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Ecological adaptation as a form of SDG's achievement attempts for the conflict community in Poso

Agit Kriswantriyono[a], Sumardjo[b], Widiatmaka[c], Machfud[d]

[a] Center for Alternative Dispute Resolution, IPB University, IPB Baranangsiang Campus, Bogor, 16127, Indonesia [+62 251-8313384]
[b] Department of Communication and Community Development, Faculty of Human Ecology, IPB University, IPB Darmaga Campus, Bogor, 16680, Indonesia
[c] Department of Soil Science and Land Resource, Faculty of Agriculture, IPB University, IPB Darmaga Campus, Bogor, 16680, Indonesia [+62 251-8629360]
[d] Natural Resources and Environmental Management Study Program, Graduate School, IPB University, IPB Baranangsiang Campus, Pajajaran Street, Bogor 16127, Indonesia

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Corresponding Author:
Agit Kriswantriyono
Pusat Kajian Resolusi Konflik, Lembaga Penelitian dan Pengabdian kepada Masyarakat, Institut Pertanian Bogor;
Tel. +62-251-8313384
Email: kriswantriyono@apps.ipb.ac.id

Abstract. *The impact of the conflict in Poso on the community's agricultural activity is significant. This research aimed to observe the community's adaptive behaviour in responding to environmental changes. The study was carried out in three villages in Poso Regency, Central Sulawesi. The data was collected through interviews and cybernetic analysis. The study showed that most of the community was pro-actively adapted to adjust the plantation agriculture pattern to the basic crop agriculture. The factors that influenced the community adaption strategy were the activities in the program, education, and social status. The adaption behaviour also had a high correlation with the level of independence, whereas the higher the level of independence, the more adaptive the behaviour is. There were relations between the village durability index with the village typology. In contrast, a village with a typology of mountainous areas and far from urban areas, its environmental tenacity index was very good. While villages with a typology of community diversity were high and had a good social tenacity index. Regarding SDG achievements, the empowerment program in Poso achieved SDG numbers 1, 5, 10, and 16.*

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INTRODUCTION

The Poso regency had a long conflict history from the year 1990 to around the year 2000. It was derived from a social conflict in Poso that developed into a separatist conflict where a certain group movement undermined national stability and security. The local community became the victim of the radicalism carried out by the group (Prasetyo et al. 2016). This condition resulted in the position of Indonesian in moderate condition. According to Global Terrorism Index in 2020, Indonesia ranks 37th out of 135 countries worldwide (IEP 2021). One reason that caused the moderate status index condition was the conflict in the Poso Regency. It affected not only the security aspect but also the conflict in Poso. It also affected the social and economic problems following up the conflict and the security itself (IPB 2014). Production governance in the agricultural sector became highly disturbed in the environment due to the long land abandonment caused by the security problem. Suppressed community, food security, and increased poverty were further felt by the community,

which became the victim of the conflict. Infrastructure development has been severely hampered, especially village road infrastructure which was supposed to improve the accessibility to remote, isolated, and underdeveloped locations. Under conflict conditions, the community still must carry out activities to meet the needs of its family.

The problems that occured in Poso Regency were getting bigger and were actually triggered by the intervention of outside parties. The testimony of the community leaders conveyed (Yunus 2014), that the high intensity of the conflict that occurred in Poso at that time was when other parties from outside Poso arrived and were involved in the vortex of conflict there, and they even became actors in the conflict that occurred. This also happened with the Balinese in Sumbawa Regency. Gradually, the existence of the Balinese began to affect the life of Samawa ethnic in Sumbawa. This condition ultimately triggered a conflict between the two ethnic groups (Ardiansyah 2010). The higher dominance of the migrant group was the cause of the conflict. This triggered social jealousy among the Samawa Ethnic towards the Balinese Ethnic, where the dominance of the Balinese Ethnic towards the Samawa Ethnic area became even greater. This condition triggers the higher intensity of the conflict. Almost similar conditions also occurred in Poso. Migrant citizens even caused higher conflict. The migrants also dominated the commanding parties.

On the other hand, the conflict also further aggravated poverty in this region. The decline in people's access to their own resources in their territory directly affected their income (Cuesta et al. 2017). The declining access of the Poso people to their fields was also due to the safety factor at that time. The way the community faced their future regardless of environmental pressures and broke away from outsiders' domination.

