasoned Action (TRA), proposed by Fishbein and Ajzen in 1975, suggests that an individual's behavior is determined by their behavioral intention, which is affected by their attitude toward the subjective norm and behavior. According to Ajzen and Fishbein (1980), intention serves as the most influential factor in determining behavior. The TRA has been widely adopted to study various behaviors, including renewable energy adoption, hybrid electric vehicle adoption, and recycling, and is a generalizable theory that applies across different cultures (Ajzen & Fishbein, 1980; Bang et al., 2000; Fishbein & Ajzen, 1975; Goldenhar & Connell, 1993; Park & Levine, 1999; Wang et al., 2014). However, no research has yet used the theory to examine the determinants that influence the adoption of carbon neutrality in Hong Kong.

### *Hypothesis development*

Despite no specific research on the relationships between knowledge, belief, attitude, and intention toward embracing carbon neutrality, prior research in the field of environmental protection, renewable energy technologies, and energy-saving products has demonstrated significant relationships among these variables. These studies have often employed the TPB or TRA as theoretical frameworks (Ajzen, 1991; Ajzen & Fishbein, 1980; Bang et al., 2000; Fishbein & Ajzen, 1975; Goldenhar & Connell, 1993; Park & Levine, 1999; Lin et al., 2012;

Wang et al., 2014; Xu et al., 2020). Hence, in our study, we use these two theories to explain the factors which influence the intention to embrace carbon neutrality in Hong Kong.

### *Carbon neutrality knowledge and attitude*

Previous studies have consistently demonstrated a positive correlation between environmental attitude, environmental knowledge, and the intention to engage in environmental behaviors (Fang et al., 2021; Haryanto, 2014; Rusyani et al., 2021; Itasanmi, 2019). These findings suggest that individuals with a higher level of environmental knowledge tend to exhibit more positive attitudes and a greater willingness to take action in safeguarding the natural environment (Haryanto, 2014). Existing empirical studies suggest that knowledge significantly influences attitudes (Pooley & O'Connor, 2000). Within the consumer context, individuals with a deeper understanding and heightened awareness of the environment generally display positive environmental attitudes (Dangelico & Vocalelli, 2017). Mostafa (2009) has shown that environmental knowledge positively impacts consumers' attitudes towards green products. Furthermore, Simanjuntak et al. (2023) discovered that environmental knowledge is important driver of environmental care attitudes in the green consumption context. Based on the findings of similar studies in environmental protection behavior, we propose the following hypothesis:

H1: There is a positive and significant effect of carbon neutrality knowledge on attitude.

### *Carbon neutrality knowledge and belief*

According to Alba and Hutchinson (1987) and Cordell (1997), consumer knowledge comprises two primary components: familiarity and expertise, which together contribute to product knowledge. Familiarity refers to product-related experience, while expertise pertains to the ability to perform task related to the products. For durable goods like refrigerators or washing machines, consumers may have limited firsthand experience with a specific brand compared to frequently replaced items. Consequently, objective factual information is more likely to influence their beliefs and perceptions about energy-efficient products and their environmental impact (Farhar, 1996). In the context of the TRA, marketing energy-saving products as energy-efficient devices and modern product innovations and energy-efficient devices can bolster consumer beliefs, as better green product knowledge fosters stronger convictions in the advantages of using such products and cultivates more positively balanced beliefs about the influence of their usage (Bang et al., 2000). Based on the findings of similar prior studies, we propose the following hypothesis:

H2: There is a positive and significant effect of carbon neutrality knowledge on belief.

### *Carbon neutrality knowledge and intention*

Wang et al. (2014) investigated the relationship between environmental knowledge, environmental value, environmental sensitivity, environmental responsibility, response efficacy, perceived behavioral control, and environmental behavioral intention. Their findings indicate that environmental knowledge positively correlates with environmental behavioral intention. This aligns with previous research that has consistently demonstrated the impact of environmental knowledge on behavioral intention, as knowledge is considered a robust predictor of behavior (Ajzen, 1991; Rusyani et al., 2021; Itasanmi, 2019; Wang et al., 2014). However, Simanjuntak et al.'s (2023) recent study found that environment knowledge does not

significantly influence consumers' intention to purchase green products. Despite the diverse results, we propose the following hypothesis:

H3: There is a positive and significant effect of carbon neutrality knowledge on intention.

