

Optimization of Penta helix in disaster risk reduction at disaster risk reduction forum F-PRB West Sumatra Province

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Abstract. This paper explains the efforts of F-PRB of West Sumatra Province in optimizing the role of actors using the Penta Helix concept. This study applied descriptive qualitative methods and data collection methods are interviews, and documentation. The conclusions of this study showed that The Penta Helix concept is the right concept to be applied in the context of disaster mitigation by F-PRB. Then the second conclusion is that implementing the Penta helix concept in F-PRB is still not optimal. It can be seen from one of the involvement of stakeholders that it is still not balanced and also not representative in terms of the number of each element. The third is collaboration process with these five stakeholders is quite optimal. There are Several recommendations need to be considered form this research. The first is that F-PRB and stakeholders in each element must increase the number of members involved and join the forum to be representative. F-PRB also needs to embrace and involve elements of society at the village level to be involved and join the membership of this forum. Then, there needs to be more intense collaboration activities related to disaster mitigation creating a resilience society.

1 Introduction

West Sumatra Province is one of the provinces in Indonesia that has a large potential for natural disasters. West Sumatra is located between the meeting of two active plates, namely the Indo-Australian Plate and the Eurasian Plate. West Sumatra is also traversed by the Mediterranean Mountains, a path in which there are many active volcanoes. In addition, there are also the Mentawai fault and the Sumatra fault. With the three earthquake sources, the tectonic complexity of the Sumatra region is increasing and causes the Sumatra region to be prone to various disasters.

Recently in 2024, precisely on May 11, the West Sumatra region was hit by a natural disaster in the form of cold lava floods and landslides. This incident occurred in the Batusangkar, Bukik Batabuah and Silaiang. This disaster was caused by the eruption of Mount Merapi, which occurred at the end of 2023 and resulted in many fatalities. This situation was exacerbated by the very high intensity of rain in West Sumatra. This condition has claimed many people died and losses of up to hundreds of millions of rupiah.

If we look at the data released by the West Sumatra Provincial Disaster Management Agency in 2022, both those designated as disasters through government decisions and those considered normal events, there were 1,021 recorded with an estimated total loss of IDR 1,136,849,587,336, as shown in Table 1:

Table 1. The number of disasters in West Sumatra (Source: data & information of disaster in West Sumatra province 2022)

No	City/Regency	Numbers of Events	Estimated Loss
1.	Padang	143	Rp. 346,500,000
2.	Bukittinggi	98	Rp. -
3.	Agam	95	Rp. 39,000,000
4.	Padang Pariaman	90	Rp. 880,500,000
5.	Pesisir Selatan	75	Rp. 35,000,000
6.	Sijunjung	69	Rp. -
7.	Pasaman	66	574,411,801,603
8.	Sawahlunto	59	Rp. 2,000,000
9.	Lima Puluh Kota	51	Rp. 5,055,500,000
10.	Tanah Datar	43	Rp. 3,457,000,000
11.	Padang Panjang	35	Rp. -
12.	Pasaman Barat	33	Rp. 551,638,885,733
13.	Kepulauan Mentawai	28	Rp. 180,000,000
14.	Dharmasraya	28	Rp. -
15.	Solok City	28	Rp. -
16.	Solok Regency	24	Rp. 450,000,000
17.	Payakumbuh	20	Rp. -
18.	Pariaman	19	Rp. 16,500,000
19.	Solok Selatan	17	Rp. 338,900,000
Grand Total			Rp. 1,136,851,587,336

From the data above, it can be seen that all areas of 19 districts and cities in West Sumatra experienced disasters of various types. In 2022, around 1.021 natural disasters occurred in West Sumatra. Then, if we look more specifically related to this disaster based on data where,

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strong winds are a disaster that often occurs, with a total of 674 incidents throughout 2022. Meanwhile, other is data on the number of disasters throughout 2022 in the West Sumatra region, (Fig. 1).

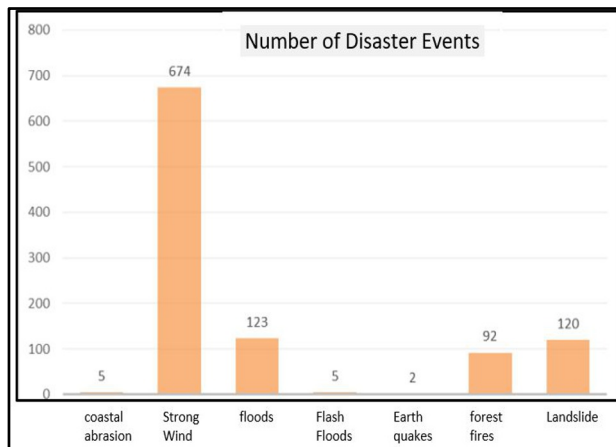


Fig. 1. Number of Disaster districts/municipalities in West Sumatra Province 2022 (source: data & information of disaster in West Sumatra province 2022)

