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THE UTILIZATION OF TRADITIONAL KNOWLEDGE ON THE IMPACT OF CLIMATE CHANGE TOWARDS ISLAND COMMUNITIES' SOCIAL WELL-BEING: THE MEDIATING EFFECT OF ADAPTIVE CAPACITY

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Abstract

Climate change is undeniably one of the greatest issues in Malaysia. Numerous studies have observed unpredictable patterns and extreme weather events. Since traditional knowledge of climate change affects the success of implementation and mitigation options, it is essential to gather information and adaptation. This study investigated the potential of traditional knowledge of island communities in Pulau Redang and Perhentian, Terengganu, Malaysia. Survey questionnaires were used for data collection, and SmartPLS-3 was used for analysis. The findings revealed that traditional knowledge (cultural beliefs, cultural practices, and personality traits) significantly supported the impact of climate change on social well-being. In addition, adaptive capacity mediated the relationship between traditional knowledge (cultural beliefs, cultural practices, and personality traits) and climate change on social well-being in the Pulau Redang and Perhentian island communities. Communities preserve traditional knowledge through cultural practices, beliefs and personality traits passed orally to the next generation.

Keywords: climate change; traditional knowledge; social well-being; culture belief; culture practice; personality traits; adaptive capacity; island community

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INTRODUCTION

Malaysia's Climate Change Action Plan 2021-2025 focuses on resilience and aligns with the World Bank Government's Green, Resilient, and Inclusive Development (GRID) approach. It aims to address the poverty and inequality exacerbated by climate change, impacting key sectors such as agriculture, fishing, and the cultivation of rubber, palm oil, and cocoa (Asian Development Bank, 2021). The Intergovernmental Panel on Climate Change (IPCC, 2022) report highlights the escalating impacts of climate change, affecting billions of people worldwide and displacing vulnerable populations. Around 3.6 billion people are highly exposed to extreme conditions such as droughts, heavy rainfall, and heat, which harm physical and mental health, marking the first inclusion of mental health in IPCC findings (World Health Organization, 2023).

LITERATURE REVIEW

Underpinning Theory

This study applies the Knowledge-Based View (KBV) theory to explore the potential of utilizing traditional knowledge (TK) to address climate change impacts. According to the KBV, creating, transferring, and integrating knowledge is essential for transforming organizational knowledge resources into valuable assets for innovation in products or processes (Cepeda-Carrion et al., 2017). In this context, TK has been passed down through generations and serves as a critical resource for innovation to mitigate the effects of climate change on social and economic well-being. The findings of this study contribute to a growing body of knowledge on climate change adaptation by highlighting the value of TK in fostering resilience and economic stability (Baharuddin et al., 2024). Additionally, this study employs Attribution Theory (AT) to examine how internal and external factors motivate individuals to use TK to mitigate the economic impact of climate change. AT suggests that individuals seek to understand and explain their behavior through internal or external factors (Aronson et al., 2010). External factors in this study included cultural beliefs and practices, influenced by the transmission of knowledge from past generations. Internal factors, such as personality traits and adaptive capacity, influence how individuals apply TK to address climate-related challenges in the modern era shaped by technology.

Climate Change and Its Effect on Social Well-being

The IPCC (2015) warns that by 2050, over one billion people could lose their homes due to worsening storms and rising seas, endangering the Paris Agreement's 1.5 °C warming goal. Rapid climate change highlights the need for urgent planning and funding to help vulnerable coastal communities.

The social dimension of climate change involves the interplay between climate impact and human vulnerability. It disproportionately affects the poorest areas, especially those living in flood-prone or extremely hot areas (Basyir, 2022). In Malaysia, climate action should align with the Sustainable Development Goals (SDGs), particularly SDG 11 (sustainable cities) and SDG 13 (climate action), emphasizing local governance and community involvement (New Straits Times, 2022). The Lancet Countdown on Climate Change and Health reports that are already affecting global populations and may become irreversible (Watts et al., 2017). Indirect mental health effects, particularly in the island and rural communities, may result from infrastructure damage, water scarcity, food insecurity, and conflicts, with broader consequences impacting natural resources, human health, infrastructure, and the environment (Mat et al., 2019; Mat et al., 2020).

