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Community Empowerment for Flood Disaster Risk Reduction in Wetland Areas

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Abstract Flood disasters often result in large material losses but also cause significant social and environmental impacts. Comprehensive and sustainable mitigation efforts are needed through community empowerment to reduce the risk and effects of flood disasters. Community empowerment in flood disaster mitigation includes training, counseling, and increased participation in decision-making. This research aims to analyze community empowerment in the context of flood disaster risk reduction in wetland areas. The number of samples in this study was 655 people from 2 villages with the most severe flood conditions in the Sungai Tabuk sub-district; 32 questions were asked about physical capital, social capital, human capital, empowerment capabilities, empowerment processes, and community empowerment. Each category of questions is designed to measure specific aspects of community empowerment and its impact on flood risk reduction. Data analysis used Structural Equation Modeling (SEM). SEM was chosen for its ability to test complex relationships between variables, including latent variables, and evaluate models with many variables simultaneously. In the context of flood disaster risk reduction, SEM can identify the influence of various indicators (physical capital, social capital, human capital, empowerment capability, and empowerment process) on community empowerment. The results show that social and human capital has not significantly affected community empowerment due to low compliance with social norms and a lack of coordination and synergy between community groups in flood management. Physical capital, empowerment capability, and empowerment process significantly influence community empowerment. The availability of flood evacuation facilities and the community's experience of flood events have a role in flood risk reduction. The role of the government through various empowerment programs is also crucial in improving community empowerment to create an independent community in flood risk reduction.

Keywords Empowerment, Community, Risk, Flood Disaster, Wetland Area

1. Introduction

Floods often result in large material losses but have significant social and environmental impacts. The community feels the effects of floods. In addition to material losses in the form of damage to houses, agricultural land, and infrastructure, floods can also cause health problems, economic losses due to the cessation of productive activities, and psychological trauma. In addition, floods can also damage ecosystems and reduce people's quality of life [1].

The main contributing factors to flooding include physical characteristics such as topography, soil type, and rainfall, human factors such as land use and infrastructure [2]. Extreme changes in rainfall patterns can cause floods to occur more frequently and with higher intensity [3]. In

addition, the area inundated by floods may expand due to rising sea levels and changes in river flow patterns. The vulnerability of areas to flooding, for example, is based on population density, type of land use, and presence of infrastructure [4].

Comprehensive and sustainable mitigation efforts are needed through community empowerment to reduce the risk and impact of flood disasters. Community empowerment is one of the practical approaches to reducing the risk of flood disasters. Community empowerment can also increase the community's capacity to manage natural resources sustainably, thereby decreasing disaster risk. Community empowerment in flood disaster risk reduction is vital to improve. Through empowerment, communities can play an active role in the decision-making process, planning, implementation, and evaluation of disaster mitigation programs [5].

Communities can be actively involved in planning and implementing disaster risk reduction policies. Community capacity in dealing with disasters can be improved through various efforts, such as training, counseling, and community participation in decision-making [6]. Community empowerment through strengthening social capital can effectively reduce disaster risk. Empowered communities will have a better capacity to rebuild after a disaster. Community empowerment strengthens social capital to become an internal force and increasingly plays a role in independently planning and implementing disaster risk reduction [7].

Community empowerment is determined by physical capital, social capital, human capital, empowerment capabilities, and empowerment processes. Physical capital concerns the facilities and infrastructure owned by the community. Human capital relates to education and the ability to interact with others in a community. Social capital covers the norms, cooperation, and care the community owns. Empowerment capability is determined by the community's knowledge, skills, and care. The empowerment process includes the quality and quantity of empowerment activities carried out by the community or other parties such as the government, NGOs, and others [8].

The indicators of community empowerment support each other. The presence of human, physical, and social capital strongly influences the empowerment process. For example, communities with substantial social capital are more likely to collaborate and support each other in dealing with disasters. In contrast, communities with adequate physical capital can be more effective in implementing mitigation measures [9]. In addition, insufficient education and training can improve human capital so communities are better prepared and able to participate in empowerment programs [10].

The most flood-prone area in South Kalimantan Province, Indonesia, is Banjar District. Flooding in Banjar Regency is caused by high rainfall and land cover change [11]. The overflow of the Martapura River causes flooding in the study area. This flooding occurs when the water of a river, ditch, or other waterway overflows when its volume exceeds its capacity [12]. The Martapura River's limited storage capacity causes water to overflow and cause flooding, especially during high-intensity rainfall events.

The sub-district with the most villages affected by flooding is the Sungai Tabuk sub-district. This is indicated by 12 villages that experienced flooding, and the two villages that experienced the worst flooding were Pembatanan village, with an average water level of 50 cm, and Tajau Ladung village, with an average water level of 45 cm. Sungai Tabuk sub-district is a wetland area located downstream of the Martapura watershed. Flooding in this area always occurs repeatedly during the rainy season. Flooding in Sungai Tabuk Sub-district has impacted the socio-economy of the community. Losses caused by flooding include damage to houses, decreased health, loss of livelihoods and decreased income [13]. Therefore, efforts are needed to reduce the risk of flood disasters, one of which is through community empowerment. Through community empowerment, flooding problems in the research area can be overcome by empowering the community in the area [14].