This data shows that the West Sumatra region is a disaster-prone area, so serious and comprehensive disaster mitigation steps need to be taken. This condition requires structural mitigation efforts involving many parties, a large budget, and continuous mitigation implementation time. In general, disaster mitigation is an effort to reduce the risk and impact caused by disasters on communities in disaster-prone areas, be it natural disasters, man-made disasters or a combination of both in a country or community. Meanwhile, according to Law of the Republic of Indonesia No. 24 of 2007 concerning Disaster Management, mitigation is a series of efforts to reduce disaster risks, both through physical development and awareness and increasing the ability to face disaster threats.

Meanwhile, the purpose of mitigation itself is to reduce losses when future hazards occur and reduce the risk of death and injury to the population, including reducing damage and economic losses caused to public sector infrastructure. Given the importance of disaster mitigation, which can provide benefits and advantages to the community and its environment, several important things need to be considered in disaster mitigation, including the availability of information and maps of disaster-prone areas for each disaster category. The second is socialization, which increases public understanding and awareness of disasters. The third is knowing what needs to be done and avoided and how to save yourself if a disaster occurs at any time. The fourth is the regulation and arrangement of disaster-prone areas to reduce the threat of disasters that occur

On this basis, there needs to be an optimally integrated interconnectedness of systems, subsystems, sectors, and stakeholders. The concept of interconnection between systems and stakeholders is the collaborative Penta helix concept [1]. This collaborative concept was born from the governance paradigm in Public Administration Science, especially the concept of collaborative governance [2]. The public administration perspective describes

disasters such as floods occurred 123 times, landslides 120 incidents, and forest fires 92 incidents. The following collaborative governance as a pattern of working together with several parties involved in a policy/activity to achieve goals [3]. This form of governance with public agencies is directly related to non-state stakeholders who are oriented towards consensus, deliberative and public policy implementation. More broadly, collaborative governance is seen as the processes and structures of decision-making and governance that involve the public in a constructive between public agencies, various levels of government, private and civil society to achieve common goals [4].

Meanwhile, the Penta helix concept is a development of the initial concept, namely Triple helix, where this concept only considers three stakeholders: government, business, and academics [3]. However, this concept later developed into Quadra helix. In this Quadra helix concept, there is an additional stakeholder, called the community or society; only in the next development was the Penta helix concept born, which added the involvement of mass media stakeholders as the fifth stakeholder [5].

From the description of the concept of Penta helix collaboration, there are many potentials uses to solve multi-party problems where stakeholders represent various interests in one location [6]. In this Penta helix concept, elements of government, academics, business entities or actors, society or communities, and the media come together to coordinate and commit to taking steps in disaster mitigation in an effort to increase the awareness of all parties.

To make a society aware of this disaster, of course, it cannot be done alone. That is why collaboration between parties is important in achieving common goals by maximizing the Penta helix concept, which involves many roles. Penta helix or multi-party, is an element of collaboration that combines various parties, including Academy, Business, Community, Government, and Media or better known as (ABCGM). In essence, the Penta helix concept is one way to overcome problems and develop disaster mitigation programs by involving cross-sectors to share roles. The focus of this Penta helix is collaboration between the government and stakeholders. Based on the explanation above, this paper aims to examine the application of the Penta helix concept in reducing disaster risk by the F-PRB Disaster Risk Reduction Forum of West Sumatra Province.

2 Method

This study uses qualitative research with a descriptive approach. According to Creswell 2014 [7], The research method is a process of activities in the form of data collection, analysis, and providing interpretations related to the study's objectives. Meanwhile, qualitative research, according to Steven Dukeshire and Jennifer Thurlow 2002 [8], qualitative research concerns data that is not numerical, collecting and analysing narrative data. This study also uses a descriptive approach, namely a research approach where researchers describe what is seen, heard, felt, and asked.

The data collection techniques used in this study are interview and documentation techniques in order to obtain data and information related to the theme of this study, both in the form of primary data and secondary data. Meanwhile, research informants are determined by the purposive sampling method [9], where researchers determine the criteria according to the theme of this study. Meanwhile, the data analysis used in this study is data analysis, according to Miles and Huberman, which has stages including Data collection, data reduction, data presentation, and drawing conclusions.