Traditional Knowledge (TK)

Traditional knowledge, shaped by indigenous peoples' long-standing interactions with nature, is vital for adapting to climate change (UNESCO, 2017). It helps communities understand the real impacts and devise strategies, with rural and indigenous groups often using local cultural systems and seasonal indicators (Gashler, 2021). This study examines how island communities utilize traditional knowledge, specifically cultural beliefs, practices, and personality traits, to adapt to the social effects of climate change.

Cultural Belief

Cultural beliefs are a shared system of knowledge within a group encompassing beliefs, values, and social norms that shape individual and community understanding and behavior manifesting as collective behavioral patterns transmitted across generations within a society (Hofstede, 1991). Elderly individuals can contribute significantly to society because of their extensive experience and knowledge of cultural heritage in their communities (Ariffin et al., 2023).

Cultural Practice

Sewell (1992) define cultural practices as structured routines encompassing virtual schemas that cannot be reduced to specific exemplifications. Describing practices as embodied habits involves bringing them to the physical or bodily level, encompassing various aspects of life from clothing and diet to speech and artistic tastes. This approach facilitates potential improvisation around cultural themes without excessive deliberation, highlighting how people influence ecosystems through cultural practices, values, and worldviews, underscoring the

importance of drawing inspiration from cultural values and reinforcing them through these practices (Aleksander, 2018).

Personality Traits

Personality traits shapes people's views on environmental issues such as resilience and adaptability, which are crucial for coping with climate challenges. Rothermich et al. (2021) suggested that individuals with personality traits of higher levels of openness and perspective-taking are more likely to exhibit pro-environmental attitudes. Higher levels of openness are associated with a greater likelihood of pro-environmental behavior, reflecting an increased concern for climate change, and people are increasingly willing to act on their worries about global warming (Brick & Lewis, 2014).

Adaptive Capacity

Adaptive capacity is an inherent trait of communities, social-ecological systems, and individuals that are activated in response to opportunities or crises (Engle, 2011). Research on adaptive capacity seeks to understand the interaction between social and biophysical systems to create mechanisms for responding to global environmental changes and enhance the effectiveness of conservation efforts with limited resources (Sexton et al., 2010). Samsuddin et al. (2024) found that adaptive capacity mediates TK and the impacts of climate change. From a socio-cultural perspective, it encompasses institutional features that allow social actors to address both short- and long-term impacts through planned or innovative responses, shaping future social, economic, and environmental outcomes. The proposed research framework is shown in Figure 1.

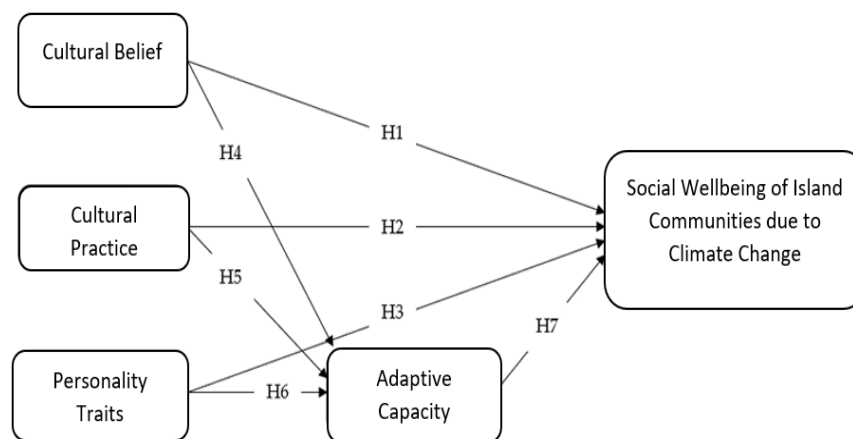


Figure 1: Research Framework

MATERIALS AND METHODS

A quantitative approach is employed in this study. The three primary research purposes were exploratory, descriptive, and hypothesis testing. This study employed a cross-sectional design using a survey to collect personal and social information, as well as beliefs and attitudes. Data collection involved a self-completed questionnaire comprising 43 questions (refer to Table 1)

