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Impact Analysis of Structural and Non-Structural Program and Collaboration of Stakeholder to Productivity of Sustainable Flood Mitigation Management

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Abstract

The flood occurred in 3 Cis[1] in Banten Province dan 5 rivers [2] in Ambon-Seram Maluku Province has interrupted the stability and productivity of the river which serves as one of the sources of life for the ecosystem, including the community living around them. Therefore, the river management and flood mitigation should be professionally handled to be more beneficial and may secure the community and other ecosystems. *Flood Management in Selected River Basin* (FMSRB) program has contributed to improving the flood mitigation productivity by reducing water volume and water inundation, as the impact of realization of both structural and non-structural activity options, along with the collaborative approach among *stakeholder*. The result of formative evaluation study with Sub-Directorate of Agriculture and Food team indicates that the impact of structural/infrastructure activities realization to the productivity of flood mitigation is very high at 58.60% and high at 31.40%. While the empowerment-based *stakeholder* collaboration approach has been affecting to the flood mitigation management performance and good behavior awareness which is very high at 48.60% and high at 35.70%. This study has not been responding 100% since there is still other factor that needs further study.

Keywords: *Structural; Non-structural; Collaboration; Productivity; Sustainability;Flood and Mitigation*

[1] 3 Cis = Ciujung, Cidurian dan Cidanau
[2] 5 Rivers = Way Ruhu, Way Batumerah, Way Batu Gajah, Way Batu Gantung, and Way Tomu

I. Introduction

The whole human development concept has a broad meaning comprising completeness of achievement and changes in all aspects of life conducted intentionally based on the priority needs-based constructive plan. (Soerjono Soekanto, 2005). This concept is relevant to FMSRB program that focuses on its concrete program on flood mitigation management.

FMRSB Program is an integrated flood management mitigation activity or *Integrated Flood Management* (IFM) that adopts the structural and non-structural program combinantion. The structural program option includes the construction of embankment or *check dam*, small ponds, slope reshapping or TPT, drainage, biopori, rainfall harvesting system, retention well, etc. The non-structural program options include empowerment and optimization of stakeholder's participation, the formation of organization or village community institution such as Disaster Preparedness Community Group (KMSB) and prepare various regulations and guideline on participatory flood risk management.

IFM approach integrates the land and water resources management in the river basin with the purpose of maximizing the utilization of river plains, and may reduce the social-economic loss due to flood[3]. *IFM* emphasizes on the participatory approach, cross-sector and transparency for decision making in flood mitigation planning. The collaboration of stakeholders is the main concern.

Systematically, IFM aims to: (1) support sustainable development by synchronizing and harmonizing between the development needs and flood risk; (2) reduce the casualties risk due to flood; (3) maximize the land use in the river basin efficiently and effectively so it can reduce social impact due to flood; and (4) environment conservation by maintaining the river and ecosystem in supporting the people livelihood in the river basin.

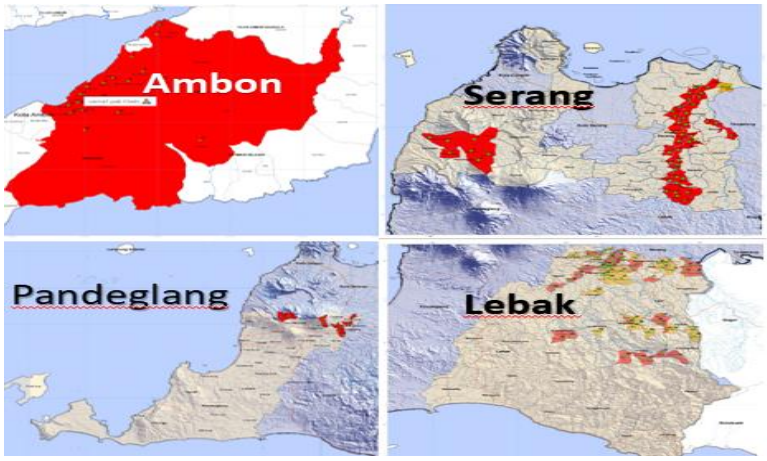

Image 1

River Basin Map for Ambon City, Serang District, Pandeglang District, and Lebak District

FMSRB Program with IFM approach has been implemented in Maluku Province (Ambon City) and Banten Province (Serang, Pandeglang and Lebak) comprises 4 outputs with 9 sub-outputs.

