Disaster Rehabilitation and Recovery Response in the Aftermath of the Taal Volcano Eruption: Towards a Sustainable Disaster Program Implementation

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Abstract— *As one of the four thematic areas of Disaster Risk Reduction and Management, disaster rehabilitation and recovery encompass measures aimed at mitigating post-disaster consequences through disaster preparedness and mitigation activities. On January 12, 2020, the Taal Volcano erupted, spewing a large amount of ash that reached the northern part of Luzon, forcing the immediate evacuation of residents in high-risk areas and the cancellation of classes and work. As a result of the eruption's impact on residents and their livelihoods, the Provincial Government of Batangas declared a state of calamity throughout the province. Following the eruption of the Taal Volcano, early recovery efforts were carried out to meet the basic needs and resume the activities in the affected areas in order to restore a sense of normalcy to affected individuals' lives. Thus, this study aims to assess the rehabilitation and recovery response in the selected municipalities of Batangas in the aftermath of the Taal Volcano Eruption in terms of agriculture, tourism and livelihood, housing and settlement, social services, and infrastructure.*

Keywords— *Agriculture, Disaster Rehabilitation and Recovery, Housing and Settlement, Social Services, Taal Volcan, Toursim and Other Livelihood*

I. INTRODUCTION

Disaster rehabilitation and recovery is one of the four thematic areas of Disaster Risk Reduction and Management. This thematic area encompasses measures aimed at reestablishing normalcy in disaster-affected localities and communities through restoration, reconstruction, improvement, and development activities guided by the principle of building forward better. Additionally, it encompasses measures aimed at mitigating post-disaster consequences through disaster preparedness and mitigation activities.

On January 12, 2020, the Taal Volcano erupted, spewing a large amount of ash that reached the northern part of Luzon, forcing the immediate evacuation of residents in high-risk areas and the cancellation of classes and work. The amount of ash emitted and the frequency with which earthquakes occurred disrupted the economic activities of cities and municipalities within a 14-kilometer radius of the Taal Main Crater. Wherein, these communities rely heavily on agriculture, fisheries, and tourism. However, among these communities, the municipalities of Agoncillo, Balete, Laurel, San Nicolas, and Talisay suffered the most catastrophic damage out of the 12 municipalities and three cities severely affected by the eruption. In these five municipalities, fissures appeared, causing irreparable damage to some roads and other infrastructure, while changes in water levels harmed several homes.

As a result of the eruption's impact on residents and their livelihood, the Provincial Government of Batangas declared a state of calamity throughout the province. And, in light of the magnitude of the damage, the President's Office issued Proclamation No. 906, declaring the CALABARZON Region in a state of calamity to accelerate the government's rescue, relief, and recovery efforts and to facilitate humanitarian assistance from various countries and development partners.

The basis of this action is the Philippine Disaster Risk Reduction and Management Act of 2010, or Republic Act 10121, which establishes the fundamental policies and coordination mechanisms for DRRM at the national, regional, and local levels through Disaster Risk Reduction and Management Councils. Section 15 of the said law specifies the criteria for identifying the lead DRRMC responsible for "preparation for, response to, and recovery from the effects of any disaster."

Following the eruption of the Taal Volcano, national and regional line agencies, as well as local government units, responded immediately to the needs of affected families and individuals. Additionally, civil society organizations, development partners, and the private sector, including private individuals, offered assistance. Early recovery efforts concentrated on meeting basic needs and resuming activities in affected areas in order to restore a sense of normalcy to affected individuals' lives.

In spite of this, according to the Post Disaster Needs Assessment Report conducted, there were issues with the implementation of rehabilitation and recovery efforts in the aftermath of the Taal Volcano Eruption. Thus, this study assessed the rehabilitation and recovery response in the selected municipalities of Batangas in the aftermath of the Taal Volcano Eruption in terms of agriculture, tourism and livelihood, housing.

