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THE CONSTRUCTION OF ENVIRONMENTAL LEADERSHIP WITH LOCAL COMMUNITY BEHAVIOR IN NATURAL RESOURCE CONSERVATION BASED ON THE MAMAR SYSTEM IN WEST TIMOR, EAST NUSA TENGGARA

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Abstract

Mamar is an artificial oasis that provides a base for natural resource conservation in West Timor. The uniqueness of *Mamar* is its application in arid natural environments through a sustainable local leadership system, and it has a positive impact ecologically, economically, and socially. However, the *Mamar* system needs to receive more attention from the government in conserving natural resources. Such studies like *Mamar*'s have been conducted elsewhere in Indonesia under different names, but they were applied in areas with wet and relatively fertile climates. Also, research on *Mamar* has been carried out by several parties related to the function of *Mamar* economically and the condition and structure of *Mamar* physically and biologically. However, research on *Mamar* related to the Construction of Environmental Leadership with local community behavior in *Mamar* based natural resource conservation has never been done. This research aims to analyze the construction of environmental leadership in

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natural resource conservation practices based on the *Mamar* system. This research was conducted through qualitative methods and critical interpretive approaches, with data collection techniques in the form of observation and interviews.

The results indicate that *Mamar* based natural resource conservation in West Timor has positively and significantly impacted social, economic, and ecological aspects and has lasted for hundreds of years since the 17th century. It is done through the mechanism of Environmental Leadership Control through a strong, effective, and sustainable Local Leadership Role in Amarasi West Timor, with Local Leaders called Atupas, Mataf, Tobe, and Temukung.

Keywords: Artificial Oasis, Ecology, *Mataf*

INTRODUCTION

Based on the local wisdom, the *Mamar* system can be understood as a mechanism of natural resource conservation actions carried out by local communities in West Timor, East Nusa Tenggara Province (NTT Province) (Moata et al., 2022). In order to simplify the understanding, *Mamar* can be referred to as an "Artificial Oasis" built by local communities in West Timor, NTT Province. Natural resource conservation measures based on the *Mamar* System as local wisdom in West Timor NTT are also practiced among other local communities in Indonesia with different names. For instance, among the Hatam tribe in the mountains of Arfak-Manokwari Papua, they have had the concept of conservation areas since the beginning, which in the local language is called *Igya Ser Hanjop*, which means areas that need to be protected (Putra, 2021).

It is also happened to the Baduy community in West Java. Through their environmental leadership role, they still maintain agricultural patterns that are harmonious with nature and carry out sustainable forest conservation (*leuweung kolot, leuweung gede, leuweung tutupan, leuweung titipan*), is a conservation area that is preserved and maintained based on customary rules and the role of the prevailing Environmental Leadership, called Pikukuh (Alexis, H., Leeja, K, 2021). Moreover, in Kalimantan, local wisdom in conserving natural resources (especially land and rivers) is generally known as Tana Ulen Lepo and Ulen Lepo River (Christina, 2021).

It happens in Sumatra; for example, in Jambi Province, there are conservation areas designated by local communities as Customary Forests called *Rimbo Panghulu* with its Environmental Leadership System led by Local Leaders called *Depati Ganto Rajo*. In Bengkulu Province, the conservation area established by local communities in environmental preservation is called *Banuang*

Sakti, with its Environmental Leadership System led by a Local Leader called *Datuk dan Pesirah*. In West Sumatra, a conservation area is established by local communities called *Temedak* Forest, with its Environmental Leadership System led by Local Leaders called *Rio and Hulubalang.*

However, there is something unique about the *Mamar* System. Suppose a conservation model similar to *Mamar* is practiced in areas or regions with a wet climate and relatively fertile land. In that case, the *Mamar* system is applied in West Timor with a dry climate and land. Furthermore, although this *Mamar*-based conservation system has received little attention from the government, it has existed for hundreds of years. The *Mamar* system has also contributed positively to the lives of local communities economically, ecologically, and socially (Ngongo et al., 2022).

To be able to explain the Environmental Leadership Construction with the behaviour of the local community in conserving Natural Resources in the Mamar System in Amarasi, West Timor, the Sustainability Leadership Model implemented by the Local Leader in Amarasi called Atupas or Uis Pah will be put forward which has enabled the Mamar System to survive for hundreds of years until now.

This is also confirmed by the research results reported in research conducted by the *University of Cambridge Program for Sustainability Leadership (CPSL)*, which collaborates with the business world, government, and civil society to build the capacity of leaders, both to meet the needs of stakeholders as well as to overcome critical global challenges (Visser & Courtice, 2011).

Research on Sustainability Leadership as referred is presented with the title: *A Journey of a Thousand Miles: The State of Sustainability Leadership* (2011), which states that a leader is someone who can set a vision and inspire people to act collectively to make it happen, responding to whatever changes and challenges arise along the way. It was further explained that a leader is a person who shows the way to others by walking ahead. It was also explained that leadership – which focuses on strategic effectiveness – is different from management – which is concerned with operational efficiency.

In relation to this, in general, the matters referred to can be divided into external contexts, where there are smaller influences (e.g. ecological, economic, political, cultural, and community contexts), as well as internal contexts of the institution or sector where leadership practices are implemented, which are generally assumed to have a higher level of influence (e.g. organizational culture, governance structure, or leadership role). To be able to explain the application of Environmental Leadership Practices or Sustainable Leadership, the Cambridge Sustainability Leadership Model is used as shown in this picture (Fig. 1).