### *Carbon neutrality attitude and intention*

According to Dangelico and Vocalelli (2017), consumers who hold a positive environmental attitude tend to demonstrate a higher likelihood of responding positively towards organic products. Although there are various studies examining environmental factors based on individuals' information, there is a scarcity of research specifically dedicated to exploring the attribute of attitude. However, it has been found that a higher environmental attitude leads to a greater perceived value of the product. Environmental attitude is significantly associated with eco-friendly purchasing behavior (Rokicka, 2002; Baldi et al., 2021). Consumers with a stronger environmental attitude tend to have more confidence in evaluating products, which directly influences their perceptions of perceived value, quality, and purchase intentions (Wang et al., 2019). Based on the findings of similar prior studies, we propose the following hypothesis:

H4: There is a positive and significant effect of carbon neutrality attitude on intention

### *Carbon neutrality attitude and belief*

The attitude towards embracing eco-innovation mirrors an individual's beliefs regarding the reduced negative environmental impact and increased benefits associated with eco-innovations, aligning with their green values (Landrigan, 2016). Numerous research has provided evidence of a positive association between consumer attitudes and the intention to adopt new technology, particularly sustainable electric vehicles (Yurdakul & Kazan, 2020; Shi, Wang & Zhao, 2017; Wang & Yan, 2016; Zhang, Bai & Shang, 2018). Based on the findings of similar prior, we propose the following hypothesis:

H5: There is a positive and significant effect of carbon neutrality attitude on belief.

### *Carbon neutrality belief and intention*

Previous studies on green energy consumption have highlighted that residents' beliefs about the benefits of green energy consumption are closely linked to their understanding and knowledge of the advantages offered by renewable energy technologies in terms of energy efficiency, energy security, and environmental mitigation (Komendantova & Yazdanpanah, 2017). Consumers tend to compare the performance of renewable energy technologies with traditional energy sources and make decisions with reference to socio-economic factors (Colmenares-Quintero et al., 2020). Therefore, it is essential to make efforts to enhance individuals' knowledge regarding the benefits of carbon neutrality. With reference to the findings of similar prior studies, we propose the following hypothesis:

H6: There is a positive and significant effect of carbon neutrality belief and intention

### *The mediating role of carbon neutrality belief*

Beliefs are mental representations of true propositions about the world that can influence individual's consciousness of the consequences resulting from their behaviors (Gifford & Nilsson, 2014; Lind et al., 2015). Within the realm of environmental matters, the term "personal efficacy" denotes the belief held by individuals that they possess the capacity to enact meaningful change in addressing collective challenges, and that their actions can contribute to the accomplishment of shared objectives (Steg & De Groot, 2010). Self-determination theory suggests that people with ecologically friendly belief systems have greater concern for environmental problems and a stronger sense of environmental responsibility, leading to autonomous motivation to align their actions with their beliefs in a compatible manner (Zhu et al., 2021). Based on the findings of prior studies, we propose the following hypotheses:

H7 Belief mediates the relationships between knowledge and intention

H8 Belief mediates the relationships between attitude and intention

## 2. Methodological approach

### *Data collection and sampling*

A questionnaire survey was conducted in Hong Kong. To ensure content validity, the questionnaires underwent a review process conducted by a university researcher, all of whom possessed research experience in attitude, belief, knowledge, and intention and two senior managers of listed companies. We mailed the questionnaire survey to senior management or middle management of the top 1000 listed companies in Hong Kong from February to June 2023 according to their market capitalization. A total of 398 responses was received, resulting in a response rate of 39.8 percent. After eliminating six incomplete responses, 392 usable responses remained for analysis. The determination of the sample size followed the guidelines of Hair et al. (2019), which suggest having 5 to 10 responses per item as the criterion. With 16 items in the questionnaire, a sample size of 80 to 160 was considered sufficient. The obtained 392 usable responses fall within the suggested range for conducting structural equation modeling, which typically requires between 100 and 200 responses. The data were subsequently analyzed using the structural equation modeling approach (Hair et al., 2019).

