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Ordered Weighted Average Parameterization for Flood Related Disaster-based Edutourism

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Abstract **–**Disaster-based edutourism can be defined as the activities of visiting environmental disaster areas occurred for education purposes. Although Kelantan witnesses flood disasters almost every year, little does the community know that the negative flooding phenomenon could be turned into disaster-based edutourism. The primary constraint of disaster-based edutourism is the limited specific parameters and sub-parameters that tourists prefer for attraction selection, within which tour packages are typically established. Moreover, regarding the parameter, there are few touches on the geospatial aspect, especially in tourist spatio-temporal movement. This study aims to perform the parameterization for attraction site selection of disaster-based edutourism utilizing the Ordered Weighted Average (OWA) model. This study has three objectives: to identify the parameters of the attraction selection for disaster-based edutourism, to carry out the parameterization of the attraction selection to create the spatial-related model for disaster-based edutourism and to design tour packages including specific disaster attractions. In brief, parameterization defines an attraction's characteristics to provide a good tour. Consequently, the study suggested including a geospatial-based proximity measure between different attractions as an output in the form of parameter. The model's outcome has shown the relationship underpinning the score of each single parameter and sub-parameter. The second output is the ranking of the attractions derived from the multiple products of OWA with the combination of parameter and sub-parameter scores. The top six attractions are Kelantan State Museum, Kelantan Public Library, Sultan Muhammad IV Kelantan Stadium, Tambatan Diraja, KTM Dabong and Tugu Peringatan Banjir. Finally, this ranking was used to produce the two types of tour packages. The first type of Set A tour package includes all six attractions in the whole state of Kelantan. Meanwhile, the second type of Set A tour package includes only the top four attractions listed for the Kota Bharu-based tour package. Though the prominence of spatial-linked parameters is of medium significance, this study is critical because it can assist tourists in planning their holidays via the suggested tour package. Subsequently, this will spur tourism in Kelantan based on the added value of disaster-based tourism.

Keywords *–Disaster-based edutourism, Tour package, Ordered Weighted Average (OWA), Spatial Parameterization*

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1.0 Introduction

Since the 1980s, the tourism industry has received massive support from the Malaysian government, which aims to promote the country as a top-of-mind tourist destination (Puah et al., 2018). Malaysia's tourism industry has many tourism services, including cultural, adventure, business, and agricultural (Tourism Malaysia, 2014). The tourism industry greatly influences the Malaysian economy by increasing foreign exchange earnings and employment opportunities. According to the World Tourism Organization (2005), Malaysia ranks 14th in countries in terms of international tourism arrivals. The data further explain that the arrival of tourists to Malaysia ranked number three after Britain and Canada among the 53 Commonwealth countries.

Furthermore, the report has equally stated that the tourism industry was a key foreign exchange earner for Malaysia in 2005, contributing to over 40% of the country's balance of payment (EPU, 2006). Stainton (2020) opines that disaster tourism is an act of visiting places that have been exposed to man-made or natural environmental disasters. Disaster tourism can come from floods, tsunamis, earthquakes, or hurricanes. People engage in disaster tourism for various reasons, such as curiosity, to witness the aftermath of these events or to understand the impact of disaster. Floods are a natural disaster in Malaysia that happens almost every year, especially during the monsoon season in Kelantan (Sulaiman et al., 2016). Nevertheless, disaster tourism can be seen as either educational experiences or exploitative. In addition, edutourism can be referred to as the tourists who travel as a group to a particular site with the sole aim of learning and experiencing the features related to the site (Bodger, 1998).

Choosing the tourist attractions is a very complex phase, especially when designing tour packages. Within the context of the tour package, disaster tourism attractions can be long-lasting and popular with tourists after the disaster (Stainton, 2020). A recent study shows that the impact of post-disaster tourism of the Indian Ocean earthquake and tsunami that hit Aceh, Indonesia, in December 2004 is one such disaster that remains indelible today. Frankly, although tourism was not a traditional business in Aceh, the tsunami metamorphosed the tourism sector into a new critical economic sector after the tragedy (Liu-Lastres et al., 2020). According to Adriansyah Nazaruddin & Sulaiman (2013), the museum, the monuments and the boathouse have become prominent attractions that attract locals and international tourists. Regardless of the natural disasters, Thorburn (2009) opines that tourists may learn about how Aceh successfully recovered while offering the

attractions valuable insights into disaster management. Thus, disaster-based edutourism attractions are selected by considering the relevant parameters and sub-parameters.

This study aims to perform the spatial-related parameterization of attraction selection for disaster-based edutourism in Kelantan. The primary objective is identifying the parameters of the attraction selection for disaster-based edutourism. The secondary aim is to parameterize the attraction selection to create a spatial-related model for disaster-based edutourism. The third objective is to design tour packages that include specific disaster-related attractions. Essentially, the main fulcrum of this study is to overcome the problem of insufficient tour packages for disaster-based edutourism offered by any travel agency in Kelantan. The tour package business has dominated the travel industry. Still, the lack of a tour package for disaster-based edutourism indicates that the tourism industry experts do not take advantage of the disaster events in Kelantan. Therefore, the deficiency of tour packages will also contribute to the deficiency of geospatial-related parameters related to disaster-based edutourism. Furthermore, considering the requirements of tourism stakeholders will somehow address the lack of design of tour packages.

Moreover, travel agencies might think that disaster is one of the negativities that affect their business and environment. Similarly, tourists will be left with the imagination of the natural disaster, which might be stressful, insecure and discomfort. This will eventually create a situation where tourists lose interest in touring such places (Coombes & Jones, 2010; Huang & Inoue, 2007; Nicholls, 2004). Even though some disaster-based edutourism attractions have been offered in the tour package, the potentiality of the attraction sites-based edutourism might be diminished. This is due to the inability of many tourists to learn about disaster-based edutourism. Thus, if people do not take the opportunity, the tourism industry will face fewer tourists visiting such places (Chockalingam & Ganesh, 2010).

Geographic information systems (GIS) have emerged as useful computer-based tools for spatial description and manipulation to utilize more interesting parameterization. Although often described as a decision support system, there have been some supporting modules for site selection based on various area conditions and conflicting objectives (site selection for large wind turbines using GIS). Given the importance of the location choice, many analytical procedures have been developed for location analysis and site selection.

