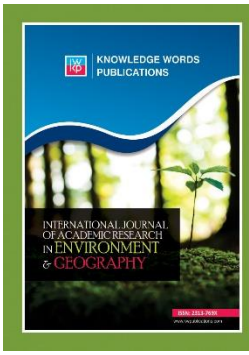

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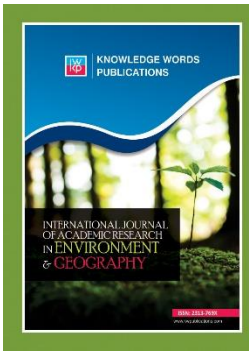

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How Possible the Coastal Erosion and Coastal Deposition to Influenced on the Life Quality of Kemeruk Residents? A Structure Equation Model Study

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Abstract

Coastal erosion is a natural process that breakdown the rock and the sediments at the shoreline, which causing the economic loss, ecological damage, and societal problems. This study investigates the coastal erosion and deposition that occur in Kemeruk residents. In-depth literature reviews were conducted to gather information of the coastal erosion and deposition that affect the human life, as well as adaptation approach in reducing the disaster. Through the reviews, eight domains of coastal erosion and deposition model are emerged from the study. The model was further validated with a quantitative survey study involving 83 residents that settled at Kemeruk villages. The findings established model for coastal erosion and deposition which focuses at Kemeruk villages.

Keywords: Literature Reviews, Adaptation, Economic Loss, Societal Problems.

Introduction

Global climate change and sea level rise became the world issues to witnessing of various disasters in harming the human life. According to IPCC Fourth Assessment Report: Climate Change 2007 expressed the sea level is rising between the past (1980-1999) to the present (2090-2099) century about 0.35m (0.23m to 0.47m) for the AIB scenario (IPCC, 2007). This matter is supported by Scientific Committee on Antarctic Research (SCAR) that reported the sea level would likely to increase as much as 1.4m by the end of this century (SCAR, 2010). Due to this report, United States suspected the sea level to rise about 2.0-3.0 mm/year along the Atlantic

and Gulf coasts (USEPA, 2010). Western Japan is also expecting the sea level to be as high as 17cm/century in western Kyushu (Sin-Iti et al, 2008). The main factors to cause rising sea level involved with melting of glaciers in lower latitudes (alpine glaciers), subsidence of continental shelves due to the recent arrival of the water mass after the last glacial epoch, and thermal expansion of the surface layers of the oceans due to atmospheric heating (Pilkey et al, 2017). The consequences of sea level rise include flooding, salt-water intrusion, as well as increased the rate of coastal erosion, especially involved with storm waves. Since coastal erosion are direct causes of major problem to human, therefore, this study conducted to determine possible coastal erosion and deposition would influenced the quality life of residents that settled near to the beaches.

Literature Review

Coastal erosion can be defined as the process of wearing away material from a coastal profile due to imbalance in the supply and export of material from a certain sections (Marchand, 2010). Specifically, coastal erosion is considered as natural process that breakdown the rock and the sediments at the shoreline, which above and below the water surface (Arnott and Ollerhead, 2011). In other words, these event is occur due to a result of the action of waves, tidal action, wind, storm surge, ice, rain, and surface runoff. Statistically, the rate of erosion can be expressed in volume/length/time, example in $m^3/m/year$, but erosion rate is often used in m/year (Mangor, 2004). Generally, coastal erosion become major issues in hunting the human, especially causing the economic loss, ecological damage, and societal problems (Marchand, 2010). For example, loss of property, infrastructure and beach width could cause billion of US dollar worth of economic damage, loss of valuable coastal habitat, significant with management issues, as well as the quality life that involved with human healthy level.

To avoid coastal erosion continuously impact the human, several suggestion on adaptation concept through appropriate research study had been conducted. According to Arnott and Ollerhead (2011) stated that three main component of adaptation can be applied in coastal erosion, namely land use zoning, engineering approaches, and slope stability. Meanwhile, the State of Oregon through the Emergency Management Plan Report in 2012 suggested education program as well as engineering solution by having soft and hard stabilization in reducing the landslide. The report also highlight several strategies include vegetation management, drainage controls, slope regrading, reinforcing structures, and surface fixing. A study conducted by Hegde (2010) is agrees to have mitigation program through implementing green belts, artificial reefs, geotextiles, zoning, setback limits, retreat (which concern on relocations, abandonment, and demolition of the structures situated along the coastal zone). Nevertheless, he also stressed that the suggestion should properly evaluated before adopted and implemented, especially having constraints on economic, environmental, social legal, etc., just to name a few.