### *Instruments*

The study utilized a two-part questionnaire, with Part One aimed at gathering information about the participants and their respective companies., while Part Two includes items that measure attitude, belief, knowledge, and intention towards carbon neutrality. The items adopted in this study were adopted from previous studies. Respondents indicated their level of agreement with the items on the same five-point Likert scale. Attitudes were assessed using four items adopted from Zhang et al. (2022), Özkan (2001), and Saba and Messina (2003). To measure the belief in carbon neutrality, a four-item scale was employed, which was developed by Doran, Hanss, and Larsen (2015). Knowledge about carbon neutrality was assessed using four-items scale adopted by Ellen (1996). The intention to adopt carbon neutrality was measured through four items adapted from Bock et al. (2005), and Tabernero and Hernández (2011). Table 1 shows the questionnaire contents (Annex).

## 3. Conducting research and results

### *Descriptive statistics*

Out of the 392 respondents who completed the questionnaire, 68.11% were male. The largest age group was 41-50 years old, accounting for 42.90% of the respondents, followed by 29.08% in the 51-60 age group. In terms of education, 60.46% had bachelor's degrees, 26.02% possessed master's degrees, 7.66% had doctoral degrees, and 5.86% possessed other qualifications. The industries of the respondents' companies were diverse, with 30.36% from industrials, 28.57% from consumer discretionary, and 8.16% from technology. The descriptive statistics are summarized in Table 2

Table 2. Descriptive statistics

| Items | Characteristics | Results |
|---|---|---|
| Gender | Male | 68.11% |
| | Female | 31.89% |
| | | |
| Education | Bachelor’s degree | 60.46% |
| | Master’s degree | 26.02% |
| | Doctoral Degree | 7.66% |
| | Other qualification | 5.86% |
| | | |
| Age | 20-30 | 2.77% |
| | 31-40 | 22.19% |
| | 41-50 | 42.90% |
| | 51-60 | 29.08% |
| | 61 or above | 3.06% |
| | | |
| Industries | | |
| | Basic Materials | 5.61% |
| | Communication Services | 5.10% |
| | Consumer Discretionary | 28.57% |
| | Consumer Staples | 8.16% |
| | Energy | 3.57% |
| | Financials | 4.08% |
| | Health care | 2.04% |
| | Industrials | 30.36% |
| | Real Estate | 3.57% |
| | Technology | 8.16% |
| | Utilities | 0.77% |

### *Common method bias*

To address the potential threat of common method bias, this study employed Kock's (2015) approach. Common method bias occurs when respondents tend to answer different questionnaire items in a similar manner, leading to shared variation among the indicators (Kock, 2015). This bias can result in inflated path coefficients, which may lead to false-positive findings (Type I errors). Additionally, as latent variables incorporate the shared variation, they can exhibit increased collinearity levels among each other, further inflating path coefficients. To detect and mitigate common method bias, the study examines the average variance extracted

(AVE) and the variance inflation factor (VIF). If common method bias is present, the correlations among latent variables would increase, resulting in higher AVEs. Moreover, increased correlations would lead to higher VIF values, indicating pathological collinearity. Kock (2015) suggests that a VIF exceeding 3.3 is indicative of collinearity issues and a model contaminated by common method bias. In the current study, all VIF values are less than 3.3, ranging from 1 to 1.040, indicating no pathological collinearity. Therefore, based on the full collinearity test, we can conclude that the model is free from common method bias (Kock, 2015).

### *Measurement model*

In this research, Partial Least Square Structural Equation Modeling (PLS-SEM) is utilized. PLS-SEM has several advantages, including its ability to handle small sample sizes, make predictions, and prevent inadmissible solutions (Fornell & Larcker, 1981). The analysis involves two steps: testing the measurement model's appropriateness and examining the hypothesized relationships in the structural equation model.

The measurement model includes standard factor loadings (SFL) of the items, Cronbach's alpha, composite reliability (CR), and average variance extracted (AVE). To establish convergent validity, CR and AVE values should exceed 0.70 and 0.50 respectively (Hair et al., 2019). The results of the measurement model, presented in Table 3 and Table 4, indicate that all constructs had CR and AVE values greater than the recommended thresholds, signifying high levels of convergent validity. The overall measurement model adequately fits the data, with all 16 items.

