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DOES COASTAL COMMUNITY NEED TAKAFUL PROTECTION FROM COASTAL EROSION?

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Abstract: *Coastal erosion is one of natural disasters which results in critical destruction to both environment and community. Not only that, components of the environment will also be negatively affected by this. The higher the severity of this phenomenon, there will be more degradation in flora and fauna in terms of quality and quantity. Simultaneously, the socio-economic activities of the coastal community will be disrupted. In this study, the negative outcome which should be emphasized is the financial burdens posed on individuals. Therefore, associated study was conducted with the purpose to optimize the hostess communities' welfare through minimum financial burdens during the occurrence of coastal erosion. The survey was conducted on the coastal community whose households received the most impact from the disaster along the entire coastline of Peninsular Malaysia, so that information regarding the overall amount of loss or damaged costs sustained when this disaster occurred could be collected. Besides, in order to investigate on the suitability of Takaful scheme, the coverage scheme, premium charge and ratio of compensation, focus group discussion (FGD) was a group among related agencies who was involved in this study.*

Keywords: *Coastal Erosion, Takaful, Risk, Disaster, Game Theory.*

Introduction

Based on the approximation performed by National Coastal Erosion Study (NCES), within the approximately 4,809 KM of coastline in Malaysia, 1,380 KM of the whole area is where erosion occurs. It is possible that coastline, widely known as coastal zone, is specified as the narrow area of land and wetland, which are adjacent to the shoreline. This is the line that is located across the sea and the land. Based on an assessment conducted by NCES ether length of coastline in Peninsular Malaysia is 2,031 KM, while it is 2,778 KM in Sabah and Sarawak. These make up the total length of coastline in Malaysia, which is 4,809 KM.

Besides being prominent, erosion along the coastline has always been focused on due to harmful environment. With the change of climate, the state of this phenomenon has been deteriorating as of currently (Intergovernmental Panel on Climate Change (IPCC), 2012 and Nicholls, 2007). In fact, climate change is the main harm that would lead to coastal erosion. From this, it can be clearly seen that the coastal area in Malaysia is heavily affected by climate change. As a proof, the increase of temperature (Kwan, 2011 and Wai, 2005), sea level (Awang and Abdul Hamid, 2013; Sulaiman and Zainal Abidin, 2012; Ercan, 2013), fluctuating rain patterns and thunderstorm (Wan Hassan, 2010), strong wind and waves (Muzathik, 2011; Razali, 2010; Sapuan, 2011), and fickle northeast monsoon patterns (Kajikawa, 2012 and Suhaila, 2010) are the crises faced by the coastal community in Malaysia. Therefore, it is evident that coastal erosion is resulted from climate change. While it is not possible to fend off natural events such as flooding from occurring, it is possible to mediate the potentially negative consequences on homes and communities through effective flood management (Strathie, Netto, Walker and Pender, 2017).

Previously, little information regarding the volume of damage associated with coastal erosion was discussed by Hassan and Rahmat (2016). The information recorded by MOSTI is displayed in Table 1 below.

Table 1: Socio-Economic Outcomes Caused By the Increase of Sea Level (source: MOSTI, 2000)

Type of Outcome	**Socio-Economic Outcomes based on the High Rate of Sea Level Increase (0.9cm/year)**
The drop of agricultural rate from eroded/inundated lands production	Western Johor Agricultural Development Project Area invested RM46 million. 25% of the national drainage area was required for the West Johor Project area accounts.
The relocation and replacement of flood victims whose business/economic activities are affected due to the increasing flood	Based on 1980 data, it is estimated that RM88 millions of loss will occur in Peninsular Malaysia, and RM12 millions of loss will occur in Sabah/Sarawak due to the long term annual flood damage. It is also estimated that there will be an increase in the annual flood damage, which is by 1.67 times.
Drop of fisheries production rate due to mangrove loss	Due to 20% rate of mangrove loss, RM300 million losses occur. This results in a loss of approximately 70,000 tonnes of prawn production which costs RM4500/tonne.
Disruption of port operation	Several improvements might be observed due to the decrease of the severity of the phenomenon.