To understand the implementation of the Sustainability Leadership Model to construct the Sustainability Leadership with Local Community behaviour in

Conserving Natural Resources in Mamar system in West Timor, then it will be narrated four important things related to the Sustainability

Leadership Model implemented by King of Amarasi (King Viky Koroh) as Atupas or Uis Pah who implemented the Sustainability Leadership System by the Uis Pah and the Mataf since the 17th Century, thus enabling Mamar as a Natural Resources Conservation System in Amarasi West Timor remain sustainable today.

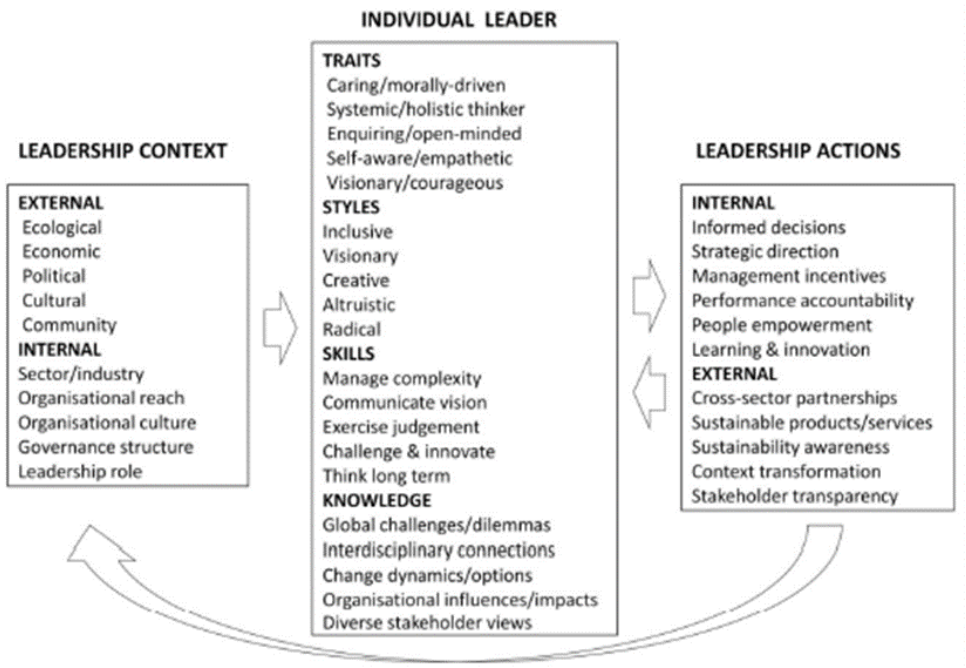


Figure 1. Cambridge Model of Environmental Leadership/Sustainability Leadership.
Source: Based on: Visser and Courtice (2011)

In line with literature review, there has been research conducted about *Mamar* (Suek, 2018), where the research in question aims to analyze the Risk, Inefficiency and Sustainability of the *Mamar* Agroforestry System by revealing the benefits of *Mamar* Agroforestry on the farmer's economy. Moreover, there have been several empirical studies on *Mamar*, such as Manafe (1990); however, their studies are limited to the potential aspects of flora and fauna regarding the economic functions of *Mamar* systems. Likewise Marsono, et.al. (2009),

regarding the grouping pattern of *Mamar* communities in Timor, which aims to determine the vegetation structure of *Mamar* communities. Furthermore, Njurumana et.al. (2009) on the Potential Development of *Mamar* as a Community Forest Model by taking into account the poverty aspects of local communities.

Meanwhile, Thomas and Openg (2015) researched on *Mamar* as Ecological Wisdom for preserving water resources in Teunnasi Village, North Central Timor District, NTT. Then, Matheus et.al. (2020) studied on the Development of a *Mamar*-based Integrated Agriculture Model in Kupang Regency, NTT. Arifin (2010), researched Banana *Mamar* Land Management based on integrated agriculture. Fanggidae, also conducted research on *Mamar* as a form of traditional agroforestry in Kupang Regency NTT, where this study only discussed *Mamar* as an alternative agricultural system for subsistence economic strength, which is in line with similar research conducted by Ngaji, K., et.al, (2020).

Dako, F.X., et.al (2008) also studied on Critical Land Rehabilitation Approach through *Mamar* Development in West Timor. A *Mamar*, as the Indigenous Agroforestry System of Timor Island, which highlighted the division of the *Mamar* Zone, and components in *Mamar*, along with interactions of components within the *Mamar* System (Ngaji et al., 2021). While empirical research on *Mamar* specifically on the construction of Environmental Leadership with Local Community Behavior in Natural Resource Conservation based on the *Mamar* System as Local Wisdom, along with related Social Institutions that allow the *Mamar* System to survive for hundreds of years until now, and provide positive impacts socially, economically and environmentally, does not seem to have been carried out.

Therefore, regarding research originality and novelty, the research on the Construction of Environmental Leadership with Local Community Behavior in Natural Resource Conservation based on the *Mamar* System is very feasible. This study aims to analyze the construction of environmental leadership with local community behavior in natural resource conservation practices based on the *Mamar System*.

METHODOLOGY

This research was conducted using the qualitative method in the critical interpretive paradigm. The Interpretive Paradigm attempts to find explanations of socio-cultural events based on the perspectives and experiences of the people studied (Bogdan & Biklen, 2007; Bungin, 2021; Maxwell, 2012). Generally, the interpretive paradigm is a social system that interprets human behavior directly through the act of observation by researchers. The interpretive paradigm considers facts as unique and having a specific context and meaning as the

essence in understanding social meaning (Burns et al., 2022; Elmusharaf, 2012; Liamputtong, 2020).