The goodness of fit (GOF) indices of the measurement model is displayed in Table 5. The results reveal that the chi-square is of significance at the 0.040 level. However, the absolute fit index of minimum discrepancy chi-square can be disregarded when the sample size is over 200 (Hair et al., 2019). The GFI value is 0.962, surpassing the recommended threshold of 0.9. Upon adjustment of the degrees of freedom, the adjusted GFI (AGFI) is 0.947, surpassing the specified threshold of 0.80. This indicates that the model successfully captures 94.7% of the variance and covariance present in the survey data.

The comparative fit indices (CFI), Tucker-Lewis index (TLI), and incremental fit index (IFI) all exceed he cutoff value of 0.9 (0.993, 0.992, and 0.993, respectively), suggesting a good fit of the model to the data (Bagozzi & Yi, 1988; Hair et al., 2019; Ho, 2006). Additionally, the root-mean-square error of approximation (RMSEA) is 0.026, which is less than the recommended threshold of 0.1 (Schumacker & Lomax, 2010). Furthermore, the relative CMIN/df value is 1.263, which is below 5, suggesting a good fit of the model (Bagozzi & Yi, 1988). Given the sufficient fit of the modified CFA model to the data, no adjustments are necessary.

Table 3. Measurement model

| Constructs | Items | Standardized factor loading | Cronbach's Alpha (ά) | Convergent Validity | |
|---|---|---|---|---|---|
| | | | | Composite reliability (CR) | Average Variance Extracted (AVE) |
| Belief (BF) | BF1 | 0.906 | 0.899 | 0.930 | 0.768 |
| | BF2 | 0.800 | | | |
| | BF3 | 0.907 | | | |
| | BF4 | 0.889 | | | |
| Attitude (AT) | AT1 | 0.900 | 0.910 | 0.935 | 0.783 |
| | AT2 | 0.786 | | | |
| | AT3 | 0.940 | | | |
| | AT4 | 0.904 | | | |
| Knowledge (KN) | KN1 | 0.832 | 0.871 | 0.909 | 0.714 |
| | KN2 | 0.868 | | | |
| | KN3 | 0.830 | | | |
| | KN4 | 0.850 | | | |
| Intention (IN) | IN1 | 0.891 | 0.882 | 0.918 | 0.737 |
| | IN2 | 0.867 | | | |
| | IN3 | 0.866 | | | |
| | IN4 | 0.807 | | | |

Table 4. Discriminant validity

| Latent variables | AT | BF | IN | KN |
|---|---|---|---|---|
| AT | 0.776 | | | |
| BF | 0.450 | 0.872 | | |
| IN | 0.516 | 0.553 | 0.839 | |
| KN | 0.411 | 0.475 | 0.420 | 0.725 |

Table 5. Goodness-of-fit indices of the CFA model

| Fit index | Modified Model | Recommended values | Source |
|---|---|---|---|
| df | 99 | | |
| CMIN ($\chi^2$) | 125.04 | | |
| p-value | 0.04 | > 0.05 | |
| $\chi^2$/df | 1.263 | ≤ 5.00 | Bagozzi and Yi (1988) |
| GFI | 0.962 | ≥ 0.90 | Hoyle (1995) |
| AGFI | 0.947 | ≥ 0.80 | Chau and Hu (2001) |
| CFI | 0.993 | ≥ 0.90 | Bagozzi and Yi (1988), Byrne |
| TLI | 0.992 | ≥ 0.90 | Hair et al. (2019), Ho (2006) |
| IFI | 0.993 | ≥ 0.90 | Hair et al. (2019), Ho, (2006) |
| RMSEA | 0.026 | ≤ 0.10 | Schumacker and Lomax (2010) |

### *Hypothesis testing*

The results of hypothesis testing are displayed in Table 6, indicating that belief exhibits the most robust correlation with intention ($\beta = 0.228$; $t = 4.660$; $p < 0.01$), while attitude has the weakest relationship with intention ($\beta = 0.06$; $t = 1.173$; $p > 0.10$). The study finds that the relationship between knowledge and attitude is not significant ($\beta = 0.067$; $t = 1.257$; $p > 0.10$), so H1 is not supported. Nevertheless, knowledge is a strong predictor of belief ($\beta = 0.133$; $t =$