2.0 Methodology

The methodology of this study has been developed based on the objectives mentioned. Figure 1 depicts a structured approach to creating a tour package, divided into three main stages, each associated with specific goals. Stage 1 focuses on conducting a preliminary study, which includes a literature review to establish a foundation for the research. A research design is formulated, and the research statement, objectives, questions, scope, and methodology are defined.

Stage 2 involves the data collection for the disaster-based edutourism attractions process. A list of attractions, parameters, and sub-parameters will be compiled to guide the selection process. Research instruments such as a questionnaire and a rubric for evaluating attractions have also been developed. The collected data is then processed, leading to the development of a model using the Ordered Weighted Average (OWA). This process helps select the best alternatives based on defined criteria and sub-criteria.

Finally, in Stage 3, the actual tour package design takes place. This includes determining the sequence of attractions, the route, and the duration of the visit. The designed tour package is validated to meet the desired objectives and quality standards. The entire process is systematically structured to achieve the goals set out in each stage, leading to the finalization of a well-designed tour package.

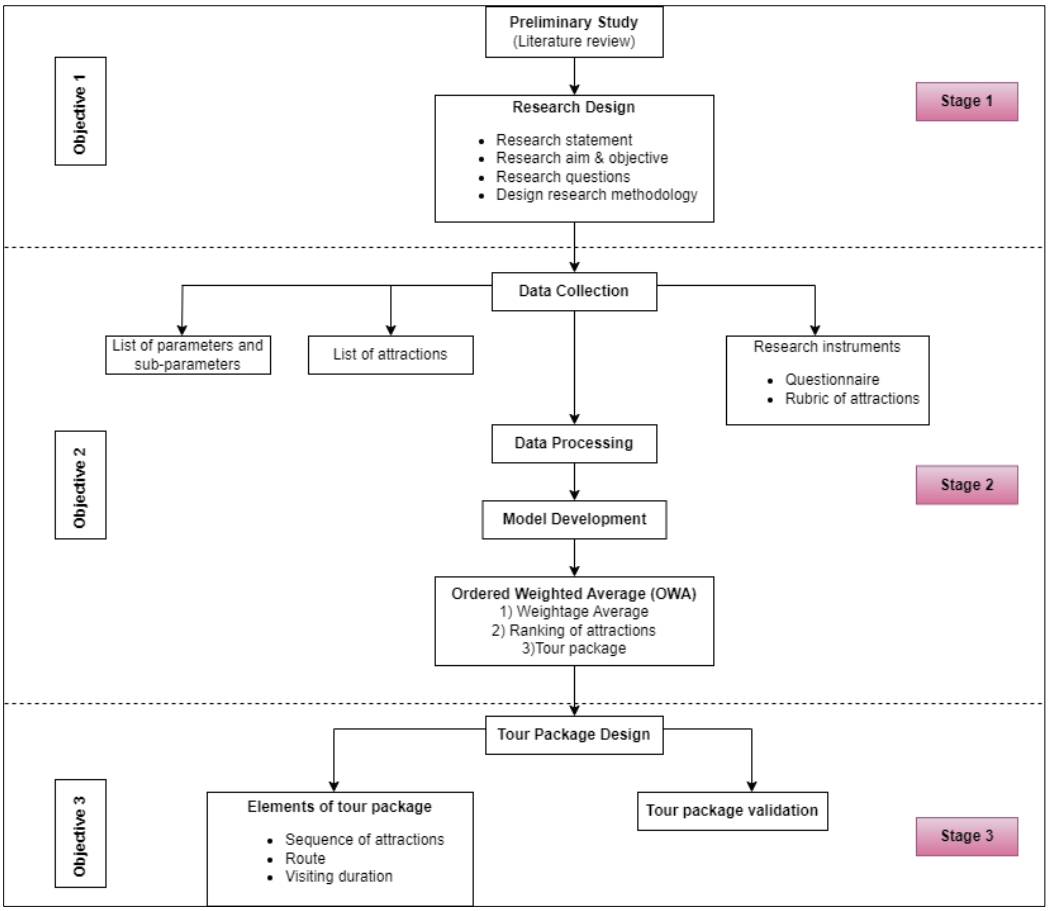

Figure 1. Methodological flow chart.

2.1 Data Acquisition for Disaster-based Edutourism Attractions

2.1.1 Selection of the Attractions

Site attractions are important for tourists' destination choices (Emir et al., 2016). Attractions can be locations, people, events or things that are the primary purpose that grab tourists' attention to visit and explore specific destinations when travelling (Benckendorff, 2015). In this study, the sites selected for the attraction covered the vicinity of Kota Bharu and its environs. Table 1 shows the list of sites of attractions that are potentially disaster-based edutourism attractions.

Table 1. List of attractions.

No.	Attractions
1.	KTM Dabong
2.	Tugu Peringatan Banjir, Kuala Krai
3.	Sekolah Kebangsaan (SK) Manek Urai
4.	Guillemard Bridge, Tanah Merah
5.	Kelantan State Museum, Kota Bharu
6.	Kelantan Public Library, Kota Bharu
7.	Sultan Muhammad IV Kelantan Stadium, Kota Bharu
8.	Tambatan Diraja, Kota Bharu

2.1.2 Identify the Parameters and Sub-parameters

According to Pantouvakis and Patsiouras (2016), the image of tourist attractions is the most critical element in deciding where tourists will travel. Echtner and Ritchie (1991) utilized several parameters to evaluate tourist attractions' image. A parameter can be called a measurable factor that describes attractions' characteristics.

In this study, four main parameters are being applied, which are 1) Assessment of physical features of the tourist attractions, 2) Assessment of existing or nearby infrastructure of the tourist attractions, 3) Assessment of the location and level of accessibility to reach the tourist attractions and 4) Assessment on people that related to the tourist attractions. Each parameter is broken down into specific sub-parameters that help assess the attractions. Table 2 shows a list of parameters with their sub-parameters that are used to explain more about the related parameters.

Table 2. List of parameters and sub-parameters.