Table 1: Measurement of all variables/ constructs and sources

Construct	No. of items	Source
Cultural Belief (CB)	8	Joose et al. (2018)
Cultural Practice (CP)	5	Colombi & Smith (2012)
Personality Traits (PT)	7	Issa et al. (2018)
Adaptive Capacity (CP)	7	Hilary (2015)
CC impact on Social Well-being (WB)	8	Semenza (2011)
Demographic data	8	

Source: Adapted

Table 1 presents the measurement constructs and sources. The instrument's Traditional Knowledge (TK), which consists of Cultural Belief (CB), Cultural Practice (CP), and Personality Traits (PT) has been adapted from Joose et al (2018); Colombi & Smith (2012); Issa et.al. (2018). Adaptive Capacity (AC) has been adapted from Hilary, 2015. The Social Well-being (SW) variable has been adapted from Semenza (2011).

Population and Sample

This study was conducted among Pulau Redang and Pulau Perhentian inhabitants in Terengganu, Malaysia, focusing on these two islands because of the potential impact of climate change on their biota. According to the Malaysian Census 2010, the combined population of Pulau Perhentian and Pulau Redang was 4,036. Using a 5% margin of error and 95% confidence interval, a sample size of 354 respondents was recommended (Department of Statistics Malaysia, 2011). However, due to the COVID-19 pandemic, only 224 questionnaires were completed, which aligns with Green's (1991) minimum requirement of 90, calculated using the formula $[50 + 8(5 \text{ constructs}) = 90]$.

Data Collection and Research Instruments

Purposive sampling was employed to select the Pulau Redang and Pulau Perhentian communities for data collection. The final questionnaire was developed by adopting scales from prior research and was pretested and revised before the survey was conducted. A closed-ended format allowed the respondents to choose from five options on a Likert scale to indicate their opinions. This interval scale effectively measured the impact of climate change, with responses

ranging from 1 (strongly disagree) to 5 (strongly agree), thus providing valuable insights into community perceptions.

Data Analysis

This study used general descriptive analysis (e.g., frequency distribution, means, and standard deviations), validity, and reliability tests using the Statistical Package for Social Sciences (SPSS) software, version 25.0, and Smart PLS software to test the hypotheses and address the research questions. The sentences suggest that while a measurement model explains the reliability and validity of constructs, a structural model goes further by conducting bivariate correlation and regression analyses. This study examined the influence of TK's dimensions - cultural beliefs, cultural practices, and personality traits - on the impact of climate change on social well-being, mediated by adaptive capacity.

RESULTS AND DISCUSSION

Descriptive Statistic Analysis

The majority of respondents in this study were female, with 113 (50.4%) identifying as such, while 111 (49.6%) were male. Most participants were in the 18-30 age group, comprising 75 respondents (33.5%), followed by the 31-40 age group (66 respondents, 29.5%). A smaller number fell into the 41-50, above 50, and below 18 age categories, with 50 (22.3%), 28 (12.5%), and 5 (2.2%) respondents, respectively. The predominant occupations were housewives (76 respondents, 33.9%), with equal numbers of self-employed individuals (76), unemployed (20), and private employees (33.9%, 8.9%). Minorities included government employees (12, 5.4%), students (11, 4.9%), and others (4, 1.8%). Most respondents were married (158, 70.5%), 61 were single (27.2%), and 4 (1.8%) were divorced or widowed. The majority identified as Malay, reflecting the questionnaire's collection from Terengganu villages. Educationally, 188 participants (83.9%) had primary or secondary education, while 28 (12.5%) held diplomas or certificates, and only 5 (2.2%) had bachelor's degrees. Most respondents earned less than RM3,000 (218, 83.9%), which is consistent with their demographics of young age, low education level, and primarily being housewives.

Table 2: Results of descriptive analysis.