This research was conducted in Amarasi Sub-district, West Timor, Kupang Regency, East Nusa Tenggara Province. Amarasi Sub-district was chosen as the research location with considering that, in this area, environmental conservation measures based on the *Mamar* System as Local Wisdom are still effectively applied. Amarasi Sub-district is a Royal Territory in West Timor with a King as a local leadership model that implements an environmental leadership system by placing an environmental leadership model oriented towards natural resource management efforts based on the *Mamar* System. This research was conducted for approximately 6 six months, from July to December 2022. The location is shown in Figure 2.

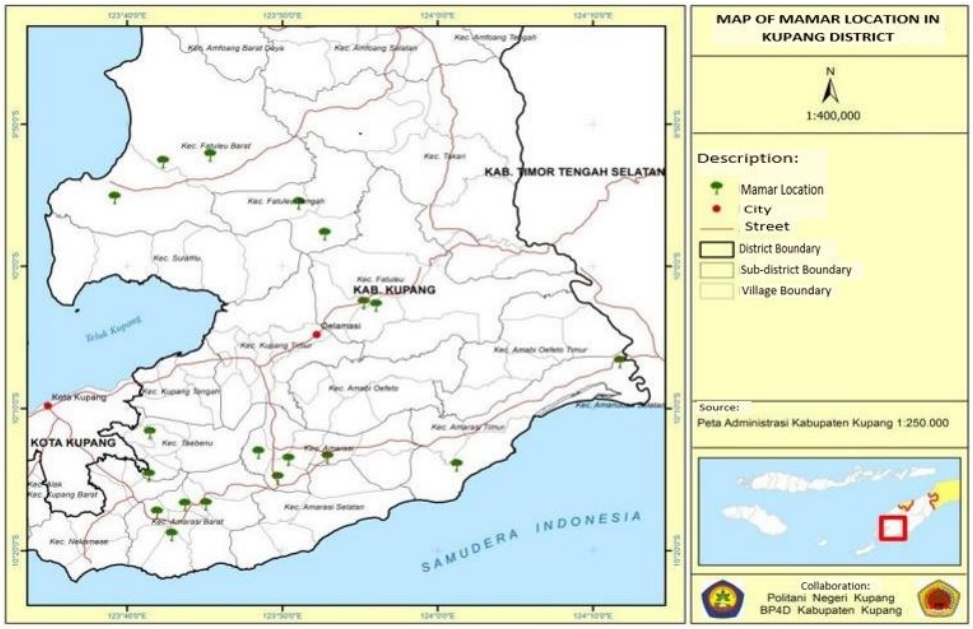


Figure 2. Map of *Mamar* location.
Source: Matheus et al. (2020)

Based on the research methodology, the procedures carried out by researchers in this study include: (a) Choose a sample of initial informants, including a local Amarasi community leader from Oekabiti Village who understands *Mamar* as a natural resource conservation system in Amarasi Sub-district and a customary chief or informal leader among local communities in Amarasi Sub-district who understands local institutions related to *Mamar* as a

natural resource conservation system (b) The following informants were chosen based on information and initial informants by following a snowball pattern. Based on clues from the initial informants, researchers then conducted in-depth visits and interviews to obtain information related to the research focus of the following informants. (c) to determine the next informant proceeds continuously until a condition in which the data collection process, the researcher no longer finds variations in information.

In detail, the number of informants who will be used as resource persons for in-depth interviews is 15 people consisting of five groups, including the Community Leader Group consists of 3 people; Customary Leader Group, which consists of 3 people; Youth Generation Group consists of 3 people, Village / Sub-district Government Group consists of 3 people, *To Tafa* (Ordinary People) consists of 3 people. Besides the data obtained from resource persons through in-depth interviews with 15 resource persons, data/information collection was also obtained through Group Discussion activities, which were divided into three groups, each consisting of 5 members. Thus, the number of resource persons for Group Discussions is 15. Therefore, the total number of resource persons for this research is 30.

DATA SAMPLE CHARACTERISTIC

The samples from the qualitative research that selected and/or appointed purposively as many as 30 people with the following characteristics:

1. 5 people from the ranks of traditional local leaders in Amarasi (all men), and over 50 years old.
2. 5 local community figures, all men and over 50 years old.
3. 5 Religious Figures from the local community, consisting of 3 men and 2 women aged between 30 -50 years.
4. 5 people from the Young Generation in Amarasi consisting of 3 men and 2 women, aged between 17-25 years.
5. 5 people from elements of the Local Farming Community who work on Natural Resource Conservation based on Local Wisdom in the Mamar System, all men aged between 30-50 years.
6. 5 Government Officials from the Forestry and Agriculture Service who carry out the Government Program in Conservation of Natural Resources in Amarasi West Timor through the Reforestation and Greening Program.