Parameter, P	Sub-parameter, SP	Citation
Assessment of physical features	a. Current physical condition	(Marzuki et al., 2011)
	b. Topography condition	
	c. Development potential	
Assessment of existing or nearby infrastructure of the tourist attractions	a. Nearby accommodation	
	b. Nearby or own food stall	
	c. Nearby information centre	
	d. Nearby or own toilet	
	e. Nearby or own prayer room	
	f. Information signage	
	g. Educational value	(Maryani et al., 2014)
	h. Ticket fee to enter the attraction	(Vengesayi et al., 2009)
Assessment of the location and level of accessibility to reach the tourist attractions	a. Proximity between an attraction and other attractions	
	b. Level of accessibility to reach the attractions	
Assessment of people related to the tourist attractions	a. Attitude of locals against tourists	
	b. Attitude of the attraction employees against tourists	
	c. Employee's knowledge of the attractions	

2.1.3 Questionnaire Design

The questionnaire is always used as a research tool in a study. It consists of questionnaires that aim to collect respondent information (QuestionPro, 2021). When designing a questionnaire, three types of scoring scales can be used: dichotomous scale, Likert or rating scale and semantic differential scale (Jenn, 2006). The purpose of the questionnaire is to let the respondents choose the parameters and sub-parameters according to their importance in designing disaster-based edutourism tour packages. The scale of importance was set from 1 to 5. For scale 1 – very unimportant, scale 2 – unimportant, scale 3 – partially important, scale 4 – important and scale 5 –

very important. An online questionnaire, Google Forms, was used in this study. However, a face-to-face survey is required to fulfil this study's objectives due to the small number of respondents.

2.1.4 Data Collection Procedure - Case Study Area

This study was conducted in Kelantan, located on the East Coast of Peninsular Malaysia. Historically, numerous significant flood phenomena have occurred in the last few decades in Kelantan. Then, one catastrophic flood was reported that had caused extensive damage to infrastructure (Eliza et al., 2016). In addition, floods have affected Kelantan's geography, landscapes, activities and attractions (Nurashikin Sungip et al., 2018). Hence, several attractions in Kelantan might be tourist spots where tourists can witness the aftermath of the disaster. Therefore, it provides the best choice of study area.

After that, a face-to-face questionnaire survey was also conducted during the field trip to Kelantan. The printed questionnaire form was distributed to the related tourism agencies in Kelantan, which are Pejabat Exco Negeri Kelantan, Kelantan Tourist Information Centre (KTIC), Centre for Strategic Studies, Ministry of Tourism, Arts and Culture (MOTAC), Kelantan State Museum Corporation and KTM Dabong staff.

As this study is focused on disaster-based edutourism, the disaster attractions in Kelantan were evaluated directly. As mentioned in Section 2.2.1, the selection of the attraction sites includes both inside and outside Kota Bharu. There are eight attractions sites in total, which are KTM Dabong, Tugu Peringatan Banjir, SK Manek Urai, Guillemard Bridge, Kelantan State Museum, Kelantan Public Library, Sultan Muhammad IV Stadium and Tambatan Diraja.

The attraction rubric evaluated each attraction site based on parameters and sub-parameters. A rubric is a scoring guide used to assess the performance of a product, object, place or others. It is divided into three sections: 1) performance requirements, 2) rating scale, and 3) indicators (Faculty Innovation Center of The U. In this study, the attractions were given scores based on the identified parameters and sub-parameters (Section 2.1.2) within the rating scale of 1 to 5. Figure 2 shows some pictures of interviews with experts during the data collection in Kelantan.

Figure 2. Pictures during data collection.

3.0 Result and Discussion

The study identified set parameters and sub-parameters used to assess tourist attractions, specifically for disaster-based edutourism, as mentioned in Section 2.1.2 (Table 2). The parameters are categorized into four main parameters: physical features, infrastructure, accessibility, and people-related factors, each associated with sub-parameters. The Ordered Weighted Average (OWA) method was applied to carry out the parameterization, utilizing the identified parameters and sub-parameters to ensure a systematic and weighted evaluation process.

This study's outcome comprises three main results: 1) weightage average, 2) ranking of attractions, and 3) tour package. There are 60 respondents based on the questionnaire administered during the field trip, and the responses were classified into the number of respondents based on each parameter and sub-parameter according to their importance. For instance, three respondents answered partially important, 16 answered important, 41 answered very important for parameter 1 (P1) and so on. Later, the weightage average can be calculated based on the questionnaire results.

Table 3. The total number of respondents is based on each parameter (P) and sub-parameter (SP) according to the importance scale.

No.	PARAMETER (UPPERCASE) and sub-parameter for disaster-based edutourism attractions	1 - Very unimportant	2 - Unimportant	3 - Partially Important	4- Important	5 - Very Important
1.	**ASSESSMENT OF PHYSICAL FEATURES OF THE TOURIST ATTRACTIONS**	**-**	**-**	**3**	**16**	**41**
	a. Current physical condition (*Referring to the condition of the tourist attractions, whether they are still well maintained or the available facilities still usable)*	**-**	**1**	**3**	**23**	**33**
	b. Topography condition (*Referring to the physical surface/features of the road and the access to the tourist attractions)*	**-**	**1**	**4**	**16**	**39**
	c. Development potential (*Referring to the potential of the tourist attractions to be used as the official disaster-based edutourism attractions, to be more popular and have educational elements)*	**-**	**-**	**7**	**18**	**35**
2.	**ASSESSMENT OF EXISTING/NEARBY INFRASTRUCTURE OF THE TOURIST ATTRACTIONS**	**-**	**-**	**2**	**14**	**44**
	a. Nearby accommodation	**-**	**-**	**6**	**19**	**35**
	b. Nearby/own food stall	**-**	**-**	**4**	**22**	**34**
	c. Nearby information centre (*Referring to the tourist information centre to make it easier for tourists to get information on tourist attractions)*	**1**	**1**	**4**	**18**	**36**
	d. Nearby/own toilet	**-**	**-**	**1**	**15**	**44**

