

Pengataa, ToKaili Customary Spatial Planning: A record of tropical settlements in Central Sulawesi, Indonesia

Zaenal Siradjuddin ^{1,*}, Puteri Fitriaty ¹, and Zhenjiang Shen ³

AFFILIATIONS

- ¹ Department of Architecture, Engineering Faculty, Tadulako University, Palu, Indonesia
 - ² Faculty of Forestry, Universitas Hasanuddin, Makassar, Indonesia
 - ³ Urban Planning Laboratory, Environmental Design Division, Graduate School of Natural Science and Technology, Kanazawa University, Kanazawa, Japan
- Correspondence:
ybmtondo@gmail.com

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ABSTRACT

Indonesia has experienced multiple disasters induced by several active tectonic faults that cause earthquakes. Central Sulawesi, one of Indonesia's Province, has an active fault known as the Palu-Koro fault. This fault periodically causes disasters (i.e., earthquakes, tsunamis, liquefaction, and landslides). The co-occurrence of these four disasters is locally termed *Nalodo*. *ToKaili* – the native tribe that inhabited Central Sulawesi Province – has faced these hazards for generations and formulated local wisdom to minimise their impacts. This local wisdom is called *Pengataa*. *Pengataa* serves as a guideline for environmental management, such as determining the location of settlements in consideration of hazards and the environmental equilibrium. This study explores the customary spatial planning (*Pengataa*) of *ToKaili* in responding to natural disasters according to disaster records evidence, including the 2018 Palu disaster. This study uses a qualitative method and finds the role of *Pengataa* in organising *ToKaili* settlements to minimise the impact of disasters that are free from the effects of *Nalodo*. This study conveys that customary spatial planning of *ToKaili* is worthy of considering in the planning of residential areas, especially in relation to natural disasters.

KEYWORDS

Pengataa Concept; Customary rules; Disasters (*Nalodo*); Local Wisdom; *ToKaili*

1. INTRODUCTION

Disaster consideration plays an essential role in determining residential/settlement areas, for it directly impacts people safety. This consideration is significant in areas located along seismic cracks, flood plains, coastlines, or high-density areas prone to disasters (Jha et al., 2013; Lee, 2017; Wang et al., 2019). In the Asian region, awareness and knowledge of local disaster sources are believed to have a different perception of risk (Nguyen et al., 2016).

Through many years of experience, local knowledge has been proven to create a safe urban environment and minimise disaster risk significantly. It is a holistic approach with environmental and socio-cultural relevance, traditionally tested in planning and housing that have sustained communities for centuries (Dayaratne, 2018). This study aims at exploring the customary spatial planning (*Pengataa*) of *ToKaili*, which is told from generation to generation in responding to its local environment (including natural disaster) in Central Sulawesi Province. The study will give an overview of residential placement according to the *Pengataa* concept considering early traditional Settlement in Central Sulawesi drawn by Kaudern (Kaudern, 1925).

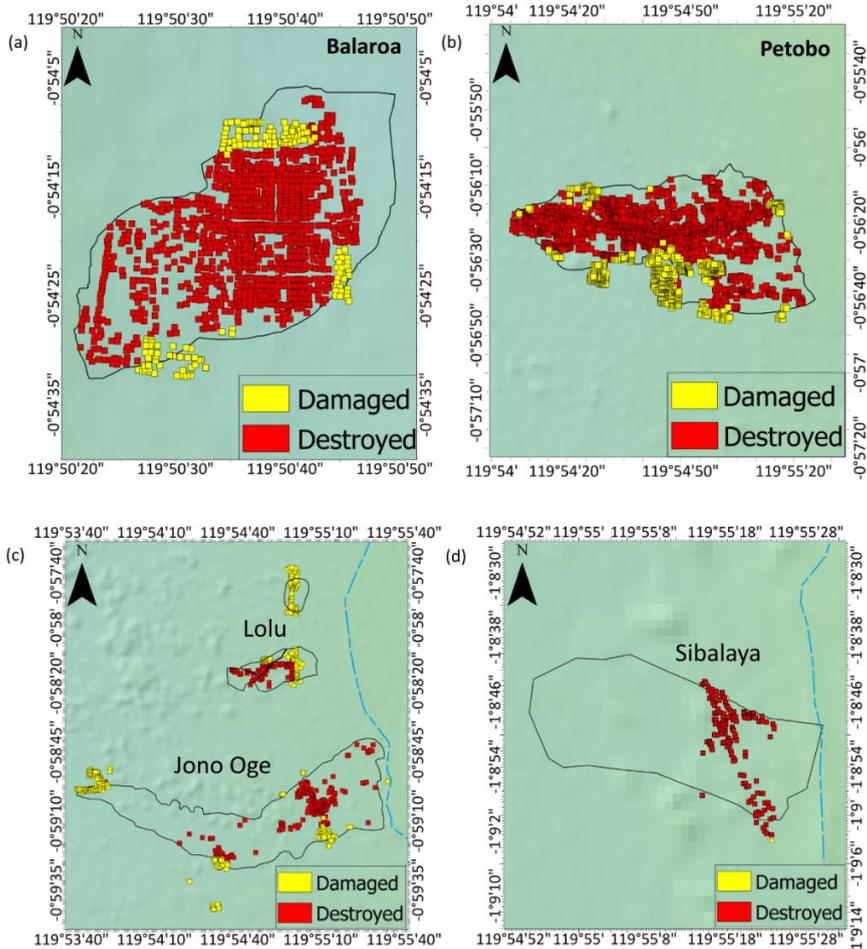


Figure 1. The extent of damage to housing infrastructure due to flow slides: a) Balaroa, b) Petobo, c) Jono Oge and Lolu, and d) Sibalaya (Rohit et al., 2021)

ToKaili is one of the ethnic groups in Indonesia that is unique for residing in the area where a main active earthquake fault lay, named the Palu-Koro fault (Darma et al., 2020). Their daily life seems to merge with earthquakes so that almost every month, they are experiencing earthquakes from a very small to large scale. The earthquakes sometimes came accompanied by other disasters like landslides, liquefaction, and tsunami, locally called *Nalodo*.