II. METHODS

The study employed a descriptive method of research utilizing a questionnaire adapted from the data from the Provincial Risk Reduction Management Office of the Province

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of Batangas prepared by the researcher. Additionally, the residents of Agoncillo, Balete, Laurel, San Nicolas, and Talisay, Batangas, were chosen to be the participants of the study as these municipalities were the severely damaged communities following the Taal Volcano eruption, according to the report of the Regional Disaster Risk Reduction and Management Council and the Provincial Disaster Risk Reduction and Management Office. Moreover, stratified random sampling was utilized to determine the total number of respondents for each municipality. Furthermore, all data were treated using PASW version 26 statistical software to further interpret the study's findings using alpha levels of 0.05 and 0.01, respectively.

III. RESULTS AND DISCUSSION

TABLE 1. Summary Table on the Disaster Rehabilitation and Recovery Responses in the Aftermath of Taal Volcano Eruption

	Indicators	Weighted Mean	Verbal Interpretation	Rank
1.	Agriculture	3.12	Effective	4
2.	Tourism and other Livelihood	2.74	Effective	5
3.	Housing and Settlements	3.25	Effective	3
4.	Social Services	3.38	Effective	1
5.	Infrastructures	3.33	Effective	2
	Composite Mean	**3.17**	**Effective**	

The summary table on disaster rehabilitation and recovery responses in the aftermath of the Taal Volcano Eruption is shown in Table 1. It can be gleaned from the table that the overall assessment was effective, and that all domains were also rated as effective. It was further determined that social services attained the highest mean score in terms of their function. Tourism and other livelihood, on the other hand, obtained the lowest mean score among the five identified areas. Thus, the findings indicate that respondents believed that the disaster rehabilitation and recovery responses of their respective local government units were delivered effectively.

The results, with social services ranking first among the indicators, reveal that the social services sector has close contact with members of the community who have been most disadvantaged by any disaster; thus, social services are one of the primary tools for addressing the social determinants of health and ensuring health equity. Similarly, this implies that the social services sector provides accessible, equitable, and high-quality services that support the social and economic well-being of all people, particularly the most vulnerable, enabling self-sufficiency and thus preserving individuals and the community's dignity and respect in the aftermath of the eruption, implying that service delivery is not reactive and crisis-driven but rather reflects a proactive and prevention-based approach.

Aside from that, it is possible to conclude that, following the Taal Volcano eruption, social services are strategically and operationally integrated within the sector, as well as with public health, clinical care, behavioral health, housing, and community development services, to ensure that resources are used as efficiently as possible to address the social factors that drive health outcomes.

TABLE 2. Summary Table on the Problems that Affect the Disaster Rehabilitation and Recovery Responses in the Aftermath of Taal Volcano Eruption

	Indicators	Weighted Mean	Verbal Interpretation	Rank
1.	Agriculture	2.01	Disagree	2
2.	Tourism and other Livelihood	2.39	Disagree	1
3.	Housing and Settlements	1.85	Disagree	3
4.	Social Services	1.67	Disagree	5
5.	Infrastructures	1.75	Disagree	4
	Composite Mean	**1.93**	**Disagree**	

Table 2 presents the summary table of the problems affecting disaster rehabilitation and recovery response in the aftermath of the Taal Volcano eruption. As evidenced by the composite mean of 1.93, respondents generally disagreed that they encountered problems in the five identified areas of disaster rehabilitation and recovery response.

This indicates that the disaster rehabilitation and recovery responses carried out by the respondents' local government units were deemed effective, as they encountered few to no problems. In light of this, local government units continue to strengthen their disaster risk reduction and management responses and services with the assistance of other related agencies in order to develop a better, safer, and more resilient community and nation. Nonetheless, the results disclose that tourism and other livelihoods ranked highest among the indicators. This may be attributed to a lack of funding and support for tourism promotion. In the aftermath of a natural disaster, tourists seek more specific factors such as health, comfort, safety, and security services. This increased demand poses a formidable challenge for the tourism industry. However, while rated as disagree, many aspects remain capable of being improved and strengthened.