First Output, the improvement in quality of flood management planning that includes two sub-outputs namely: (1) the upgrade of data and information on river basin and flood risk management plan; and 2) institutional strengthening, planning and coordination.

Second Output, The enhancement of land management and the improvement of flood retaining structure, that includes 4 sub-outputs: (1) the agriculture land management and sustainable agriculture practice; (2) the improvement of run-off and erosion control; (3) *Detailed Engineering Design (DED);* and 4) civil work in the river basin.

[3] *ibid*. World Meteorological Organization, Geneva, Switzerland.

Third Output, The enhancement of community-based flood risk management capacity; and *fourth output*, the improvement of policy, construction and capacity in the central level. There are 2 sub-outputs comprising (1) project management; and (2) monitoring and evaluation.

As *Central Project Implementation Unit* (CPIU), Sub-Directorate of Agriculture and Food-Directorate for Synchronization of Regional Government Affairs 1 (SoRGA 1) Directorate General of Regional Development Ministry of Home Affairs is consistent in the enhancement of capacity for community-based flood risk management, and consistent in carrying out the collaboration of concept into 5 main activities such as: (1) The handling of construction and the improvement of small-scale irrigation infrastructure as small ponds, TPT, drainage, biopori, PAH and retention well; (2) community-based treatment to reduce flood risk; (3) prepare emergency response planning; (4) identify the flood risk in the local location; and (5) strengthen community participation forum in the form of gender-based KMSB.

The contribution of Sub-Directorate Agriculture and Food in this program is more meaningful since it is able to oversee the collaboration and partnership among the regional agencies (OPD) and flood management institution at the province and district/city level, as well as being able to synergize the structural and non-structural program in *Community Driven Development (CDD)* dan *Community Participation in Procurement or Community participation in the planning (CPP)* approach. Both are important principles in the empowerment approach which begins with community organizing in the gender-based KMSB.

KMSB which is legalized with Decree of Village Head and Notarial Deed is an organization which is identical with *Lembaga Kemasyarakatan Desa* (LKD) as regulated in Village Minister's Regulation No. 17 year 2009 on General Guideline on Village Community Development and Empowerment, Article 1, point 24.

The implementation of CDD in the community level begins with the socialization of program, the formation of KMSB, Problem Identification and Analysis Situation, program options (structural and non-structural), and the preparation of Community Action Plan document (CAP). (POR. 2023-QE3 and QE4).

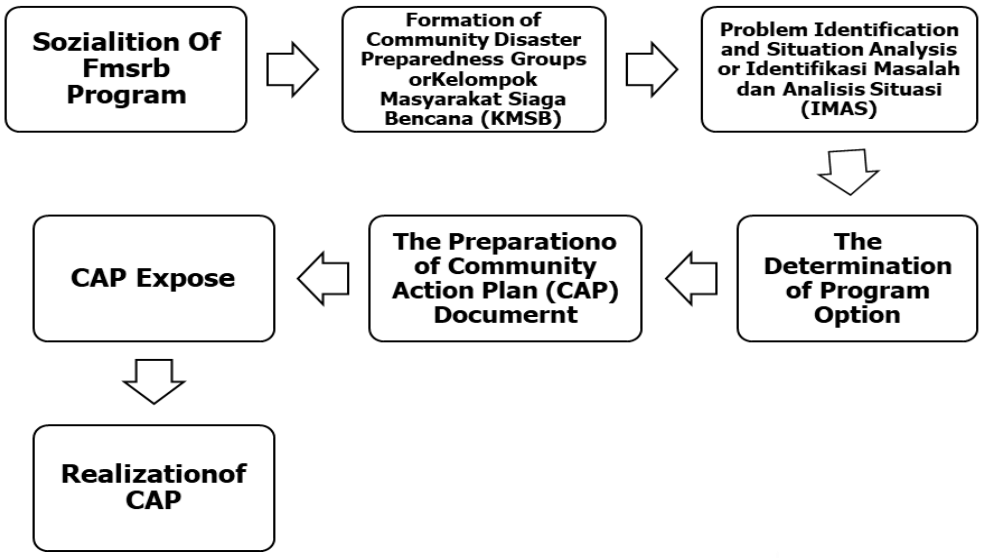

Image2
CDD Flow

The structural and non-structural program option are realized after being verified through CAP expose, and are in accordance with the cost, technical, social (local wisdom) feasibilities, and the priority or relevant needs with flood and landslide mitigation.