One of the largest earthquakes in this area happened in Palu on 28 September 2018 with M_w 6.1 foreshock and M_w 7.5 mainshock. It claimed more than 4000 lives, 10,679 injured, 667 people missing and caused more than 200.000 refugees (Mason et al., 2021). This earthquake was accompanied by a maximum 10.7 m height tsunami and a large-scale landslide and liquefaction simultaneously at four key locations, namely Balaroa, Jono Oge, Petobo, and Sibalaya (Jalil et al., 2021). Furthermore, this event caused extensive ground displacements ranging from several hundred meters to more than one kilometre, which destroyed more than 6400 residential buildings within the impacted area (Figure 1) (Hazarika et al., 2021; Montgomery et al., 2021; Rohit et al., 2021).

Learning from the 2018 earthquake, authors try to explore the local wisdom of *ToKaili*, which was available hundreds of years ago. The ancestors of *ToKaili* created local wisdom related to spatial planning called *Pengataa* to reduce the impact of natural disasters on their living environment. *Pengataa* serves as a guideline for environmental management, such as determining the location of settlements, agriculture, and protected areas considering possible dangerous situations such as *Nalodo*.

In the past, the wording in *ToKaili* community was one of the customary rules applied in determining the ideal settlement location and had a potential impact that was estimated to have a minimum dangerous situation according to historical experiences. The wording contains the standard rules and criteria used by *Totua* (The elder, traditional community leader) to determine the house's location for his son, which later developed into a settlement.

This understanding of customary rules is now abandoned and almost forgotten. To the young people in the present, these rules are no longer known. The actual evidence of today's people ignoring the local wisdom related to spatial planning is that many buildings' location development (i.e., residential or office buildings) in Central Sulawesi are built on dangerous areas prohibited in *Pengataa* customary rules. The absence of efforts to explore and implement the local knowledge resulted in enormous consequences – casualties, massive damage, and property loss – to the local community when the 2018 earthquake occurred. Therefore, to minimise the effects of future hazards, it is imperative to look deeper into the local knowledge and rules to achieve a sustainable, happy, and safe urban-rural environment.

Thus, this study is essential to remind all the stakeholders (government, community, planner and designer, developer, and industry) to pay attention to local wisdom as the fundamental consideration for designing and planning policy for urban resiliency. Furthermore, the studies on local wisdom from the traditional communities often discussed in the perspective of climate-responsive buildings or settlements (Fitriaty et al., 2011; Fitriaty et al., 2017; Motealleh et al., 2018; Steiner, 2018; Winarto et al., 2015). Only a few studies discussed the traditional spatial planning concept from the perspective of disaster consideration (Liao et al., 2016). Hence, this study will enrich scientific discussion on traditional spatial planning concepts related to disaster mitigation.

2. BACKGROUNDS KNOWLEDGE

This research starts from searching the targeted study location. So, an initial understanding of each local community is needed. To start this research, the researcher has background knowledge that can help see various points of view on the lives of the people who are the object of study.

This research uses literature as background knowledge, including discussion about local wisdom, vernacular architecture, housing and settlements, and spatial planning concerning the reduction of disaster impact. Cultural canalisation in the observed community becomes the basis for researchers' ability to capture disasters and local knowledge phenomena.

2.1 Local wisdom

Wisdom is a sort of knowledge that goes beyond the ordinary. The original sources of wisdom came from the values of religious customs, ancestral advice, or local culture, built naturally in society to adapt to its local environment (Vitasurya, 2016) called local wisdom. It might be used in response to extraordinary challenges, or to provide an exceptional knowledge of the future, or when faced with the necessity of choice and action in a situation that cannot be comprehended, where outcomes contain

unpredictable hazards that should be avoided (Ramirez et al., 2019).

Imparting wisdom was considered to be an essential part of education. Therefore, it was told from generation to generation in a traditional community. Local wisdom is needed to create a better living environment through envisioning, planning, implementing, and evaluating (Oliver et al., 2021).

2.2 Vernacular architecture

Vernacular architecture or local architecture was not necessarily born from a trial-and-error process. However, it definitely portrayed local forms full of cultural elements and environmental experiences vividly. It includes the effects of local disasters (Liao et al., 2016) and climates (Fitriaty et al., 2011; Gou et al., 2015; Suleiman & Himmo, 2012), which are in the physical condition of architectural forms, such as layout, structure, and ornate details.

Vernacular is related to economic potential, local resources, and local wisdom. Vernacular uniqueness is expressed through traditions, knowledge, and methods that develop, according to the needs, habits of the community, and adaptation to the potential of its surrounding natural environment (Rapoport, 1977).