The duration of recovery following natural disasters is highly variable, ranging from as little as one month to as long as 93 months. (World Travel and Tourism Council, 2019). Notable is the diversity of the tourism industry's response during the post-disaster period. Despite having undergone reconstruction and restoration, certain locations face difficulties in their efforts to recover and attract tourists. Meanwhile, like other parts of the economy, the tourism industry and the places it serves are vulnerable to natural disasters. The frequency and severity of such events have been on the rise in recent years due to the effects of climate change. (Walters, Mair, & Ritchie, 2015). Initially, it can be observed that the incidence of natural calamities has a tendency to reduce the total influx of global visitors.

Tourists typically seek out destinations for the purpose of finding relaxation. However, in the event of a natural disaster or emergency situation in a tourist destination, tourists may opt to explore alternative destinations in order to optimize the utility derived from tourism activities. As a result, a reduction in tourist arrivals leads to a significant decline in economic revenues for a destination. This exacerbates the negative impact of natural disasters on the affected location.

Due to the increased vulnerability of tourism businesses and destinations to global environmental changes, rapid economic development, increasing urbanization,

environmental and ecological factors, political changes, and epidemics, the tourism industry is widely regarded as a susceptible and vulnerable sector. (Santana, 2003).

risk. While risks cannot be avoided, they can be mitigated by limiting exposure and reducing vulnerability.

TABLE 3. Difference of Responses on the Disaster Rehabilitation and Recovery Responses on the Aftermath of Taal Volcano Eruption When Grouped According to Municipality

	place	Mean Rank	λ^2_c / U	p-value	Interpretation
Agriculture	Laurel	147.85			
	Talisay	47.23			
	Balete	98.97			
	San Nicolas	137.16			Highly Significant
	Agoncillo	173.3	30.795	<.001	
Tourism and other Livelihood	Laurel	236.76			
	Talisay	57.09			
	Balete	58.27			
	San Nicolas	80.07			Highly Significant
	Agoncillo	119.5	171.041	<.001	
Housing Settlements	Laurel	178.6			
	Talisay	45.91			
	Balete	71.8			
	San Nicolas	148.55			Highly Significant
	Agoncillo	150.02	39.536	<.001	
Social Services	Laurel	141.87			
	Talisay	74.68			
	Balete	136.57			
	San Nicolas	173.17			
	Agoncillo	164.32	15.221	0.004	Significant
Infrastructures	Laurel	201.31			
	Talisay	50.68			
	Balete	109.57			
	San Nicolas	149.36			Highly
	Agoncillo	127.75	64.011	<.001	Significant

TABLE 4. Difference of Responses on the Problems that Affect the Disaster Rehabilitation and Recovery Responses on the Aftermath of Taal Volcano Eruption When Grouped According to Municipality

	place	Mean Rank	λ^2_c / U	p-value	Interpretation
Agriculture	Laurel	127.65			
	Talisay	267.95			
	Balete	200.37			
	San Nicolas	169.29			Highly Significant
	Agoncillo	154.17	33.57	<.001	
Tourism and other Livelihood	Laurel	68.03			
	Talisay	279.77			
	Balete	233.2			
	San Nicolas	223.43			Highly Significant
	Agoncillo	184.93	175.873	<.001	
Housing Settlements	Laurel	108.47			
	Talisay	236.82			
	Balete	254.6			
	San Nicolas	182.86			Highly Significant
	Agoncillo	162.93	64.767	<.001	
Social Services	Laurel	117.06			
	Talisay	269.36			
	Balete	212.63			
	San Nicolas	170.03			
	Agoncillo	160.83	47.633	<.001	Significant
Infrastructures	Laurel	78.94			
	Talisay	254.5			
	Balete	189.6			
	San Nicolas	165.24			Highly
	Agoncillo	195.14	128.603	<.001	Significant

The comparison of disaster rehabilitation and recovery responses when grouped according to municipality is presented in Table 3. The obtained p-values were less than the alpha level of 0.05, denoting that the responses vary significantly. Additionally, based on the post hoc test conducted, it was revealed that residents of the Municipality of Laurel have a better assessment of the disaster rehabilitation and recovery response in the aftermath of the Taal Volcano eruption.