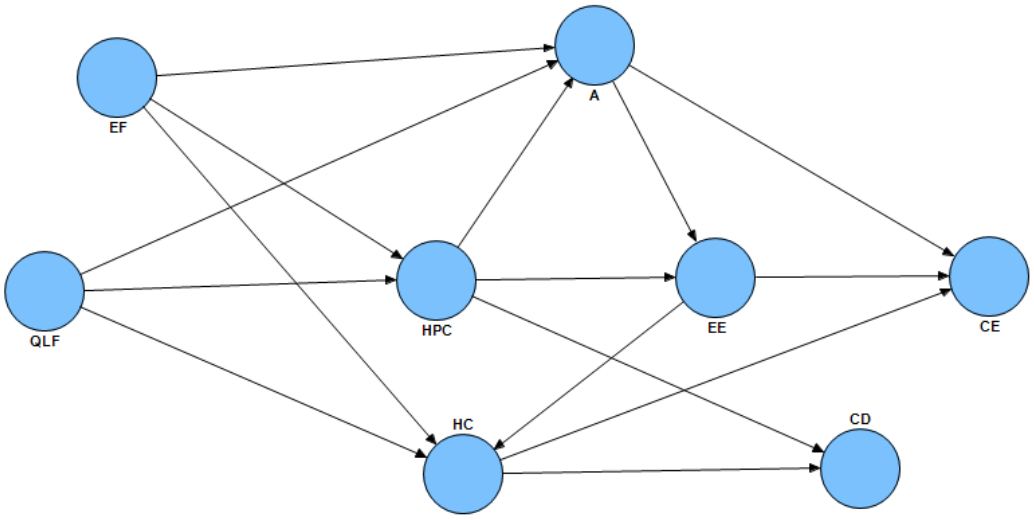
Several opinion above are totally agreed by Federal Department of Town and Country Planning Malaysia, which also suggests on adaptation of coastal erosion should be carry out by having the beach reclamation, coastal protection by plants, dune restoration, as well as formation and maintenance (JPBD, 2010). Therefore, a part of coastal erosion that effectively impacts the quality of human life through destruction on healthy and property, therefore, adaptation concept

towards coastal erosion and deposition plays an important role in reducing the negative effect to the human. So, this study conducted to investigate and to develop a model based on coastal erosion and deposition in Kemeruk residents, Malaysia.

Methods

Establishing a Model of Coastal Erosion and Deposition based on Domain Design

Based on literature review conducted, the result indicate 8 domains of coastal erosion and deposition model, which is *adaptation, coastal deposition, coastal erosion, erosion effect, education factor, health characteristic, house physical characteristic,* and *quality of life factor*. These domains are important to determine possibility of coastal erosion and deposition model that emerged from review study can be adapted, implemented, and reassessed according to the researcher's need (Creswell, 2005). Therefore, the model is required to further validate with quantitative survey study involving 83 local residents that experienced exposure to the coastal impacts.



(A=Adaptation; CD=Coastal Deposition; CE=Coastal Erosion; EE=Erosion Effect; EF=Education Factor; HC=Health Characteristic; HPC=House Physical Characteristic; QLF=Quality of Life Factor)

Figure 1: The model of Coastal Erosion and Deposition

Participants

Quantitative survey data were collected from 83 residents that settled adjacent to the coastal. Majority participants involved is male (n=49, 59%), followed by female (n=34, 41%). Most of the residents are Malay, which having the ages between 41 to 50 are 34 people (41%), followed by 51 to 60 with 24 people (29%) and 31 to 40 with 12 people (15%). In term of education level, most residents are studied until secondary school with 52% (n=43), 24% (n=20) in primary school and 12% (n=10) in pre-university level. Majority participants are married status (n=62, 75%) that working as fisherman (n=20, 24%), housewife (n=17, 21%), and self-employed (n=16, 19%), which

settled for 11 to 20 years with 21 people (25%), 41 to 50 years with 14 people (17%), and 21 to 30 year with 12 people (15%).