Several studies in various countries have also proven the importance of community empowerment in improving capacity for disaster risk reduction. Research in Nigeria shows a positive relationship between flood risk awareness and the level of community preparedness; thus, increasing flood risk awareness at the community level is an essential strategy for improving disaster preparedness [15]. In line with these findings, the Malaysian study also emphasized the importance of adequate training for rescue workers and communities to improve disaster response and reduce risks [16]. Meanwhile, research in Serbia shows that public awareness initiatives can help millions of people prepare for disasters [17]. In addition to awareness and training, research in the Philippines highlights the importance of local and national capacity in disaster risk management, where strengthening community capacity through continuous training and extension is needed to improve disaster preparedness and response [18].

Thus, this research aims to analyze community empowerment in the context of flood disaster risk reduction in wetland areas. This research is expected to contribute to local governments, non-governmental organizations, and other related parties to formulate more targeted policies and programs to increase community capacity against flood disasters in wetland areas. This research has a literature review as a foundation for understanding community empowerment, disaster risk, and flood disasters. These theories provide a theoretical framework to analyze how communities can be empowered to reduce disaster risk, particularly flooding. Community empowerment theory focuses on how individuals and groups within communities are given the ability, knowledge, and resources to take the initiative in managing and overcoming the challenges they face. Psychological empowerment includes emotional, behavioral, and cognitive components, all contributing to

an individual's ability to participate in decision-making processes and resource management [19]. In disaster mitigation, community empowerment enables them to play an active role in the planning and implementing mitigation programs, thereby increasing community resilience to disasters. A strengths-based approach to community empowerment can strengthen the capacity of individuals and groups to overcome the social and economic challenges they face. By empowering communities, they can be more independent and make the right decisions in disaster management [20].

Disaster risk theory explains the relationship between the factors that cause disasters and their impact on society. Meteorological disaster risk assessment and management are essential for disaster prevention and mitigation planning. In the context of flooding, understanding risk factors, such as extreme rainfall, land use, and existing infrastructure, is critical to developing effective mitigation strategies [21]. Disaster risk management requires a comprehensive approach, including community involvement in every stage. This research shows that communities involved in disaster risk management have a better understanding of the risks they face and can take more effective action in emergency situations [22].

Disaster risk reduction, especially in this research, focuses on flood disasters. Flood disasters include understanding the causes, impacts, and mitigation strategies associated with flood disasters. Local and national capacity in disaster risk management is essential, along with community capacity strengthening through continuous training and counseling, which is needed to improve disaster preparedness and response. Involving the community in the mitigation process, is expected to create a more resilient community that is ready to face the challenges posed by floods [18].

2. Materials and Methods

2.1. Research Location

This research was conducted in Sungai Tabuk Sub-district, South Kalimantan, Indonesia, at 3.3244 ° South, 114.6965 °East. Kecamatan Sungai Tabuk is a wetland area that always floods during the rainy season [23]. The research location map is shown in Figure 1.

