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DISASTER RESILIENCE RURAL COMMUNITY (DRRC) COMMUNITY CAPITALS: CASE STUDIES IN THE RURAL AREA OF EAST COAST, PENINSULAR MALAYSIA

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Abstract

According to scholars in disaster and resilient-related studies, the focus in building a resilient community in disaster is the need to understand three capitals particularly economic, social, and environmental. This study aims to identify the capitals of internal and external resilience factors for the flood-related disasters experienced by three rural communities in Malaysia. A total of 43 resilience factors were identified from the three key capitals. Field research was carried out to identify the internal and external factors that had contributed to the resilience of the rural communities to floods in Malaysia. Case studies and a questionnaire survey were conducted in the following households: (1) Lubok Setol village in Kelantan state; (2) Teladas village in Terengganu state; and (3) Gajah Mati village in Pahang state. A total of 90 respondents participated in the survey that was carried out from January 2018 (right after the major flood occurred in December 2017) to mid-February 2018. Data analysis was carried out using the Relative Importance Index (RII) method mainly for prioritising and categorising answer key components of community resilience. Responses that received higher RII scores were ranked higher or given a higher priority compared to factors with a lower RII score. Findings indicate that the respondents agreed that all three community capitals strongly influence DRRC.

***Keyword**:* Community Resilience Capitals, Flood, Relative Importance Index (RII), Malaysia

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INTRODUCTION

Resilience community refers to a community that is able to bounce back better by reducing the risk of losses caused by a disaster and recovering in a short period of time (Graveline & Germain, 2022; Hayashi, 2017), thus safeguarding community critical functions and valuable assets. To explore further the state of community resilience, this study seeks to identify the internal and external resilience factors specifically for flood-related disasters experienced by three rural communities in Malaysia. Scholars have noted that Malaysia is highly impacted by floods (Chan, 2012; Mohamed Shaluf & Ahmadun, 2006) rather than landslides, earthquakes, and mudslides, particularly in the rural areas on the east coast of Malaysia. The resilience level of a community, whether strong or weak, can be assessed based on a set of indicators (Cutter, 2020; Cutter, Ash, & Emrich, 2016; Kamarudin, Razak, Ngah, Ibrahim, & Harun, 2015; Sharifi, 2016; Wilson, 2012). In this study, a total of 43 resilience factors were identified from the literature review (economic, social, and environmental capitals) and used to survey the community. Three case study areas were identified, and a total of 90 respondents were interviewed. The main activity of the survey was to rank 43 resilience factors as identified earlier based on the Relative Importance Index (RII) method.

LITERATURE REVIEW

The main concern in building a resilient community in a disaster stemmed from the understanding of economics (Avila-Foucat & Martínez, 2018; Cutter, 2016; Ellis, 1999; Sharifi, 2016; Sherrieb, Norris, & Galea, 2010), social (Aldrich, 2012; Cutter, Emrich, & Burton, 2010; Miller & Rivera, 2011; Sharifi, 2016; Vallance & Carlton, 2015), environmental (Cutter, Ash, & Emrich, 2014; Magill, Wilson, & Okada, 2013; Sharifi, 2016), infrastructure (Cutter et al., 2014; Sharifi, 2016), and institutional (Cutter et al., 2014) capitals. Of these elements, three elements–economic, social, and environmental–have received common agreement from scholars. This finding is in conjunction with the sustainable development theory.

According to Wilson (2011), a community with strong capital (i.e. for all three capitals) would demonstrate a stronger resilience spirit and will be able to bounce back better when a disturbance occurs (Figure 1). Those with well-developed capital will find it easier to recover from a disaster and bounce back.