Vernacular architectural conditions are made to meet unique needs, such as accommodating the growth of the culture that influences it and the natural wonders that have occurred. Vernacular architecture is born from people who live together and form a group (community and kinship). The homogeneity of society is a challenge in living together as a community. Spaces design in vernacular architecture was based on an in-depth understanding of natural surroundings, local climate, available resources, and inhabitants values and lifestyle attributes (Philokyprou et al., 2021). Skills made them passed down from generation to generation, thus becoming traditions as a way of life produced through their local wisdom (Doxiadis, 1968).

Organised groups tend to settle down in one place from generation to generation, so they regard it as a birthplace. The residence's incarnation and facilities are more determined by the process and experience than the resulting product. In carrying out the process, it is a necessity that every stage is made aware of the community's traditions. Vernacular architecture is a tangible form and formed intangible space such as social and symbolic spaces, reflecting the created area and its inhabitants (Oliver, 1987).

2.3 House and settlement

The processes of producing vernacular architecture are inherited among generations or following the development of local culture, and the results are not necessarily the same. Vernacular architecture describes three things, namely: place, person, and period (Healey, 2009), containing local wisdom as the keyword. Settlements are then formed by vernacular architecture groups and are called local because they grow. This growing settlement by urbanisation process often changes the traditional settlements. Traces of history, such as original early settlements, often remain in the middle of expanded urban areas along with new developments. The preservation of original early settlements as evidence of urbanisation, history, culture, and local life value may conflict with public interests (Poomchalit et al., 2018).

The settlement has specific natural characteristics and spatial structures as a place for people to live. Critical orientations such as the relationship between location and natural conditions with various positive and negative potentials are part of living space, housing, and settlements, without neglecting social culture and civilisation. The house and settlement construction and shape are considered as the manifestation of the cultural values of the people who grow and develop (Rapoport, 1969). Settlements will die if they no longer provide services for human needs, so a typical society must provide

comfort, security, tranquillity, and a sense of security for humans (Johnson, 1986).

The settlement creates both a physical environment and an institutional environment. The modification process (evolution) occurs as one of the factors extending the order life. The evolutionary procedure can be explained by clarifying the size of the observations (i.e., settlement, dwelling units, living space), population, and area. In developing settlements related to planning pragmatism, the product is very rapid in the planning dimension. In some opinions, pragmatism ideas include an assessment of philosophy influence on a developmental theory about the nature, purpose, and method of planning. However, critical pragmatism from practical and "neo-pragmatic" philosophers prevented the influence of pragmatism on the initial concept of planning as a rational process (Dalsgaard, 2014).

The perspective of Friedman, Lindblom, and Schon; on Forester's development of "critical pragmatism"; shows the contribution of planning theory in the 1980s - 1990s. This perspective identifies pragmatic ideas in the planning dimension as practical social learning, which harnesses human capacities and fosters the ability to critically change transformative systems in the public sphere (Johnson, 1986).

2.4 Spatial planning concept

Spatial planning is an effort to plan processes of social, economic, and environmental change to achieve certain goals, including the preparation of plans, maps, or diagrams showing where sociospatial activities should be carried out and served in cultivating and enhance the qualities people value in environments (Huxley & Inch, 2020; Sidiq, 2021). It is largely known to serve the aim to influence the future spatial distribution of people activities by constructing territorial land uses in an orderly arrangement by considering the linkages between land uses, and balancing development demands with the need to protect the environment, and achieving social and economic goals (Yoshida et al., 2020).

Spatial planning is also important to motivate a proactive and preventive adaptation of human settlements to the disaster risk caused by hazards (McMillan et al., 2021). The management of ecosystems through suitable spatial planning can provide various socio-ecological benefits, including reduction of disaster risk (Kato & Huang, 2021). This can be done by providing natural protection, and enhancing livelihood resilience (Estrella & Saalimaa, 2013; Panpakdee et al., 2021).

Sustainable maintenance and management of forests and water area are crucial for reducing the risk of disaster because they provide crucial ecosystem services. In reducing exposure to floods, land use policies should promote the restriction of future development on floodplains and relocating existing buildings to higher grounds (Kato & Huang, 2021).

3. METHODS

This study employed a qualitative method with a phenomenological approach. Even though the phenomenological approach results are not structured, constructed, or systematically designed, it reveals an obvious and robust problem (Vagle et al., 2017). The research was designed in two main stages of this research namely: mini tour and grand tour stages. The selection of this method is based on the consideration of Tokaili actual conditions with the rules and customs of speech culture traditions instead of written culture. This verbal information was then extracted through mini-tours and grand tours. Result of grand tour then followed up by in-depth interview where each step includes analysis processes (Figure 2).

3.1 Research approaches and techniques

In gathering information, several techniques were utilised, such as observation – used to reveal empirical reality – and interview to discover the reasons for existence and insights that can explain phenomena behind practical reality in *ToKaili* Spatial Planning. Analytical procedures and analysis results with high reliability are based on three parameters: ethical reduction, phenomenological reduction, and transcendental deduction (Figure 2).

Ethical reduction is a consideration to explore information that gives birth to various empirical themes that can be achieved through object awareness and identification awareness. Phenomenological reduction aims to explore themes through the interaction of pieces, which is continued by building concepts. Transcendental reduction designs the essence of ideas that lead to a record of initial formation concepts (cannot be generalised).