2.740; p < 0.01), and the impact of knowledge on intention is significant (β = 0.137; t = 2.828; p < 0.01), supporting H2 and H3, respectively. Attitude is not a significant determinant of intention (β = 0.060; t = 1.173; p > 0.10), so H4 is not supported. H5 and H6 are supported as the impacts of attitude on belief are significant (β = 0.134; t = 2.765; p > 0.01), and the effects of belief on intention are significant (β = 0.228; t = 4.660; p < 0.01). The study also observes that the mediating effect of belief on the relationships between knowledge and intention is significant (β = 0.031; t = 2.384; p < 0.05), supporting H7, and the mediating effect of belief on the relationships between attitude and intention is significant (β = 0.031; t = 2.350; p < 0.019), supporting H8. The results of our hypotheses are largely consistent with our findings except H1 and H4. The model is shown in Figure 1 as follows:

Table 6. Hypotheses Testing

| Hypotheses | Beta | p-values | t-values | Decision |
|---|---|---|---|---|
| H1: KN-> AT | 0.067 | 0.209 | 1.257 | Not Supported |
| H2: KN -> BF | 0.133*** | 0.006 | 2.740 | Supported |
| H3: KN -> IN | 0.137*** | 0.005 | 2.828 | Supported |
| H4: AT -> IN | 0.060 | 0.241 | 1.173 | Not supported |
| H5: AT -> BF | 0.134*** | 0.006 | 2.765 | Supported |
| H6: BF -> IN | 0.228*** | 0.000 | 4.660 | Supported |
| H7: KN → BF → IN | 0.031** | 0.017 | 2.384 | Supported |
| H8: AT → BF → IN | 0.031** | 0.019 | 2.350 | Supported |