RESEARCH METHODOLOGY

Identifying Community Resilience on Disaster Factors through Literature Review

A total of 43 factors were identified from the literature review (from the economic, social, and environmental components) and used for a survey of the

community. Three case study areas were identified, and a total of 90 respondents were interviewed. The main activity of the survey was to rank 43 resilience factors as identified by the Relative Importance Index (RII) method. Four (4) enumerators were appointed to assist the researcher (principal investigator) during the household survey interview. Respondents were asked to answer on a five-point Likert scale ranging from 1 (*very low importance*) to 5 (*highly important*).

Household Questionnaire Survey

The household survey focused on the factors that contributed to building a resilient community. A total of 90 respondents participated in the survey that was carried out from January 2018 (right after a major flood in December 2017) until mid-February 2018 (Table 1). Sample size calculation was based on population size and a simple random sampling technique. The sample size was calculated using the following formula with a 90% of confidence level or 10% error:

$$n = \frac{327}{1 + 327\,(0.1)^2}$$

n - *sample size*
N - *population size*
e - *level of error*

Source: Kamarudin, 2013; Khailani, 2012; Neuman, 2013 & Author's Calculation (2017)

Table 1: Distribution of sample size of all three case study areas

Village	Number of families	% of each village	Sample size (n=90)
Lubok Setol	131	40	37
Teladas	121	37	32
Gajah Mati	75	23	21
Total	**327**	**100**	**90**

Source: Research fieldwork, 2018

Data Analysis Technique

The Relative Importance Index (RII) technique was adopted for the data analysis. The RII technique has been used widely in construction management research to rank factors contributing to a certain phenomenon, for example, delay factors in construction projects (Muhwezi, Acai, & Otim, 2014; Rooshdi, Majid, Sahamir, & Ismail, 2018), causes and effects of delays in the Malaysian construction industry (Sambasivan & Soon, 2007), and factors influencing project consultants performance (Kamarudin & Samek, 2016; Kometa, Olomolaiye, & Harris, 1994). In the current study, the main intention of using the RII was to prioritise and categorise answers to all 43 key factors for community resilience in all three economic, social, and environmental components. A similar approach was adopted but with slight modification in the examination of factors that contribute to rural community resilience towards a disaster. All the identified factors were

examined and ranked based on criticality as perceived by the respondents. The calculation of the RII value was as follows:

$$RII = \frac{\Sigma W}{A*N} \quad (0 \leq RII \leq 1)$$

RII - *relative importance index;*
W - *weight of factor given by the respondents which ranges from 1 to 5 (where 1 represent "strongly disagree" and 5 represent "strongly agree");*
A - *represent the highest weight (in this case is 5); and*
N - *represent the total number of respondents*

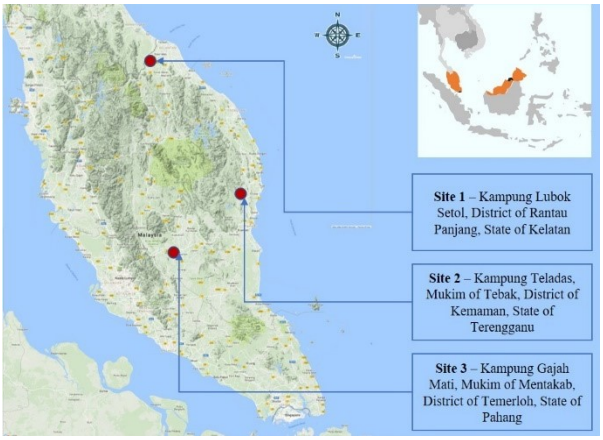
Responses that received a higher RII score were then ranked higher or given a higher priority compared to those with lower RII scores. The RII method enabled the researchers to identify, rank, and formulate a list of relevant factors for community resilience to floods in the case study areas.

Selection of Case Study Areas

Situated in the East Coast regions of Peninsular Malaysia, the case study areas were selected based on five (5) criteria:

- Traditional villages with disaster risk identified in NRPPP 2030 (Criteria 1);
- Village in the East Coast region that had experienced frequent disaster occurrences identified by the Social and Welfare Department (JKM) (Criteria 2);
- Village with established disaster response team sub-committee under the Village Development and Security Committee (JKKK) (Criteria 3);
- Village with Standard Operating Procedure (SOP) being acknowledged by NADMA (Criteria 4); and
- Village that participated in Community Based Disaster Risk Management (CBDRM) Program by MERCY Malaysia (Criteria 5).