For the sustainable program objective and sense of asset belonging, the realization of CAP for the infrastructure development always optimizes the stakeholders' participation including the community. There are 3 applicable development models that consist of: 1) the development implemented by the contractor (contractual). The community is involved in the planning team and acts as craftsman/labor; 2) the operational cooperation between contractor with KMSB; and 3) CPP where KMSB undertakes the development process from the beginning till the end. PUPR Agency acts as the supervisor.

The empowerment of program undertaken in the community level is facilitated by the trained Community Facilitator (CF). They work proffesionally in the collaboration coridor, *CDD and CPP*. The recrutment of consultant and TPM is undertaken by DGRD collaborating with PT. Inacaon Luhur Pertiwi. During 5 years, the status of TPM is progressive. At the beginning of the program running, TPM was positioned as TPM Perintis. In the mid of the program, they are positioned as TPM Transisi, and towards the end of the program, they are positioned as TPM Pelopor. Each position has progressive quality and work character.

Directorate General of Regional Development and the consultant team with their *Institutional Development for Community-Based Flood Risk Management (ID-CBFRM),* are committed to implement a collaborative approach at every level, including with all stakeholders in the Ministries level [4], cross-Regional Agencies/*Organisasi Perangkat Daerah* (OPD),[5] as well as the community. This collaborative approach becomes a strategy to enhance the participation and performance of flood mitigation management.

With the stakeholders' collaboration, the realization of both structural and non-structural program is effective, right on target and able to increase the productivity among other reducing water volume and water overflow, reducing puddle and flood.

Collaboration can be the solution if it is consistently conducted. The principle of collaborative work is mutual engagement in the coordinated efforts to solve the problems together. The collaborative interaction is characterized by shared goals, interdependence, and high degree of negotiation.

II. Methodology

This study uses the formative evaluation method with qualitative descriptive analysis, with summative and descriptive evaluations in its process. The formative evaluation is designed to collect information regarding the real situation which is currently taking place, and analyze the cause of a particular phenomenon or the result being achieved. (Masri Singarimbun-Softan Effendi, 1987) and Michael Scriven (in Arikunto, 2007).

The summative evaluation as a part of formative evaluation, is used to assessing the program benefit. (Lehmann, 1990). While descriptive evaluation is to synergize between the *content analysis* with *trend analysis* or trend analysis purposes. (Travers, 1987 and Consuelo G. Sevilla-Jesus A. Ochave-Twila G. Punsalan-Bella P. Regala-Gabriel G. Uriarte, 1993). With the qualitative descriptive analysis, data and information becomes easier to be understood since it's more concise (Istijanto, 2009). This reason is

[4] Cross-Ministries = Ministry of PPN-BAPPENAS, Ministry of Home Affairs, Ministry of Public Works and Housing, Ministry of Agriculture, and Ministry of Finance.
[5] Cross-OPD = Bappeda, Public Works and Spatial Planning Agency, Regional Disaster Management Board, Agriculture Agency and Environment Agency.

confirmed by Sugiyono (2014) since the description of data collected does not make the general conclusion or generalization.

With the formative evaluation, it has been obtained information on stakeholders and community participation, barriers and obstacles, the target of activity being achieved, the impact of activity to river productivity and community empowerment-based flood mitigation management.

The process of collecting data and information is conducted through observation, interview, and questionnaire distribution (Pasolong, 2012, Hetifah Sj Sumarto, 2004, Singarimbun and Effendi, 1985). Likert-scale questionnaire data (1-5) is processed by using tabulation and interpretation. (Sugiyono, 2018).