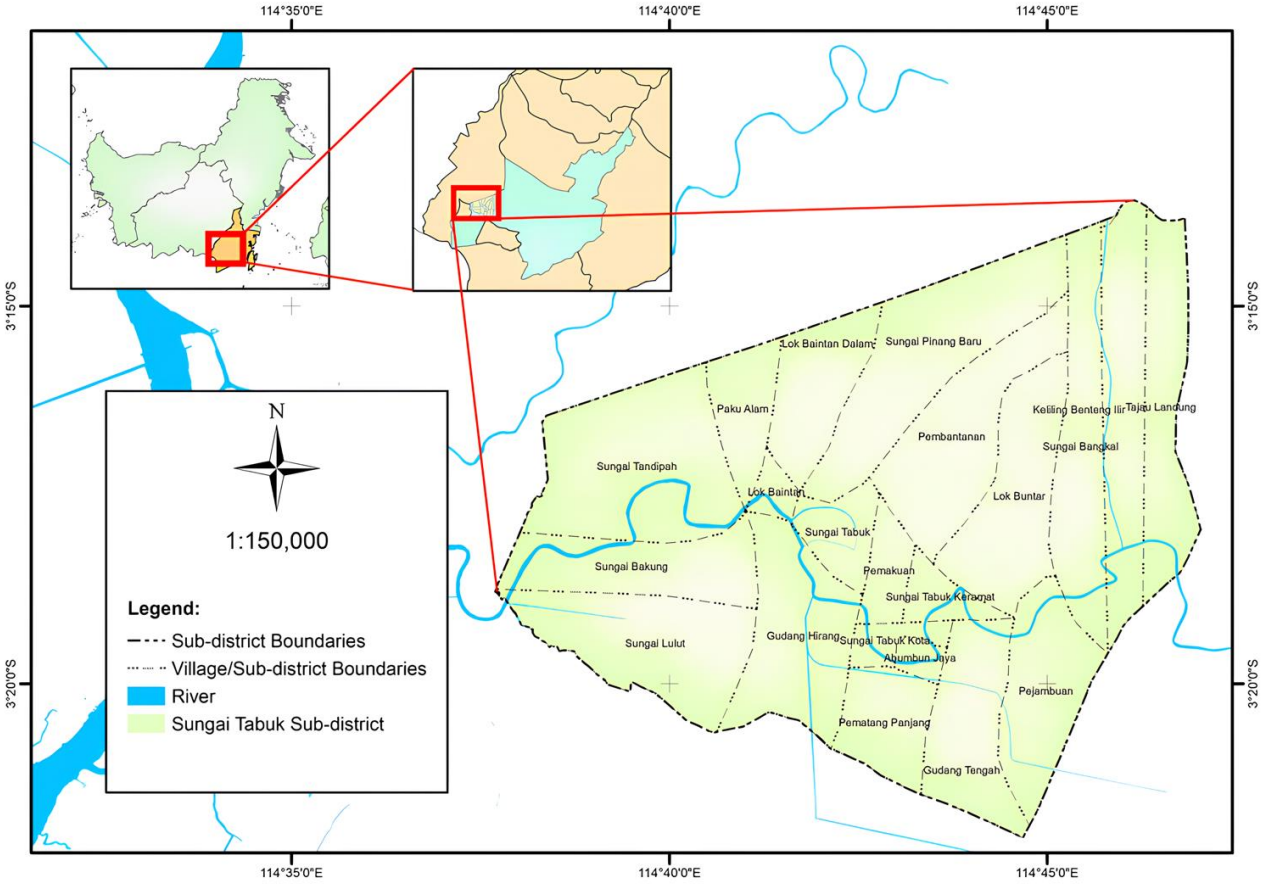

Figure 1. Research location map

2.2. Data Collection

Data were collected using a 32-question questionnaire to formulate a community empowerment model. The questions were grouped into physical capital, social capital, human capital, empowerment capabilities, empowerment processes, and community empowerment. Each category of questions was designed to measure specific aspects of community empowerment and its impact on flood risk reduction. The study population is the number of people affected by flooding in Sungai Tabuk with severe categories. Villages with flood depths > 40 cm, categorized in severe conditions, are Pembatanan Village and Tajau Landung Village, with a total population of 4901 people. The sample was selected based on the Krejcie and Morgan table, which was 655 people from 2 villages with the most severe flood conditions in Sungai Tabuk Sub-district.

2.3. Research Question

This research aims to answer the following questions:

1. How does community empowerment influence flood disaster risk reduction in Sungai Tabuk Sub-district?
2. What is the role of stakeholders in improving community empowerment for flood disaster risk reduction in Sungai Tabuk Sub-district?

2.4. Data Analysis

Questions used a Likert scale (1-4, strongly disagree - strongly agree). Data were analyzed using structural equation modeling (SEM). The strength of the relationship between the observed items and their respective latent factors was determined through factor loading to evaluate discriminant validity. Only items with factor loadings above 0.50 were retained in the model. The hypotheses to be proven in this empowerment are as follows:

1. Physical capital significantly influences community empowerment in flood disaster risk reduction in the Sungai Tabuk Sub-district.
2. Social capital significantly influences community empowerment in flood disaster risk reduction in the Sungai Tabuk Sub-district.
3. Human capital significantly influences community empowerment in flood disaster risk reduction in the Sungai Tabuk Subdistrict.
4. Empowerment capability significantly influences community empowerment in flood disaster risk reduction in the Sungai Tabuk Sub-district.
5. The empowerment process significantly influences community empowerment in flood disaster risk reduction in the Sungai Tabuk Sub-district.

3. Results and Discussion

Community empowerment model for flood disaster risk reduction: The load factor values are relatively high, with values > 0.5 and Cronbach's Alpha > 0.6. Table 1 presents a summary of the measurement model. Based on these load factor values, the load factors are met, and the reliability values are also relatively high.

Table 1. The Value of Loading Community Empowerment Factors to Reduce the Risk of Flood

Construct	Item	Loading Factor	Cronbach's Alpha
Physical Capital (PC)	P1	0,732	0,806
	P2	0,750	
	P3	0,717	
	P4	0,703	
	P5	0,723	
	P6	0,623	
Human Capital (H)	H1	0,789	0,638
	H2	0,624	
	H3	0,854	
Social Capital (S)	S1	0,504	0,789
	S2	0,715	
	S3	0,852	
	S4	0,808	
	S5	0,790	
Capacity Empowerment (C)	C1	0,653	0,867
	C2	0,802	
	C3	0,822	
	C4	0,788	
	C5	0,794	
	C6	0,785	
Empowerment Process	EP1	0,826	0,916
	EP2	0,883	
	EP3	0,882	
	EP4	0,877	
	EP5	0,859	
Community Empowerment	CE1	0,667	0,860
	CE2	0,886	
	CE3	0,859	
	CE4	0,893	
	CE5	0,685	

Table 2 presents the data from the field analysis with a significant P value of <0.5 and insignificant >0.5. Correlation analysis between variables shows a weak relationship between community empowerment efforts and disaster risk reduction. The P value obtained above the maximum limit of significance indicates that the empowerment efforts that have been carried out have not been effective enough in reducing flood risk in Tabuk River.