Based on all five (5) criteria listed above, three (3) potential villages were identified as fulfilling most of the selection criteria and therefore were selected as the case study areas. The villages are (1) Lubok Setol village in the State of Kelantan; (2) Teladas village in the State of Terengganu; and (3) Gajah Mati village in the State of Pahang. The location and distribution of these villages are shown in Figure 1.



State	Village	Assessment Criteria				
		C1	C2	C3	C4	C5
Kelantan	Lubok Setol	√	√	√	√	NA
Terengganu	Teladas	√	√	√	√	NA
Pahang	Gajah Mati	√	√	√	√	√

Figure 1: Location and Distribution of Selected Case Study Areas based on Selection Criteria
Source: (https://i2.wp.com/investvine.com/wp-content/uploads/ecer_all4.gif, authors, 2017)

FINDINGS AND RESULTS

Analysis of Key Components of DRRC

Analysis of data was organised as follows: (1) calculation and ranking of RII value for all 43 community resilience factors: (2) shortlisting of 10 most important and 10 least important factors to community resilience; and (3) calculation of RII mean value and ranking into three key components of economic, social, and environment.

The RII value ranges from 0 to 1 (0 not inclusive): the higher the RII score, the more important the factor of DRRC. The RII was then ranked as one (1) to forty-three (43) cross capitals (economic, social, and environmental). The results of the analysis are shown in Table 2.

Table 2: Ranking of Resilience Factors based on RII Value/Score Given by the Kampung Lubok Setol (LS), Teladas (T), and Gajah Mati (GM)

Resilience Factors Components	No.	Factors contribute to resilience	Lubok Setol (n=37)		Teladas (n=32)		Gajah Mati (n=21)		TOTAL (n=90)	
			RII	Rank	RII	Rank	RII	Rank	RII	Rank
Economic	1	Economic well-being/advantage	0.7351	43	0.9188	7	0.9333	1	0.9178	1
	2	Diversified income streams/Diversify source of income	0.8486	26	0.8563	41	0.8857	33	0.8600	39
	3	Low dependency on external funds	0.8811	9	0.9125	10	0.9048	14	0.8978	10
	4	Diversified business	0.8649	17	0.8938	27	0.8952	22	0.8822	22
	5	Employment rate	0.8865	6	0.8938	27	0.8762	36	0.8867	15
	6	Job opportunities	0.8973	2	0.8938	27	0.8952	22	0.8956	12
	7	Individual saving	0.9189	1	0.9000	21	0.9143	9	0.9111	2