The population of the study is the generalization area consisting of object and subject (Hadi, 1986, Nawawi, 1995), and Sugiyono, 2008). The population in question is the relevant OPD in the province and district (Bappeda, BPBD, PUPR Agency and Forestry

Agency), ID-CBFRM consultant, TPM, and KMSB. All are spread in the FMSRB working area in Banten Province (Serang, Lebak, Pandeglang) and Maluku Province in Ambon City.

There are total of 2,290 population. There are 327 selected respondents (krejcie & Morgan, 1970). They are representative of the population (Creswell, 2010). They are representative of the population (Harbani Pasolong, 2012). They are a source of data and information reflecting the whole population (Nawawi, 1995, and Pasolong, 2012).

Table 1
Population and Sample

No	Institution	Population		Sample
		Prov	Dist	
1	Bappeda	1	4	5
2	PUPR Agency	1	4	5
3	BPBD	1	4	5
4	Forestry Agency	1	1	2
5	Regional experts	9	-	9
6	TPM	-	33	33
7	KMSB		2231	268
Total			2290	327

The location of study in Banten Province refers to Keppres No. 12 year 2012 on Determination of River Basin in Banten Province. While Ambon City refers to Ambon Mayor's Decision No. 311 year 2017 on the Formation of Command and Completeness of Personnel in the Structure of Flood and Landslide Emergency Response Command Post in Ambon City (Kodoaties, 2008).

III. Literature Review

Indonesia is flood-prone area because of the climate and topography. The most frequent flood occurred in 2019 with 1,271 times, 997 and 776 times respectively in 2017 and 2013. The flood has declined or occurred at least 516 times in 2015. Then, it increased in 2016 by 785 times.

Badan Nasional Penanggulangan Bencana (BNPB)/National Agency for Disaster Management recorded that 7,574 times of floods occurred in Indonesia from 2011 to 22 September 2020. Although it was fluctuating, the disaster had a fairly frequent intensity over the last 10 years. The flood that occurs every year in most areas of Indonesia has increased in frequency, resulting in economic loss reaching $ 430 millions per year (Databoks 2011-2020).

In 2013, the flood occurred in Ciujung River in Banten Province affecting 19,674 households, 50,527 refugees and disrupting the traffic along Jakarta-Merak toll road that connects Java to Sumatera. In 2013, flash floods also occurred in Ambon City, destroying 59 houses, 10 people dead, 5 people missing, and 7,212 people displaced *(PAM, 2018).*

Banten and Maluku Provinces have similar cases in terms of the potential and the increase in floods. 3Cis River Basins in Banten Province and Ambon Seram River Basin in Maluku Province tend to increase. So, FMSRB Program makes both provinces as pilot in flood mitigation management as the effort to reduce the disaster risk, through physical development and awareness and capacity building in dealing with the disaster threats (Regulation of Government of Indonesia No. 21 year 2008).

Overcoming floods is one of the program's priorities. In *Rencana Pembangunan Jangka Menengah Nasional*/RPJMN 2015 – 2019, flood risk management policy is one of pillars to develop *Flood Risk Management* (FRM) based on *Integrated Water Resources Management* (IWRM) approach.

The integrated work principles in FMSRB include: (1) integrate land management and water resources management; (2) manage the water cycle as a whole and not only flood design; (3) synchronize and integrate the planning and implementation of program/activity from the relevant institution in organizing FMSRB program; (4) integrate the structural and non-structural approaches; (5) arrange the administration boundaries and the provisions of river basin management; (6) use the integrated strategy of flood risk management; (7) combine the risk management principles; and (8) ensure the participatory approach.