Qualitative research with a phenomenological paradigm used in this study refers to the view of Edmund Husserl (Husserl, 1982). Thus, it emphasises internationalism (consciousness) to produce objective awareness that is conscious because it will only appear when supporting data (Phyletic Data) empirical reality is explored. The functions of objective consciousness and identification consciousness connect objects and data to find their validity.

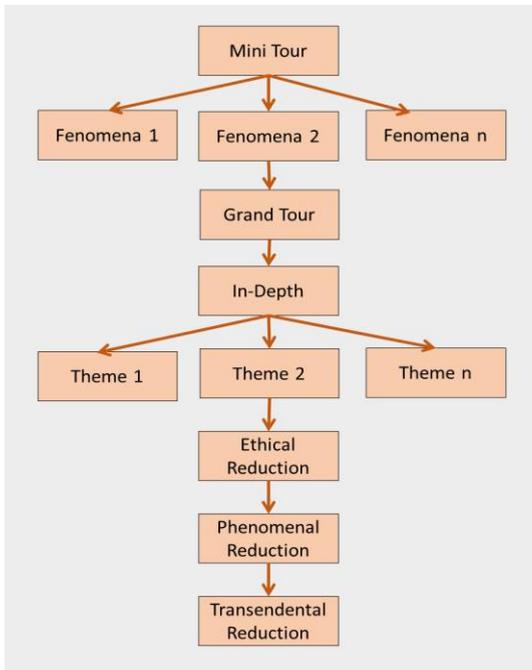


Figure 2. Research Design

Human perception and activity have different awareness, such as awareness in thinking and doubt, which requires identification awareness to direct various data from certain events. The excavation depth is established in an object with multiple aspects such as motivation, interest, and involvement as a guide. The goal is for similar things that meet the required reliability requirements. If none of the plans qualifies, it causes the dream to become a "sensation" or something that can be seen but has no meaning.

Correlation consciousness is the view of objects that are identical to each other; A

pair of relationships between the front sight and the side view form an inseparable whole, showing the level of intimacy of the relationship on which the theme develops. Object connectivity provides an opportunity for the subject to experience similar events in the future. Correlation/connection means that identical objects will always overshadow the prospect of a thing to be explored further towards institutional awareness that can construct themes that show the reality behind empirical reality and become a concept.

3.2 Study site

This study was conducted in several locations in Sulawesi Tengah (Central Sulawesi) Province, namely Palu, Sigi Biromaru, and Donggala District, Indonesia (Figure 3). The study location situated near the Equator line and astronomically placed between Latitude 2°22' North dan 3°48' South, and Longitude 119°22' - 124°22' East.



Figure 3. The Map of Study Location, Central Sulawesi Province, Indonesia

3.3 Data collection

This study seeks to uncover local knowledge of how the *ToKaili* determined their ideal settlement and explain their evolutionary process. Data collection process to achieve study objectives started from mini-tour which investigated the impact of 2018 earthquake, across two regencies and a city, namely Sigi Biromaru Regency, Donggala Regency, and Palu City. The mini-tour is carried out to collect the data about the impacted location, the size of the distructed area, and number of cassualities. The result of the mini-tour explaining earthquake, tsunami and liquefaction impact phenomenon ranging from mild to severe as a form of reality. These data then elaborated with the data from literature and used to determine the restricted are in spatial planning analysis.

A year after the earthquake, when the community began adapting to the impact of the earthquake, a grand tour process was carried out. The grand tour was executed to explore the relation between 2018 disaster impact and the placement of human activities space in the present compared to traditional spatial planning wisdom. The grand-tour started from Toro and Behoa and then expanded to other areas based on recommendations from previous interviewees. The grand-tour were executed using field surveys and elaborating observation techniques and interviews techniques. Observations were done using observation form and visual image recording. It was designed to explore empirical reality and comments, lead to local knowledge on Pengataa – ToKaili spatial arrangement concept – and discover its implementation evidence related to disaster resilience planning by physical traces. The aspects in the *ToKaili* Settlement were found also through the grand-tour process.

Based on mini tour and grand tour, the reality findings are stored and then in-depth interview was carried out. In-depth interviews were done by recording instruments to deepen the data completeness from other techniques, such as participant observation and document tracing (Usop et al., 2022). In-depth interviews with Totuas (traditional community leader) were designed to reveal other phenomena behind the practical reality that observations cannot vividly capture, called metaphysical reality by employing snowball technique.

In-depth interviews by open interview were conducted with 9 (nine) traditional leaders or former community leaders (*Totua*) over 60 years old. The interviewed Totuas are distributed in several district: four Totuas in Sigi Regency (each is in Lindu, Toro, Bora, and Ngata Baru); four Totuas in Lore of Poso Regency; and one Totua in Palu City. From these interviews the data about location where earthquake occurred in the past; settlement location requirement based on traditional knowledge; restricted area that cannot be used as human activities; and philosophy of ToKaili were collected.

3.4 Data analysis

Data analysis were conducted with several stages from reducing, displaying, and verifying the data. The reduction includes summarising, selecting primary data, focusing on the essential information, looking for themes, and excluding irrelevant data. Data is then displayed using Matrix for a precise reading. Following data analysis used by Usop et al. (2022), this study applied the Stevick-Colaizzi-Keen analysis technique by describing the events experienced by the informant; Assessing each verbal statement related to the study problem; recording relevant questions; and creating lists or meaning units for specific themes.