Figure 2 presents a community empowerment model to reduce flood risk in Sungai Tabuk. SEM analysis shows interesting patterns of relationships between indicators on the community empowerment variable. Structural Equation Modeling (SEM) as a data analysis tool allows researchers to evaluate the complex relationships between these variables. SEM provides the ability to identify the direct and indirect effects of social capital, human capital, and physical capital on community empowerment. The analysis shows that empowerment capability significantly influences community empowerment, the empowerment process, and social capital. Human capital has no significant influence on community empowerment. Human capital has a considerable influence on empowerment capabilities and social capital. Physical capital significantly affects the empowerment process, human capital, and community empowerment. The empowerment process has a substantial influence on community empowerment. Social capital has no significant influence on community empowerment. The findings in the field on each indicator are as follows:

1. Physical Capital

Some communities in Sungai Tabuk own water transportation, such as kelotok (wooden motorized boats) and jukung (non-motorized boats). These assets play an essential role in the mobility and distribution of logistics during floods. Other physical capital includes the availability of medicines, health workers, and public kitchens that provide food for flood victims. However, every village has not yet received early warning systems and flood monitoring technology. This shows that the region still lacks supporting infrastructure for disaster management. In addition, the village government also needs to conduct comprehensive mapping to optimize the distribution of aid and evacuation of flood victims.

2. Human Capital

Community groups, especially youth members of youth organizations, have potential in disaster management. However, the optimization of their role is hampered by the lack of structured training and clear task focus. This has resulted in an insignificant contribution of human capital to community empowerment. In addition, suboptimal coordination between youth organizations and related parties, including with the local disaster management agency (BPBD), hampers the effectiveness of disaster management efforts. Limited access to adequate equipment, especially early warning system technology and flood monitoring, is also an obstacle. Although the community has basic skills such as swimming and operating traditional boats, mastering technology is still essential in improving the ability to deal with disasters.

Table 2. Model Summary

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Conclusion
Capacity Empowerment -> Community Empowerment	0,236	0,233	0,046	5,140	0,000	Significance
Capacity Empowerment -> Process Empowerment	0,610	0,609	0,033	18,604	0,000	Significance
Capacity Empowerment -> Social Capital	0,446	0,447	0,035	12,929	0,000	Significance
Human Capital -> Capacity Empowerment	0,470	0,470	0,036	13,018	0,000	Significance
Human Capital -> Community Empowerment	-0,004	-0,005	0,038	0,109	0,913	Not Significance
Human Capital -> Social Capital	0,424	0,424	0,035	12,105	0,000	Significance
Physical Capital -> Community Empowerment	0,108	0,107	0,032	3,405	0,000	Significance
Physical Capital -> Human Capital	0,483	0,486	0,041	11,695	0,000	Significance
Physical Capital -> Process Empowerment	0,116	0,119	0,033	3,511	0,000	Significance
Process Empowerment -> Community Empowerment	0,578	0,580	0,041	14,197	0,000	Significance
Social Capital -> Community Empowerment	0,028	0,029	0,043	0,644	0,520	Not Significance