The conflict that occurred in Poso had disrupted the social society system, which had previously been well organized (Asrori 2015). The disruption of the socio-ecological order, which was shown by the changes in the environment, the way of life of the community, and the carrying capacity of natural resources, has encouraged the community to carry out adaptation strategies (Bräuchler 2017). Disruption of socio-ecological systems encouraged adaptive attitudes toward various strategies adapted to their environmental conditions (Sapkota 2018).

The conflict has caused people to become poorer and have higher income inequality (Adhi et al. 2016). Since the conflict first appeared in 2000, many people have become poor. The cause of this poverty was the decline in residents' income, especially from businesses that used to support their families, namely in the agricultural sector, which suddenly became non-existent. Ahmad et al. (2018) explained that the cause of structural poverty in rural areas was income factors.

These changes in the environment encourage people to adapt. The diversity of elements in the ecosystem with their respective condition status and the elements in the social system determined the form of adaptation in response to their environment. The existence of local wisdom in the social system has a positive effect in forming a positive reactive attitude in responding to environmental conditions (changes). Likewise, other elements, such as conducive climatic conditions, harmonious community relations, good natural carrying capacity, and good community life attitudes, encourage adaptive responses to the changes in their environmental systems. A good attitude to life in society and the existence of harmony in the system of social life were not only good social capital for survival (Laura et al. 2018; Marfai et al. 2018), but it was also a creative social energy (Sumardjo et al. 2019) that could foster better adaptability in responding to environmental changes or extreme environmental conditions.

Adaptation behavior in socio-ecological systems explains how humans carry out survival strategies against their environmental conditions or changes that change previous habits (Dhar and Khirfan 2016). In the perspective of conflict resolution, formed adaptive behavior in conflict communities in conflict areas requires humanist approaches and strategies through integrating social, religious, and economic approaches (Poteete et al. 2010; Rao and Vidyattama 2017; Trijono 2007, 2009). Soemardjo et al. (2018, 2019), clarified the ability of humans to adapt to environmental changes through the development of urban farming, that it is the environment that shapes human attitudes to adapt to the nature of their environment or due to changes in environmental conditions – for example, due to natural disasters. In his adaptation, Sumardjo explained that

there were 4 (four) behaviors from the weakest to the strongest adaptation behaviors, namely (1) apathy, (2) reactive, (3) proactive, and (4) anticipatory.

The form of adaptation behavior carried out by humans in the form of adaptation strategies Marteen (2008) mentioned that the strategies carried out by humans to lead to the expected process of change. Local wisdom was a catalyst in forming a good adaptation strategy for a person and community (Jati 2013; Meitaulina 2018). This adaptation occurred through interaction between different environmental elements and the human being (Yudianisa 2018). In such a changing environment, humans were required to carry out strategies. Elements in the ecological system form a strategy for adapting to their environment, both elements contained in the social system and in the ecological system (Marteen 2008).

Based on the conditions mentioned above, efforts to deal with problems in Poso were not enough just to carry out repressive actions by prioritizing a security approach only. The more important to handle is reinvigorating the slumped of society as a victim of the occurred conflict, at least it was a concern considered by various parties (Muqoyyidin 2012; Fatony 2011; Hartani and Nulhaqim 2020; Irwandi et al. 2017; Malik 2017). During the post-conflict period of 2000–2014, the government still emphasized a more repressive approach by placing joint apparatus security posts in 3 villages with the worst intensity of conflict in Poso, namely Padalembara, Pinnedapa, and Masani Villages. The victims were given assistance where orientation was less or not directed towards strengthening the capacity of the community and the sustainability livelihood It was not until 2014 that a new approach was applied to victims and former perpetrators by involving universities. Through a humanist and dialogical community empowerment program in conflict areas, economic, social, and environmental interventions were carried out in beneficiary communities (Firmansyah et al. 2017; Iqbal et al. 2017; Mufid 2012). The program is in line with the research conducted by Prasetyo et al. (2016) and Ludoni et al. (2016), who had seen a model of assessing the act of strengthening community participation in poverty alleviation by increasing community capacity (Duff et al. 2017). In this program, companions/caseworkers were present every day in the midst of the community to listen to their aspirations and to jointly carry out community capacity-building activities and the implementation of developing potential local resources that were expected to help the sustainable lives of the victims and former perpetrators. Before the program was implemented, socio-economic mapping was first carried out. The results of the socio-economic mapping formulated a program to construct waterways in 3 villages as a source of irrigation to agricultural lands that will be developed in the next stage of the program. The community needed irrigation as a sustainable livelihood solution at that time (Altieri 2018).