The collaboration principle emphasizes coordination and interdependence among the parties. Emily R. Lai (Pearson, 2011) underlines that *Collaboration is the mutual engagement of participants in a coordinated effort to solve a problem together. Collaborative interactions are characterized by shared goals, symmetry of structure, and a high degree of negotiation, interactivy, and interdependence.*

Chrislip and Larson (1994) have provided learning that the critical point of collaboration management is in its strategy. Ten success factors of collaboration strategy, comprising: (1) on time; (2) obvious needs; (3) supported by solid stakeholders group; (4) extensive involvement (strive for the involvement of many participants from various sectors); (5) credibility and transparency of the process; (6) commitment and involvement of top-level or visionary leaders; (7) support or agree upon the determination of authority or power; (8) overcome mistrust and skepticism; (9) strong leadership to the provisional success process; and (10) moving on to a broader concern. In terms of overcoming the problem, the role of collaboration is not adversarial or non-adversarial approaches. (Straus, 2002).

The collaboration and active participation of all parties, in particular, the community is an absolute requirement, starting from the preparation/planning, implementation, utilization, management phases, and not only benefitting the result of development. (Agus Suryono, 2001).

The important aspects of collaboration include: (1) transparency in which the stakeholders should take and give for generating a mutual solution; (2) respect for different perception, idea, and solution; (3) all parties responsible to achieve an agreement on a strategic solution; (4) the agreed solution is required for the interaction direction among the stakeholders in the future; and (5) need mutual awareness that the collaboration is a constructive process.

The collaboration of stakeholders in FMSRB program not only confined to the concept but also the program management. The collaboration has given a significant impact to the success of the program. This is in accordance with Bachtiar Effendi's view (2002) that the succes of development derives from the active role of the community in many cases, in making initiative and decision, and increasing all resources in planned and sustainable manner with the principle of efficiency and equitable use, fair as the empowerment work principle.

The empowerment work principle includes the optimization of community participation, capacity building (knowledge, skill and attitude), education, transformation, contribution optimization, self-help, local wisdom-based, collaboration and prioritizing justice (Owin, 2004).

The most prominent collaboration in FMSRB is the collaboration of concepts regarding the importance of the structural and non-structural program realization for river productivity and flood

mitigation. In this case, productivity is defined as more results, better quality, and better with the same efforts. Therefore, productivity is interpreted as the efficiency of process to produce the result of sources being used as much as possible (Anaraga, 2009). The productivity is positive result from the comparison between output and input (Hasibuan, 2003).

The productivity aspect in flood mitigation is interpreted with the success of implementing the qualified and efficient infrastructure development, so it causes the decrease of water volume and puddles. The productivity of non-structural aspect includes the formation of KMSB and the improvement of knowledge, skill and awareness for not disposing the garbage and waste into the river, drainage, small pond and other public facilities.

Specifically, the operational definition of structural/infrastructure is all physical facilities. Infrastructure is all long-lived assets owned by local government, regional and central governments. (Nurmadinah, 2012). The irrigation infrastructure is a set of physical element and infrastructure used to get the water, facilitate and monitor the water flow from the source to the area which is expected for economic development such as for agriculture, plantation, and flood control (Small and Svendsen, 1992).

The operational definition of non-structural in FMSRB program includes the formation of KMSB and Waste Bank, participation and training of TPM, KMSB and Waste Bank in order they have abilities in mitigation management and flood control. All the activities are in accordance with Barry Chysway's view (2002) that the training is a process to teach the skill, knowledge, and attitude to be able to do the responsibilities according to the standards. Similar to Mathis's opinion (2002) that the target of training is a process to achieve a specific ability in line with the goal.

The simultaneous combination of structural and non-structural with the stakeholder collaboration approach, has significantly affected flood mitigation productivity. (POR. 2023-QBI, QB4 and QC1). Total of 2,276 built infrastructures spread in 4 District/City (Ambon Maluku, Serang, Pandeglang and Lebak Banten) have affected the decrease of water volume and puddles.

Table 2
Built Infrastructures

Infrastructures	District/City				Σ
	Ambon	Serang	Pandeglang	Lebak	
Drainage	48	57	57	112	274
Small pond	-	3	-	21	24
TPT	21		91	32	144
Evacuation route	-	12	-	-	12
PAH	2	17	24	4	47
Retention well	16	6	24	4	50
Biopori	1010	471	164	80	1725
Total	1097	566	360	253	2276

Source : Lap. ID-CBFRM 2022

Although FMSRB is a local-scale program, but its implementation has been in line with national development ideliasm that is as a series of efforts to manifest planned and mindful gowth and changes towards modernity in the framework of *nation-building* (Siagian, 2001).