It has become the government's responsibility to administer millions ringgit in aid of the victims of the erosion in order to enable the recovery process for them. This is due to the adverse outcomes and physical damages which are due to this phenomenon. Besides, the purpose of this is also for the redevelopment of areas impacted by the disaster. The redevelopment is done by, for example, renewing the infrastructure. The recovery costs administered by the government for each state are as reported in the news.

Table 2: Recovery costs administered by the Government (source: News The Star)

State	Administered Cost (RM)
Pahang	15 Million
Kelantan	17 Million
Terengganu	1.07 Billion
Selangor	7.5 Million
Melaka	100, 000
Johor	5 Million

The effects of climate change, as stated by Badjeck (2009), occur to both the environment and community. Due to the harmful impacts posed by climate change on coastal community, awareness on environmental changes is important among coastal community. This can be seen from how the community will have a better preparation against numerous hazards on coastal erosion, provided if their awareness on climate change increases. This will result in them being equipped with sufficient amount of knowledge and awareness in overcoming this disaster. Therefore, through awareness, the coastal community will possibly be knowledgeable and alert of any proactive plans or adaptation strategies in the effort of preventing the hazards and decreasing the risks.

Based on the previous studies, numerous adaptation strategies could be put into practice for the reduction and adaptation of coastal erosion. However, it should be noted that it is more efficient to put adaptation strategies to practice among the coastal community. However, effective implementation of the adaptation strategies in preventing coastal erosion is not possible around the coastal zones. This is due to the heavy debate coming from the community itself. This is because even by putting the adaptation strategy in practice, the financial burden shouldered by the community would not be relieved. It is important that adaptation strategies economically and socially meet the qualifications needed by coastal community. The qualifications needed are not complicated, as what is needed is only a means of reducing the burden and compensating for the cost of losses caused by the disastrous erosion. It has also been realized by this community that there will be no stopping to this phenomenon. An exception would be when it is important for them to prepare for early prevention due to the continuous nature of this erosion. Therefore, it is suggested that authorities present other alternative which has not been stated in the previous research. Example of such alternative is the creation of a framework of coastal erosion Takaful scheme, where financial protection for the coastal community who are the victims to this disaster is emphasized on. It is also recommended that a Takaful scheme is designed as a strategy to encourage recovery after the disastrous coastal erosion.

Accordingly, this study was conducted with the objective towards the introduction and emphasis to a new adaptation strategy. This objective was fulfilled through the creation of a coastal erosion Takaful scheme framework for the coastal community in Malaysia. Takaful scheme is one of the approaches in managing risks. Furthermore, it is a social device where there is a possibility of grouping the uncertain risk of individuals together in order to make them more specific. This comes with the possible reimbursement of the financial support provided by individuals as a small periodic for those who suffer losses. It can also be said that the uncertainty of life bore by any individual or group can be shouldered by others. This also indicates the possibility of sharing losses among all members of a group on some equitable basis. However, the fact that coastal erosion is a never ending phenomenon due to the climate

change should not be ignored. Therefore, it is important to make the initial preparations in order to manage the risks and losses resulting from erosion. It can be summarized that this Takaful product is important for the coastal community who are the victims of coastal erosion. This is because this product helps cutting down the cost of losses which are the result of this unpredictable phenomenon. Ultimately, how the involvement of Takaful in this phenomenon would aid in the protection of the coastal community from the danger of erosion, and how it can be a strategy to provide support after the occurrence of this disaster become the focus of this investigation.