3 Results and discussion

Table 2. Membership lists for F-PRB West Sumatra Province for the 2018-2021 period (source: governor decree no. 360.811.1-2018 management structure of FRB West Sumatra 2018/2021)

No	Sectors	Members
1	Government Body	1. Gubernur Provinsi Sumatera Barat 2. DPRD Provinsi Sumbar 3. BPBD Provinsi Sumatera Barat 4. BAPPEDA Provinsi Sumbar 5. POLDA SUMBAR 6. Dinas Kesehatan Provinsi Sumbar 7. KOREM 032 Wirabraja 8. Damkar Kota Padang 9. UPT BNPB
2	Private Sector	1. PT. Semen Padang 2. INKINDO
3	University	1. Universitas Bung Hatta 2. Universitas Andalas 3. Pakar kebencanaan
4	Civil Society	1. Ulama 2. Ormas NU 3. Ormas Muhammadiyah 4. Jemari Sakato 5. PKBI Provinsi Sumatera Barat 6. Mercy Corps 7. PKPU 8. KOGAMI 9. Gerakkin 10. Bumi Ceria 11. ASB 12. PMI Sumbar 13. PPDI 14. IOF 15. HGWI 16. HWDI 17. Pegiat Kebencanaan 18. CARITAS 19. WALHI Sumbar
5	Mass Media	1. Classy FM

In West Sumatra itself, there is an institution that serves as a forum for the five elements to join. The institution is the Disaster Risk Reduction Forum or abbreviated as F-PRB of West Sumatra Province. This forum consists of many volunteer members. This forum was established based on Law Number 24 of 2007 concerning Disaster Management and Government Regulation Number 21 of 2008 concerning the Implementation of Disaster Management, which mandates the existence of a Disaster

Risk Reduction Forum abbreviated as the PRB Forum as a non-formal institution that is not separate from the implementation of disaster management, as a forum for stakeholders related to disasters [10].

This local PRB forum is also mandated through Government Regulation Number 21 of 2008 concerning the Implementation of Disaster Management in Article 8, which explains the function of the multi-stakeholder forum in preparing the Regional Action Plan for Disaster Risk Reduction (RAD-PRB). It is also regulated that members of this forum include elements from the government, academics, the community, business institutions, and the mass media. In West Sumatra itself, this F-PRB, until 2021, had a membership of 36 members consisting of various elements. If grouped based on the elements in the Penta helix concept, it can be described in Table 2.

Based on the membership table above, it can be seen that the F-PRB of West Sumatra Province, in terms of membership, has actually fulfilled the five elements in the Penta helix concept where there are elements of Government, Private Sector, University/Academics, Society/Community, and Mass Media. However, if we analyse the composition of the membership of the F-PRB, it is still not balanced. The number of members from the community elements has the largest number of members, around 19 members consisting of various elements such as NGOs/NGOs, and Community Organizations. Meanwhile, from the government element, 9 organizations consisting of the Provincial Government, Regional Apparatus Organizations, DPRD, as well as the police and TNI. Furthermore, from the academic and university elements, there are only 2 members, namely Bung Hatta University and Universitas Andalas. Then the number of members from the private sector only amounts to 2 members, PT. Semen Padang and INKINDO, and the mass media element only have 1 membership, namely from Radio Classy FM.

Judging from the composition of the F-PRB membership, it is clear that it is still not balanced and does not cover all the elements in each element. This condition certainly affects the role that each element must carry out. For example, in the context of disaster risk reduction, the government has three roles at once in the Penta helix concept. The first is that the government acts as a regulator and controller with a regulatory function. In this case, the government must always be involved in all types of activities, such as planning, implementation, monitoring, control, promotion, financial allocation, licensing, and others. In addition, the government also acts as a coordinator for stakeholders who contribute to the disaster mitigation program.

In the context of the Penta helix, the government plays a central role in making policies, the government is also responsible for formulating regulations that encourage mitigation, preparedness, response and post-disaster rehabilitation efforts. In this context, government organs such as the National Disaster Management Agency (BNPB) and the Regional Disaster Management Agency (BPBD) are the main actors and also the leading sector in disaster management. In addition, the government plays a role in building disaster-resistant infrastructure. Then

design evacuation centres and early warning systems in the community and conduct simultaneous coordination with the central government, regions, and international institutions in handling disasters. With the composition of the F-PRB membership consisting of only a few government organizations, it will be difficult to realize this role optimally and comprehensively.