The development focuses on a process of changes for better through the planned efforts for substantial, valuable, and fair social changes. Saul M. Katz in Teguh Yuwono (2001).

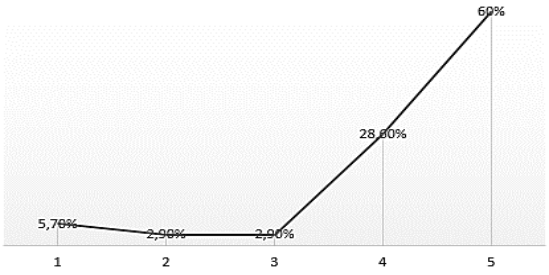

Chart 1
KMSB and Effectiveness of Flood Management (POR. 2023-QF1)

The contribution of FMSRB program for macro-scale development has paid attention to the dimension of social economy, the dimension of transformation, the dimension of stability and participation, the dimension of harmony between human and environment, and the dimension of human in general. This case is in accordance with Tjokoamidjojo's view (1985) on 5 dimensions need to be paid attention by the development actor, namely: (1) social economy welfare; (2) social transformation from the community to modern community; (3) nation-building or popular with national perspective including the integration of stability and participation; (4) balance and harmony between human life and environment; and (5) human includes knowledge, skill and attitude.

IV. *Result and Discussion*

Directorate of Regional Development has formed 140 KMSBs and 140 Waste Banks in the program villages that spread in 4 districts/city. Ambon City has 21 KMSBs and 21 Waste Banks, Serang has 48 KMSBs and 48 Waste Banks, Pandeglang has 10 KMSBs and 10 Waste Banks, and Lebak has 61 KMSBs and 61 Waste Banks. KMSB and Waste Bank have contributed for flood and landslide mitigation management. In chart 1, 60% respondents states KMSB is "very effective" in flood management and only 20% respondents states "effective".

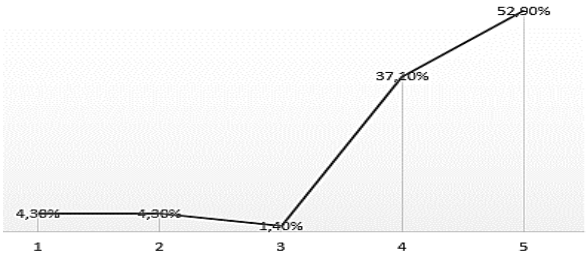

Chart 2
Stakeholders Collaboration and The Increase in Productivity (POR. 2023-QD4)

KMSB and Waste Bank have contributed to raising the people's awareness for good behavior or not disposing the garbage into the river, drainage, small pond and other public facilities. Flood management becomes more productive because of the collaboration of stakeholders in carrying out the coaching. In chart 2, 52.90% respondents state that the collaboration has "very great" effect to the productivity, and 37.10% state "great".

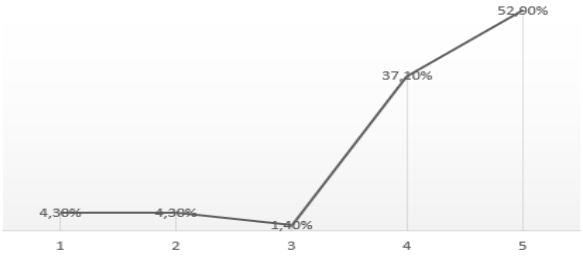

Chart 3
Gender and Empowerment-Based Stakeholders Collaboration (POR. 2023-QD1)

The collaboration applied in FMSRB Program has a more positive impact because of gender and empowerment-based. Chart 3 indicates 52.90% respondents state "very high", and have

assessed that FMSRB applies the gender and empowerment-based collaboration, and only 37.10% of respondents state "high".
Gender and empowerment-based collaboration have a positive impact, as well as the realization of the structural and non-structural program. (POR. 2023-QB8-9), and also the potential for the sustainable program (POR.2023-QG10). In chart 4, 61.40% of respondents state that the structural and non-structural program being proposed through CAP is "highly compatible" with the flood control needs, and only 28.30% of respondents state "compatible".