	8	Community-saving	0.8649	17	0.9125	10	0.9238	3	0.8978	10
	9	Collectively own local resources	0.8162	39	0.8875	34	0.8671	40	0.8511	41
	10	Business continuity plan	0.8270	35	0.9000	21	0.9048	14	0.8711	34
	11	Village insurance and social welfare	0.8703	13	0.9438	1	0.8952	22	0.9022	6
	12	Emergency fund	0.8811	9	0.9063	16	0.9048	14	0.8956	12
	13	Inward investment	0.8162	39	0.8813	40	0.8286	42	0.8422	42
	14	Connection with regional economy	0.8054	42	0.8563	41	0.8286	42	0.8289	43
Social	1	Close interaction between people	0.8811	9	0.9250	4	0.9333	1	0.9089	3
	2	Ability o rely on neighbours at times of crisis	0.8919	3	0.9125	10	0.9143	9	0.9044	5
	3	Availability of skills training and education	0.8541	22	0.9063	16	0.8952	22	0.8822	22
	4	Good health and sanitation	0.8541	22	0.9125	10	0.8952	22	0.8844	19
	5	Availability of multiple services	0.8378	32	0.9000	21	0.8857	33	0.8711	34
	6	Low level of corruption	0.8496	26	0.9313	2	0.8762	36	0.8844	19
	7	Good communication between stakeholder groups	0.8919	3	0.9188	7	0.8952	22	0.9022	6
	8	Female empowerment/empowerment of ethnic/religious minorities	0.8270	35	0.9000	21	0.9238	3	0.8756	30
	9	Open-minded community	0.8486	26	0.9125	10	0.8952	22	0.8822	22
	10	Good and transparent land ownership regulations	0.8649	17	0.8875	34	0.9048	14	0.8822	22
	11	Stakeholders in control of development trajectories	0.8270	35	0.9250	4	0.8952	22	0.8778	27
	12	Strong governance structure at multiple geographical scales	0.8486	26	0.9313	2	0.9143	9	0.8933	14
	13	Community bond, social support, and social institutions	0.8865	6	0.9250	4	0.8952	22	0.9022	6
	14	Safety and security	0.8703	13	0.8938	27	0.9048	14	0.8867	15
	1	High levels of biodiversity	0.8865	6	0.9063	16	0.9238	3	0.9022	6
	2	Good water quality and availability	0.8541	22	0.8875	34	0.9048	14	0.8778	27
	3	Sustainable soil management	0.8432	30	0.9000	21	0.8952	22	0.8756	30
	4	Predictable agricultural yields	0.8595	20	0.9000	21	0.8857	33	0.8800	26
	5	Localized energy supplies	0.8108	41	0.8938	27	0.8667	38	0.8533	40
	6	Multifunctional resources	0.8270	35	0.9063	16	0.9048	14	0.8733	33
	7	Infrastructure robustness and redundancy	0.8378	32	0.8938	27	0.8667	38	0.8644	37
	8	ICT infrastructure	0.8541	22	0.9188	7	0.9048	14	0.8844	19
	9	Inclusive and multimodal transportation networks and facilities	0.8703	13	0.8938	27	0.9143	9	0.8867	15
	10	Land use planning and urban design	0.8703	13	0.8375	43	0.9143	9	0.8689	36
	11	Leadership and participation	0.8378	32	0.8875	34	0.9238	3	0.8756	30
	12	Contingency, emergency and recovery planning	0.8919	3	0.9125	10	0.9238	3	0.8778	27
Environmental/Physical/ Infrastructure/ Institution	13	Equity and diversity	0.8595	20	0.8875	34	0.8952	22	0.9067	4
	14	Research and development	0.8432	30	0.8875	34	0.8571	40	0.8622	38
	15	Regulation and training	0.8811	9	0.9063	16	0.9238	3	0.8867	15

Source: Research fieldwork, 2018

Based on the RII scores and ranks of community capital indicators as shown in Table 2, the ten (10) factors deemed most important in building DRRC were then extracted and presented in Table 3. Social capital contributes five (5) indicators to the below-ten (10) ranking, namely *close interaction among people* (rank 3), *leadership and participation* (rank 6), and *communication between stakeholder groups* (rank 6). While the following four (4) economic capital indicators rank below eleven (11): *household income* (rank 1), *individual saving* (rank 2), disaster insurance (rank 6), and *aid recipient from government agencies and NGO* and *community funds* (rank 10). The remaining one indicator ranks eleventh (11) in the environmental/physical capital, which is *equity and diversity* (rank 5).

Based on the ranking of the 10 most influential factors in DRRC community capitals (rank 1 to 10), five (5) indicators are from social capital, followed by four indicators from economic capital, and only one (1) indicator from environmental/physical capitals (Table 3). This finding indicates that social capital is viewed as having a strong influence on DRRC, followed by four (4) economic capitals, whereas one (1) environmental capital was given lesser consideration by the respondents in building DRRC. The rural communities are small-scale in nature, thus making them closer to each other. These communities are therefore viewed by the researcher as a close-knit set of people. The close interaction among the people has contributed to DRRC as the villagers know each other well. They are able to respond to each other when a flood occurs. Therefore, social capitals were viewed by the respondents as vital in building DRRC. Economic capital is also considered a strong factor contributing to the DRRC.