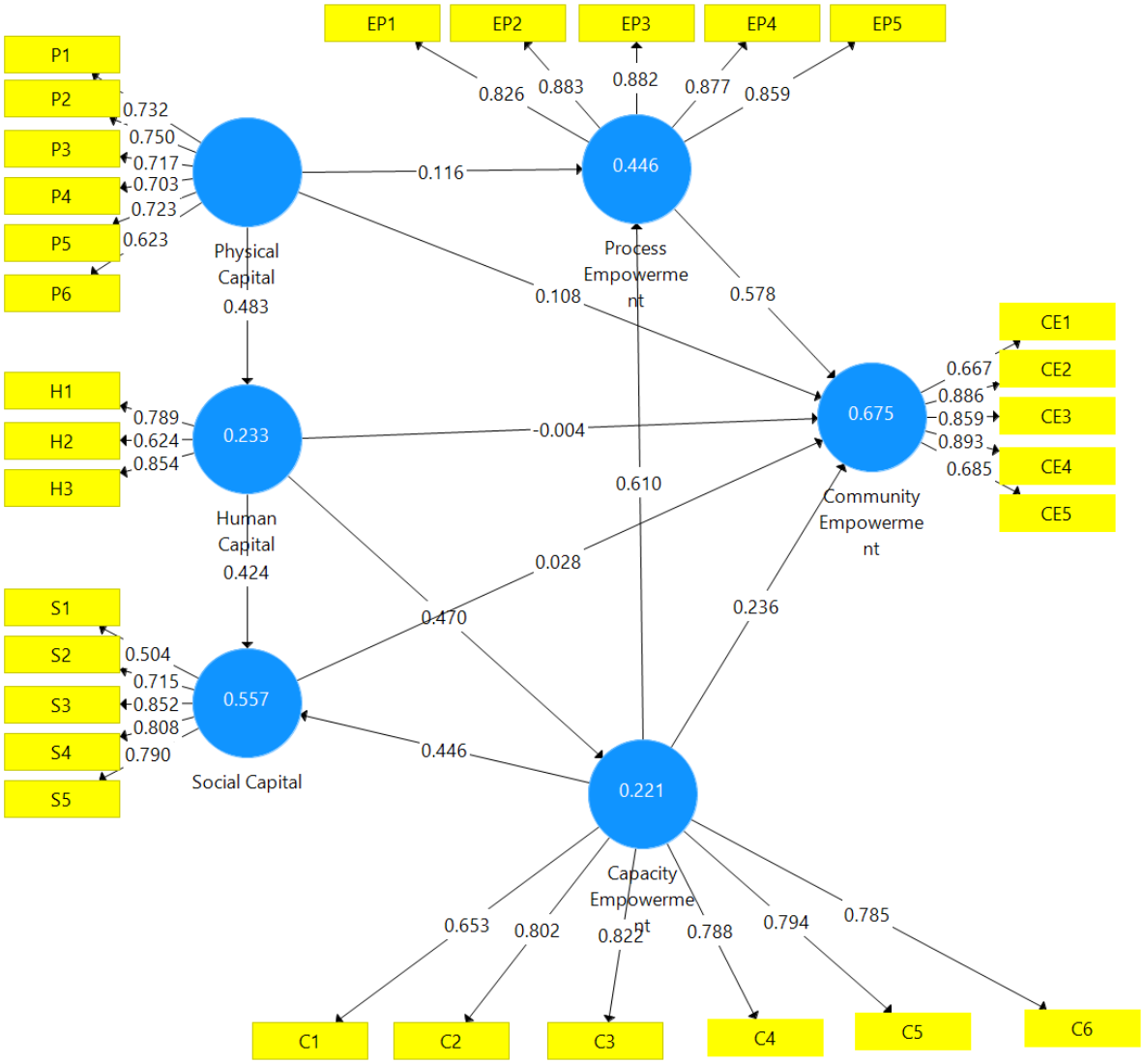

Figure 2. Community empowerment model to reduce flood risk (SEM Results)

3. Social Capital

Local wisdom comes from people's knowledge and experience in managing the environment and is essential in building social resilience. Beliefs in spiritual practices and social norms indicate solidarity and cooperation in dealing with disasters. The reality in the field is that people still do not fully have good knowledge and experience in waste management. This lack of understanding can exacerbate the river's waste problem and increase the risk of flooding. On the other hand, the absence of community groups specifically dealing with disaster risk reduction indicates a lack of initiative, cooperation, and collective awareness in disaster mitigation. Although Karang Taruna plays a role in aid distribution, it is not accompanied by a structured work program and adequate skills in disaster management.

4. Empowerment Capability

The community's knowledge of wetlands and flood triggers is vital in managing disaster risk. While experiences from previous flood events have shaped the community's adaptation strategies, they are still traditional and rely on instinct and empirical knowledge. Lack of skills in utilizing modern flood monitoring technology hinders the community's efforts to improve its adaptability. While individuals in the community play an active role in disaster preparedness, limited technological knowledge must be addressed to improve the effectiveness of disaster mitigation efforts.

5. Community Empowerment Process

Community involvement in program planning and implementation is essential to increase the effectiveness and sustainability of empowerment programs. However, existing programs tend to be spontaneous and unplanned, hindering disaster mitigation efforts. Unsystematic program evaluation also hinders the improvement and enhancement of program effectiveness. Despite the challenges, the potential of communities as key actors in disaster risk reduction has been seen, indicating the need for further support in developing community capacity and

self-reliance.

6. Community Empowerment

Community empowerment efforts to reduce the risk of flooding in Sungai Tabuk are still not optimal. This can be seen from the social and human capital that has not significantly influenced the community empowerment process. The low level of community compliance with existing norms indicates weak social capital. The involvement of Karang Taruna in disaster management, which is still ad-hoc and unstructured, shows the lack of optimal utilization of human capital. On the other hand, physical capital, empowerment capabilities, and the empowerment process significantly influence community empowerment, indicating the importance of these aspects in increasing community capacity in dealing with flood disasters.

3.1. Discussion

Community empowerment is crucial to disaster risk mitigation efforts, especially in vulnerable areas such as Kecamatan Sungai Tabuk. This research selected two villages out of 12 in the Sungai Tabuk Sub-district most affected by flooding, focusing on Pembatanan and Tajau Ladung villages. The selection of villages based on the criteria of flood depth and the resulting socioeconomic impacts ensures that the study results can be generalized and provide insights relevant to disaster risk reduction policy. This aligns with findings showing that community involvement in disaster risk management can improve disaster preparedness and response [24]. In this discussion, an in-depth understanding of the various indicators influencing community empowerment is essential to formulating effective strategies. This study analyzes how physical capital, human capital, social capital, empowerment capabilities, and empowerment processes contribute to community empowerment in reducing flood disaster risk. By examining each indicator separately, it is expected that a clearer picture of the indicators that affect the success of the empowerment program can be obtained.

3.1.1. Physical Capital in Community Empowerment

Physical capital includes the availability of transportation and infrastructure, as well as health and public kitchen facilities. Transportation facilities and infrastructure, such as skeletons and *jukungs*, are available during floods. Some communities in Sungai Tabuk own *kelotoks* and *jukungs. Kelotok* is a wooden motorized boat, while jukung is a non-motorized boat, also known as *sebora.* Water transportation is essential for the community regarding daily mobility and logistics distribution during floods. Meanwhile, motorized boats are generally owned by certain circles and are used to assist evacuations on a larger scale. Rubber boats are an asset of the Regional Disaster Management Agency (BPBD) and the Indonesian National Army (TNI), as shown in Figure 3. Rubber boats function in the aid distribution even though the distribution is not optimal. In addition, flood monitoring tools are not yet available in every village.