The data were interpreted using text and discourse interpretation techniques by analysing the informant's language, including message preparation, logical reasoning, and convincing facts. This interpretation includes the structure of ideas, thought processes, choice of speaker's language, and situations. Graphical drawings are used to interpret disaster records over an existing map of Central Sulawesi Province. In verifying Pengataa Concept's accuracy, the resulting graphical drawings map was then superimposed with the early traditional settlement of ToKaili drawn by Kauderen (1925). Verification or conclusions then can be obtained through a conditional disjunctive hypothesis proposition.

4. RESULTS AND DISCUSSION

4.1 Results of Past Disasters Event

The field survey highlighted some indications that *ToKaili* had experienced various disasters since their ancestors, this was shown by numerous relics around their residential area. Among some of the physical remains that can still be found is the formation in Lindu Lake in the Sigi Biromaru district. Other physical traces are located in the Marine Center recreation area (Donggala district). Furthermore, the evidence also can be seen in the formation of a lake in the Balesang Donggala district, caused by a tectonic earthquake that occurred thousands of years ago. Because *ToKaili* did not have a written culture, the earthquakes experienced by *ToKaili* were not recorded properly. The knowledge of disasters can only be obtained from the memories of some *Totuas* who received information from the previous elders and by placing a memorial stone in the location where the earthquakes took place. Some of these stone can still be found today as a relic.

Other types of disasters that ever occurred in central Sulawesi province was included liquefaction events in several areas. These Liquefaction events were generally recorded by *ToKaili* in the form of "naming the area" where the liquefaction ever

occurred. For example, the toponym of "Jono Oge" is attributed to watery land all year round; the toponym of "*Petobo*" means the watering area; and *Balaroa* means a water catchment area. These names are used to guide people that there had been an extraordinary event in those locations where the soil has high water content. Consequently, the ground can be moved (displaced) due to the soil characteristic being soft (low bearing capacity), resulting in the movement of trees and plants from a higher to a lower location. Therefore, places like this should be avoided and unrecommended to be used as living and working spaces. This naming action is considered as traditional method in implementing spatial planning in *ToKaili* Land, based on *Pengataa* Concept.

Other disaster findings are debris in the form of landslides and flash floods caused by high rainfall factors as a result of illegal logging by irresponsible people. This kind of incident occurred in 2003 in *Tojo Una-Una* district, *Podi* Village. This incident caused the entire village to be dragged by the mud flood into the sea. A similar case occurred in 2019 in the Sigi Biromaru district that hit *the Dolo sub-district, which caused two villages buried in mud up to 2 meters.*

Furthermore, the other disasters in Central Sulawesi are tsunamis that generally hit settlements near the coast. For example, in the 1960 tsunamis that *hit Tonggolobbi* village, *Donggala* district, where the tsunami reached the height of coconut trees, damaged fishers' settlements. And the last tsunami occurred on 28 September 2018, which hit almost all villages within the Palu Bay coastline.

Indications of past disasters provide lessons for the community so that various local wisdom is initiated by *Totua* (traditional community leaders), which is then used as guidelines for *ToKaili's* in carrying out his daily life. These guidelines are a kind of agreement related to Tokali's philosophy of life contained in *Pehakovia*, *Hintuvu* and *Katuvua*. Some customary rules regulating ToKaili to minimise the impact of disasters gives birth to local wisdom related to governance are called *Pengataa*.

With modernisation and digitalisation in every aspect of *ToKaili* life today, the customary rules and local wisdom were increasingly abandoned. In *Pengataa*, the space and place where human could build for settlements should be higher than the water level and not to be too close to the water bodies. Therefore, place like the river, the sea, the lake, and swamps, should be avoided. This regulation is related to ToKaili macrocosm which determine house and settlement placement which will be discuss later in macrocosm and microcosm section. However, in today's spatial planning implementation in most ToKaili regions, the settlement location is exactly where the water bodies located like those in *Petobo*, *Balaroa*, *Talise* and *Jono Oge*, the most severely impacted area for 2018 *Nalodo* disaster (liquefaction, tsunami, subsidence, and tectonic earthquakes). Many lives were taken, and massive environmental damage was unavoidable, as mentioned in the introduction part. The Recorded impact of *Nalodo* in 2018 showed that Palu City and Sigi Biromaru District areas were experiencing a severe damage. While *Donggala* and *Parigi* District only had a relatively small impact from 2018 *Nalodo*.

The areas that had a powerful impact in Palu city included the *Talise* beach area in Palu bay and *Balaroa* (Figure 4). Due to a large mass concentration on the platform of Palu Bay Festival event, many people died when the earthquake and tsunami occurred. This platform was built exactly above the sea (tidal area) which is against the rules stated in *Pengataa* Concept. At the same time, the *Balaroa* housing area was experiencing liquefaction. Due to the swift movement of the ground, many people did not have time to escape. Most houses, including the occupants, were rolled into the ground during liquefaction incidents. *Petobo* housing areas were experiencing a similar situation.

Meanwhile, the liquefaction behaviour in the Jono Oge area has a slightly different pattern (Figure 5). Instead of the rolling ground, the land in Jono Oge flowed like water in the river. The displacement ranges from several meters to more than 1 kilometre from its original place in Jono Oge.