QUESTIONNAIRE AND OBSERVATION STRUCTURE

The of in-depth interview questions as follows:

1. Are there any leadership problems related to natural resource conservation that have occurred or are currently occurring in West Timor?
2. What is the role of Local Leaders in West Timor in the Conservation of Natural Resources based on the Mamar System?
3. How is the implementation of Environmental Leadership by Local Leaders in West Timor related to Natural Resource Conservation based on the Mamar System?
4. What is the role of Formal Government Leaders in the Conservation of Natural Resources based on the Mamar System in West Timor?
5. How is the Government Program for Natural Resources Conservation implemented in West Timor?
6. How is Collaborative Cooperation between Transformational Local Leadership and Formal Transactional Leadership in Natural Resource Conservation in West Timor?
7. How is the Sustainability Leadership System implemented by Local Leaders in Natural Resource Conservation based on the Mamar System in West Timor?
8. What are the significant differences between the Local Leadership Pattern which prioritizes a Sustainability Leadership System and the Formal Transactional Government Leadership Pattern in Natural Resource Conservation in West Timor?
9. What are the significant differences between Natural Resource Conservation Actions Based on the Mamar System through the Sustainability Leadership Model and Natural Resource Conservation Actions carried out by the Government through the Reforestation and Greening Program in West Timor with the Formal Leadership Model from the Local Government?
10. Why has the Mamar System-based Natural Resources Conservation Action in West Timor been running for almost hundreds of years, and persists to this day?
11. How is the Heritage System implemented for Mamar as an Heirloom Treasure of the Local Community in West Timor?
12. How is the implementation of Ceremonies and Taboos in Local Regulations related to Natural Resource Conservation based on the Mamar system in West Timor with the Environmental Leadership/Sustainable Leadership Model?

OBSERVATION STRUCTURE

The observation was carried out to see the physical condition of *Mamar* as an “Artificial Oasis” as well as the environmental situation around the *Mamar* area, observation of environmental conditions through observing the situation and conditions in the field. Form this, then proceed with observations regarding the following conditions such as land, water, environmental conditions of Flora and Fauna, Conditions of the Amarasi community, conditions of agricultural work in the local community, socio-economic life of the community based on the researcher’s observations. Observing the Physical Condition of *Mamar* as an "Artificial Oasis" with the help of Photography or Photography of the situation around the *Mamar* Environment in the form of Local Community activities, both agricultural, livestock, and social activities. Lastly, Observation of Environmental Leadership/Sustainability Leadership Activities by Local Leaders in the Conservation of Natural Resources based on the *Mamar* System at the Research Location.

PRESENTATION OF DATA ANALYSIS AND INTERPRETATION

Based on the findings and analysis of research data, an interpretation can be put forward that the application of the Environmental Leadership Construction Model or Sustainability Leadership with Local Community Behavior in Natural Resource Conservation actions in the Local Wisdom-based Mamar System in Amarasi West Timor is as follows:

To be able to implement Natural Resource Conservation actions based on Local Wisdom by implementing the Mamar system in Amarasi West Timor effectively and sustainably, an Environmental Leadership/Sustainability Leadership Construction is needed that can accommodate Formal Bureaucratic Leadership with Traditional Local Leadership in West Timor with a Collaborative Collective Environmental Leadership Model which is oriented towards the Sustainability Leadership Model, namely the Implementation of Environmental Leadership in Natural Resources Conservation by involving the local Government Bureaucracy in the form of a harmonious mix and combination between Integrated Field Extension Officers in the Reforestation and Greening Program with Environmental Supervisors in the Mamar System known as Mataf.

Collaboration, as intended, is very important to implement in the practice of conservation of Natural Resources in the Mamar System in Amarasi, West Timor, because the Atupas or Uis Pah Leadership Model prioritizes the Construction Model and Principles of Sustainability Leadership which is the "Strongest Pillar" in preserving the Environment and Natural Resources in Amarasi West Timor Environmental Leadership in Amarasi West Timor within the Environmen-

tal Fetoran area through Mataf's role as Environmental Guardian and Supervisor, has a very important role in determining the success of preserving Natural Resources in West Timor, East Nusa Tenggara. This is because the Environmental Leader or Sustainability Leader holds the steering wheel to direct his members toward the planned direction and goals and prevent damage to natural resources in West Timor in increasingly severe and worrying situations and conditions.

Therefore. constructing the right leadership model, namely the Sustainability Leadership Model, will not only bring environmental conservation efforts to achieve the vision and mission of preserving natural resources but also enable the realization of the potential for harmonization of the collaborative roles of parties or stakeholders in efforts to preserve natural resources and the environment. on the Mamar System in Amarasi West Timor.

RESULTS AND DISCUSSION

The application of the *Mamar* system to the conservation of land resources among Amarasi local communities is based on the consideration that land is a source of life and a symbol of social status. In terms of economic benefits, the more fertile the land owned by local communities, the more it affects the increase in productivity towards economic progress (farming) of the concerned local community. It is because land resources are one of the factors that determine the life and death of their agricultural economic activities. It is because the only source of livelihood for the Amarasi people is farming and raising livestock such as cows, pigs, and goats. Land cultivation techniques for agricultural purposes are still traditionally done in terms of farming procedures, ground cultivation, and maintenance (Ngaji et al., 2020).

The research on the *Mamar* as a Natural Resource Conservation System in West Timor has been conducted by many researchers, but is limited to the physical and biological aspects of the Mamar System. This finding is similar with a research related to the socio-economic aspects of the Mamar System, as well as aspects of the Mamar as an Agroforestry or Agroforestry System for local communities (Moata et al., 2022). Meanwhile, research related to aspects of Environmental Leadership based on Local Wisdom of Local Leaders called Atupas (King) and Mataf as Mamar Guardians, which allow the Mamar System as a natural resource conservation mechanism to survive for hundreds of years, has never been conducted.

In addition, the success of the Mamar System as a mechanism for natural resource conservation in West Timor by the local community appears to be superior and productive in environmental conservation. It occurs when compared to the Local Government Program through the Reforestation and Afforestation

Program because the program is considered by the local community as a Government Project so that the local community does not feel ownership (Pujiono et al., 2021).

Further, conservation through the Reforestation and Afforestation Program carried out by the local government is not seen by local communities as part of community ownership because it is considered a government project. Meanwhile, the Mamar system is seen by local communities as an inseparable part of their social system of life with an environmental leadership control mechanism led by Atupas and Mataf so that it is maintained properly for generations.