	e. Nearby/own prayer room	**-**	**-**	**-**	**10**	**50**
	f. Information signage (*To provide clearer information to tourists about the attractions, such as directional signs and historical information signs)*	**-**	**-**	**2**	**17**	**41**
	g. Educational value (*Referring to the context of learning while travelling with the existence of educational values at the tourist attractions)*	**-**	**-**	**2**	**24**	**34**
	h. Ticket fee to the tourist attractions	**-**	**3**	**9**	**27**	**21**
3.	**ASSESSMENT OF THE LOCATION AND LEVEL OF ACCESSIBILITY TO REACH THE TOURIST ATTRACTIONS**	**-**	**-**	**2**	**20**	**38**
	a. Proximity between an attraction and other attractions (*Referring to the number of attractions within a radius of 3km from another attraction)*	**-**	**-**	**6**	**36**	**18**
	b. Level of accessibility to reach the attractions *(Referring to a good road network, whether the attractions are placed within the city centre or outside the city)*	**-**	**-**	**1**	**19**	**40**
4.	**ASSESSMENT OF PEOPLE THAT RELATED TO THE TOURIST ATTRACTIONS**	**-**	**-**	**3**	**23**	**34**
	a. Attitude of locals against tourists	**-**	**1**	**2**	**18**	**39**
	b. Attitude of the attraction employees against tourists	**-**	**-**	**2**	**10**	**48**
	c. Employee's knowledge of the attractions	**-**	**-**	**2**	**12**	**46**

3.1 Weightage Average Calculation

The weighted averaging (OWA) introduced by Yager (2004) is suitable for multicriteria decision-making (MCDM). Weighted average is a computation that considers the degrees of importance of the numbers in a data set. The scale of importance for each parameter and subparameter is the assigned weight, which is 1 to 5. Meanwhile, the responses are classified into the number of respondents based on each parameter and sub-parameter according to the importance scale (Table 3), known as data values. The formula used to compute the weightage average is shown in Equation (i). The weighted average is equal to the sum of the product of the assigned weight multiplied by the data value and divided by the sum of the assigned weights. In addition, Figure 3 shows the example weightage average calculation for parameter 1 (P1), which assesses the physical features of the tourist attractions sites using an online weightage average calculator. Table 4 shows the calculated weightage average value for all the parameters. Meanwhile, Table 5 shows the average value for all the sub-parameters.

$$WA = \frac{\text{Sum of (Weight} \times \text{Data Value)}}{\text{Sum of all the Weights}} \qquad \text{Equation (i)}$$

*WA - weightage average

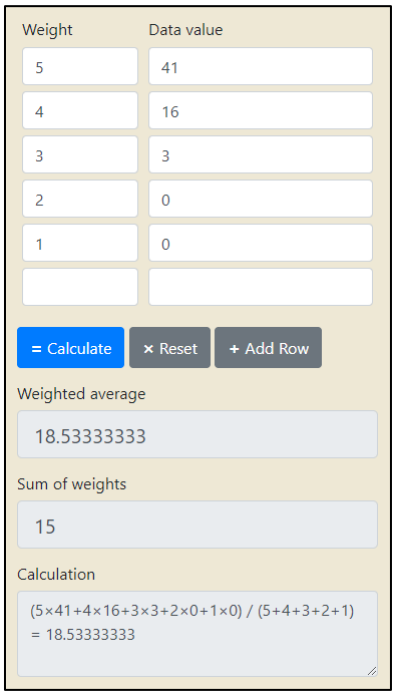

Figure 3. Weightage average calculation for Parameter 1 (P1).

Table 4. The weightage average value for each parameter.

PARAMETERS (P)	WEIGHTAGE AVERAGE (WA)
P1: ASSESSMENT OF PHYSICAL FEATURES OF THE TOURIST ATTRACTIONS	**18.53**
P2: ASSESSMENT OF EXISTING/NEARBY INFRASTRUCTURE OF THE TOURIST ATTRACTIONS	**18.80**
P3: ASSESSMENT OF THE LOCATION AND LEVEL OF ACCESSIBILITY TO REACH THE TOURIST ATTRACTIONS	**18.40**
P4: ASSESSMENT OF PEOPLE THAT RELATED TO THE TOURIST ATTRACTIONS	**18.07**

Table 5. The weightage average value for each sub-parameter.

SUB-PARAMETERS (SP)	WEIGHTED AVERAGE (WSP)
SP 1a: Current physical condition	**17.87**
SP 1b: Topography condition	**18.20**
SP 1c: Development potential	**17.87**
SP 2a: Nearby accommodation	**15.27**
SP 2b: Nearby/own food stall	**18.00**
SP 2c: Nearby information centre	**17.80**
SP 2d: Nearby/own toilet	**18.87**
SP 2e: Nearby/own prayer room	**19.33**
SP 2f: Information signage	**18.60**
SP 2g: Educational value	**18.13**
SP 2h: Ticket fees to the tourist attractions	**16.40**
SP 3a: Proximity between an attraction and other attractions	**16.80**
SP 3b: Level of accessibility to reach the attractions	**18.60**
SP 4a: Attitude of locals against tourists	**18.33**
SP 4b: Attitude of the attraction employees against tourists	**19.07**
SP 4c: Employee's knowledge of the attractions	**18.93**

3.2 Rubric for the Attractions

As mentioned in Section 2.1.4, the rubric (R) is a scoring guide to evaluate the attractions. The rubric has three elements, which are 1) performance criteria, 2) rating scale, and 3) indicators.

Then, each attraction will be evaluated according to the specified parameter and sub-parameter. In summary, Table 6 shows all the rubric scores for each attraction according to the parameter. Then, the score is named RPm, which stands for rubric score for the parameter, while **m** is the maximum number of parameters, either parameter 1, 2, 3 or 4. For instance, KTM Dabong receives three scores for (RP_1), four scores for (RP_2), two scores for (RP_3) and four scores for (RP_4) respectively.

Table 6. Rubric score for each attraction according to the parameter (RP_m).