Source: Village Archives, 2021

Figure 3. The Indonesian Military (TNI) conducted an evacuation of flood victims using rubber boats

Physical capital is also in the form of health infrastructure, such as the availability of medicines and health workers. Other physical capital is the availability of public kitchens and foodstuffs. The availability of physical capital affects people's access to food. Public kitchens are a form of physical capital in the context of flood disaster management. When flooding occurs, the availability of public kitchens is critical to provide a source of food for flood victims. Public kitchens, shelters, and other infrastructure are essential to support rescue and recovery efforts [25]. The availability of physical capital can increase community self-reliance in reducing flood risks.

An essential prerequisite for effective evacuation planning is the availability and condition of adequate infrastructure. The study area generally has sufficient facilities, but the government needs to do comprehensive mapping on the existence and distribution of these facilities. Accurate information on infrastructure will significantly assist in optimizing aid distribution and evacuation, significantly impacting community empowerment. Although the availability of water transportation modes owned by government agencies is still limited, several communities have initiated ownership of private transportation modes in each house, as shown in Figure 4. This indicates the significant potential of physical capital in community empowerment. However, the use of technology, especially in flood monitoring systems, needs to be optimized. Increasing physical capital capacity in line with improving community technical skills is an absolute prerequisite in facing the challenges of flood disasters [26].

Figure 4. Availability of water transportation modes at residents' homes in flood-prone areas

3.1.2. Human Capital in Community Empowerment

Human capital in disaster management includes human resources, ranging from the general public to formal institutions such as the TNI/Police. Communities, often organized into youth groups, have great potential in disaster management efforts. However, a lack of task focus and minimal training organized by the Regional Disaster Management Agency (BPBD) have hindered the optimization of the role of human capital. As a result, the contribution of human capital in empowering communities to deal with disasters is insignificant. The low capability of human capital has led to the low ability of the community to cope with flood events independently.

Effective coordination between youth groups and related parties, including the Regional Disaster Management Agency (BPBD) and the sub-district government, is critical in flood monitoring and management efforts. However, in practice, coordination between agencies is often not optimal. The main obstacles are the lack of structured training programs, especially in using flood monitoring technology, and limited access to adequate equipment. As a result, the ability of the community, especially youth groups, to make the right decisions in dealing with flood disasters is limited. This has a significant effect on the ability of the community and the social capital that exists in the community.

Community capacity building using flood monitoring technology is crucial in disaster management efforts. Communities with adequate technical skills will be more independent in making decisions and actions in a disaster. In addition, a strong synergy between community groups and various government agencies, especially the Regional Disaster Management Agency (BPBD), is the key to success in disaster management. BPBD, as an institution responsible for disaster management, must play an active role in developing community capacity, designing comprehensive programs, and facilitating flood monitoring technology. Good coordination between BPBD and various stakeholders can increase the effectiveness of disaster management programs.

3.1.3. Social Capital in Community Empowerment

Local wisdom is derived from knowledge and experience in managing the environment from the community. Local wisdom is based on a long tradition in dealing with disasters. Through this knowledge and experience, people can adapt to the environment. The ability of humans to adapt to nature allows them to live in harmony with nature. Social capital consists of trust, norms, and social networks [27].

The community has a sense of trust in local village officials. The community fully hands over disaster relief management, which is obtained to be counted and distributed to the community. Strong trust is a solid foundation in the community's life in Sungai Tabuk. Mutual respect and cooperation in various activities characterize them. Gatherings at religious events further strengthen the social bonds between residents. This high trust enriches social life and positively impacts common challenges like floods. When flooding occurs, the community more easily unites in cooperation activities to clean up the neighborhood. This shows that a strong sense of trust can strengthen solidarity in adversity.

Social norms related to the environment have not been matched by strict and comprehensive regulations regarding waste management, so waste disposal still relies heavily on individual awareness. The lack of waste management infrastructure, such as waste disposal sites (TPS) and waste collection officers in each region, further exacerbates this problem. As a result, people tend to dispose of waste carelessly, both in the surrounding environment and in water bodies such as rivers. This indicates a link between the lack of infrastructure and low public awareness of managing waste.

Social capital, which consists of shared values, norms, and trust within a group, is the foundation for strong social networks. These values form the basis for cooperation and mutual trust [28]. In this case, community involvement in the collaboration of social organizations reflects the condition of social networks in the community. Non-governmental organizations (NGOs) do not deal with this issue in disaster risk reduction efforts in the Sungai Tabuk sub-district. The lack of active participation from various parties exacerbates this condition. As a result, communities in this area are still vulnerable to the threat of flooding and its negative impacts. Community participation in non-governmental organizations is also lacking. In Sungai Tabuk, no role of social organizations focuses explicitly on flood risk reduction or management. This condition illustrates the local community's lack of initiative and collective awareness in dealing with potential flood threats in their area. This causes the influence of social capital on community empowerment to be insignificant. Communities that still tend to find it difficult to coordinate in flood management can still not independently overcome flooding in the area.

The role of Karang Taruna in disaster management in

Sungai Tabuk Sub-district is crucial given the absence of disaster preparedness groups specifically formed for disaster mitigation. One of Karang Taruna's roles during the flood was distributing aid to the community, as shown in Figure 5. Without a disaster preparedness group, the burden of disaster management is primarily borne by the Youth Organization. On the other hand, without a structured work program and adequate training, Karang Taruna's potential to reduce disaster risk cannot be optimized. This condition shows a gap between the community's need for disaster preparedness and the capacity of youth organizations at the local level. Preparedness is a series of actions to anticipate disasters through appropriate and effective organization and action [29]. Preparedness enables governments, organizations, communities, and individuals to respond to disasters quickly and appropriately. Preparing disaster management plans, maintaining equipment, and training staff are all part of flood risk reduction measures. However, these are still absent from organizations in the Sungai Tabuk sub-district community.