Literature Review

Coastal region is an important area for the coastal community in terms of residency, fisheries, tourism, recreation, and agriculture (Hassan et al., and Rahmat et al., 2016). Urbanization, agriculture, industrialization, trading and port-related activities, fishing and aquaculture, salt production and also tourism, mining and quarrying (Lodhia, 2011; Muhammad, 2012; Fahmi, 2013; Hassan et al., and Rahmat et al., 2016). Through these activities, coastal ecosystem will face adverse effects, which subsequently lead to coastal erosion through the increase of sea level, drought, tropical cyclones, flood, and other natural disasters (Lodhia et al., 2011). The risks create by flooding are a global problem (Strathie et al., Netto et al., Walker et al., and Pender et al., 2017). However, this particular argument contains inconsistency. This is the reason why the conclusion that the main factors of coastal erosion are climate change and human actions should be drawn by authors. After all, erosion is the result of man actions and the nature itself (Ghazali, 2006). Moreover, coastline changes are influenced by natural factors (sea level rise, erosion, and sedimentation) and the activities carried out by humans (reclamation and development of coastal area) (Hassan et al., and Rahmat et al., 2016). Erosion and sediment redistribution are essential, naturally-occurring components of the river system (Ahilan, S., Guan, M., Sleigh, A., Wright, N., & Chang, H., 2016).

In regards to the National Coastal Erosion Study (1986), the erosion occurring at the shoreline in Malaysia has been separated into three stages. The stages of erosion are illustrated in the table below:

Table 3: Stages of the erosion in Malaysia's shorelines (source: NCES, 1986)

Category	Explanation
1st Category	Erosion of shoreline starts. This results to the severe destruction of facilities or infrastructure. Therefore, attention needs to be paid to this matter so protection could be given promptly. Extreme hazard can also be observed.
2nd Category	Due to the delay of the shoreline to reach the risky point, erosion and hazard will occur for 5 to 10 years. Within a few years, this area will be a harmful coastal zone in a few years. An exception would be when preventive steps are taken.
3rd Category	The minor occurrence of erosion would take place at the shoreline which is yet to be developed. Furthermore, there will be minor or no effects from that provided if it is uncontrollable.

From early 1980's to the present, the topic regarding coastal erosion has been the focus by a number of studies. To illustrate this, while the causes and effects of coastal erosion on environment and coastal community have been focused on by most of the previous studies, variety of adaptation strategies in curbing coastal erosion are investigated. Furthermore, the

topic regarding coastal erosion mitigation approaches is the emphasis for most of the studies in the field of erosion. In the approaches, hard and soft engineering tools are utilized, rather than the Takaful scheme. The purpose of this research is the creation of a new framework of coastal erosion Takaful scheme which is mainly for coastal community. Therefore, experiment performed on the role of Takaful scheme in aiding the coastal community upon the occurrence of coastal erosion is the objective of this study.

There are several impacts from coastal erosion: environmental degradation, loss of human lives, deterioration of economic state, and social problems. A disaster statistics in the US are displayed in Table 4. The data regarding the loss of human lives and economic deterioration due to disaster, which took place from year 1980 until 2010, are presented in the table below.

Table 4: Data Regarding the Loss of Human Lives and Economic Deterioration Due to Disaster (1980-2010) (source: CRED)

No of people killed	1,239
Average killed per year	40
No of people affected	639,344
Average affected per year	20,624
Economic damage (US$ x 1000)	1,867,500
Economic damage per year (US$ x 1000)	60,242

Based on the data presented in table 4, it can be seen that these losses happen due to disasters such as earthquake, tsunami, landslides, typhoon, storms, flood, and tornado. The phenomenon of coastal erosion is mainly the result of these disasters. Therefore, this data would be suitable as a reference for investigating the loss and damage needed to be sustained after the phenomenon. The loss, damage, and the financial loss experienced per year in terms of US Dollar are displayed. Due to this fact, recalculating of the approximate losses in Malaysian Ringgit (MYR) is possible in these studies. This currency is used as a general knowledge regarding the losses sustained. The data regarding the recalculation for the losses of human lives and the economic deterioration in MYR is displayed in Table 5.