No.	Attractions	RP_1	RP_2	RP_3	RP_4
1.	KTM Dabong	3	4	2	4
2.	SK Manek Urai	3	2	2	2
3.	Tugu Peringatan Banjir	4	3	3	2
4.	Guillemart Bridge	3	2	2	2
5.	Kelantan State Museum	4	4	4	3
6.	Kelantan Public Library	4	4	4	3
7.	Sultan Muhammad IV Kelantan Stadium	4	3	4	3
8.	Tambatan Diraja	5	4	4	2

Meanwhile, Table 7 indicates all the scores for each attraction according to the sub-parameter. Then, the score is named **RSP_{mn}**, which stands for rubric score for sub-parameter. At the same time, **m** is the maximum number of parameters, either parameter 1, 2, 3 or 4 and **n** is known as the sub-parameter that lies under each parameter. For example, KTM Dabong receives five scores for (RSP_{1a}), two scores for (RSP_{1b}), and three scores for (RSP_{1c}). Next, KTM Dabong has one score for (RSP_{2a}), four scores for (RSP_{2b}), one score for (RSP_{2c}), five scores for (RSP_{2d}) until (RSP_{2g}) and two scores for (RSP_{2h}). Then, KTM Dabong scored for (RSP_{3a}) and two scores for (RSP_{3b}). Lastly, a four score was given to (RSP_{4a}) and a five score for (RSP_{4b}) and (RSP_{4c}) respectively.

Table 7. Rubric score for each attraction according to sub-parameter (RSP_{mn}).

No.	Attractions	RSP_{1a}	RSP_{1b}	RSP_{1c}	RSP_{2a}	RSP_{2b}	RSP_{2c}	RSP_{2d}	RSP_{2e}	RSP_{2f}	RSP_{2g}	RSP_{2h}	RSP_{3a}	RSP_{3b}	RSP_{3c}	RSP_{4a}	RSP_{4b}
1.	KTM Dabong	5	2	3	1	4	1	5	5	5	5	2	1	2	4	5	5
2.	SK Manek Urai	3	2	3	4	4	1	1	3	1	4	1	1	2	5	1	1
3.	Tugu Peringatan Banjir	3	5	5	3	4	1	4	4	5	5	1	1	5	5	1	1
4.	Guillemard Bridge	3	4	3	1	1	1	1	3	4	3	1	1	3	3	1	1
5.	Kelantan State Museum	5	5	4	4	5	5	5	5	5	3	1	3	5	3	4	4
6.	Kelantan Public Library	5	5	3	3	5	4	5	5	5	5	1	3	5	3	4	4
7.	Sultan Muhammad IV Kelantan Stadium	5	5	3	3	4	3	5	5	4	2	3	3	5	5	4	3
8.	Tambatan Diraja	5	5	5	4	4	3	4	4	4	4	1	3	5	5	1	1

3.3 Ranking of Attractions

The ranking of attractions consists of SET A, which includes all the parameters and the sub-parameters. Furthermore, the calculation for ranking of attractions for SET A involves all the weightage averages of the parameter (WP), the weightage average of the sub-parameter (WSP) and the rubric score of the sub-parameter (RP_{mn}). Meanwhile, m is the maximum number of parameters, and n is the maximum number of sub-parameters. Some mathematical formulas are also applied to get the ranking. Hence, Equation (ii) shows the first formula for ranking SET A. First, there is a need to find the value of T_{mn}. T_{mn} is the product of the weightage average of the parameter (WP_m) and the sub-parameter (WSP_{mn}), and the results are shown in Table 8.

$$T_{mn} = WP_m \bullet WSP_{mn} \qquad \text{Equation (ii)}$$

Table 8. Product of weightage average of parameter vs weightage average of sub-parameter, Equation (ii).

T_{mn}	TOTAL VALUE
T_{1a}	331.13
T_{1b}	337.25
T_{1c}	331.13
T_{2a}	287.08
T_{2b}	338.40
T_{2c}	334.64
T_{2d}	354.76
T_{2e}	363.40
T_{2f}	349.68
T_{2g}	380.84
T_{2h}	308.32
T_{3a}	309.12
T_{3b}	342.24
T_{4a}	331.22
T_{4b}	344.59
T_{4c}	342.07

Next, the calculation is performed to get the final result of the attractions ranking for SET A. Hence, Equation (iii) shows the second formula for ranking attractions SET A. From the T_{mn} value in Table 8, we multiply with the rubric score of the sub-parameter (RSP_{mn}). Then, the multiply product we called $FSB_{mn,}$ as shown in Table 9. Then, sum up all the values of FSBmn for each attraction and call it a grand total.

$$FSB_{mn} = T_{mn} \bullet RSP_{mn} \qquad \text{Equation (iii)}$$

Table 9. The product of Equation (iii).

No.	Attractions	FSB_{1a}	FSB_{1b}	FSB_{1c}	FSB_{2a}	FSB_{2b}	FSB_{2c}	FSB_{2d}	FSB_{2e}	FSB_{2f}	FSB_{2g}	FSB_{2h}	FSB_{3a}	FSB_{3b}	FSB_{4a}	FSB_{4b}	FSB_{4c}	**Grand Total**
1.	KTM Dabong	1655.65	993.39	287.08	1353.60	334.64	1773.80	1817.00	1748.40	1904.20	616.64	309.12	648.48	648.48	1324.88	1722.95	1710.35	**18910.68**
2.	SK Manek Urai	993.39	993.39	1148.32	1353.60	334.64	354.76	1090.20	349.68	1523.36	308.32	309.12	648.48	648.48	1656.10	344.59	342.07	**12460.52**
3.	Tugu Peringatan Banjir	993.39	1655.25	861.24	1353.60	334.64	1419.04	1453.60	1748.40	1904.20	308.32	309.12	1711.20	1711.20	1656.10	344.59	342.07	**18081.41**
4.	Guillemard Bridge	993.39	993.39	287.08	338.40	334.64	354.64	1090.20	1398.72	1142.52	308.32	309.12	1026.72	1026.72	993.66	344.59	342.07	**11606.58**
5.	Kelantan State Museum	1655.65	1324.52	1148.32	1692.00	1673.20	1773.80	1817.00	1748.40	1142.52	308.32	927.36	1711.20	1711.20	993.66	1378.36	1368.28	**22348.84**
6.	Kelantan Public Library	1655.65	993.39	861.24	1692.00	1338.56	1773.80	1817.00	1748.40	1904.20	308.32	927.36	1711.20	1711.20	993.66	1378.36	1368.28	**22157.67**
7.	Sultan Muhammad IV Kelantan Stadium	1655.65	1686.25	939.39	861.24	1353.60	1003.92	1773.80	1817.00	1398.72	761.68	924.96	927.36	1711.20	1656.10	1378.36	1026.21	**20929.44**

8.	Tambatan Diraja	1655.65	1686.25	1655.65	1148.32	1353.60	1003.92	1419.04	1453.60	1398.72	1523.36	308.32	927.36	1711.20	1656.10	344.59	342.07	**19587.75**

Table 10. Ranking of attractions for SET A.