On the basis of the findings, the Municipality of Laurel may provide more opportunities for determining the direct and indirect impact of a hazard event and highlighting the action that will be most effective in mitigating the impacts on individuals, communities, and governments. Aside from that, the findings indicate that having a more accurate assessment and being prepared can reduce the fear, anxiety, and losses associated with natural disasters. More importantly, communities, families, and individuals are aware of what to do during and after a natural disaster.

Furthermore, the assessment of the respondents may provide crucial information that can be used to make decisions that reduce the disaster risk of exposed populations and assets in the present while preventing the future creation of disaster

Table 4 displays the comparison of responses to the problems that affect the disaster rehabilitation and recovery responses when grouped according to the municipality. It was observed that there was a significant difference in the problems encountered by the respondents when grouped according to municipality since the obtained p-values were less than the alpha level of 0.05. This signifies that the responses vary significantly, and based on the post hoc test conducted, it was revealed that residents of Laurel experienced a higher degree of problems encountered than those from other municipalities.

This may be attributable to a lack of monitoring of post-disaster rehabilitation and recovery initiatives, which would have enabled quick and efficient adjustments as needed, replication of viable DRRM practices, and accelerated project implementation in the aforementioned municipality.

To address this, the Municipality of Laurel should formulate policies and plans, as well as implement measures and interventions relating to disaster rehabilitation and recovery responses, focusing on the five identified areas—agriculture, tourism and other livelihood, housing and settlement, social services, and infrastructure—in accordance with the mandates stated in the Philippine Disaster Risk Reduction and Management Act of 2010, as these are

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fundamental components of an effective disaster rehabilitation and recovery response.

TABLE 5. Relationship Between the Disaster Rehabilitation and Recovery Responses on the Aftermath of Taal Volcano Eruption and Its Problems

Agriculture	rho	p-value	Interpretation
Agriculture	-.726**	<.001	Highly Significant
Tourism and other Livelihood	-.204**	<.001	Highly Significant
Housing and Settlements	-.380**	<.001	Highly Significant
Social Services	-.241**	<.001	Highly Significant
Infrastructures	-.168**	0.003	Significant
Tourism and other Livelihood			
Agriculture	-.519**	<.001	Highly Significant
Tourism and other Livelihood	-.887**	<.001	Highly Significant
Housing and Settlements	-.542**	<.001	Highly Significant
Social Services	-.428**	<.001	Highly Significant
Infrastructures	-.609**	<.001	Highly Significant
Housing and Settlements			
Agriculture	-.528**	<.001	Highly Significant
Tourism and other Livelihood	-.432**	<.001	Highly Significant
Housing and Settlements	-.675**	<.001	Highly Significant
Social Services	-.342**	<.001	Highly Significant
Infrastructures	-.344**	<.001	
Social Services			
Agriculture	-.199**	<.001	Highly Significant
Tourism and other Livelihood	-0.141**	0.004	Significant
Housing and Settlements	-.149**	0.009	Highly Significant
Social Services	-.509**	<.001	Highly Significant
Infrastructures	-.145*	0.011	Significant
Infrastructures			
Agriculture	-.338**	<.001	Highly Significant
Tourism and other Livelihood	-.502**	<.001	Highly Significant
Housing and Settlements	-.395**	<.001	Highly Significant
Social Services	-.442**	<.001	Highly Significant
Infrastructures	-.716**	<.001	Highly Significant

Table 5 demonstrates the relationship between the effectiveness of the disaster rehabilitation and recovery responses of the Local Government Units in the aftermath of the Taal Volcano eruption in terms of agriculture, tourism and other livelihood, housing and settlements, social services, and infrastructure, and the problems encountered.

The computed rho-values indicate a moderate to strong indirect correlation, and the resulting p-values were all less than the 0.01 alpha level. This suggests that there was a significant relationship, implying that the better the disaster rehabilitation and recovery response in the aftermath of the Taal eruption, the fewer problems encountered.