Source: Village Archives, 2021

Figure 5. Karang Taruna conducted a distribution of aid during the flood

Flood risk reduction in the face of disasters is a situation where people can prepare themselves physically and mentally to face disasters [30]. Social capital is expected to be a bulwark in the face of flood disasters. However, the potential of social capital in Sungai Tabuk has not been fully optimized to reduce the risk of flood disasters, so social capital does not significantly affect community empowerment. First, although there is a norm prohibiting littering, the practice in the field shows that community compliance is still low. This indicates a gap between norms and behavior. Second, the lack of waste management facilities, such as landfills, exacerbates the problem of environmental pollution and increases the risk of flooding. Third, Karang Taruna's involvement in disaster management is still ad-hoc and unstructured. The lack of a unique organization or institution focusing on disaster management makes the efforts less effective.

3.1.4. Human Resource Capability in Community Empowerment

Empowerment capabilities include knowledge and skills in managing the environment and reducing flood disaster risks. Community capabilities determine the success and sustainability of the empowerment program. Empowerment capabilities have a significant effect on community empowerment. Community knowledge about wetlands can reduce the risk of flooding. There is a basic understanding of the community and the characteristics of their area as a wetland that is vulnerable to flooding. The community has identified heavy rains and water flow from upstream as the main triggering factors for flooding. Experiences from previous flood events can become the community's adaptation strategy in facing flood risks [31]. In addition, using social media to obtain up-to-date information on weather conditions and the potential for flooding indicates a proactive effort from the community in facing disaster risk. However, the reliance on informal information through social media and the lack of knowledge of more sophisticated flood monitoring technology indicate the potential for improving the community's capacity in early detection and response to disasters. Individuals in the community play an active role in disaster preparedness efforts, including their ability to make decisions, coordinate, and take necessary actions [32].

Although communities have basic flood-fighting skills, such as swimming and operating traditional boats (*jukung*), their ability to conduct early detection of flood events still relies heavily on instinct and empirical experience. While effective in certain situations, reliance on visual monitoring of water levels has limitations in providing accurate and timely early warnings. Lack of skills in utilizing modern flood monitoring technologies, such as water level sensors or web-based early warning systems, hinders community efforts on improving adaptive capacity to climate change and flood disaster risks. Factors that influence the capabilities of individuals in the community are, such as age, education, socioeconomic status, and previous experience with disasters [33].

The skills possessed by the community are sufficient for flood disaster prevention, with these skills being able to carry out preparedness and prevention if floods hit. The community's ability as empowerment actors in dealing with flood disasters in Sungai Tabuk significantly influences the empowerment process and social capital. Communities have basic knowledge about the characteristics of their area and the factors that trigger flooding, as well as adaptive skills such as swimming and operating a *jukung*. However, there are still limitations regarding modern flood monitoring technology knowledge and more accurate early detection skills. Reliance on empirical experience and social media for weather information points to the need for capacity building to utilize more sophisticated technology and early warning systems. Nonetheless, communities' basic capabilities are essential assets that can be further developed to improve their preparedness and resilience in facing flood disaster risks. Well-managed knowledge can improve individual skills in dealing with disasters—the importance of continuous learning to enhance skills in disaster management.

3.2. Community Empowerment Process

Empowerment processes such as the quantity and quality of empowerment, empowerment program planning, program implementation, and evaluation can improve the community's ability to make decisions to reduce flood disaster risk. The empowerment process has a significant influence on community empowerment. Community empowerment is crucial in flood disaster risk reduction efforts, especially in vulnerable areas such as Sungai Tabuk. The concept of community resilience is highly relevant to the idea of building overall community resilience. Community development often involves efforts to empower people. This empowerment focuses not only on individuals but also on building the collective capacity of the community [34].

Communities in areas with solid empowerment programs tend to cope better with disasters. The existence of sustainable and quality community empowerment programs is a critical factor in flood disaster mitigation efforts [35]. However, such programs have not been implemented optimally in the Sungai Tabuk area. The existing activities tend to be spontaneous and driven by the empirical experience of the community when facing floods. The community-based approach in disaster risk management is closely related to community empowerment programs. These programs empower communities to be better prepared for disasters, reducing the risk of more significant losses [36]. Disaster risk management includes various efforts to reduce the negative impacts of disasters, including preparedness training [37]. The lack of programs specifically and systematically designed to increase community capacity in flood risk management results in a lack of comprehensive understanding of effective mitigation techniques. As a result, the community's efforts are often partial and have been unable to overcome the root causes of flooding.