Thus, every member of the community tries as much as possible to always maintain their land resources in various ways including by applying the *Mamar* system to maintain the sustainability of these resources. With the diversity of landforms in Amarasi Subdistrict in the form of flat to undulating land, the community in Amarasi Subdistrict applies the *Mamar* system to preserve land resources based on local institutions called *Nuni*, which is an obligation for everyone to protect and maintain soil fertility. This rule was established by a customary authority in Amarasi during the 17th century called *Atupas* (Emperor) and applied collectively to every community in Amarasi sub-district.

Pranata Nuni was developed as a control mechanism for the utilization and management of land resources by the Amarasi community in order to maintain and preserve land resources used for farming. Except that the application of *Nuni* also aims to maintain the value of land resources as economic and social assets. The control mechanism applied in the Nuni institution stipulated that local people who used their land for farming would be supervised by the *Mataf* (supervisor of the implementation of the rules in Nuni), who was elected by the community members and authorized by the Atupas (King or Emperor).

The Nuni rules stipulate that each community member must take action to conserve land resources by planting trees on critical land. Suppose one community member does not plant trees on critical land (his land). In that case, other community members are obliged to report or convey to Mataf (Nuni supervisor in the *Mamar* system) to be subject to strict action by taking back the land that has been cleared and cultivated to be handed over to Atupas or Raja.

LOCAL COMMUNITY BEHAVIOR IN WATER RESOURCE CONSERVATION BASED ON MAMAR SYSTEM

Mamar, as a traditional natural resource conservation system among local communities in Amarasi Sub-district, is very influential in providing ecological benefits to the preservation of water resources. It is because there are potential water resources in *Mamar*. Residents utilize existing water sources primarily for household needs (Nimwegen et al., 2009)**.** Among the local Amarasi people, farmer groups have been formed based on the order of *Atupas* (king or emperor) that all farmers within the Amarasi kingdom should be in farmer groups and led by a group leader called *Tuas*.

A *Tuas* is chosen by the members of a group of farmers and authorized by the Atupas. The management and utilization of water resources in *Mamar* system are regulated by the local institution called *Oe Nale* for the utilization and management of water resources. Based on the provisions of *Oe Nale*, it is emphasized that, when distributing water to members of the community both to irrigate rice fields and a household's consumption, the priority in each group is given to members of community who are already 60 years and above, and then to members under 60 years old who are determined by rotation of *Tuas*.

In a socio-economic context, traditional rules and regulations related to managing and utilizing water resources are effective based on provisions in the management and utilization of water called *Oe Nale*. It is because water is a source of basic needs for the life of the human population. If there is a mistake, for example, flowing water not in its turn or contaminating the water source, a fine of one cow will be imposed on the *Atupas*.

In the *Nuno* institution, it is stated that the utilization of water resources for the life of people must be obtained from the primary water source that must be maintained and safeguarded simultaneously called *Oe Hae. Oe Hae* is the primary source of water that irrigates agricultural areas and is also the headwaters of small rivers in Amarasi Sub-district. Pranata *Nuno* obliges every community member to protect and maintain *Oe Hae* as a primary water source with the condition that community members of local communities in Amarasi Subdistrict should not take the water directly from *Oe Hae.* Moreover, the members of local community are also prohibited from felling trees around the *Oe Hae* location and feeding and bringing livestock closer to the *Oe Hae* location. The local community is required to maintain cleanliness in the environment around the *Oe Hae* location and is strictly prohibited from talking dirty and fighting around the *Oe Hae* environment.

LOCAL COMMUNITY BEHAVIOR IN FLORA RESOURCE CONSERVATION BASED ON *MAMAR* SYSTEM

The application of the *Mamar* system towards the conservation of floral resources has contributed significantly to the socio-economic life of the local community in the Amarasi sub-district. Based on observations in the field, it is clear that flora resources in the *Mamar* system tend to be maintained with economic value in addition to flora resources with ecological value. Regarding economic benefits, the preservation of flora resources is indicated by the characteristics of coconut, banana and areca nut plant species. In areas of *Mamar* where areca nut and coconut trees are less dense, banana trees are very well developed. It is supported by a research which stated that Mamar is a traditional agricultural system in Kupang Regency that has multiple functions and benefits for the community, including ecological, economic, and socio-cultural aspects. It serves as a conservation system for springs, provides sustainable income for farmers, and maintains the local wisdom and religious values (Basri et al., 2021).

However, in areas densely covered by areca nut and coconut trees, the growth of banana trees could be better. However, compared to the growth and production of banana plants inside and outside the *Mamar* area, banana plants inside *Mamar* have better growth and production than those outside *Mamar*. Banana sapling production in *Mamar* can reach up to 10 trees per clump, and fruit production ranges between 7 and 9 bunches per clump for each harvest. Outside of *Mamar* there are 5-7 saplings per clump and fruit production of 4-5 bunches per clump each harvest. In addition, this situation is different for coconuts. Coconut growth and production are better outside *Mamar* than inside *Mamar*. Coconut trees inside *Mamar* are up to 30 meters with an average production of 25-30 fruits per tree, while outside *Mamar* they are less than 20 meters with a production of 30-40 fruits per tree for each harvest. The *Mamar* coconut trees are generally located relatively close to each other, as well as the fact that they are quite old.