According to Keerthiratne and Tol (2018), high incidents of poverty may increase a community's vulnerability towards a disaster. Based on the disaster resilience model, a higher vulnerability indicates a lower/weaker community resilience. The rural community is often associated with poverty and a lack of infrastructure, which hinder progress towards development, particularly when dealing with the recovery of damaged properties due to disasters. Therefore, the respondents opined that economic capitals such as household income are sufficient to save for the monsoon season, while disaster insurance could assist them in better recovery from a disaster. The finding indicates that although currently, the respondents are highly dependent on the aid provided by the government and NGOs for recovery, it is their goal to reduce the dependency and reinforce self-help and mutual assistance among the community members. To strengthen their economic capitals, the "equity and diversity" (environmental/physical indicator) of access and opportunities to the resources are essential.

Table 3: Most Important Factors Contributing to DRRC as Rated by the Respondents

No.	10 Most Important Factors	Key Component	RII	Rank
1	Household income	Economic	0.9178	1
2	Individual saving	Economic	0.9111	2
3	Close interaction among people	Social/Cultural	0.9089	3
4	Equity and diversity	Social/Cultural	0.9067	4
5	Neighbours are reliable in times of crisis	Social/Cultural	0.9044	5
6	Disaster insurance	Economic	0.9022	6
7	Communication between stakeholders group	Social/Cultural	0.9022	6
8	Community support system and social institution	Social/Cultural	0.9022	6
9	Leadership and participation	Social	0.9022	6
10	Aid recipients from the government and NGO	Economic	0.8978	10
11	Community fund	Economic	0.8978	10

Source: Research fieldwork, 2018

Meanwhile, the ten (10) least important factors contributing to the resilience of rural communities towards flood are listed in Table 4. However, it is worth mentioning the very small differences in the RII scores between these factors (i.e. with only $\pm$ 0.05 difference). The difference is also considered marginal compared to the 11 most important factors listed in Table 3. Despite a small gap in the RII value score, at least from the researcher's point of view, these 10 least important factors could be included in the discussions of the result and the later phase of implementation in this study. The least important factors in building DRRC as identified by respondents are five (5) in economic capitals, four (4) from environmental/physical capitals, and one (1) from social capitals. The "connection with regional economic" and "inward investment" are given less consideration due to the respondents focusing on local issues and needs. Local resources are still at an optimum level and therefore do not require planning for DRRC. "Diversification of income stream/source of income" is hindered by the limited job opportunities, particularly in non-farm activities. "Business continuity plan" is also given less consideration due to minimal impact on local businesses (domestic DRR measures also applied by local businesses owner). While for environmental/physical capital, the "predictable agricultural yield" is given less priority due to the nature of agricultural yield in the case-study villages, which indeed, are impacted by the monsoon season. "Accessibility to local services" is the only indicator in social capitals listed in the least important factors. This factor could be due to the satisfaction of the availability of multiple services in the village, thus requiring no further enhancement.