The process of community empowerment in Sungai Tabuk is facing flood disaster risk and still faces several challenges. Despite independent initiatives and the involvement of organizations such as Karang Taruna, structured and sustainable empowerment programs are still not optimal. The quantity and quality of programs are still limited, with activities tending to be spontaneous and reactive. Program planning does not fully involve the community, while implementation requires improvements in coordination and structure. Program evaluation is also less systematic, hampering efforts to improve and increase effectiveness. Nonetheless, the potential of communities as crucial actors in disaster risk reduction has been seen, indicating the need for further support to optimize these empowerment efforts, with active community involvement in flood risk reduction efforts, covering aspects such as program planning, implementation, and evaluation. This is in line with the idea that actively involving communities can increase the effectiveness and sustainability of empowerment programs [38]. Community participation is essential in raising awareness of flood risks and preparedness. This is in line with the concept of community empowerment in facing disasters [39]. This limitation in the empowerment process prevents community empowerment from being optimally implemented in the planning, implementation, and evaluation of programs and policies prepared by local governments.

3.3. Community Empowerment

Community empowerment to reduce the risk of flood disasters is still not optimally implemented in the research area. Some variables that do not affect community empowerment, such as social and human capital, still do not significantly affect community empowerment. This is because in the human capital indicator, community knowledge and skills are still lacking in using technology and early detection of flood disasters, there is a lack of coordination and synergy between community groups and stakeholders in flood evacuation training, and there is a lack of community initiative in community empowerment programs. In addition, the social capital indicator has a norm prohibiting littering, but practices in the field show that community compliance is still low. This indicates a gap between norms and behavior. This is due to the lack of waste processing facilities, such as landfills, which are exacerbating the problem of environmental pollution and increasing the risk of flooding. Third, Karang Taruna's involvement in disaster management is still ad-hoc and unstructured. The lack of a unique organization or institution focusing on disaster management makes the efforts less effective. On the other hand, physical capital, empowerment capability, and empowerment process significantly influence community empowerment, indicating the importance of these aspects in improving the community's capacity to deal with flood disasters.

This finding aligns with other studies that show that social capital plays a vital role in building community resilience to disasters. Social capital is one of the factors that influence community resilience. They found that communities with strong social networks can better adapt and respond to challenges, including natural disasters [40]. This suggests that strengthening social capital in Sungai Tabuk could significantly increase community resilience to disaster risk.

The indicators of physical capital, empowerment ability, and empowerment process significantly influence community empowerment. The empowerment program has improved the community's abilities and skills in disaster adaptation. The Sungai Tabuk community, as an area that is often hit by floods, has developed a level of adaptation and ability to deal with disasters. Their ability to make independent decisions, such as choosing to evacuate or stay during floods, reflects the empowerment that has naturally taken place. Community involvement is needed in the process of identifying problems and potential solutions, making decisions about alternative solutions to deal with

problems, making efforts to overcome difficulties, and assessing the changes that occur [41]. This will increase their capacity to address the issues and take initiative.

Through years of experience dealing with flooding, the Sungai Tabuk community has built strong local knowledge and survival skills. This allows them to respond more quickly to emergencies, reduce the negative impacts of disasters, and even create local innovations in flood management. Nonetheless, it is essential to continue to support and improve the capacity of the Sungai Tabuk community through more structured empowerment programs so that they can face increasingly complex disaster challenges in the future.

Despite the lack of structured empowerment programs, the community's awareness of reducing flood risks has grown independently from their experiences. This is reflected in forming volunteer groups, such as youth organizations involved in disaster management efforts. The existence of these groups indicates the initiative of the community to help each other and work together in dealing with floods. The formation of a disaster volunteer team allows the community to participate actively in disaster management. The obstacles in flood management in community groups are limited coordination and a lack of technological mastery in overcoming flood events. Nevertheless, the community's role is vital in flood risk reduction. These community groups are responsible for evacuation, first aid, and post-disaster recovery efforts [42].

However, these independent efforts are still sporadic and not yet supported by a more integrated system. Communities must develop adaptation and resilience strategies to reduce the impact of flooding. Studies have shown that communities with more robust capacities tend to better adapt to and recover from disasters [43]. The Sungai Tabuk community faces several challenges, but it has shown progress in its empowerment in the face of flood disasters. The community's adaptability is demonstrated by its ability to make decisions when facing floods. Local knowledge, survival skills, and strong social relationships have been built through the flood experience. A more organized and sustainable empowerment program is needed to optimize community empowerment. A structured program can strengthen the ability of volunteer groups, involving every citizen from all walks of life in community empowerment during floods.

4. Conclusions

In community empowerment to reduce the risk of flood disasters in Sungai Tabuk, several indicators, namely social and human capital, are not significant. Social capital related to the community's garbage disposal norms has not run well. The involvement of community groups only has a youth group whose role is still not optimal in disaster management. Human capital does not have a significant influence due to the lack of coordination with agencies and governments related to disaster management training and programs. However, other indicators, such as physical capital, the empowerment process, and the ability of empowerment actors, significantly influence community empowerment. The availability of transportation modes owned by the community is instrumental in flood evacuation. The adaptability of the community is shown by their ability to make their own decisions when facing floods. Local knowledge, the ability to survive, and strong social relationships have been built through the experience of facing floods. A more organized and sustainable empowerment program is needed to optimize community empowerment. Such programs can strengthen the ability of volunteer groups to involve every citizen from all walks of life in community empowerment during floods. The limitations of this study include the sample not being fully representative due to the limitations of respondent selection and the potential for respondent bias in filling out the questionnaire. Future research is advised to collect qualitative data for a more comprehensive understanding and involve more villages to increase the sample's representativeness.

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