How that empowerment approach has had an impact on community adaptation in conflict areas is the topic of discussion in this study. Based on the above-mentioned background and the problems, research problems could be formulated as follows: (1) How society adapts to ecological changes so that it can realize common prosperity; (2) How is regional resilience in supporting the sustainable life of the community; (3) What is the proper empowerment strategy to overcome poverty.

The general aim of this research is to overview the adaptive behavior of people in conflict areas in response the changes in the environment in that area. In particular, the objectives of this study are: (1) Analyzing the adaptive behavior of the people in the Poso conflict area; (2) Analyze the resilience of the region in supporting the community's sustainable life; (3) Analyze SDG's achievements towards the implemented empowerment programs.

METHOD

Location and Study Period

The study area in this research is Poso Regency as the research location because this area has a high intensity of conflict. The study was conducted in 3 conflict villages with different typologies in Poso Regency: Masani, Padalembara, and Pinnedapa Villages. The research was carried out from December 2021 to April

2022. Interviews were conducted with 75 respondents consisting of government figures, traditional leaders, youth, and residents who were directly involved in the empowerment program.

Data Analysis

The research was conducted by interviewing 75 respondents in 3 villages: local leaders, government officials, and the community. In the interview used a structured questionnaire. The analytical method in this study uses cybernetic analysis, namely quantitative analysis supported by qualitative information. To answer the objectives of this study, an analysis of ecological adaptation and social, economic, and environmental resilience will be used. Ecological adaptation analysis explains how the community responds to environmental conditions. While the analysis of social, economic, and environmental resilience is used to explain regionally (each village), the extent of social, economic, and environmental resilience in that region.

Ecological adaptation analysis was used to explain how people respond to environmental conditions. While social, economic, and environmental tenacity analysis were used to regionally (each village) explain, the extent of its social, economic, and environmental tenacity aspects in the region. To observe how the adaptation strategy was carried out by the community ecological adaptation analysis as formulated by Sumardjo et al. (2023) would be used, it divides the stages of community adaptation into 4 stages, namely; (1) Skepticism/apathy, (2) Reactive, (3) Pro-active, and (4) Anticipatory. According to Sumardjo et al. (2018), the characteristics of each adaptive attitude were as follows: anapathetic/skeptical landscape reflects the attitude of people who are ignorant and usually do not care about innovation. Reactive attitude reflects people who act after facing or being threatened with risk and are usually behind in adopting innovations. A proactive attitude reflects people who are swift in facing risks and are usually quite active in communicating innovations to prevent greater risks. Meanwhile, the anticipatory attitude reflected people who can read the phenomenon of environmental changes possibility that have not even occurred or have the potential to occur. This is an innovative type of person and is very active and progressive in communicating innovations.

Analysis of community ecological adaptation was obtained from the respondents collected/interviewed in the three villages based on their respective typologies. All these respondents would be classified as shown in Figure 2. Furthermore, in a more in-depth discussion, an analysis of how the co-adaptation between the social system and the ecosystem would be carried out.

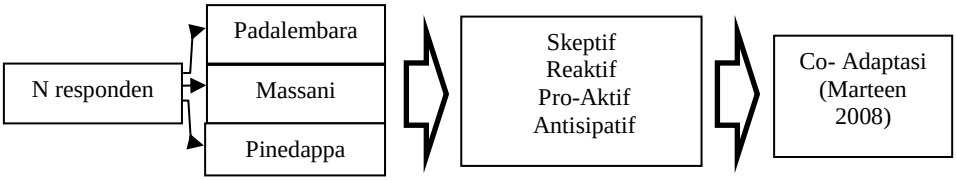

Figure 1 Adaptation behavior

The community ecological adaptation analysis in each village would be tabulated, classifying the percentage of categorization adaptation of N respondents. Furthermore, based on the results of classifying community adaptation behavior, a correlation analysis would be carried out between adaptability and the following changes: social status, education, gender, and activeness in the program. The equation of such a correlation relationship is as follows.

$$Ad_i = b_0 + b_1p_i + b_2s_i + b_3k_i + \varepsilon_i$$

Description:

Ad	: Adaptation behavior	p	: Education
s	: Social Status	k	: Activeness in program activities
b_0	: Autonomous		
I	: Respondents		
b_1,b_2,b_3	: Variable coefficient		

Social, economic, and environmental tenacities are indices that would compositely form the Establishment of Village Index. This composite index is developed by the Ministry of Villages, Remote Area Development and Transmigration, consisting of social, economic, tenacity, and environmental tenacities. In this study, each of these indices was recalculated by adjusting the factors/variables used to measure the social, economic, and environmental tenacity indices. The adjustment of each factor in the index is as follows.