Figure 4. Destroyed Area in Palu City impacted by Nalodo



Figure 5. The impacted area by Nalodo in Jono Oge (left), Petobo (middle), and Biromaru (right) in Sigi Biromaru District

4.2 Discussion

4.2.1 ToKaili's philosophy

ToKaili's culture and technology development seem to require principles that become a frame of reference in creating and improving their living culture, which is refined into principles to achieve a harmonious life. These principles are also the basis for customary rules that guide everyday life. The three principles are *pehakovia*, *hintuvu*, and *katuvua* (Figure 6), explained as follows.

- *Pehakovia*

Pehakovia is defined as manners by which human beings get closer to the ruler of nature. *Pehakovia* has a connection with the positive forbidden area, which shows how *ToKaili* maintains the upland environment from destruction by human's activity. The upland area is believed to be a source of sustenance and protection from the influence of evil spirits and other supernatural creatures that have the potential in causing natural disasters such as earthquakes. Other disasters such as diseases are also believed to be caused by supernatural beings (Sirajuddin, 2020).

The house is believed to have a head, body, and feet. These three parts represent three realms, upper, middle, and lower realm. The housetop and the ridge bottom were used as shrines for offerings presented to The Ruler of Nature (God) to avoid disasters. It is believed that if the offering is not made, a disaster will occur

As an authoritarian way to interact with the ancestors, *pehakovia* is also used to ask for help when people experience various problems, such as illness (*mo balia*) or a marriage that has not been blessed with offspring. A ritual is usually performed by

calling the spirits of the ancestors, and the elders will have a dialogue with the ancestral spirits to find a way out, which is called *ba siga*. In this light, the existence of the upper realm is essential to *ToKaili's* life.

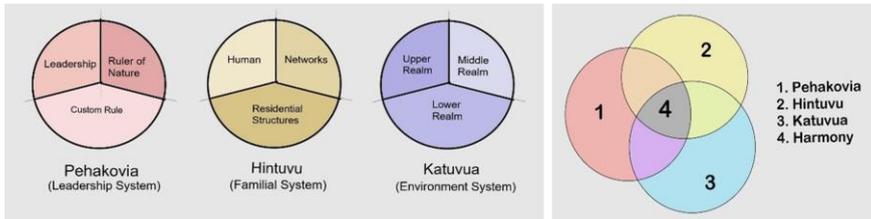


Figure 6. The Principles of *ToKaili* Philosophy includes Leadership System, Familial System, and Environmental System (Sirajuddin, 2020).

- *Hintuvu*

The *Hintuvu* is the etiquette to build a sense of community in the *ToKaili* groups. One form of politeness is customary rules governing the distribution of inheritance between men and women, prohibition of endogamy, and various other human activities. *Hintuvu* is implemented outside the positive prohibited area, such as the *pangele*. Instead, *hintuvu* is implemented in the *pahawa pongko* zone. In this public place, all humans can pursue activities, typically a production forest area that *ToKaili* uses as a source of livelihood. *Hintuvu* is also implemented in the oma zones, residential areas, and settlements that inevitably have special rules in building relations among fellow human beings, such as being neighbours or conducting collective activities (*nosarara nosabatutu*). The difference in regulations and implementation of *hintuvu* in each community or sub-ethnic sometimes cause inter-group wars.

As a code of conduct, *hintuvu* is equipped with various rituals and customary rules to create harmony between humans. Rituals and standard traditions, such as rules governing the greeting as a form of respect, visiting, and socialising, are subject to sanctions when violated. These rules also include procedures for using production forests (in *pahawa pongko*) and other procedures for environmental management. The mechanism for sanctions is contained in *Vaya*, a set of techniques used by the Totua to enforce the customary rules (Sirajuddin, 2020).

Vaya is equipped with procedures for carrying out customary law, called *mogane*. *Mogane* consists of a series of stages: *mogane*, *digane*, *disompo*, *digivu*. *Mogane* is the process of reporting an act of violation, *digane* is the investigation process to determine the suspect, *digivu* is the litigation process and verdict decisions such as compensation or fine for wrongdoing; and finally, *disompo* is the application of the penalties, usually in the form of a fine. The *sompo* process is carried out by paying the fine to the community. The *sompo* ended with a meal together, which indicates that the person concerned is declared free from the penalty imposed on them.

- *Katuvua*

Katuvua is a philosophy of the relationship between humans and their environment. It can also be interpreted as a human effort to preserve the surrounding natural environment so that it is free from various disasters that often come in multiple hazards (Nalodo) such as landslides, flash floods, earthquakes, and liquefaction. Preventive measures against the impact of disasters can be seen in rules such as the prohibition to build settlements in the lowland or lower than the surrounding river. One example is the customary rules regarding tree cutting that regulate the trunk's diameter. Certain tree species of 30 cm or more are allowed to be felled, and the cutting method should avoid damaging other trees.

As the settlement formation is closely related to the three principles, it consistently emphasises minimising disasters and building a harmonious and peaceful social life. These principles show how important it is to protect the surrounding environment to avoid disasters. This belief is partly derived from the possible damage humans cause to the environment. Furthermore, building a harmonious relationship among fellow human beings can minimise conflicts, such as the habit of war between groups in society. Whether as a positive forbidden, neutral, or negative no-go zone, this natural environment is traditionally guarded. Their existence can be maintained by obeying the customary rules set by the leader.

The absence of efforts to explore and implement the local knowledge affected the 2018 disaster that caused massive impacts: it killed thousands of people and caused enormous damage. Therefore, to minimise the effects of future hazards, it is necessary to look deeper into the local knowledge and rules.