Attractions	Ranking
Kelantan State Museum	1
Kelantan Public Library	2
Sultan Muhammad IV Kelantan Stadium	3
Tambatan Diraja	4
KTM Dabong	5
Tugu Peringatan Banjir	6
SK Manek Urai	7
Jambatan Guillemard	8

The attractions were sorted from the highest to the lowest grand total value (Table 9) to get the ranking of attractions for SET A. Table 10 shows Kelantan State Museum is at the top because it got the highest grand total, which is 22348.84, followed by Kelantan Public Library 22157.67, Sultan Muhammad IV Kelantan Stadium 20929.44, Tambatan Diraja 19587.75, KTM Dabong 18910.68, Tugu Peringatan Banjir 18081.41, SK Manek Urai 12460.52 and lastly the lowest attraction goes to Jambatan Guillemard 1106.58. Table 10 shows the ranking of attractions for SET A.

3.4 Tour Package and its Validation

A good tour package should include itinerary components such as the list of attractions with specified arrival times and visiting durations and the route elements at each attraction (Khanan, 2014). The list of attractions is rationally ordered and includes the visitation arrangement from one attraction to another. It indicates which attractions should be visited first and last (Xia & Arrowsmith, 2005). Regarding the list of attractions that have been ranked, the tour package design can take place, and only the top six attractions are included in the tour package. Furthermore, following the ranking of attractions for SET A, the tour package will be divided into two types. The first type of SET A tour package includes all attractions in the Kelantan. Meanwhile, the second SET A tour package only included attractions in Kota Bharu.

Figure 4 shows the first type of SET A tour package. It consists of the top 6 attractions in the whole of Kelantan. This tour package, tourists will start visiting the attraction at 8:30 am, and the trip will be ended at 7:15 pm. Tourists will first visit the attraction inside Kota Bharu, the Kelantan State Museum, and then end their visitation outside Kota Bharu, Tugu Peringatan Banjir. The duration for each attraction visit was one hour.

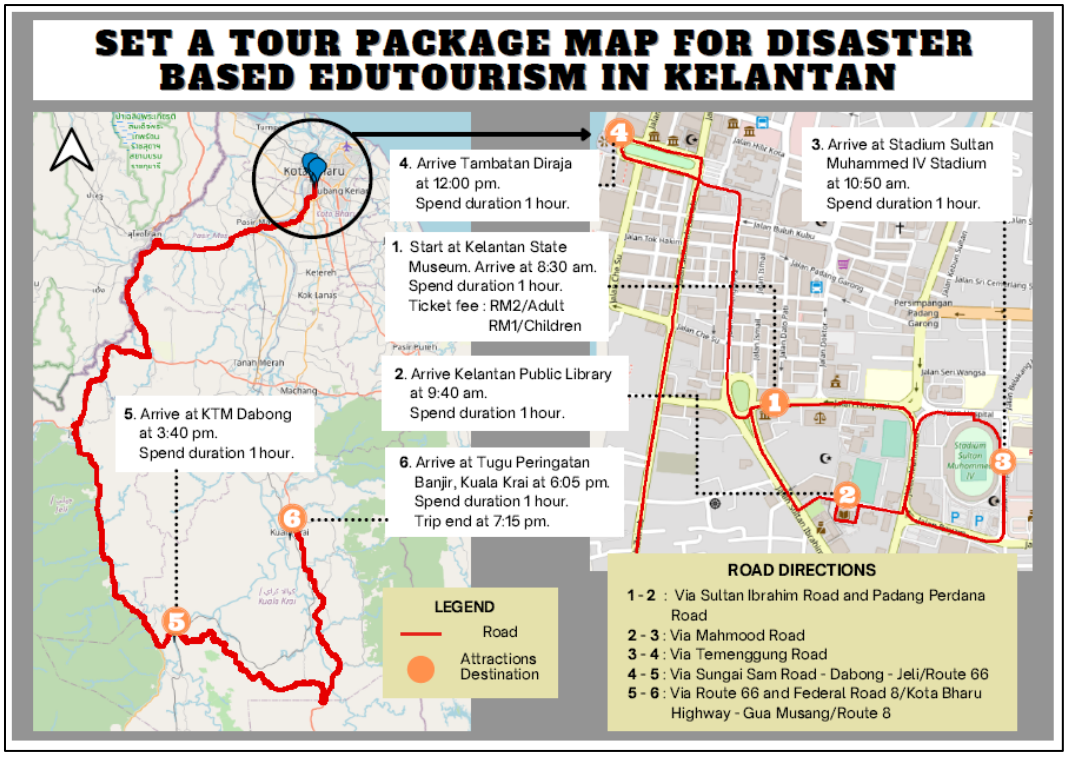

Figure 4. SET A tour package includes all the top six attractions inside and outside Kota Bharu.

Figure 5 shows the second type of SET A tour package. It consists of four attractions that are located only inside Kota Bharu. This type of tour package enables tourists to start visiting the attraction sites by 9:00 am, but the trip will end early at 4:25 pm. Tourists will first visit the Kelantan State Museum and subsequently end their visitation at Tambatan Diraja. The duration for each attraction visit is one hour and 30 minutes.