Constructs	Mean	Standard Deviation	Level
Cultural Belief (CB)	3.4	0.988	Medium
Cultural Practice (CP)	3.47	0.977	Medium
Personality Traits (PT)	3.46	0.969	Medium
Adaptive Capacity (AC)	3.9	1.062	High
Social Well-being (SW)	3.38	0.991	Medium

Descriptive analysis included the mean, standard deviation, and significance level for TK. Table 2 presents the levels of cultural belief (mean = 3.40), cultural practice (mean = 3.47), personality traits (mean = 3.46), and social well-being (mean = 3.38), all of which were categorized as medium. By contrast, the level of adaptive capacity was high, with a mean of 3.90. A high score in adaptive capacity indicates that the community possesses a strong ability to respond to environmental changes and challenges. This suggests that the respondents felt equipped to manage risks associated with climate change, potentially due to prior experience, resources, or knowledge.

Assessment of Measurement Model Construct Validity and Reliability

The measurement model analysis assessed the internal consistency, indicator reliability, convergent validity, and discriminant validity of the reflective model.

Table 3: Results of construct validity and reliability.

Construct	Code	Factor Loading	CR	AVE	Cronbach's Alpha
Cultural Belief	F2	0.71	0.808	0.512	0.682
	F4	0.765			
	F5	0.675			
	F7	0.701			
Cultural Practice	G1	0.616	0.818	0.532	0.704
	G2	0.827			
	G3	0.73			
	G5	0.724			
	H1	0.715			
Personality Traits	H4	0.623	0.845	0.523	0.773
	H5	0.713			
	H6	0.773			
	H7	0.766			
	K1	0.769			
Adaptive Capacity	K2	0.719	0.882	0.6	0.832
	K3	0.824			
	K4	0.811			
	K7	0.744			
Social Well-being	D1	0.786	0.819	0.649	0.741
	D2	0.765			
	D3	0.793			
	D4	0.644			

Table 3 displays the evaluation of the reliability and validity of the measurement model. Following this assessment, nine items (F1, F3, F6, F8, G4, H2, H3, K5, K6, D5, D6, and D7) were eliminated from the recycling constructs due to their low factor loading. Therefore, items with a loading of 0.400 were

removed to achieve AVE. All the other items used in this study had adequate indicator reliability. The items in the analysis were retained because their factor loadings fell within the range of 0.644 to 0.827, all exceeding 0.6. Moreover, Average Variance Extracted (AVE) values for all variables fell within the range of 0.512 to 0.649, indicating the reliability of the measurement model (Ramayah et al., 2016).

The convergent validity of the accepted items, with an AVE greater than 0.5, ranged from 0.512 to 0.649. Cronbach's alpha ranged from 0.808 to 0.882. All constructs met the threshold, as indicated at 0.7, except for cultural belief, which was slightly below at 0.682 (Hair et al., 2019). Said (2018) suggests that a Cronbach's Alpha value between 0.6 and 0.8 is acceptable (Wim et al, 2008). Therefore, these results supported convergent validity and were also valid and reliable for the factor loading, CR, and Cronbach's α criteria, which were above the generally recommended values (Hair et al., 2019; Sarstedt et al., 2019). Discriminant validity was evaluated using the HTMT ratio (Henseler et al., 2015). Some authors suggest a threshold of 0.85 (Kline, 2011). However, Gold et al. (2001) disagreed with this finding and recommended a threshold of 0.90. Therefore, the HTMT criterion should be used for this purpose so that the interpretation of the causal effect in the modelling analysis is not misleading.

Table 4: Results of discriminant validity test using the Heterotrait-Monotrait (HTMT).

Construct	AC	CB	CP	SW	PT
Adaptive Capacity (AC)	0.512				
Cultural Belief (CB)	0.653	0.682			
Cultural Practice (CP)	0.738	0.719	0.738		
Social Well-being (SW)	0.571	0.651	0.802	0.571	
Personality Traits (PT)	0.732	0.637	0.863	0.646	0.732

Table 4 presents the HTMT values for the latent constructs in the overall model, ranging from 0.671 to 0.863, and all values were below the threshold of 0.90. This indicated that the correlation values between constructs demonstrate acceptable discriminant validity. Consequently, the study's measurement model was deemed reliable and valid.