Table 5: Data of Recalculation of Losses of Human Lives and Economic Deterioration in MYR

No. of lives lost:	1239
Average of lives lost per year:	40
No. of people affected:	639,344
Average number of people affected per year:	20, 624
Economic Damage (1, 867, 500 x 4.12 x 1000)	7694, 100, 000
Economic Damage per Year (60, 242, 4.12 x 1000)	2481, 197, 040

The amount of economic damage (MYR) is extremely high. At this extent, not only the amount of damage is severe, it is also unexpected. However, the real value is obtained from disastrous phenomena. Based on the currency exchange on 27 November 2017, which is 1 USD = RM 4.12, calculation of the amount of economic damage has been made.

It is acceptable that the excessive damaged costs sustained are measured and taken into consideration. Hypothetically, if the damage occurred to a house would sustain RM 500,000 to RM 600, 000, how much would it cost for dozens or hundreds of houses? The issues regarding financial burden and administration of compensation are also questioned. Therefore, the main focus of this study is the investigation on financial burden.

Definition of Terms

Takaful

Takaful is a type of Islamic insurance, where members contribute money into a pooling system in order to guarantee each other against loss or damage. Takaful-branded insurance is based on Shariah, Islamic religious law, and explains the responsibility of individuals to cooperate and protect each other. Takaful concepts are free from the prohibited elements which are gharar, maisir and riba'. The basic concept of Takaful is cooperation and mutual assistance. Takaful also focuses coverage on the financial instrument. Takaful sticks on the concept of donation, called as Tabarru' and it is free from uncertainty elements and gambling. In this formation of Takaful scheme, it acts as saving instruments fundamentally through the use of annuity Takaful and investment linked Takaful.

Risk

Risk is a probability or threat of damage, injury, liability, loss or any other negative impact caused by external or internal vulnerability. The classical conception views risk as "the chance of injury, damage, or loss." It defined risk as the probability that a particular adverse event occurs during a stated period of time, or results from a particular challenge while detriment is defined as a numerical measure of the expected harm or loss associated with an adverse event. The probabilities and consequences of adverse events are assumed to be produced by physical and natural processes in ways that can be objectively quantified by risk assessment. There are three classifications of risk which are pure risk, speculative risk, and fundamental risk.

Disaster

Disaster is a sudden event, such as an accident or a natural catastrophe that causes great damage or loss of life. It also involves economic or environmental losses that exceed the community's or society's ability to cope using its own resources. Though often caused by nature, disasters can have human origins. A disaster is defined by the Asian Disaster Reduction Center (2003) as a serious disruption of the functioning of society, causing widespread human, material or environmental losses which exceed the ability of affected society to cope using only its own resources. Disaster types have been reviewed, and it was found that natural, man-made and hybrid disasters cover all types of disastrous events.

Coastal Erosion

Coastal erosion is the wearing a way of land and the removal of beach or dune sediments by wave action, tidal currents, wave currents, drainage or high winds. It involves the breaking down and removal of material along a coastline by the movement of wind and water. It leads to the formation of many landforms, and combined with deposition, it plays an important role

in shaping the coastline. The biggest factor affecting coastal erosion is the strength of the waves breaking along the coastline. The effects of coastal erosion can be observed on cliffs, tidal flats and salt-marshes, and beaches. The main roots of coastal erosion are man-induced and natural disaster.

Game Theory

Along the study, there are significant effects posed by coastal erosion on individuals, governments and society. Furthermore, economic scope is also involved in coastal erosion effects. In order to prove this, financial burden was one of the incidents associated with this disaster. Therefore, the framework of coastal erosion Takaful was proposed in this study with the objective of maximizing the hostess communities' welfare. This objective was fulfilled through the minimization of the post disaster financial burdens. Accordingly, a capable and acceptable theory was sought in this study so there would be a connection between the framework of coastal erosion Takaful scheme and this study. This was with the purpose of curbing the financial impacts related to the disaster.

Through an evolutionary game theory approach, the purpose of this study is to seek for an appropriate coastal erosion Takaful scheme. This is purchased by resident families or coastal communities who have experienced and suffered from the danger of coastal erosion. Aside from that fact, it is apparent that this theory can be used in order to determine the type of scheme offered by Takaful operator. It is also useful for discussions on the type of scheme which should be purchased by resident families according to how much salary they receive. However, investigation of the premium should be purchased by the participants. Additionally, in reducing the damages, the ratio of compensation will be covered for the resident families.