The second element is the private sector. Private or business actors, in the form of an agency or business actor, act as enablers and also play a role in presenting technological infrastructure and capital to optimize the resources owned to mitigate and overcome disasters. Then, this private element must also apply quality standards to prevent disasters in its business development efforts. In addition, the private sector also has a role in providing logistical support, funding, and resources for the emergency response process. In addition, through the Corporate Social Responsibility (CSR) program, businesses can provide support for activities related to disaster mitigation, such as the construction of disaster-resistant public facilities, the provision of early warning tools, or the provision of socialization and training for the community. Furthermore, the private sector can also collaborate with the government and other institutions to develop long-term strategies to strengthen disaster resilience. Looking at the composition of the number of members involved in this PRB Forum, where only 2 members are recorded, is certainly not sufficient. Meanwhile, in reality there are many large companies in the West Sumatra Province, both international, national, and local companies.

Next is the academic or university element. In the Penta helix concept, academics act as concepts that conduct research and assist in managing potential identification and development opportunities. Academics are also responsible for increasing the capacity of knowledge and skills because academics are a source of knowledge that includes a collection of concepts, theories, and the latest development models that are relevant to existing conditions through research and scientific studies conducted. Furthermore, academia has a role in providing science-based research and innovation that can be used to improve disaster mitigation and management systems. The results of research conducted by universities and research institutes can help provide a better understanding of disaster risks, patterns of occurrence, and more effective solutions to deal with them. Academia also contributes to the development of disaster mitigation technologies, such as more sophisticated early warning systems, accurate disaster risk mapping, and evaluation of policies that have been effectively implemented. In addition, through education, academics help prepare a younger generation that has an awareness of the importance of disaster mitigation. This can be realized optimally if academics and campus institutions are involved in the institution that focuses on disaster mitigation, namely F-PRB. However, when viewed from the existing membership composition data that comes from campus institutions, there are only 2 campuses, namely Bung Hatta University and Universitas Andalas. This condition is certainly far from optimal because in

West Sumatra there are many universities, both private and government-owned.

The next element is the community in the society. In the context of disaster mitigation, the community in the community has a strategic and urgent role. Some of the roles that this community can carry out are conducting socialization and assistance in order to increase public awareness of the risks and dangers of disasters being directly involved in handling disasters when disasters occur and being directly involved in post-disaster recovery. Given the importance of the role that is the responsibility of this community element, it is necessary to involve the communities in this community in this F-PRB Institution so that they can provide maximum contribution to disaster mitigation.

On the one hand, the community is the party most affected by disasters, but on the other hand, in the Penta helix concept they are also important actors in disaster management efforts. The role of the community is vital, especially in terms of preparedness, mitigation and emergency response. This preparedness can be in the form of disaster response training, the formation of disaster resilient groups or communities, and participation in simulation activities organized by the government. Furthermore, when facing a disaster, the role of the local community is very important, especially people who understand the conditions of the surrounding environment. They control the area so that they can provide direct information related to emergency needs. Then the community can also volunteer to help the evacuation process and the distribution of logistical assistance to the community. Involving the community in every stage of the disaster will create a sense of belonging and a sense of shared responsibility that will strengthen community resilience. Judging from the membership data of this F-PRB, the number of members from this community element is quite large and varies greatly depending on its composition. There are environmental activists, religious, humanitarian, women's and children's protection, and disaster activists. This certainly greatly supports the process of creating a disaster-aware society, especially disaster mitigation.

The last element in the Penta helix concept is the media. In the context of disaster mitigation, the media has an important role in providing and disseminating information related to disasters to the public. The media also plays a role in always reminding and educating the public about preparedness to reduce disaster risk and minimize victims and losses if a disaster occurs. Furthermore, the important responsibility of the media is to provide accurate and correct information with valid sources to overcome and clarify information or Hoax news circulating in the community. In principle, the mass media has an important role in disseminating information related to disasters that occur, both before, during and after disasters occur. Mass media, both mainstream and non-mainstream, brick-and-mortar and online media, are vital information channels in raising public awareness about potential disaster risks, mitigation measures, and safe evacuation procedures. Then, in emergency situations the mass media has a function as a liaison between the government and the community, conveying

information about disaster developments, current conditions, and instructions from the authorities. In addition, the mass media also plays a role in shaping public opinion, so as to encourage active participation of the community and other parties in disaster management efforts. Through precise and accurate reporting, the media can raise awareness and encourage solidarity to help disaster victims.