Assessment of Structural Model

The study's structural model investigated the relationships among key constructs, analyzing path coefficients, t-statistics, variance, and p-values. The significance of the paths was assessed using the bootstrapping method with 240 cases and 5000 replicate samples at a 5% significance level. The predictive power of the model was evaluated by hypothesis testing. Table 6 presents a summary of the results of the analysis. The study employed Cohen's (1988) classification for R-

squared, categorizing it as high, moderate, or low with rates of 0.26, 0.13, and 0.02, respectively, to evaluate predictive accuracy.

Table 5: Results of Coefficient determination, effect size, predictive relevance, and impact of predictive relevance).

Construct	R ²	f ²	Q ²	q ²
Adaptive Capacity	0.469	0.3	0.269	0.078
Social Well-being	0.231		0.115	

Table 5 displays the R-squared values for adaptive capacity and social well-being, indicating that approximately 46.9% of the variance in adaptive capacity and 23.1% in social well-being are explained by their respective predictors (cultural belief, cultural practice, personality traits, and adaptive capacity). Following Cohen's (2013) criteria, the R-squared values in this study were considered medium, as they exceeded 0.13. The Q² values for adaptive capacity and social well-being are 0.269 and 0.115, respectively. The fact that these values are greater than zero supports the assertion that the model in this study possesses sufficient predictive ability and relevance for the endogenous construct examined. As per Cohen's (1988) recommendation, f² values exceeding 0.35 are categorized as large effect sizes, those between 0.15 and 0.35 are deemed medium, values between 0.02 and 0.15 are considered small, and any values below 0.02 are classified as having no effect. Researchers have commonly utilized this rating system in Partial Least Squares (PLS) analysis. The study effect size (f²) and the impact of predictive relevance (q²) are categorized as medium.

Hypothesis Testing

The analysis outcomes are detailed in Table 6. It presents the results of hypothesis testing, specifically focusing on the direct effects, to investigate the relationship between dimensions of TK (such as cultural belief, cultural practice, and personality traits) and the effects of climate change on social well-being.

Table 6: Results of hypothesis testing (direct effect)

Path Analysis	Original Sample (O)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	Sig.	Decision
Cultural Belief -> Social Well-being	0.103	0.031	3.355	0.01	Supported
Cultural Practice -> Social Well-being	0.112	0.039	2.849	0.04	Supported
Personality Traits -> Social Well-being	0.175	0.038	4.643	0.00	Supported

Table 6 displays the path between cultural beliefs and social well-being demonstrating a significant positive relationship (Std. beta = 0.103, t = 3.355, p-value < 0.01), indicating that H1 is supported. Cultural practice had a significant positive relationship with social well-being (Std. beta= 0.112, t= 2.849, p-value <0.04), indicating that H2 is supported. The path from personality traits has a significantly positive relationship with social well-being (Std. beta = 0.175, t = 4.643, p-value < 0.00), indicating that H3 is supported. In addition, the mediation analysis results are detailed in Table 7.

Table 7: Results of hypothesis testing (mediating effect)

Path Analysis	Original Sample (O)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	Sig.	Decision
Cultural Belief -> Adaptive Capacity -> Social Well-being	0.103	0.031	3.355	0.001	Supported
Cultural Practice -> Adaptive Capacity -> Social Well-being	0.112	0.039	2.849	0.004	Supported
Personality Traits-> Adaptive Capacity -> Social Well-being	0.175	0.038	4.643	0.000	Supported

Table 7 shows that the indirect effect of cultural beliefs on economic well-being through adaptive capacity is statistically significant, with a medium effect size (Std. beta= 0.083, t= 3.366, p-value <0.00). The bias-corrected confidence interval (CI) further confirmed this significance, as it did not

encompass 0, with the lower level (LL = 0.038) and upper level (UL = 0.134) both falling outside this range. Thus, H4 is supported.