Ecologically, a multi-layered crown is assembled because, generally, *Mamar* is overgrown by various types of trees, shrubs and herbaceous plants. The top of the canopy is generally dominated by areca nut and coconut trees and other trees with a height of more than 25 m. Underneath is a second canopy layer with a tree growth between 10-25 m consisting of mango, breadfruit, banyan, kapok, ketapang and others. Tree canopy with a height ranging from 5-10 m consists of guava, orange, star fruit, teak plants, etc. Turi, lamtoro, lady fruit and others form the lower canopy (2.5-5 m high).

Similar to applying the *Mamar* system in the preservation of land and water resources, normative rules in the preservation of flora resources also have local institutions that regulate it referred to as Bunu. This institution obliges every

member of the local community in Amarasi Sub-district to plant and maintain any tree in and around the *Mamar*. Besides, the regulation of mandatory tree planting applies to everyone without any exception. the pattern of regulation is effectively carried out through family or household members. The *Bunu* institution stipulates that each family member in a household is required to plant and maintain at least five economically and five ecologically valuable trees around the *Mamar* area.

The death of the trees is the responsibility of the family members who plant them. If the planted trees did not survive, then the person who planted them as a community member of the Amarasi community is charged with replanting the same type of tree in multiple numbers of dead trees on his land in and around the *Mamar* area. Besides such sanctions or fines, local community members who do not plant trees as stipulated in the paranata Bunu will be socially ostracized and considered as people who do not know customs or do not have good manners.

LOCAL COMMUNITY BEHAVIOR IN FAUNA RESOURCE CONSERVATION BASED ON *MAMAR* SYSTEM

Based on observations in the field, it was revealed that the application of the *Mamar* system to the conservation of fauna resources is related to the potential of *Mamar* as a place to cultivate domestic animals and a place or habitat for wildlife fauna such as deer and lizards, birds and other types of animals, concerning the presence of the *Mamar* system as a place or medium for cultivation or a place for raising livestock, especially Cattle, Goats and Pigs. Livestock husbandry in *Mamar* is an activity the local community in Amarasi Sub-District, West Timor, has long practised. Livestock husbandry in *Mamar* is an activity the local community in Amarasi Sub-District, West Timor, has long practised.

The reason for choosing *Mamar* as a location for breeding livestock is because it is easy to find animal feed and a water source for livestock (Rachmawatie et al., 2019). Local feeds generally obtained from *Mamar* include turi leaves, lamtoro, waru, kapok, beringin and natural grasses. The most commonly kept livestock are cows, goats and pigs. Cows are tied up under the trees or in simple sheds (made from local materials). In terms of soil fertility, the livestock breeding system in *Mamar* is highly beneficial because it can cause the recycling process of nutrients from livestock manure into the soil. The presence of livestock in the *Mamar* system means that it increases the commodity diversification of the *Mamar* ecosystem.

The primary commodities of *Mamar* farms consist of annual crops. The cattle, pig and goat rearing system in *Mamar* is a customary practice among local community farmers in Amarasi Sub-district that has been practised for generations. This behaviour has persisted for a hundred years because local

institutions serve as a control mechanism for the local community's behaviour in animal husbandry, as mentioned above.

Normatively, there are institutions that regulate this issue called *Puin Mat Naen***.** *Puin Mat Naen* emphasized that livestock such as cows, pigs and goats are "living gold" that must be maintained and utilized properly for the social and economic welfare of the local community in Amarasi Subdistrict. It is also stipulated that these three types of domesticated animals symbolize the social status of the owner, thus they are not allowed to be released and damage the crops of the local community.

If there is a violation of the *Puin Mat Naen* in form of the livestock escape that damages other people's crops, then the animal must be sacrificed. Under the terms of this arrangement, if the owner of the animal is able to pay for the damage to the crop with the calculation that one damaged crop must be replaced with 50 stems, then the flesh of the animal that has been killed can be divided between the owner of the animal and the owner of the damaged crop. However, if the owner of the animal is unable to pay on the mentioned terms above, then the owner of the animal only gets the head of the animal that has been killed.

CONSTRUCTION OF ENVIRONMENTAL LEADERSHIP WITH LOCAL COMMUNITY BEHAVIOR IN NATURAL RESOURCE CONSERVATION BASED ON *MAMAR* SYSTEM

The characteristics of the socio-cultural life of local communities in Amarasi Subdistrict are characterized by attitudes and behaviors that help each other, both in difficult and good conditions. Various social activities in form of help and mutual cooperation are actualized as local institutions or rules in *Mamar* system that can provide social benefits to the local community as follows :

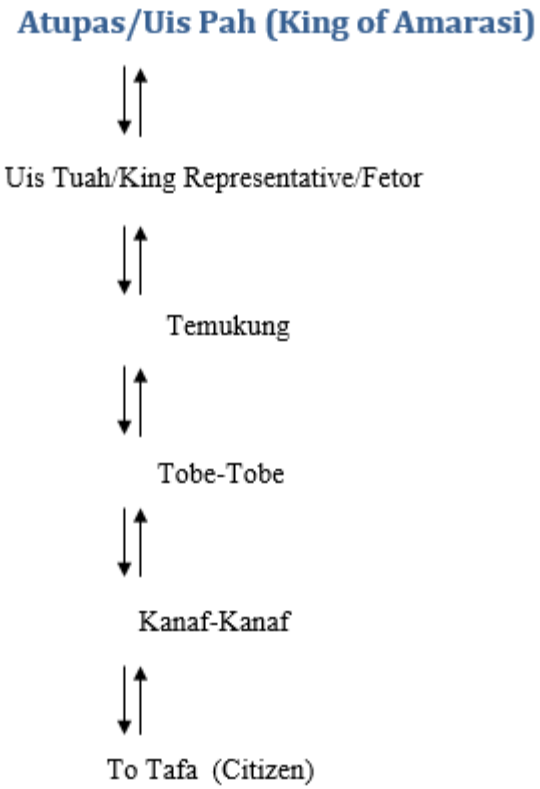
Bua or literally means gathering. It can be realized in form of gathering energy, thoughts, food during the preparation of an activity. Besides that, there is also a principle of local community life in Amarasi West Timor called *Fiti*, which means mutual cooperation to help the older or weaker ones. Literally, *Fiti* means work to reduce work. In Indonesian, Fiti means *jinjing. Ma Fiti* means working together to make things easier. *Fiti* or *Ma Fiti* contains a very deep psychological meaning, because in carrying out these activities there is mutual satisfaction where those who are helped feel satisfied and those who help feel relieved because they have helped others.