From explanation above it can make a simple Penta Helix model of F-PRB West Sumatra Province as shown in Fig. 2:

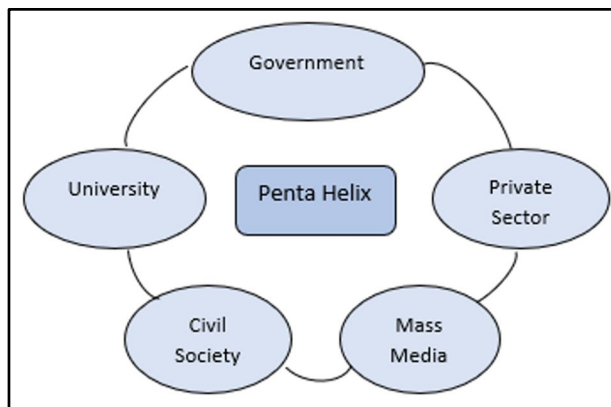


Fig. 2. Penta helix model of F-PRB West Sumatra Province

Based on the description of the data above, in the context of optimizing Penta helix in disaster mitigation in F-PRB West Sumatra, it can be said that it is not yet optimal. This can be seen from the composition of the membership that is included in this forum, which is still not balanced and representative of each element. In fact, the more organizations in each element are involved in disaster mitigation and are included in this forum, the more it will be able to optimize the role and function of this forum, especially in disaster mitigation. Next, besides the membership issue, in the Penta helix concept, the most important thing is the occurrence of a collaborative process that is synergistic and integrated with each other.

In the context of this collaboration, all elements or stakeholders must be involved in program activities and activities related to disasters, especially disaster mitigation. The collaboration is carried out not only at the level of discussions, seminars, or other scientific meetings but also in strategic matters such as government involvement in policy making. Disaster risk reduction requires the involvement of the entire community to prevent and reduce disaster risks through integrated implementation of inclusive efforts. F-PRB relies heavily on coordination mechanisms within and across sectors and with relevant stakeholders at all levels. PRB requires full involvement from all state institutions, executive and legislative, at the national and local levels. In addition, a clear description of the responsibilities of all stakeholders is needed to facilitate outreach, partnerships, and joint accountability. Of course, the synergy of these five elements in disaster management will have a very good impact on implementing disaster management. Because of course, in disaster management, the government, both central and local governments, cannot deal with it alone. There needs to be synergy with these elements in order to

reduce the risk of disasters that may occur. Therefore, the government should also open up as much space as possible for related elements that want to synergize, especially in disaster management because disasters should be a shared concern, not just the government.

The occurrence of a Penta helix collaboration in disaster management will bring many benefits and positive impacts such as; with this Penta helix approach, synergy will be created between various sectors that have resources and expertise. Then, by collaborating, each sector can complement each other so that disaster management measures become more comprehensive and integrated. In addition, this Penta helix collaboration will accelerate the process of making tactical and strategic decisions in normal and emergency situations. Furthermore, with this collaborative mechanism which involves various parties, Penta helix is able to increase long-term resilience. Not only that, Penta helix does not only focus on handling disasters after they occur, but also encourages better prevention and mitigation through research, innovation, education, and resilient infrastructure development by involving various sectors. In general, it can be concluded that the application of the collaboration concept with the Penta helix approach in dealing with disasters in Indonesia is quite ideal even though in practice there are still many shortcomings. This approach allows each party to contribute according to their respective capacities in creating an effective, efficient and sustainable disaster management system. With solid cooperation between these five elements, it is expected that it will be able to increase resilience.

4 Conclusion

Based on the analysis presented above, it can be concluded that several things are related to the optimization of Penta helix in reducing disaster risk in the F-PRB of West Sumatra Province. The first is that the Penta helix concept is the right concept to be applied in the context of disaster mitigation by F-PRB. This is because F-PRB is a cross-stakeholder forum that cares about disaster issues. Thus, a multi-actor approach is needed that collaborates with each other to achieve common goals. Then the second conclusion is that implementing the Penta helix concept in F-PRB is still not optimal. This can be seen from one of the involvement of stakeholders, who are still not balanced and also not representative in terms of the number of each element. This non-representative composition certainly has an impact on the collaboration process carried out related to disaster mitigation. Meanwhile, the third is related to the collaboration process carried out by F-PRB with these five stakeholders, and it can be concluded that it is quite optimal. This is reinforced by the frequent meetings, both formal and informal, that discuss disaster issues. There is also a communication media platform in the form of a WhatsApp group that supports communication at all times between its members.

From the results of this study, there are several recommendations that need to be considered in optimizing the implementation of Penta helix in disaster

risk reduction by F-PRB West Sumatra. The first is that F-PRB and stakeholders in each element need to increase the number of members involved and join the forum so that it is representative. Related to that, F-PRB also needs to embrace and involve elements of society at the village level to be involved and join the membership of this forum so that it will facilitate coordination and socialization to the community at the village level. Then, the next thing is that there needs to be more intense and planned collaboration in carrying out programs and activities related to disaster mitigation so that a society that is aware of and cares about disasters in West Sumatra can be created.

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