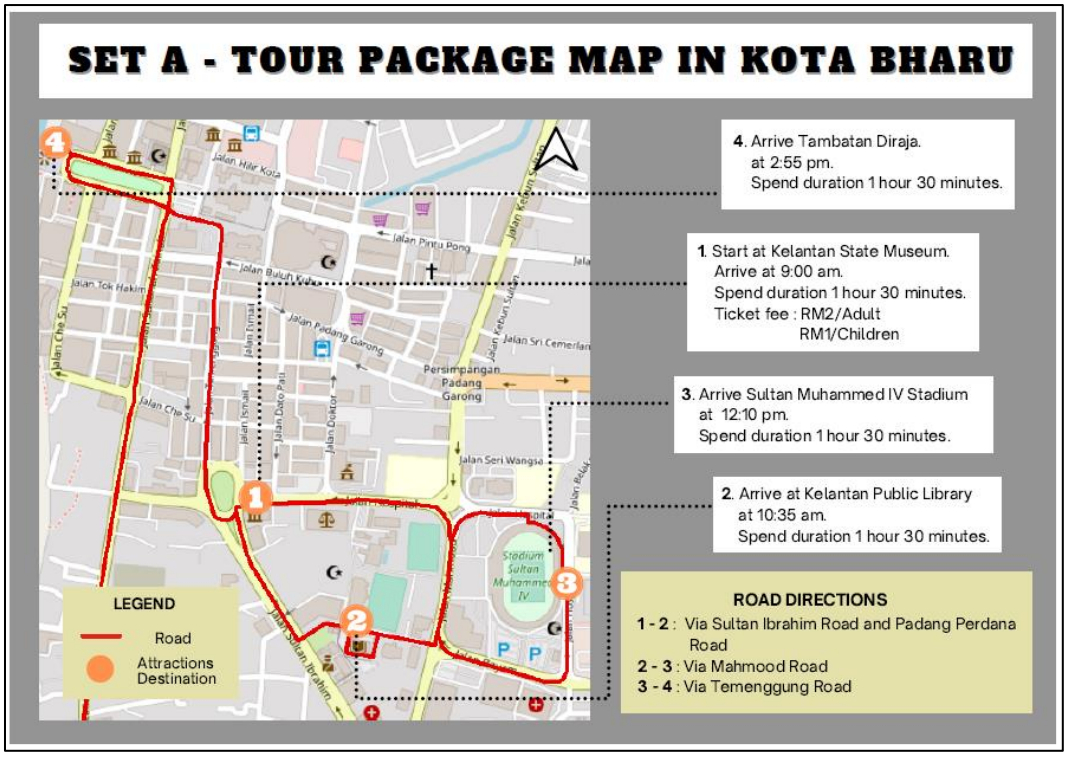

Figure 5. Second type of SET A tour package that includes only four attractions inside Kota Bharu.

In addition, the tour packages are validated by experts from tourism agencies through the distributed validation form. This validation aims to ensure a study's reliability, validity and quality. Figure 6 shows the pie chart for the first SET A tour package type. The result shows that 100% of the respondents partially agree with the first type of SET A tour package, as designed in Figure 4. Meanwhile, Figure 7 shows the pie chart for the second SET A tour package type. The result shows that 66.7% of respondents partially agree and 33.3% agree with the second type of SET A tour package as designed in Figure 5.

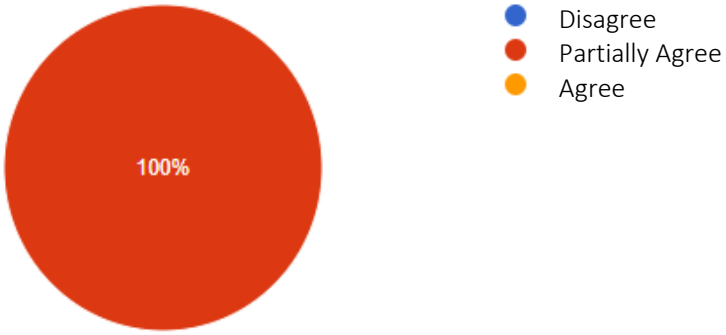

Figure 6. The pie chart for the first type of SET A tour package.

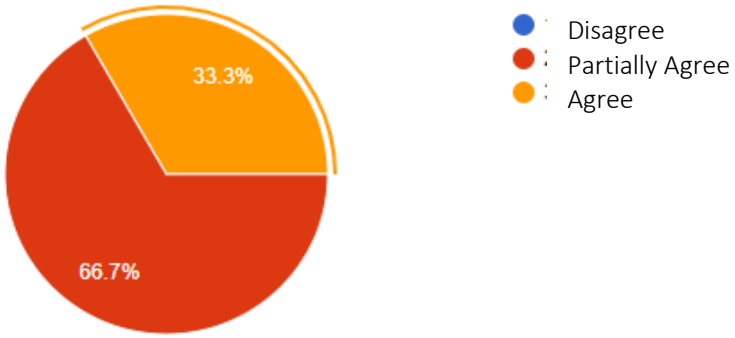

Figure 7. The pie chart for the second type of SET A tour package.

4.0 Conclusion

Conclusively, the Ordered Weightage Average (OWA) technique was applied in this study, which is suitable for multicriteria decision-making (MCDM). As a result, the list of attractions can be ranked, and the tour package map can be designed as the product of this study. However, this research must have limitations that the researcher cannot control.

This study may provide fewer geospatial parameters, which may cause the geospatial parameters that we anticipated in this study not to be too prominent. In addition, there is a limitation on the attractions related to disaster-based edutourism. Some of the attractions in Kelantan might have been rebuilt and rebranded after the disaster. Rebuilding and rebranding attractions can strategically revitalize the local economy by drawing tourists back to the area. For instance, a site once known for its cultural heritage might be rebranded to highlight its survival and recovery from a natural disaster, thus creating a new draw for visitors.

For further studies, geospatial parameters are needed to supply information about tourist destinations, availability, prices, climate, geography, and movements. Furthermore, the more attractions anticipated in this study, various tour packages can be designed, and each set may have multiple disaster-based edutourism attractions. In addition, further researchers may use different techniques or methods for better results.

This study was set to benefit the Ministry of Tourism, Arts and Culture (MOTAC) by improving more tourist spots, especially the destinations related to disaster-based edutourism in Kelantan. Apart from this agency, the transportation sector will also be beneficial because transportation development is always relevant to tourism development. Besides that, the parameters provide a structured framework for analyzing and understanding disaster tourism, enabling academicians to explore various aspects of this unique form of tourism in a systematic and meaningful way. Overall, this study was accomplished through three objectives mentioned in Section 1. Thus, the aim of this study was also achieved.