Feineka, the activity of helping others is not in physical form, but mentally its presence helps to open other people's minds. For example, the presence of someone to encourage others to work. His presence is not to work, but to provide moral encouragement to others able to complete a job. All of these

activities have an impact on environmental preservation, which is the effort to maintain the values of togetherness in the society.

It is a fact that the survival of *Mamar* as a mechanism for natural resource conservation in Amarasi, West Timor, is largely determined by the environmental leadership system applied in *Mamar* based on natural resource conservation practices. It is said that the survival of *Mamar* as a traditional natural resource conservation system among the Amarasi community is significantly influenced by the local leadership system.

During the royal period, *Amarasi* people were led by an Emperor *(Atupas)*. The Emperor *(Atupas)* was very concerned about the conservation of natural resources based on local institutions within the *Mamar* system. It can be seen in Figure 3. In implementing its leadership, the government was run by a king who was assisted by several fetors and minor nobles at the difectorial level. The level below this is referred as the *temukung* area. At this level of support, there is a leader who is called *temukung*. At this level of support, a *temukung* is assisted by a *tobe*. Then the level below that is directly related to ordinary people called as *nakaf*. At this level of leadership, every member of the community is obliged to maintain and obey all the provisions of the *Mamar* system, which serves as a social control mechanism for the *Amarasi* community's behavior in conserving natural resources.



Descent line: Line of command from the king/leader to the people.

Rising line: Line of relationship between the people and the leader/king.

Figure 3. Traditional Leadership Structure in Amarasi West Timor.
Source: Author's own elaboration.

Besides, there were also other elements, such as the *kapitan* who was tasked with helping the *tobe* organize tribute from the people to the king. In addition, there is a meo element that functions as a commander. Within a *ketemukungan* there are genealogical ties and no territorial boundaries. A village is now a combination of several *ketemukungan*, while district is now a combination of several village. When ketemukung was made into a new-style village, there was a *temukung* who tried to maintain that one village had to be a *ketemukung*. The underlying consideration is that in this way, the authenticity of *kanaf* in region will be maintained.

CONCLUSION

Based on the results of the research through the findings, it can be concluded that *Mamar* is an artificial oasis built by the local *Amarasi* community in West Timor as a human response to the unfavorable natural environment. Then, the response of the Amarasi local community in West Timor is realized in the form of a process of life adaptation through environmental conservation actions towards the natural resources of land, flora and fauna as the source of life of these local communities in Amarasi, West Timor. The *Mamar* system has survived for so long since the 17th century because it is carried out with the mechanism of Environmental Leadership Control through a strong and effective Local Leadership Role in Amarasi West Timor.

Furthermore, the strength of environmental leadership system in Amarasi is complemented by the strength of Local Rules and Institutions that serve as social control mechanisms for the local community's behavior in Amarasi, West Timor. In *Mamar* system there is a local rule called *Nuni*, which is an obligation for everyone to maintain the fertility of the land in *Mamar* and to protect and maintain the water sources in *Mamar.* Except there is also a rule called Bunu, which is a rule and or prohibition not to cut any kind of tree in *Mamar*. Moreover, *Bunu* also stipulates a strict prohibition on clearing *Mamar* by burning anything in *Mamar*.

In *Mamar* system there are *Mamar* guards called *Mataf* or spies, who are tasked with guarding and catching people who violate the rules of *Mamar* conservation system such as cutting down trees in *Mamar*, hunting or catching wild animals in *Mamar*. *Ketiut po'an and Mataf* impose restrictions or *Meo* that no one is allowed to break. If someone violates the restrictions set by the *Mataf and Ketiut po'an*, then they will receive a fine or sanction or *Tasane*.

In addition, here the most important findings of the study as follow:

- Mamar is a man-made oasis that the Amarasi community in West Timor constructed in response to the adverse local climate.
- In Amarasi, West Timor, the *Mamar* system has endured since the 17th century because of local leadership roles and environmental leadership control.
- The strength of local institutions and rules that act as social control mechanisms for the behavior of the local community in Amarasi, West Timor, complements the strength of the environmental leadership system in the area.
- The *Mamar* system consists of customs like Nuni, which requires everyone to preserve the land's fertility and safeguard water supplies, and Bunu, which forbids clearing trees and setting fire to anything in Mamar.