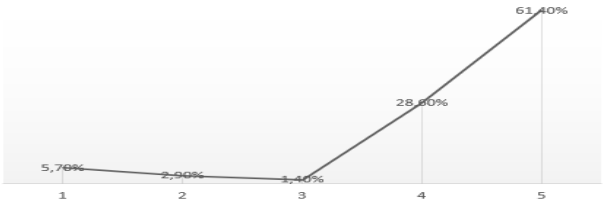

Chart 4
The realization of structural and non-structural program that is in accordance with the need of flood control
(POR. 2023-QB1)

The result of the study indicates that the unit of infrastructure has also had positive impact on flood management and control. In chart 5, 64.30% of respondents state that the construction of drainage "greatly affects" the puddles, and only 25.70% of respondents state "affect".

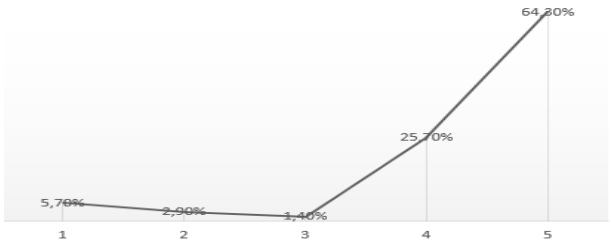

Chart 5
Drainage channel and the reduction of puddles. (POR.

Conceptually, puddle causes the flood. The drainage serves to speed the water flow, likewise small pond which affects the function of water reservoir. Chart 6 indicates 52.90% of respondents state that small pond "greatly affects" the function of water reservoir and only 37.20% of respondents state "affects".

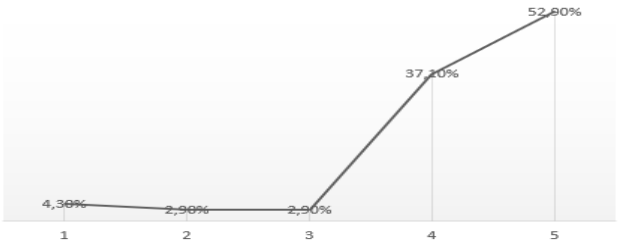

Chart 6
Small pond and function of water storage. (POR. 2023-QG2)

Rainfall Harvesting System or Pemanenan Air Hujan (PAH) is people's option that is relevant to flood control. The uncollected rainwater will affect the overflow in the river, including the puddle in the settlement. Chart 7 indicates PAH "greatly affects" rainwater collection or 57.40%, and only 32.90% of respondents state "affects".

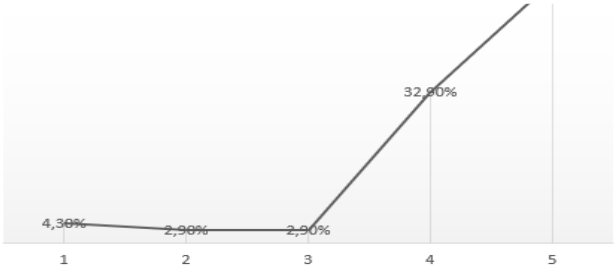

Chart 7
PAH and rainwater storage
(POR. 2023-QG3)

Chart 8 indicates 55.70% of respondents state that biopori "greatly affects" the reduction of puddles, and only 32.90% of respondents state "affects".

Chart 9 indicates 48.60% of respondents state that the retention well "greatly affects" the reduction of puddles, and 40% of respondents state "affects". It means that the retention well can control the flood in the river and puddles in the settlement.

for Tembok Penahan Tebing/TPT. Chart 10 indicates 60% of respondents state that TPT "greatly affects" the soil erosion, and only 30% of respondents state "affects". It means TPT can reduce the erosion. If TPT is not built, the erosion will be potentially occurred and will disrupt the safety of ecosystem and fulfillment of mud or soil to the river.