Table 4: Least Important Factors Contributing to DRRC as Rated by the Respondents

No.	10 Least Important Factors	Key Component	RII	Rank
1	Connection with regional economy	Economic	0.8289	43
2	Inward investment	Economic	0.8422	42
3	Community own resources	Economic	0.8511	41
4	Predictable agricultural yields	Environmental/Physical	0.8533	40
5	Diversified income streams/sources of income	Economic	0.8600	39
6	Research and development	Environmental/ Physical	0.8622	38
7	Multifunctional environmental resources	Environmental/ Physical	0.8644	37
8	Inclusive and multifunctional transportation networks and facilities	Environmental/ Physical	0.8689	36
9	Business continuity plan	Economic	0.8711	34
10	Accessibility to local services	Social	0.8711	34

Source: Research fieldwork, 2018

The RII score was used to calculate the RII mean values to rank community capital based on economic, social, and environmental components. The calculation of the values and ranking of all the DRRC components (economic, social and environmental) are presented in Table 5. The mean value score for social/cultural is 0.8884; economic capital is 0.8814; and environmental/physical is 0.8773. The mean value score for all three community capitals of economic, social/cultural, and environmental/physical are not significant (differences in mean value score > 0.8). This result indicates that the respondents agreed that all three community capitals would strongly influence DRRC.

Table 5: Mean Value of RII and ranking of resilience key components of Kampung Lubok Setol

Resilience components	RII	Rank
Social	0.8595	1
Environmental	0.8533	2
Economic	0.8510	3

Source: Research fieldwork, 2018

CONCLUSION AND RECOMMENDATION

Building resilient rural communities towards flood in Malaysia will enable them to bounce back better by reducing the risk of loss caused by the disaster in the community, and recovery in a short period of time (Hayashi, 2017), thus safeguarding the community's fortune. As suggested by Wilson (2012), a community with strong capital (for all three capitals) would presumably show a stronger resilience spirit and will be able to bounce back better when a disturbance occurs. Based on the field research and results presented in Tables 2 to 4, it is crucial for building a strong resilience rural community towards flood

in Malaysia to consider the adoption of the 10 most important factors in the DRR strategies (Figure 3).

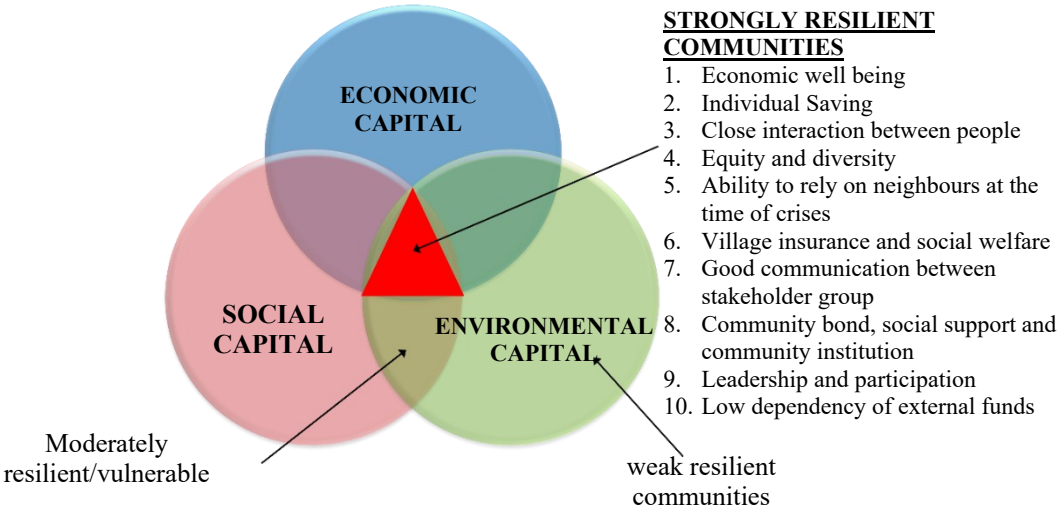


Figure 2: Community Resilience Capital for All Three Case Study Areas.
Source:(Miller & Rivera, 2011, authors, 2018)

The findings of this study may advance the existing knowledge of community resilience, particularly in Malaysia as a developing country (Omar Chong & Kamarudin, 2018). The methodology of the study and the effective use of RII may benefit future research projects on disaster-resilient rural communities. The ranking of resilience factors may also assist the community and agencies involved in implementing building community resilience programmes in the short and long terms.

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