Survey Questionnaire

The survey questionnaire used in this study consisted of two sections that correspond to the demographic details and eight main variables in the coastal erosion and deposition model generated from the review study. There were total of 39 items. The items were created based on the data of each theme generated from the review study. The items used a categorical scale of measurement ranging from 1 to 5, the Likert type scale with '1' indicate 'strongly disagree' and '5' indicate 'strongly agree'.

Data Analysis

For testing the validity and reliability of the model, PLS-SEM analysis was performed in two stages. First, the validity (construct validity and discriminant validity) and reliability (composite reliability and Cronbach's alpha internal consistency reliability) of the variables (the eight themes) were examined to ensure that the items validly and reliably represented the concepts of the eight variables in the model. Secondly are the relationships among the variables were identified and reported.

Results

PLS-SEM is a non-parametric model testing analysis that does not require the data of the items involved in the analysis are normally distributed. However, the validity and reliability of the variables in the model should be established prior to examination of the relationship among the variables. This is to ensure that the eight variables are validly and reliably represented by their indicators, which are the instrument items. In PLS-SEM analysis, the eight variables are latent variables that are reflectively represented by their indicators. The convergent validity of a variable is achieved when the loadings of the items for each variable are (i) greater than 0.5 for the loadings of each individual item, and (ii) the average variance extracted (AVE) for the variable being greater than 0.5 (Hair et al, 2016). On the other hands, the variables are considered reliable when both values of Cronbach's alpha and composite reliabilities are greater than 0.7 to address the variable is achieved (Hair et al, 2016). Table 1 showing the validity and reliability analysis of eight variables and the results are achieved the validity and reliability analysis.

Table 1: Validity and Reliability of Variables in Model

Latent Variables	Indicator	Convergent Validity		Reliability		R Square	Redundancy
		Loading	AVE	Composite Reliability	Cronbach's Alpha		
A	A1	0.743					
	A2	0.673					
	A3	0.690	0.6997	0.8492	0.7198	0.7808	0.1499
	A4	0.694					
	A5	0.732					
CD	BD1	0.699					
	BD2	0.840	0.6404	0.8215	0.7082	0.7143	0.1565
	BD3	0.665					
	BD4	0.805					
CE	BE1	0.710					
	BE2	0.741					
	BE3	0.690	0.6960	0.8425	0.7925	0.8562	0.0571
	BE4	0.694					
	BE5	0.764					
EE	EE1	0.860					
	EE2	0.886					
	EE3	0.682	0.6678	0.8613	0.8913	0.7600	0.0298
	EE4	0.874					
	EE5	0.661					
EF	EF1	0.674					
	EF2	0.675					
	EF3	0.775	0.6974	0.8691	0.7512	-	-
	EF4	0.726					
	EF5	0.758					
HC	HC1	0.619					
	HC2	0.612					
	HC3	0.759	0.6354	0.8346	0.7780	0.7610	0.2556
	HC4	0.764					
	HC5	0.799					
HPC	HPC1	0.698					
	HPC2	0.809					
	HPC3	0.778	0.6669	0.8107	0.7266	0.7651	0.0438
	HPC4	0.645					
	HPC5	0.648					
QLF	QLF1	0.687					
	QLF2	0.854					
	QLF3	0.727	0.6781	0.8705	0.8138	-	-
	QLF4	0.878					
	QLF5	0.720					

A=Adaptation; CD=Coastal Deposition; CE=Coastal Erosion; EE=Erosion Effect; EF=Education Factor;
HC=Health Characteristic; HPC=House Physical Characteristic; QLF=Quality of Life Factor

The discriminant validity of a construct is achieved when inter-correlations among the variables in the model are smaller than 0.9. The implication is that the variables are independent to one another and no overlapping of concepts is found. Multi-collinearity causes overlapping of concepts among the variables in a model. This problem exists in model testing due to extremely strong inter-correlations (r≥0.9) between variables in the model (Bryne, 2010). The results in table 2 show that the inter-correlation coefficients among all of the variables were less than 0.9. The variables are free of multi-collinearity problems, and therefore the discriminant validity of the variables for the model is achieved.