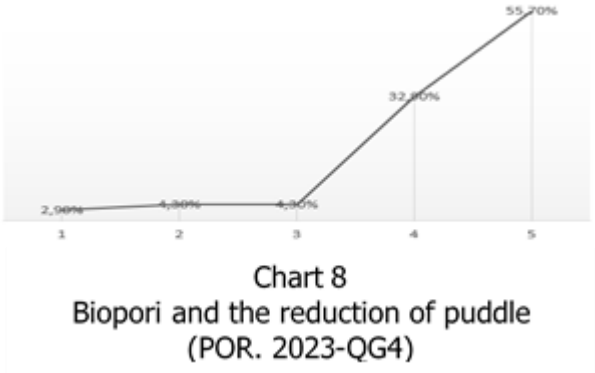

Chart 8
Biopori and the reduction of puddle
(POR. 2023-QG4)

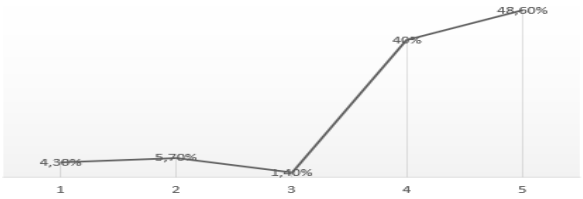

Chart 9
Retention well and the reduction of puddle.
(POR-QG5)

The realization of the structural and non-structural programs with collaborative approach has given a significant impact to the productivity of rivers and sustainable flood management. 90% of respondents confirmed that the flood occurs more than 2 times per year before FMSRB (POR. 2023-QG12). 94.3% of respondents confirmed that after FMSRB, a flood occurs less than 2 times per year (POR.2023-QG13). 92,9% of respondents confirmed that the frequency of puddles before FMSRB was more than 2 hours (POR. 2023-QG16), and 81,4% of respondents confirmed that the frequency of puddle was less than 2 hours (POR.2023-QG17).

To realize the sustainability and preservation of integrated flood risk management in the district/city, FMSRB program also produces mid-term planning called *Rencana Pengelolaan Risiko Banjir Daerah* (RPRBD) or Flood Risk Management Plan (FRMP). RPRBD/FRMP document is a collaborative product among institutions in the region by involving pentahelix or multi stakeholders consisting of government, academics, enterpreneur, community and media.

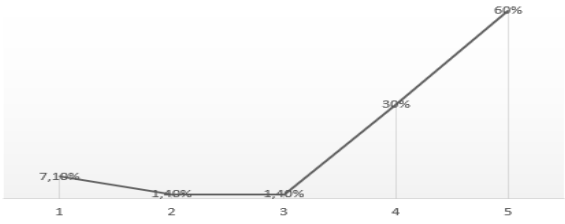

Chart 10
TPT and soil erosion (POR. 2023-QG6)

Conclusion and Recommendation

The combination of structural and non-structural development realization with the collaborative approach of all stakeholders based on empowerment and gender is an important factor in increasing river productivity and integrated and sustainable flood mitigation management.

The implementation of CDD and CPP methods becomes a motivation tool for all stakeholders in sustainable flood management. CDD emphasizes education values, contribution, and participation optimization, so the realization of program options is priority need that is realistic, measurable, and based on local wisdom.The existence of TPM is a concrete step to optimizing the local resources. KMSB and Waste Bank are forums of participation and community empowerment in sustainable flood mitigation management, as well as strategic and efficient solutions.

In carrying out facilitation, TPMs should have a mission in order that KMSB can achieve independent and progressive status, and have abilities to facilitate partnership of KMSB and Waste Bank with other agencies (POR. 2023-QH1).

The village government that has sustainable flood management mission, may collaborate with KMSB, both in work and sharing financing soured from the village fund (POR.2023-QH2).

The relevant OPDs such as Bappeda, PU Agency and BPBD can place KMSB and Waste Bank as work partnerships in sustainable flood mitigation. KMSB is ready to implement the infrastructure program. The training and the like are the hope of KMSB and the needs of KMSB and Waste Bank (POR.2023-QH3-HS).

The consistency of regional government in implementing RPRBD/FRMP and the effort to allocate the budget required for 5 years ahead, is a mainstay for the sustainabilities of process and collaboration in flood risk mitigation in the region.

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