On the other hand, the indirect effect of cultural practice was also statistically significant, with a small effect size of the coefficient path from the subjective norm to economic well-being (Std. beta= 0.061, $t = 2.295$, $P < 0.02$). The bias-corrected CI, with the lower level (LL = 0.018) and upper level (UL = 0.122), did not encompass 0. This observation supports the confirmation of H5.

The path from adaptability between personality traits and economic well-being was statistically significant, with a medium effect size of the coefficient path from the subjective norm to economic well-being (Std. beta = 0.87, $t = 2.564$, $p\text{-value} < 0.01$). The bias-corrected CI with a lower level (LL = 0.031) and upper level (UL = 0.163) did not encompass 0, indicating support for H6.

Figure 2 summarizes the results of the PLS analysis of the overall model, including the path coefficients (β), which are significant at the 99% and 90% significance levels with the associated p -value and R^2 coefficients to support the hypothesized relationships.

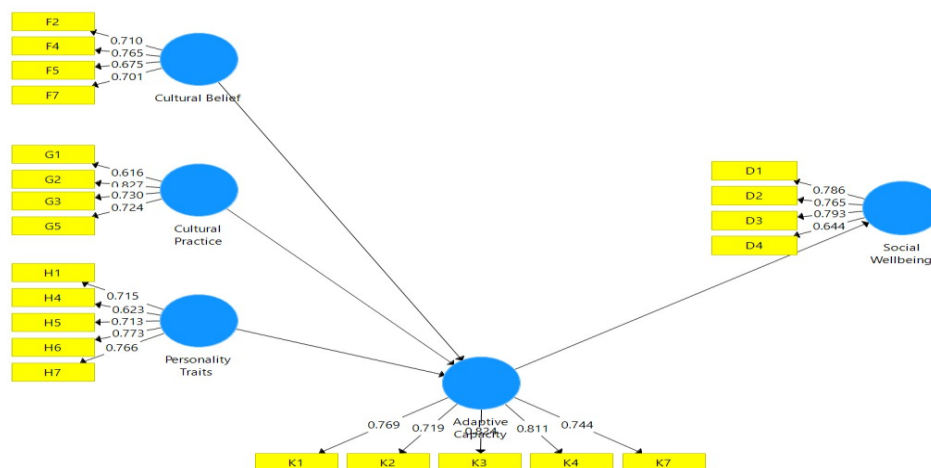


Figure 2: PLS Analysis of Proposed Structural Model

CONCLUSION

This study identified the key dimensions of traditional knowledge (TK)-cultural beliefs, practices, and personality traits-as significant factors influencing the impact of climate change on social well-being. Adaptive capacity was found to moderate the relationship between personality traits and social well-being in Malaysian island communities. This research introduced a model combining knowledge-based view theory and attribute theory to assess the role of traditional

knowledge in mitigating climate change effects, extending these theories into the context of climate change.

The findings showed that the Pulau Redang and Pulau Perhentian communities have unique worldviews rooted in traditional ecological knowledge, shaping their perceptions and responses to climate change. Preserving access to traditional lands, natural resources, and cultural sites, as well as maintaining language and ecological knowledge is essential as they face climate change, land-use shifts, and policy changes. These communities tend to resist policies that limit access to culturally significant landscapes, whereas projects aligned with their values and aspirations have a higher chance of success.

Island communities prioritize various goals: social development (e.g., aquaculture and tourism), education (youth employment and training), environmental stewardship (e.g., co-managing national parks), and preserving cultural heritage (such as transmitting traditional knowledge and safeguarding cultural sites). This diversity offers multiple opportunities to develop successful adaptation strategies. However, the key challenge for governments and service providers is to genuinely engage with these communities' worldviews and design equitable and effective strategies for climate change adaptation.

Although this study focused on Pulau Redang and Pulau Perhentian, the perspectives of other Malaysian islands and developing countries might differ. Comparative studies with other islands or countries could enhance understanding and reveal the consistency or divergence of traditional knowledge's role in climate change adaptation and economic well-being.

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DISCLOSURE STATEMENT / ETHICAL STATEMENT

The authors declare no conflicts of interest related to this research. The authors affirm that this paper is original, plagiarism-free, and has not been submitted for publication elsewhere.

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