Table 2: Inter-correlation among the Variables in Model

Latent Variables Correlation	1	2	3	4	5	6	7	8
A	1.0000							
CD	0.0746	1.0000						
CE	0.3552	0.6279	1.0000					
EE	0.2424	0.3314	0.5760	1.0000				
EF	0.5743	0.4079	0.6854	0.6267	1.0000			
HC	0.0830	0.5392	0.6827	0.7827	0.5810	1.0000		
HPC	0.6120	-0.0989	0.2049	0.1766	0.3361	0.1000	1.0000	
QLF	0.5268	-0.3536	-0.0481	-0.1024	0.1767	-0.2207	0.5537	1.0000

A=Adaptation; CD=Coastal Deposition; CE=Coastal Erosion; EE=Erosion Effect; EF=Education Factor;
HC=Health Characteristic; HPC=House Physical Characteristic; QLF=Quality of Life Factor

The Final Model

PLS-SEM analysis using SMART PLS was performed to establish the relationship among the variables in the model. SMART PLS is one of the latest software applications that enable researchers to accurately and effectively model and analyze inter-relationships among latent variables that have multiple indicators (Hair et al, 2016). Specifically, the SMART PLS is able to multiple equations of the correlational and causal relationships in a model are computed simultaneously. It enables researchers to support their theories by extending the standard multivariate analytical methodology, which includes regression, factor analysis and analysis of variance.

The final model resulted in Figure 2 consists of coastal erosion and deposition with its six core factors. In other words, coastal erosion is directly influenced by the education factor and quality of life factors; and indirectly influenced by adaptation factors. Meanwhile, coastal deposition is influenced by both factors of education and quality of life. The data in Table 3 indicate that the factors contribute 85.6% of coastal erosion (R^2=0.856) and 71.4% of coastal deposition (R^2=0.714).

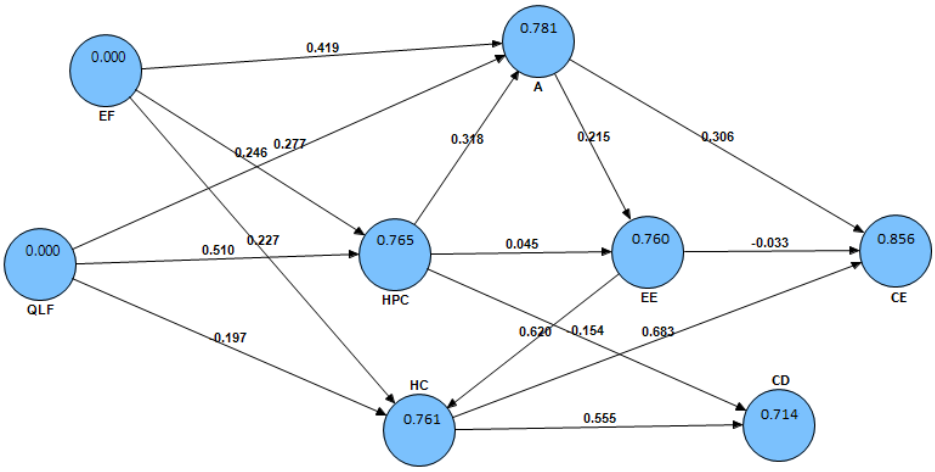


Figure 2: The Model of Beach Erosion and Deposition Influenced by Education and Quality of Life Factor

Table 3: T-statistic and Standardized Regression Weight (β) of the Relationship Among Variables in Model

Hypothesis	Relationships (IV -> DV)	T- Statistics value	Standardized Regression Weight (β)	Supported
H1	A -> CE	10.068****	0.306	**Supported**
H2	EE -> CE	0.680	-0.033	Not Supported
H3	HC -> CE	15.720****	0.683	**Supported**
H4	EF -> A	14.664****	0.419	**Supported**
H5	HPC -> A	8.298****	0.318	**Supported**
H6	QLF -> A	8.963****	0.277	**Supported**
H7	EE -> HC	18.200****	0.620	**Supported**
H8	EF -> HC	5.885****	0.227	**Supported**
H9	QLF -> HC	7.356****	0.197	**Supported**
H10	HC -> CD	16.791****	0.555	**Supported**
H11	HPC -> CD	2.984***	0.154	**Supported**
H12	EF -> HPC	6.340****	0.246	**Supported**
H13	QLF -> HPC	14.097****	0.510	**Supported**
H14	A -> EE	12.680****	0.215	**Supported**
H15	HPC -> EE	0.724	0.045	Not Supported