In identifying the evolutionary of game theory, several terminologies were reviewed in this study in order to acquire further understanding, as stated by Coles and Zhuang (2011). The terminologies are as follows:

- Actor (Player): In general, this word is associated with an individual, agency, organization, government, or business which has an involvement in a game with other actor (people).
- Benefactor: Actor who is equipped with resources for other actor.
- Game: A framework used for actors to interact with each other.
- Entering actor: Actor who normally does not function at the locations of disaster before the occurrence of it.
- Local actor: Actor who originally functions at the disastrous zones before disaster happens.
- Nash equilibrium: A stability point in the game condition. This is the condition where the advantages could not be obtained by any actor through changes of his/her strategy. Meanwhile, the strategies of other actors remain the same.
- Payoff: Each actor acquiring the benefits at the end of the game.
- Objective: Certain objectives of each actor in a game are maximized or minimized.
- Outcome: The payoffs for each actor are included by the verdict of a game after the game.

The terminologies above are for the investigation concerning on how game theory can be applied during decision making in the field of disaster recovery operations (Coles and Zhuang et al., 2011). This theory is a study regarding the methods used by economic agents for profit production with those agents being the priority. This is where there is the possibility of the profit in issue being planned by none agents (Samuelson, 1997). The interaction where multiple actors are involved and the production of profit at the end are the issues focused by game theory studies (Camerer, 2003). Moreover, besides being divided into particular games, the interaction occurs at specific time, which results in a payoff for each actor who is involved (Coles and Zhuang et al., 2011). Von-Neumann and Morgenstern (1944) mentioned the wide usage of game theory in a number of various research areas. Examples of those are sciences, political, engineering, biology, economics, computer sciences, and philosophy. This is due to its capability of natural, credible, and strategic interaction with individuals, organizations, and countries (Son and Rojas, 2011). When it comes to evolutionary games, a certain environment will be available, where decision on the optimum strategy profiles is possible amongst individuals of large population who are equipped with their own actions and strategies. However, the strategy profiles are dependent on the payoffs (Samuelson et al., 1997).

It has been suggested from this study that what are valuable for the participant when it comes to the Takaful plan are the lowest premium value and coverage, the most comprehensive coverage, and equitable compensation.

Framework of Coastal Erosion Takaful Scheme

The framework of Coastal Erosion Takaful scheme relies on three basic principles which are accessibility, affordability and simplicity of contracts. Figure below shows the application of the scheme:

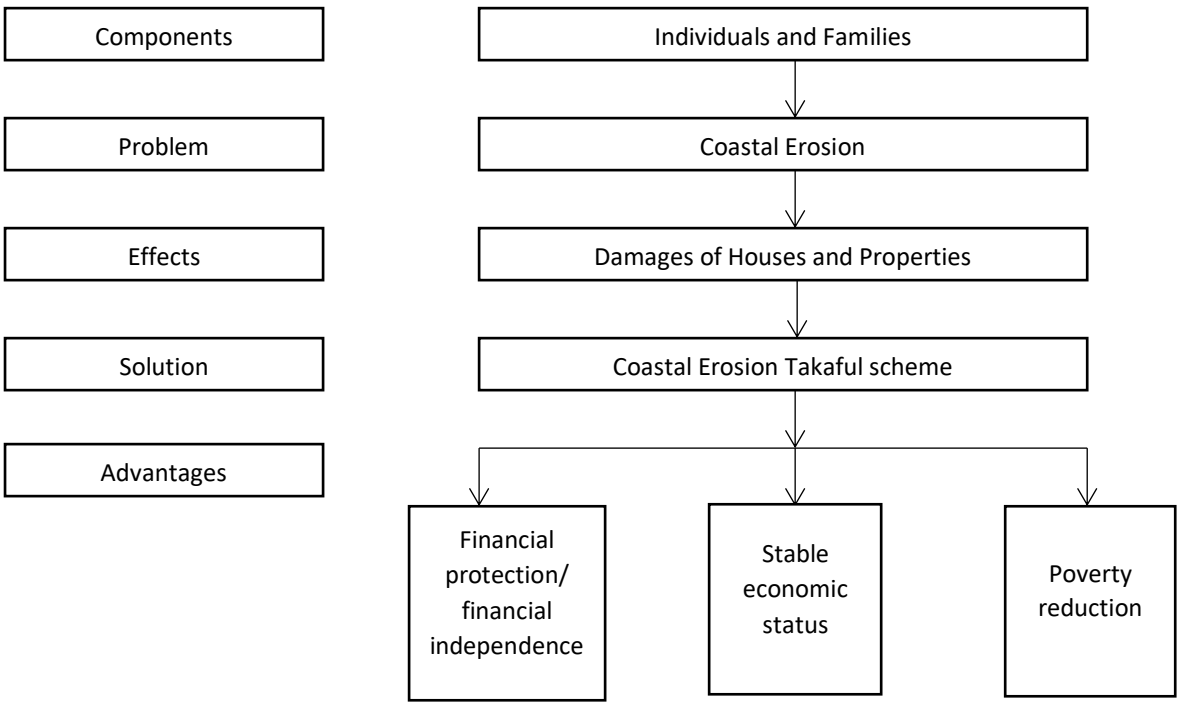

Figure 1: Framework of Coastal Erosion Takaful Scheme

Research Methodology

This part provides information on the location, population and method chosen to answer the research questions. This research utilized a multi-strategy research design by implementing both quantitative and qualitative methods. The quantitative method was conducted via survey while qualitative method was conducted via focus group discussion (FGD). Therefore, this study uses two parts of unit of analysis that differ based on the method which are coastal community for quantitative method and FGD conducted among Takaful operators and selected agencies to develop the framework of Takaful scheme for qualitative method. The research location and research design used are discussed in detail below.