Table 1 Variable adjustment in regional tenacity index analysis

Tenacity Index	Variables used	Variable adjustment
Social (IKS)	Education	Education
	Healthy Social capital	Healthy Social capital
	Settlement	Settlement
		Harmony/Social cohesiveness
Economics (IKE)	Production diversity	Production diversity
	Access to trading centers and markets	Access to trading centers and markets
	Logistics access	Logistics access
	Banking & credit access	Banking & credit access
	Regional openness	Regional openness
		Community welfare
Environment (IKL)	Environmental quality	Environmental quality
	Natural disasters	Natural disasters
	Disaster response	Disaster response

In the social tenacity index (IKS), a variable was added, namely social harmony. While, in the economic tenacity index (IKE), a variable was added, namely community welfare. The social harmony variable was observed from the religious harmony index issued by the Ministry of Religion in 2020, while the conflict resolution variable was observed from the number of social conflicts/crime events. While the variable of public welfare was measured from the number of poor people data. The measurement method of each tenacity index is:

$$I_i = (\sum X_i) / X$$

Description:

Ii : Tenacity index (social, economy, and environment)

X_i : Indicators in each of the tenacity indices

X : Maximum value

In the meantime, the SDG's achievements in community empowerment activities will be analyzed by looking int the indicators of conformity of achievements as analyzed in SDG's.

RESULTS AND DISCUSSION

Behavior Adaptation

Conflict pressures many people to adapt as a form of their resilience. Around 71% of respondents in 3 villages stated that they had to evacuate (15%), were frightened (9%), and had to make a job change (8%) because their gardening activities in the mountains became limited (39%). Among these residents, many people who fled from Poso and did not return resulting in their gardens and assets being abandoned or sold through returned family members. People who could not go to the garden eventually try to find other jobs either by farming on vacant land around the house or working outside the farm such as being a construction worker, trading, etc. As many as 9% of residents said they chose to stay home because of fear and worry after the conflict.

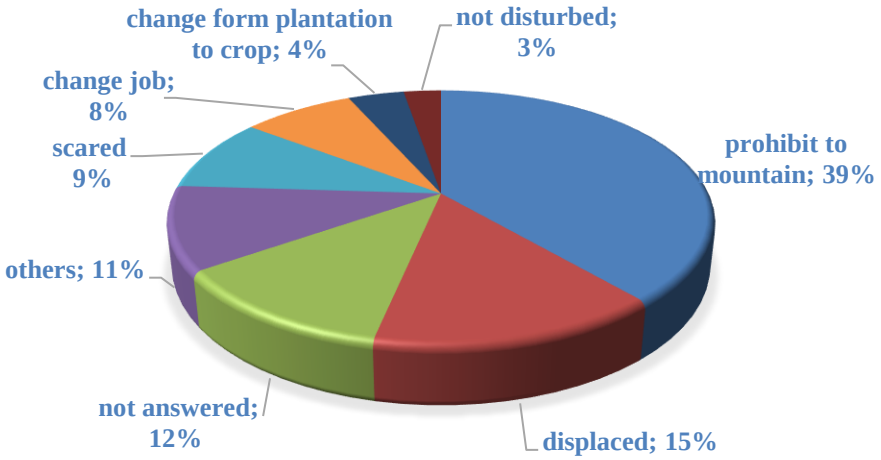

Figure 2 Community activities during the conflict

In responding to the environmental change conditions as a result of the conflict, the community's highest adaptation behavior in the three villages was pro-active. The factors that positively influenced the adaptation behavior of the highest society were activeness (coef = 0.3627), next is education (coef = 0.0072), and finally social status (coef = 0.000026). The age of society negatively affected (coef = 0.00308) the adaptation behavior. Based on this analysis, it can be seen that the higher the level of activity, the length of education, and the social status of the community, positively correlated to the more adaptive behavior to the changes in the occurred environment. This was in line with the research carried out by Iksan et al. (2018), and Ramadhani (2022).