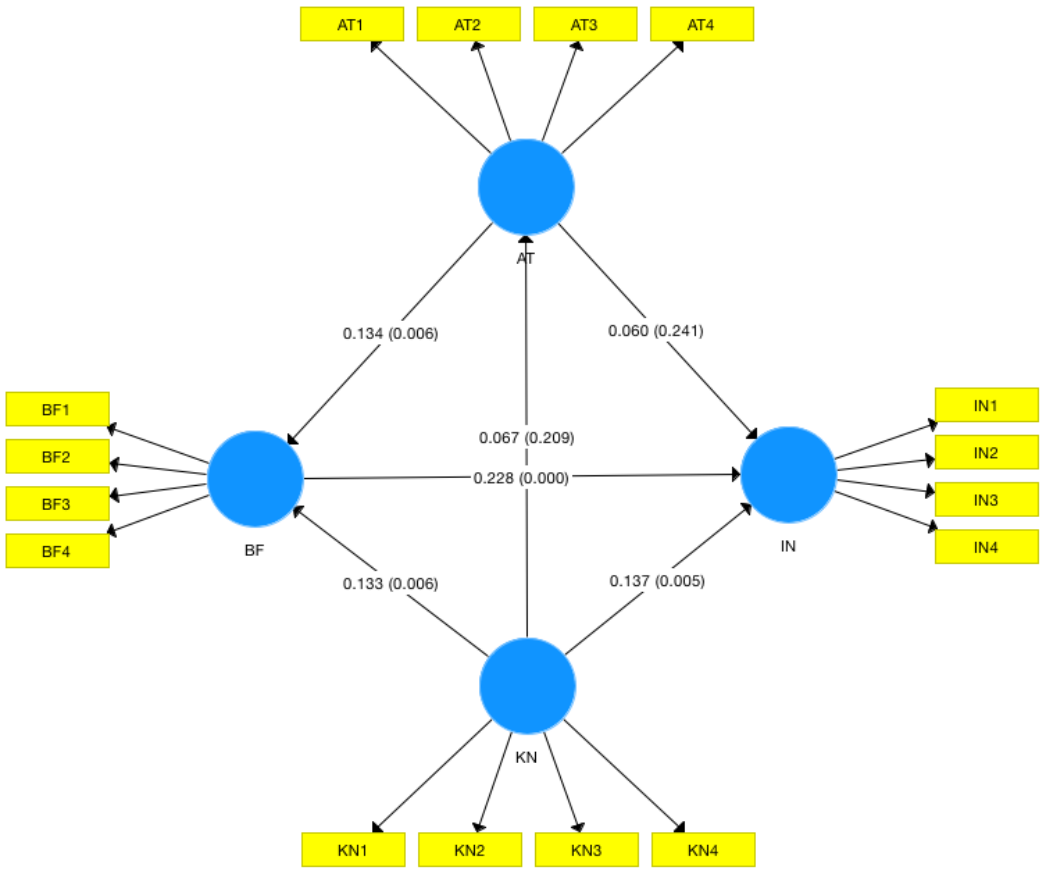


Figure 1. Results of the model

## 4. Discussion

This research aims to examine the relationships among belief, attitude, knowledge, and intention towards carbon neutrality, drawing on the TPB and the TRA. We hypothesize that belief, attitude, and knowledge are strong predictors of the intention to adopt carbon neutrality. The findings are overwhelmingly aligned with prior research, except for the insignificant relationships between knowledge and attitude, and between attitude and intention. Specifically, our results align with those of existing studies which have explored the context of environmental products, indicating that green product knowledge results in stronger beliefs about their benefits and more positive beliefs about the influence of product use (Alba & Hutchinson, 1987; Bang et al., 2000; Cordell, 1997). Additionally, knowledge has a positive influence on the intention to adopt carbon neutrality, in line with earlier research that suggests environmental knowledge is a significant predictor of behavioral intention (Ajzen, 1991; Rusyani et al., 2021; Itasanmi, 2019; Wang et al., 2014). However, this is in contrast with the results of Simanjuntak et al. (2023), providing more empirical data to support the positive relationship between environmental knowledge and behavioral intention.

Contrary to our expectations, we do not identify a significant relationship between attitude and intention. This finding contradicts prior studies suggesting that environmental attitude leads to a greater perceived value of products (Rokicka, 2002; Baldi et al., 2021; Wang et al., 2019). The failure of attitude to predict purchase intention suggests the presence of an attitude-behavior gap, a phenomenon that has been recognized by numerous scholars (Schäufele & Hamm, 2018; Xu et al., 2020).

However, our results show that attitude plays a crucial role in influencing belief in carbon neutrality. The current finding is consistent with previous research indicating that individuals' attitudes can enhance their beliefs in the benefits of new technologies (Zhang, Bai & Shang, 2018; Shi, Wang & Zhao, 2017; Yurdakul & Kazan, 2020). Regarding Hypothesis 6, as expected, our analysis demonstrates that higher levels of belief act as motivators for adopting carbon neutrality. This finding is in line with recent studies suggesting that individuals are more likely to use energy technologies if they believe in their value (Komendantova and Yazdanpanah, 2017; Colmenares-Quintero et al., 2020).

Contrary to our expectations, we do not find a significant correlation between knowledge and attitude, which contradicts prior research suggesting that individuals who possess a greater level of knowledge and environmental consciousness are more inclined to exhibit favorable environmental attitudes (Dangelico & Vocalelli, 2017; Fang et al., 2021; Rusyani et al., 2021; Simanjuntak et al. (2023); Itasanmi, 2019). Our findings are similar to those of Sun, Teh and Linton (2017), who also find no significant relationship between knowledge and attitude. Therefore, it is likely that the relationship between environmental knowledge and attitude is context-dependent (Sun, Teh & Linton, 2017). Further research is required to have better understanding on the important contextual variables, since knowledge is frequently regarded as a contributing factor to the development of a more favorable attitude.

Our findings show that belief plays a mediating role in the correlation between knowledge and intention, as well as between attitude and intention. This means that knowledge can increase intention levels either directly or through belief, while attitude does not have a direct effect on intention but strengthens belief, which in turn enhances intention. Therefore, our study reveals that attitude's impact on intention is context-dependent, and it does not have a significant direct effect on intention. However, attitude has a strong indirect influence on intention through belief. This implies that the effect of attitude on intention is dependent on other factors in the context, and it relies on belief to influence intention.