*Significant at p<0.1; **Significant at p<0.5; ***Significant at p<0.01; ****Significant at p<0.001

Among the three factors, education factor (β=0.419, p<0.001) is the main factor to influenced the adaptation, followed by quality of life (β=0.277, p<0.001) and house physical characteristic (β=0.318, p<0.001). Simultaneously, the main influenced to health characteristic in three factors are erosion effect (β=0.620, p<0.001), continued by quality of life (β=0.197, p<0.001) and education factor (β=0.227, p<0.001). On the other hands, health characteristic (β=0.683, p<0.001) and adaptation (β=0.306, p<0.001) are subjected to directly influenced the coastal erosion. Meanwhile, in coastal deposition, the factor to influenced is health characteristic (β=0.555, p<0.001) and house physical characteristic (β=0.154, p<0.01); and in house physical characteristic, the factor to influenced is quality of life (β=0.246, p<0.001) and adaptation (β=0. 510, p<0.001). Lastly, erosion effect is suspected to have directly influenced by adaptation (β=0.215, p<0.001).

The sub-models of coastal erosion and deposition model are presented in Table 4. These sub-models are the basics of the coastal erosion and deposition model focuses in Kemeruk residential area.

Table 4: Sub-models of the Coastal Erosion and Deposition Model

No.	Sub-model Regression Model
1	CE=0.306A + 0.419EF
2	CE=0.306A + 0.277QLF
3	CE=0.306A + 0.318HPC + 0.510QLF
4	CE=0.306A + 0.318HPC + 0.246EF
5	CE=0.683HC + 0.227EF
6	CE=0.683HC + 0.197QLF
7	CD=0.620HPC + 0.246EF
8	CD=0.620HPC + 0.510QLF
9	CD=0.555HC + 0.227EF
10	CD=0.555HC + 0.197QLF

Discussion

According to Table 4, ten criteria from the study can be used in defining the model of coastal erosion in Kemeruk residential area. Based on coastal erosion as dependent variable, the disaster occur could bring various destruction to house physical characteristic and health characteristic, which could influenced the quality of life factor. For example, coastal erosion happen due to extreme windy, strong beaches waves, unstable highly tides period, marine erosion, etc., which would destruct the furniture, vehicles, livestock, electrical equipment, and others important document. This matter could cause emotion disrupted, worries situation, restless, and uncomfortable feeling due to destruction of property, inadequate food supply, insufficient clean water supply, as well as threaten diseases. Therefore, adaptation concept is suggested to be the best methods to sustain the quality of life and education factors. For example, effective adaptation is considered through preparation by keeping food supplies, having a boat, building temporary fortress, received accurate and current weather information, identify places for transfer (especially involved with life and important document), and report to the headmaster

for immediate action. This action may reduce the negative affect on the quality of life on Kemeruk residents.

Apart of coastal erosion, coastal deposition is also suspected to occur on the Kemeruk settlements. Fortunately, the formation of coastal deposition is happen in minor impact to the resident, especially involved with the formation of sand shelf which could bring several issues on garbage pollution. Therefore, this problem will only require minimum adaptation like construct stilt houses to avoid sand deposition happen to the houses.

Conclusion

This study generates a model for the implementation of coastal erosion and deposition in Kemeruk residential. Researchers can use this information to identify unanswered issues or questions in the literature and define future research directions concerning on coastal erosion and deposition. This study helps educators better understand the concept of effective adaptation towards house physical characteristic and health characteristic in reducing the coastal erosion and others factors that are related to it.

The strength of this study is that it's suggests an approach to further validating the model to improve the generalizability of the model. However, the findings to this study are limited to the characteristics of the Kemeruk residential, and yet further research in coastal erosion and deposition can be conducted in other locations and field studies to provide greater picture of coastal erosion and deposition.

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