Table 2 Correlation of adapted variable coefficients

Variable	Adaptation	Social status	Age	Education	Activeness
Adaptation	1	0.816*	–0.382	0.432	0.905*
Social status	0.816	1	–0.363	0.359	0.884*
Age	–0.382	–0.363	1	–0.046	–0.389
Education	0.432	0.359	–0.046	1	0.455
Activeness	0.905*	0.884*	–0.389	0.455	1

*Level of significance (α = 0.05);

Adaption behaviour = 0.642 + 0.000026 social status (rb) – 0.00308 age 0.0072 education + 0.3627 activeness

Pro-active behavior is characterized by swift behavior in facing risk and is active enough to carry out innovative communication to prevent greater risks. The community with this behavior at the research site were community leaders from the government, female cadres, traditional leaders, and group leaders, who were often involved in community activities and became figures and drivers of activities among other residents. The community's survival strategy in adapting is to optimize the surrounding resources by applying appropriate and environmentally friendly agricultural technology.

People's adaptive behaviors also correlate with their empowerment capacity. Communities with high level of empowerment (powerful and autonomous), were found to be pro-active and anticipative, that was adaptation behaviors that encourage responses to build better conditions (Table 3). Figures with pro-active and anticipatory adaptation behaviors can influence other citizens to engage positively in the direction of these positive behaviors. To achieve a common vision, they do so through effective participatory communication (Muchtar 2016). The results of this study were in line with the results of the research conducted by Sumardjo (2021), which investigated the empowerment model in the eastern border region of Indonesia. It further

strengthened the thesis that adaptive behavior is closely related to the level of empowerment of its community. The higher the level of empowerment, a person tends to have more adaptive behaviour. Figures with pro-active and anticipatory adaptation behaviors can influence other citizens to engage in positively directed behaviors.

Table 3 Respondents' adaptation behavior in conflict areas

Capacity/ Empowering	**Adaptive behavior**									
	Fatalist		**Reactive**		**Proactive**		**Anticipative**		**Total**	
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**N**	**%**
Powerless	12	92.3	1	0.7	0	0	0	0	13	100
Powerful	0	0	10	20.8	28	58.3	10	20.83	48	100
Autonomous	0	0	4	22.2	8	44.4	6	33.3	18	100
Total	12	16	15	20	36	48	16	12	75	100

Marteen (2008) stated that people carry out adaptation strategies, among others, to survive the environmental conditions they face. For example, the form of community adaptation strategy at the research site in agricultural activities was to switch to cultivating food crops and vegetables on lands close to their settlements. In the meantime, the social adaptation strategy was to maintain cohesiveness by living in harmony with fellow citizens and maintaining tolerance and mutual respect. This social adaptation strategy is very helpful in forming a conducive atmosphere and harmony.

Regional Tenacity Index

The Tenacity index measurement of village areas was carried out through an assessment of social tenacity (IKS), economic tenacity (IKE), and environmental tenacity (IKL). This index measured the extent of tenacity in the village area in terms of sustainability. The measurement results showed that the highest IKL was in Padalembara and Masani Villages, while in Pinnedapa Village, the highest was IKS with consecutive scores being Padalembara with a score of 0.800, Pinnedapa with a score of 0.817, and Masani Village with a score of 0.867.

The high environmental tenacity index in Padalembara and Masani Villages was due to this region's lack of natural disasters. In addition, disaster mitigation facilities in the village through an early warning system had already existed, and only safety equipment and disaster evacuation routes were not available in the village yet. In the dimension of social tenancy, the residential aspect scored the highest, where the community in the two villages has been served with PAMSIMAS clean water, and even the PAMSIMAS service in Padalembara Village has the best predicate in Poso Regency. Most people already have their own latrines or access public latrines, and the residents' houses have been served by electricity (*Perusahaan Listrik Negara*), and the internet network in this village is quite good. In Pinnedapa Village, where the social tenacity index occupies the best position, this village is characterized by the most tribal diversity, there are 12 tribes in this village, and the harmonious living among the people is maintained quite well.

In all the villages, it was shown that the economic tenacity index was the lowest compared to the other two indices. It indicated that three villages' potential for natural resources and economic infrastructure was low. Based on these conditions, it can be seen that based on Muller and Leupelt (2012), the level of sustainability in Padalembara and Masani is in the high category, while in Pinnedapa it is medium. Based on the analysis results, there was a relationship between village tenacity and its typology. A village with a typology of mountainous areas and far from urban areas where it was far from pollution-producing activities, its environmental tenacity index is very good. While villages with a typology of community diversity are high, have a good social tenacity index. Based on these conditions, it can be seen that based on Muller and Leupelt (2012), the level of sustainability in Padalembara and Masani is in the high category, while in Pinnedapa it is medium.