## Conclusion

In conclusion, this study has explored the impacts of attitude, knowledge, and belief on carbon neutrality, with a particular emphasis on the Hong Kong context. The results shed light on the significance of understanding individual beliefs, attitudes, and knowledge in influencing the intention to embrace carbon neutrality in the city. The study has highlighted the worldwide challenge of climate change and the urgent desire for countries to take stronger actions to address it. The results of the study provide contribution to the existing literature by highlighting the importance of knowledge exposure in fostering positive attitudes and behavioral changes towards carbon neutrality. It emphasizes the need for educational initiatives and awareness campaigns to enhance individuals' understanding of carbon neutrality and its implications. Additionally, the study underscores the significance of belief in shaping individuals' intentions, suggesting that policymakers should design policies to strengthen individuals' belief. The findings emphasize the need for comprehensive strategies that encompass policy interventions, educational initiatives, and support to promote widespread adoption of carbon-neutral practices.

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## Appendix

Table 1. Contents of questionnaire

| | |
|---|---|
| **Section 1: Please indicate which of the following options best represents you or your company.** | |
| 1. | What is your gender? |
| A. | Male |
| B. | Female |
| 2. | Which of the following indicates your highest education qualification? |
| A. | Bachelor's Degree |
| B. | Master's Degree |
| C. | Doctoral Degree |
| D. | Other qualification |
| 3. | What is your age group? |
| A. | 20-30 |
| B. | 31-40 |
| C. | 41-50 |
| D. | 51-60 |
| E. | 61 or above |
| 4. | Which of the following industry does your company operate in? |
| A. | Basic Materials |
| B. | Communication Services |
| C. | Consumer Discretionary |
| D. | Energy |
| E. | Financials |
| F. | Health care |
| G. | Industrials |
| H. | Real Estate |
| I. | Technology |
| J. | Utilities |

**Section 2: Please indicate which of 1 to 5 best represents your agreement to the statements**

| | Strongly Disagree | Disagree | Neither Agree nor Disagree | Agree | Strongly Agree |
|---|---|---|---|---|---|
| 1. It is easy for me to determine the environmental implications of my company's operation being carbon neutral. | 1 | 2 | 3 | 4 | 5 |
| 2. I am confident that I can give consideration to the impacts of carbon neutrality when making business decisions. | 1 | 2 | 3 | 4 | 5 |
| 3. I know more about carbon neutrality than the average person. | 1 | 2 | 3 | 4 | 5 |
| 4. I am familiar with the current guidelines of carbon neutrality in Hong Kong. | 1 | 2 | 3 | 4 | 5 |
| 5. Carbon neutrality is one of the most important issues facing society today. | 1 | 2 | 3 | 4 | 5 |
| 6. We should pay a considerable amount of money to promote carbon neutrality. | 1 | 2 | 3 | 4 | 5 |
| 7. Unless each of us recognizes the need to embrace carbon neutrality, future generations will suffer the consequences. | 1 | 2 | 3 | 4 | 5 |
| 8. I think it is necessary for managers to understand and learn about carbon neutrality. | 1 | 2 | 3 | 4 | 5 |
| 9. Neutralizing the net effects of carbon emission helps enhance sustainability of my company. | 1 | 2 | 3 | 4 | 5 |
| 10. By choosing environmentally | 1 | 2 | 3 | 4 | 5 |

| | | | | | |
|---|---|---|---|---|---|
| friendly means of doing business, I can help neutralize the effects of carbon emission. | | | | | |
| 11. By neutralizing the net impacts of carbon emission, I am confident that I can encourage others to do the same. I am confident that I can come up with creative ideas to help neutralize the impacts of carbon emission on the environment. | 1 | 2 | 3 | 4 | 5 |
| 12. I would give part of my income if I were certain that the money would be used to absorb carbon emitted by my company. | 1 | 2 | 3 | 4 | 5 |
| 13. The government should enhance the awareness of management to absorb carbon emitted by companies although it will cost me money. | 1 | 2 | 3 | 4 | 5 |
| 14. I would agree to an increase in taxes if the extra money were used to build facilities to absorb carbon emission. | 1 | 2 | 3 | 4 | 5 |
| 15. I am willing to incorporate the concept of carbon neutrality in exploring innovative business solutions upon the completion of relevant training in carbon neutrality. | 1 | 2 | 3 | 4 | 5 |