4.2.2 *ToKaili's macrocosm and microcosm*

The development of spaces boundaries in the early stages of *ToKaili* life was done by providing the community with an understanding of cosmology. Their use of freedom gave birth to their belief in the macrocosm and microcosm, which became a reference in structuring their living spaces, settlement procedures, patterns, as well as customary rules related to the spatial arrangement. The traditional settlements of the *ToKaili* are also closely related to disasters reduction, which shows the frequent occurrence of disaster events.

ToKaili believes that the universe consists of the upper, middle, and lower realms (Figure 7). These three domains transform horizontally and determine housing and settlement patterns. In housing, the implementation of the macrocosmic notion is shown vertically with the terms head, body, and feet. Horizontally, they recognise the terms sacred, private, and public. In settlements, the terms religious, personal, and public space are also applied to build social capital, a combination of trust, norms, and social networks that enable a community to drive coordinated collective actions (Putnam et al., 1993).

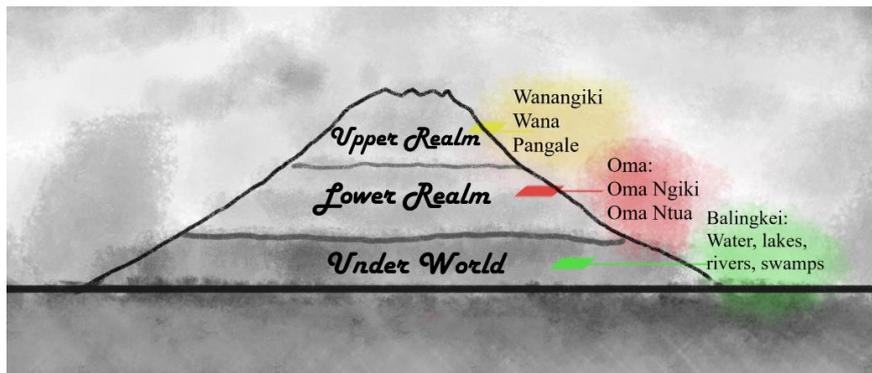


Figure 7. Hierarchy of Macrocosm According to *ToKaili* Believes

The upper domain – the realm of ancestral spirits – is considered to provide protection for the community and provide fortune. This realm can also be called a positive forbidden area because when human beings are allowed to enter the kingdom, they may damage the environment and distract their fortune; and disturb the peace of the ancestral spirits, which is believed to be a source of wealth. The ancestral spirits are also thought to be able to cure when members of *ToKaili* get sick. As a positive forbidden area, the upper realm starts from *Wanangkiki*, *wana*, and *pangale*, believed as forbidden

places.

Meanwhile, the middle domain, the region designated for human life, is called the neutral region, consisting of *pahawa pongko*, a source of human food, forest products, and *oma*, where humans live. This spatial zoning shows that the middle world is believed to be a place where human beings can pursue their lives, and therefore *ToKaili* believes that humans should only occupy the middle world. Furthermore, the middle realm consists of three spatial zones with different functions. *ToKaili* believes humans should settle in the *oma* that consists of three zones: 1) *Oma Ngiki*, 2) *Oma Ntua*, 3) *Oma Nguku*. In the three zones of *oma*, *ToKaili* developed settlements by introducing various forms of residence. Starting from *torowau* or shelter from rain and sun, the *Bamaru Ncamali* is a more developed *torowau* with the same function.

They have a group leader and live on a passive basis, constructed a *Bolanoa* –the residence of the leader– and *Bolawo* as the residence of the ordinary people. Usually, they build a group of buildings consisting of one *Totua* (leader) house and several homes for married couples. Developing settlements with small groups of houses is a way to minimise the disasters they often experience.

The underworld is believed to be inhabited by the jinn who can interfere with human life, therefore considered the 'negative' forbidden area. The underworld is believed to be occupied by jinn and ancestral spirits who have misbehaved during their lives. Souls who faced various obstacles brought to the upper realms settled in the underworld and merged with other beings. Creatures like jinn and demons that inhabit the underworld always cause disasters to humans.

ToKaili, understand the underworld as a wet area and some areas around a damp place. Therefore, the underworld is typically located at the foot of a mountain, hills, or valleys adjacent to water bodies such as swamps, lakes, and rivers that drain into the sea. The underworld is one of the realms avoided by *ToKaili* because it has a character that can cause disasters. The underworld is divided into two terrains: permanently inundated areas and those that are not; the former is believed to be the source of disasters.

The belief of three realms existence shows a form of harmony between humans and the "rulers of nature" as a source of fortune. At the same time, the relationship between humans is imperative for building social capital. Additionally, environmental sustainability can be achieved through human respect for their environment.

The advancement of *ToKaili* technology and culture has initiated communication with the underworld. As a result, the meaning of the prohibition against the underworld is shifting. They create ritual materials used to communicate with supernatural powers and perform black magic, which is used to carry out wars between groups. Nevertheless, the underworld remains prohibited for housing and can only be managed as agricultural land to produce food. This change occurs supported by various customary rules that provide space for *ToKaili* to compromise with the inhabitants of the underworld through a series of rituals to counter various disturbances and negative influences of evil spirits, demons, and jinn.

From then, *ToKaili* began living in a small group based on nuclear families and spreading everywhere, which developed into a community that lives in larger groups, requiring adequate housing space. This development led the *ToKaili* people to enter a phase of openness that allowed other cultures to enter into their community groups. This process helps to shape the *Pengataa*. Changes in the society from a closed community to an open organisation allow the formation of new customary rules that are more developed.