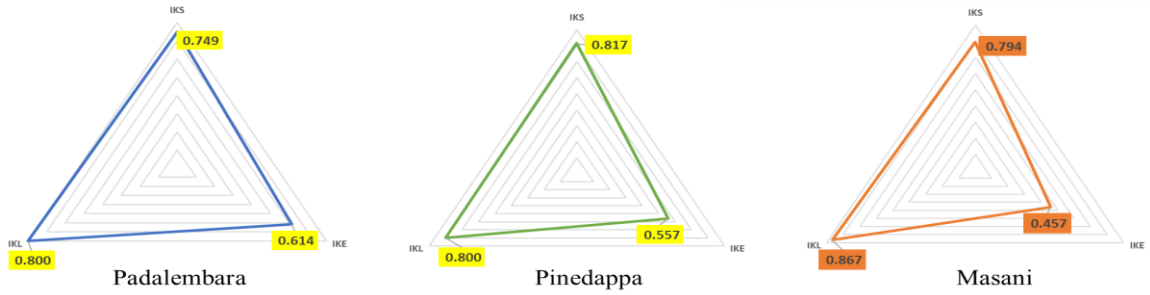

Figure 2 Regional Tenacity Index

SDG's Achievement

This program also has an impact in terms of SDG's achievements in all villages. The analysis associated with SDG's achievements is intended to show that the implementation of the assistance program, in addition to conflict resolution, was also aimed at supporting the achievement of global issues (Shishin et al. 2016; Rezai et al. 2018). Some of the SDG's achievements that can be described in this paper are:

SDG's #1: No Poverty

The empowerment program reduced the number of poor people in the conflict area from 18% in 2015 to 15.65% in 2019. These empowerment efforts can reduce poverty (Hanafi 2020; Hardianto 2022). In the meantime, the increasing productive use of land increased the average income by 115.94% in all villages. The increase in people's income was triggered by a better cultivation system, provided through training for the duration of the program assistance to increase planting productivity in several commodities. The training received by residents in the three villages, such as soil rehabilitation training for cocoa plantations, integration of livestock and crop gardens such as cocoa, pepper, durian, and vegetable gardens, all support increasing crop productivity.

SDG's #5: Gender Equality

One of the active targets in the program's involvement is the women group and widows of the conflict victims. This group has been given strengthening skills, such as processing instant ginger products, some agricultural processed products, and sewing. The additional knowledge and expertise received by this gender group can increase their economic independence, reduce and even eliminate their dependence on daily vegetable needs. This is because in the yard of the house there were various types of vegetables available as the output of the yard land use program.

As research conducted by Yanda and Fauziah (2018) and Umriana et al. (2016), show that in order to strengthen gender groups, mentoring and dialogue activities are needed as well as improving their skills so that they are able to be economically independent. Independence in terms of the economy will reduce the dependence of women on other people.

SDG's #10: Reduce Inequality

Another impact of the increased income that occurs on the beneficiaries, was the decreased income inequality between them. Before the program as implemented the ***gini*** index in 3 villages was 0.854, after the implementation of the program for 4 years the Gini Index decreased to 0.738. Based on this figure, it could be concluded that there had been a better distribution of people's income in the 3 villages. The program had reduced the gap among victims of conflict. Similar research by looking at the impact of community empowerment on reducing income gaps in society, among others, was carried out by Hanafi (2020), Khumaini and Aprianto (2018).

SDG's #16: Peace, Justice and Strong Institution

The final achieved SDG's achievements were about the realization of peace, justice and strengthening local institutions (SDG's 16). Empowerment programs with a community mentoring approach that prioritizes dialogical aspects of communication in the conflict area have helped reduce the intensity of conflict in the region. The harmonies situation and conditions after the empowerment implementation, made the community more aware of the importance of the situation, to continue maintaining for future community activities smoothly without any fear, such as when the intensity of conflict is still high.

CONCLUSION

This research concludes that the higher the level of community empowerment in conflict areas, the more they have adaptive behavior towards their environment. Most of the society behaves pro-actively and anticipatorily. Factors that positively influenced cyclical behavior on people's adaptation behavior are activeness, and education. The community adapted to the conflicts that occured with various carried out strategies, for example adjusting business patterns in agriculture. The performance of regional carrying capacity concludes that typology of mountain villages had high index of environmental tenacity, whereas the typology of villages with high social diversity had a high index of social tenacity. The empowerment programs implemented had also achieved global goals as set out in the SDG's. There were 4 goal achievements, namely SDG's 1, 5, 10 and SDG's 16.

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