Procedure for Quantitative Approach

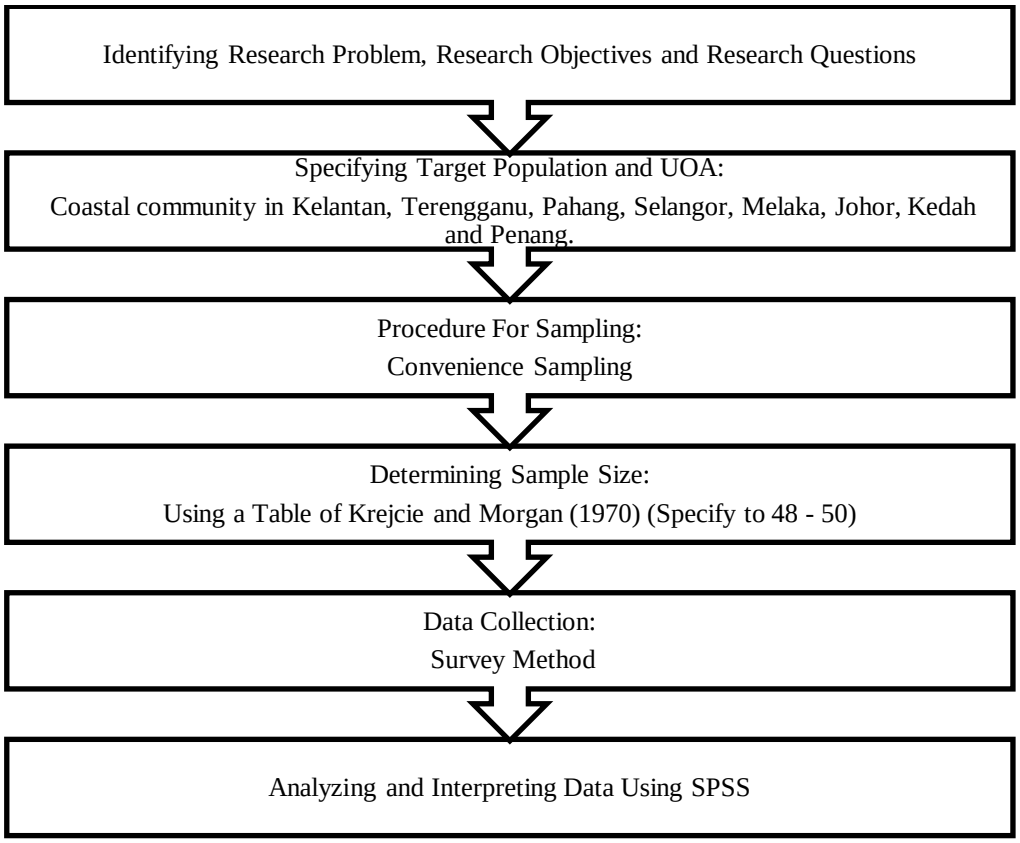

Figure 1: Phases of Quantitative Data Analysis

Procedure for Qualitative Approach

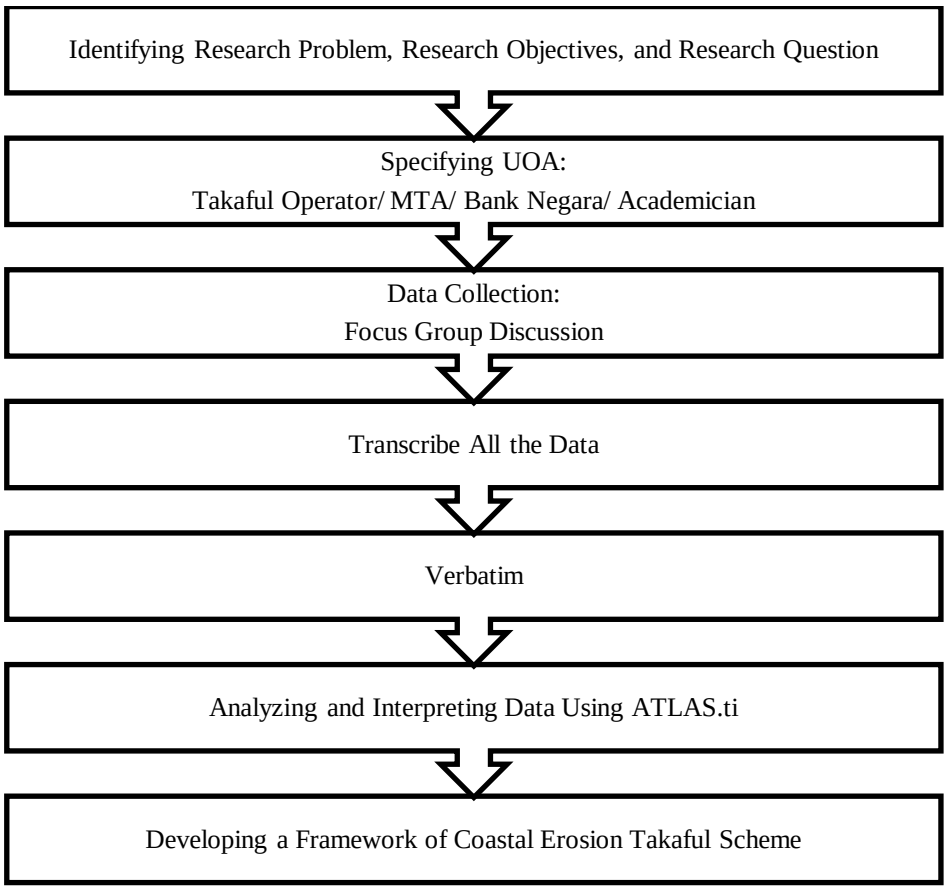

Figure 2: Phases of Qualitative Data Analysis and Developing a Framework

Findings

From the quantitative approach, the study found that coastal community are interested to participate in such a scheme, but mostly are only willing to contribute a minimum amount about RM50-RM100 per month due to the damaged costs incurred when the erosion strikes. Table 6 below shows the contribution affordable by the coastal community.