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Reference

Adriansyah Nazaruddin, D., & Sulaiman, R. (2013). Introduction to “Tsunami Tourism”: Notes from Aceh, Indonesia. *International Journal of Sciences*, *2*(Mar), 71–81. https://doi.org/10.5281/zenodo.3348198

Benckendorff, P. (2015). *Attraction, tourism*. https://doi.org/10.1007/978-3-319-01669-6_12-1

Bodger, D. (1998). Leisure, Learning, and Travel. *Journal of Physical Education, Recreation & Dance*, *69*(4), 28–31. https://doi.org/10.1080/07303084.1998.10605532

Chockalingam, M., & Ganesh, A. A. (2010). Problems encountered by tourists. *Business and Economic Horizons*, *3*(October 2010), 68–72. https://doi.org/10.15208/beh.2010.28

Coombes, E. G., & Jones, A. P. (2010). Assessing the impact of climate change on visitor behaviour and habitat use at the coast: A UK case study. *Global Environmental Change*, *20*(2), 303–313. https://doi.org/10.1016/j.gloenvcha.2009.12.004

Echtner, C., & Ritchie, J. (1991). The meaning and measurement of destination image. *Journal of Tourism Studies*, *2*(2), 2–12.

Eliza, N., Mohamad, H., Yoke, W., & Yusop, Z. (2016). Jurnal Teknologi Rainfall Analysis Of The Kelantan Big. *Jurnal Teknologi*, *4*, 83–90.

Emir, O., Bayer, U., Erdoğan, K., & Karamaşa, Ç. (2016). Evaluating the destination attractions from the point of experts' view: An application in eskişehir. *Turizam*, *20*(2), 92–104. https://doi.org/10.5937/turizam1602092e

Faculty Innovation Center of The University of Texas Austin. (2017). *Where do I start the process of creating a rubric?* 1–5. https://facultyinnovate.utexas.edu/sites/default/files/build-rubric.pdf

Huang, C., & Inoue, H. (2007). Soft risk maps of natural disasters and their applications to decision-making. *Information Sciences*, *177*(7), 1583–1592. https://doi.org/10.1016/j.ins.2006.07.033

Jenn, N. C. (2006). *Designing A Questionnaire*. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4797036/

Khanan, A. (2014). Development of Tour Packages through Spatio-Temporal Modelling of Tourist Movements. *Curtin University Library Curtin's Institutional Research Repository Http://Espace.Library.Curtin.Edu.Au/R?Func=dbin-Jump-Full&local_base=gen01-Era02&object_id=204941*, *October*, 1–194.

Liu-Lastres, B., Mariska, D., Tan, X., & Ying, T. (2020). Can post-disaster tourism development improve destination livelihoods? A case study of Aceh, Indonesia. *Journal of Destination Marketing and Management*, *18*(September), 100510. https://doi.org/10.1016/j.jdmm.2020.100510

Maryani, E., Yani, A., & Naga, K. (2014). Local Wisdom Of Kampung Naga In Mitigating Disaster And Its Potencies For Education. *ASEAN Journal on Hospitality and Tourism*, *14*, 72–85.

Marzuki, A., Hussin, A. A., Mohamed, B., Othman, A. G., & Som, A. P. M. (2011). Assessment of nature-based tourism in South Kelantan, Malaysia. *Tourismos*, *6*(1), 281–295. http://see-articles.ceon.rs/data/pdf/1790-8418/2011/1790-84181101281M.pdf

Nicholls, S. (2004). *Climate change and tourism intertwined*. 238–240. doi:10.1016/j.annals.2003.08.006

Nurashikin Sungip, F., Khairul Amri Kamarudin, M., Hafiz Md Saad, M., Abd Wahab, N., Puad Mat Som, A., Umar, R., Ing Hoe, L., Hakparn, S., Lertbunchardwong, K., Potikengrith, T., & Harith, H. (2018). The Impact of Monsoon Flood Phenomenon on Tourism Sector in Kelantan, Malaysia: A Review. *International Journal of Engineering & Technology*, *7*(4.34), 37. https://doi.org/10.14419/ijet.v7i4.34.23577

Pantouvakis, A., & Patsiouras, C. (2016). Tourists' Selection Criteria and Motivation. Does Nationality Matter? *SPOUDAI Journal of Economics and Business*, *66*(1), 22–31. http://spoudai.unipi.gr

Puah, C.-H., Jong, M.-C., Ayob, N., & Ismail, S. (2018). The Impact of Tourism on the Local Economy in Malaysia. *International Journal of Business and Management*, *13*(12), 151. https://doi.org/10.5539/ijbm.v13n12p151

QuestionPro. (2021). *The ultimate guide to great questionnaires*. https://www.questionpro.com/blog/what-is-a-questionnaire/

Stainton, H. (2020). *Disaster tourism explained: What, why and where*. https://tourismteacher.com/disaster-tourism-what-why-and-where/

Sulaiman, Z., Mohamad, N., Ismail, T. A. T., Johari, N., & Hussain, N. H. N. (2016). Infant feeding concerns in times of natural disaster: Lessons learned from the 2014 flood in Kelantan, Malaysia. *Asia Pacific Journal of Clinical Nutrition*, *25*(3), 625–630. https://doi.org/10.6133/apjcn.092015.08

Thorburn, C. (2009). Livelihood recovery in the wake of the tsunami in Aceh. *Bulletin of Indonesian Economic Studies*, *45*(1), 85–105. https://doi.org/10.1080/00074910902836171

Tourism Malaysia. (2014). *Types of Tourism in Malaysia*. https://www.tourismmalaysia.com.my/Types of Tourism in Malaysia.html

Vengesayi, S., Mavondo, F. T., & Reisinger, Y. (2009). Tourism destination attractiveness: Attractions, facilities, and people as predictors. *Tourism Analysis*, *14*(5), 621–636. https://doi.org/10.3727/108354209X12597959359211

Xia, J., & Arrowsmith, C. (2005). Managing scale issues in spatio-temporal movement of tourists modelling. *MODSIM05 - International Congress on Modelling and Simulation: Advances and Applications for Management and Decision Making, Proceedings*, 162–169.

Yager, R. R. (2004). Modeling prioritized multicriteria decision making. *IEEE Transactions on Systems, Man, and Cybernetics, Part B: Cybernetics*, *34*(6), 2396–2404. https://doi.org/10.1109/TSMCB.2004.837348