This data point scrutinizes the local government units' capacity to implement policies, programs, and procedures in the aftermath of a disaster, primarily the Taal Volcano eruption. Definitely, local government units must take all the factors into consideration in the event of such natural occurrences in order to completely enact legislation, schemes, and initiatives. Thus, streamlined planning must be prioritized in order to optimize disaster rehabilitation and recovery responses in the identified areas.

Consequently, it is past time for the national government and its relevant stakeholders to act and implement the policies outlined in RA 10121 to ensure a more proactive disaster rehabilitation and recovery response at the local, provincial, national, and international levels.

IV. CONCLUSIONS

The study's findings reveal that the disaster rehabilitation and recovery response in the aftermath of the Taal Volcano Eruption with regard to agriculture, tourism and other livelihood, housing and settlements, social services, and infrastructure were found to be effective. Meanwhile, significant differences in the effectiveness of the disaster rehabilitation and recovery responses of the affected Local Government Units in the aftermath of the Taal Volcano eruption have been observed. Moreso, the participants encountered few to no problems with regard to social services, infrastructure, housing and settlements, agriculture, and tourism and other livelihood. Wherein, significant differences in the problems encountered that affect the effectiveness of the Local Government Units' disaster rehabilitation and recovery responses in the aftermath of the Taal Volcano eruption have also been observed. Nonetheless, the residents of the Municipality of Laurel encountered more problems than the residents of other municipalities. Furthermore, there is a moderate to strong indirect correlation between the effectiveness of the disaster rehabilitation and recovery responses of the Local Government Units and the problems encountered by the respondents with regard to agriculture, tourism and other livelihood, housing and settlements, social services, and infrastructure in the aftermath of the Taal Volcano eruption, implying that a significant relationship exists and further indicating that the better the disaster rehabilitation and recovery responses, the fewer problems the respondents encountered. Finally, a plan of action is proposed to enhance the effectiveness of the Local Government Units' disaster rehabilitation and recovery responses in the areas of agriculture, tourism and other livelihood, housing and settlements, social services, and infrastructure.

V. RECOMMENDATIONS

1. In terms of the disaster rehabilitation and recovery responses in the aftermath of the Taal Volcano eruption as to agriculture, local government units, through the Sangguniang Bayan, may determine the funding requirements and sources for the implementation of their action plans in support of the strategies outlined in their Disaster Risk Reduction and Management Plan, which will meet the needs of their farmers and fishermen.
2. As part of the Taal Volcano eruption disaster rehabilitation and recovery efforts for tourism and

livelihood, local government units, through the Municipal Tourism Office, may implement programs, projects, and activities to increase support for digital and content marketing, participation in travel and trade fairs and exhibits, and familiarization tours, leading to the promotion of tourism-related businesses as well. They may also develop tourism policies and guidelines in accordance with the provisions of Republic Act 9593, or the Tourism Act of 2009, post ordinances in visible locations, and disseminate tourism information through flyers and leaflets to tourism stakeholders and tourists for proper guidance.

3. As for the disaster rehabilitation and recovery responses for housing and settlements in the aftermath of the Taal Volcano eruption, shelter financing assistance, in coordination with the Sangguniang Bayan and Budgetary Office, may be made available to guarantee the long-term viability of resettlement areas.

4. With regard to the disaster rehabilitation and recovery responses in the aftermath of the Taal Volcano eruption as to social services, local government units, through the Municipal Information and Communications Technology Office, may devise a communication strategy that takes into account the social and cultural context of the affected areas.

5. Concerning the disaster rehabilitation and recovery responses in the aftermath of the Taal Volcano eruption as to infrastructure, the local government units may adopt public policies and actions that support the role of public service workers in strengthening coordination and funding mechanisms and procedures for post-disaster recovery and reconstruction, or they may explore partnership schemes.

6. The proposed action plan may be integrated and mainstreamed in the overall disaster plan of the Province of Batangas.

7. Future researchers may undertake similar studies, integrating potential variables, to further strengthen this study and contribute significantly to the overall development of the country's Disaster Risk Reduction Management, such as local governance, livelihood and business development, environment protection and sustainability, and land resource management.

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