Table 6: Contribution

Contribution (RM)	Total Respondents	Percentage
50 – 100	111	27.8
101 – 150	110	27.5
151 – 200	73	18.3
Above 201	106	26.5
Total	**400**	**100.0**

The study also found that coastal community suffered damaged of houses and properties. Its involves the high costs of losses. Table 7 below shows the damaged costs incurred of houses and properties suffered by the coastal community due to the phenomenon of coastal erosion.

Table 7: Damaged of Houses

Damaged Costs (RM)	Total Respondents	Percentage
Below 50 000	108	27.0
51 000 – 100 000	192	48.0
Above 100 001	100	25.0
Total	**400**	**100.0**

Table 8: Damaged of Properties

Damaged Costs (RM)	Total Respondents	Percentage
Below 1000	116	29.0
1 001 – 10 000	160	40.0
Above 10 001	124	31.0
Total	**400**	**100.0**

The damaged costs of houses and properties posed on the individuals especially breadwinner giving them awareness to have a financial protection in order to aid them undergo recovery process during post disaster.

Next, regarding on the qualitative approach, the FGD conducted based on the discussion with industrial members represented by Malaysia Takaful Association (MTA), Syarikat Takaful Malaysia Berhad, Pru-Bsn Takaful and Bank Negara Malaysia consider on the formulation of this Takaful scheme. All the decision of the formulation such scheme should fulfill the requirement some sort like specification of building construction around the coastal area. They suggested that all the building specification are essential for Takaful operator in order to determine either the claim for losses are valid or not. In short, industrial members from Bank Negara Malaysia agreed on the proposed research for this basic protection from coastal erosion in producing new product to help coastal community facing the losses arrising out from this serious phenomenon. The higher the amount of losses incurred, the higher the amount of Takaful contribution required. The industrial members also suggested that the new product was community's dependence on the government with the involvement of the interested stakeholders on the contribution fee as part of their corporate social responsibilities.

Finally, FGD supports the coastal erosion Takaful framework as proposed in figure 1 above. People who contribute in coastal erosion Takaful scheme will be covered the losses on the damaged of houses and properties based on the contribution paid by the paticipants and the coverage suitable to use a parametric model which is Takaful operator agrees to make a payment upon the occurrence of a triggering events.

Conclusion and Recommendation

The recovery and risk management of the financial burden shouldered by coastal community or people who are impacted by the coastal erosion phenomenon is the primary concern of coastal erosion Takaful scheme. This scheme assist in covering the loss and damage sustained in the houses and properties.

As proposed in this study, coastal erosion Takaful scheme provides aid to anyone (especially in the coastal community) who is interested in joining it. The combination of damage and loss incurred is an effort that this scheme performs. However, additions of other losses coverage which are quite related to the issue of coastal erosion required an additional payment as a contribution into the policy. With this combination scheme, the value of contribution paid by

participant would be saved. This is a better option compared to participants needing to pay separate amount for each loss or damaged name they include.

It is important to remember that coastal erosion Takaful scheme plays a role as an effective instrument of resilience for a counter-attack against the disastrous coastal erosion. In the context of Takaful scheme, resilience is in terms of financial instruments. Furthermore, the dimensions of financial resilience from disaster can be separated into amount of damage sustained and speed of recovery (Kousky and Shabman, 2016). With a speedy recovery, where more financial support is allocated in the policy, Takaful scheme assist participants who have gone through this disaster. This is a better option compared to the dependency on the assistance given by the government. Although it is an undeniable fact that the government is available for assistance, victims will not be able to obtain the assistance as fast as the one provided by the Takaful scheme. Moreover, there is the possibility of inadequacy of the assistance provided for the victim to be under the recovery process. This is due to the fact that the assistance supplied by the government is not only for one victim, but thousands of them. Therefore, victims of coastal erosion will be able to recover from disaster in a more comfortable way through this Takaful scheme.

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