REFERENCES

1. Arifin, Z. (2010). *Penataan Lahan Mamar Pisang Berbasis Pertanian terpadu di Timor Barat*. Politeknik Pertanian Negeri Kupang.
2. Basri, M., Rupa, M., Ranta, F., & Lewar, Y. (2021). Study and Mapping of Mamar Potential as Local Wisdom in Kupang Regency – East Nusa Tenggara Province. *IOSR Journal of Agriculture and Veterinary Science*, *14*(8). https://doi.org/10.9790/2380-1408022336
3. Bogdan, R., & Biklen, S. K. (2007). *Qualitative research for education: An introduction to theories and methods*.
4. Bungin, B. (2021). *POST-QUALITATIVE SOCIAL RESEARCH METHODS: Kuantitatif-Kualitatif-Mix Methods Positivism-Postpositivism-Phenomenology-Postmodern Filsafat, Paradigma, Teori, Metode dan Laporan*.
5. Burns, M., Bally, J., Burles, M., Holtslander, L., & Peacock, S. (2022). Constructivist Grounded Theory or Interpretive Phenomenology? Methodological Choices Within Specific Study Contexts. *International Journal of Qualitative Methods*, *21*, 160940692210777. https://doi.org/10.1177/16094069221077758
6. Christina, E. (2021). *Tana Ulen Lepo A Virtual Concervation Tradition for the Recognition of Teritories of life in North Kalimantan*.
7. Dako, F. X., Ranta, F., & Kristinawanti, I. (2008). KAJIAN PENDEKATAN REHABILITASI LAHAN KRITIS MELALUI PENGEMBANGAN MAMAR. *Politekni Pertanian Negeri Kupang*, *15*(1). https://doi.org/http://dx.doi.org/10.35726/jp.v15i1.113
8. Elmusharaf, K. (2012). *Qualitative Data Collection Teqniques*.
9. Liamputtong, P. (2020). *Qualitative Research Methods*. Oxford University Press.
10. Manafe, A. D. J. (1990). *Ekosistem "mamar" sebagai suatu bentuk wanatani tradisional di Kabupaten Kupang, Nusa Tenggara Timur*. Universitas Gajah Mada.
11. Marsono, D., & Njurumana, G. (2009). *Pola Pengelompokan Komunitas Mamar di Timor*. Universitas Gajah Mada.
12. Matheus, R., Basri, M., & Lewar, Y. (2020). Pengembangan Model Pertanian Terpadu Berbasis Mamar di Kabupaten Kupang, Nusa Tenggara Timur. *Seminar Nasional Lahan Suboptimal*.
13. Maxwell, J. A. (2012). *Qualitative research design: An interactive approach*.
14. Moata, M. R. S., Rosario, P., Berg, T. V. D., Sinlae, D. V, Rua Ora, Y. A. N., Wardhana, L. D. W., Takalapeta, A., & Benu, Y. (2022). Can local agroforestry systems survive for rural development and sustainable ecosystems in dryland areas? A case study in Timorese Mamar systems.

IOP Conference Series: Earth and Environmental Science, *974*(1), 012108. https://doi.org/10.1088/1755-1315/974/1/012108

15. Ngaji, A. U. K., Baiquni, M., Suryatmojo, H., & Haryono, E. (2020). Sustaining subsistence culture in Mamar agroforestry management in West Timor, is it possible? *E3S Web of Conferences*, *200*, 02023. https://doi.org/10.1051/e3sconf/202020002023
16. Ngaji, A. U. K., Baiquni, M., Suryatmojo, H., & Haryono, E. (2021). Assessing the sustainability of traditional agroforestry practices: a case of Mamar agroforestry in Kupang-Indonesia. *Forest and Society*, 438–457. https://doi.org/10.24259/fs.v5i2.14380
17. Ngongo, Y., Basuki, T., DeRosari, B., Hosang, E. Y., Nulik, J., DaSilva, H., Hau, D. K., Sitorus, A., Kotta, N. R. E., Njurumana, G. N., Pujiono, E., Ishaq, L., Simamora, A. V., & Mau, Y. S. (2022). Local Wisdom of West Timorese Farmers in Land Management. *Sustainability*, *14*(10), 6023. https://doi.org/10.3390/su14106023
18. Nimwegen, P. van, Lloyd, D., Vanclay, J., Ffoulkes, D., Butarbutar, T., & Budisantoso, E. (2009). *Prospects for integrated timber– forage–livestock agroforestry systems for economic diversification in West Timor farming communities*.
19. Pujiono, E., Sri Raharjo, S. A., Njurumana, G. N., Prasetyo, B. D., & Rianawati, H. (2021). Sustainability status of agroforestry systems in Timor Island, Indonesia. *E3S Web of Conferences*, *305*, 04003. https://doi.org/10.1051/e3sconf/202130504003
20. Putra, L. M. (2021). *Igya Ser Hanjop, Arfak Tribe's Ecological Management*. Econusa.
21. Rachmawatie, S. J., Widiastuti, L., Sutrisno, J., & Rahayu, E. S. (2019). Integrated farming system development based on local potential to improve food security and increase the farmers income: case study in Jatisari Village, Jatisrono Sub-district, Wonogiri Regency. *IOP Conference Series: Earth and Environmental Science*, *347*(1), 012094. https://doi.org/10.1088/1755-1315/347/1/012094
22. Suek, J. (2018). *Risiko, Ineffisiensi dan Keberlanjutan Sistem Wanatani Mamar di Wilayah Timor Barat*. Universitas Gajah Mada.
23. Thomas, V., & Openg, K. (2015). MAMAR SEBAGAI KEARIFAN EKOLOGI MASYARAKAT ADAT ATOIN METO DALAM KAITAN PELESTARIAN SUMBER DAYA AIR DI DESA FEMNASI, TIMOR TENGAH UTARA. *Humanis : Journal of Arts and Humanities*, *13*(1).
24. Visser, W., & Courtice, P. (2011). *A Journey of a Thousand Miles: The State of Sustainability Leadership*.

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