Looking at *ToKaili*'s understanding of macrocosm and microcosm, environmental management's efforts are focused on minimising the risk of future hazards. The findings

implied that there are spatial zones inherently correlated with the source of disasters in the definition of macrocosm and microcosm. The disaster-related area is located in the lower realm's 'negative no-go zone'. In contrast, the protected environment is located in the upper realm's 'positive forbidden zone'. Humans are permitted to live and work in the neutral zone of the middle realm. This zoning shows that disasters have been a significant concern in *ToKaili's* life since a long time ago. Efforts to prevent the destruction of primary forest at the uplands are one way to minimise the risk, as the destruction can lead to landslides and floods that damage settlements.

4.2.3 The formation of *ToKaili* settlements and *Pengataa*

ToKaili's settlements are developed in stages. The settlement starts from the middle realm (*Oma Nguku*), where they built temporary accommodation. Several forms of buildings are used as a gathering place called a *bola*; the building is used by the group leader as a residence and at the same time as a gathering place for all group members (Sirajuddin, 2020). They gathered at *bola* to perform rituals, including those conducted as a prayer to be spared from future disasters. The sites used as gathering places (*bola*) are generally located in a *Balingkae* or the transition area from the middle to the underworld realm.

The *ToKaili* culture continues to develop due to their interactions with various immigrants who came with their own culture. This intervention affects the way *ToKaili* experiences cultural and technological changes. One of the effects is the change in the perspective on *Balingkae* (transition area), which becomes a permanent residence area, with various customary rules that must be obeyed to use it. These customary rules are greed by *ToKaili* as they believe that *Balingkae* is a place inhabited by spirits. Therefore, when humans decide to occupy the area, they must perform various forms of rituals as a permission request to settle collectively and not interfere with each other.

Settlement in *ToKaili* perception is a repertoire they can use to meet daily needs individually or collectively. This view is one step in developing *ToKaili* culture that gave birth to the notion of a permanent settlement called *Ngata*; and the area suitable for human Settlement or *Pengataa*. The rapid change of *ToKaili* culture is influenced by various sources, including internal and external factors. One such internal influence is how *ToKaili* build relationships among human (*hintuvu*). The *hintuvu*, as a set of rules of social interaction of the *ToKaili*, determine the living patterns so that they can evade the influence of evil spirits by assigning suitable locations to serve them as a residential location through a series of rituals. The influence of evil spirit are believed to be stronger within the water area according to *ToKaili* cosmology. Hence, *ToKaili* settlement tend to be placed in certain distance from the water bodies and never be lower than the level of water bodies.

Social networking begins with exclusive small groups or nuclear family groups. External factors pushed *ToKaili* to develop into larger groups and slowly become an open group. Other communities that have not accepted the changes still live exclusively and return to *oma ngiki*, such as the *wana* community, small indigenous groups who live in the mountains. *Wana* people still inhabit the forest and consider the trees as their home. *Wana* people still exist in the *Bulan* plains, in the border area between regencies of *Tojo Una-Una* and *Morowali*, and those in the regency of *Luwuk Banggai*.

The cultural evolution of the *ToKaili* people also created several types of settlements, namely migration, semi-migration, and permanent settlements. The period of permanent settlement can be seen as a compromise between humans inhabiting the middle realm and the inhabitants of the lower realms to minimise the impact of future disasters. This period is marked by the demands of an ideal settlement, which requires humans to perform various rituals believed to be repellent to catastrophe. This period was also marked by the movement of settlement locations closer to the valley or the

boundary between the middle and underworld realms, with various buildings and houses for residence and rituals.



Figure 8. *ToKaili* Temples / Shrines

Among the houses in the settlement, a building was built as a place of worship, and each community group referred to it by different terms such as *Lobo*, *Duhunga*, or *Baruga* (Figure 8). The *Lobo* is often found in Kulawi, Lindu, and Pipikoro. Meanwhile, *Baruga* is used for the same meaning by people in the lowlands, such as the City of Palu. *Duhunga* is a temple building in the highlands such as those in the districts of Lore, but *Duhungan* can no longer be found. Meanwhile, buildings dedicated to group leaders are called *Bolawo* and *Bolanoa*.

As the *ToKaili* began to understand that the natural environment could be cultivated to meet necessities, various knowledge was developed, and they established multiple customary rules that shaped their traditional epistemology. In the subsequent development, the rational views that influence the traditional ones reduce the conventional requirements for their settlements only to meet basic needs and avoid calamities, as disasters are believed to be coming from the natural rulers and human wrongdoings. Hence, basic needs are met by their ability to carry out environmental engineering that is friendly to the surrounding environment by applying customary agreements that have become their customary rules.

The rational view in the *ToKaili* society that grows out of changes in science, culture, and technology then provides opportunities for improving their engineering abilities. Thus, this shift encourages *ToKaili* to develop customary rules as a form of local wisdom including *Pengataa*. *ToKaili*'s perspective shapes the change in their social organisation: the traditional leadership phase developed into a leadership system that was influenced by culture from outside, which introduced new forms of leadership such as kings and forms of social strata as aristocrats. This change translated into the development of large villages that became royal territories. This development created seven kingdoms in the west and eight kingdoms in the East of the Kaili region in Central Sulawesi.

The development of permanent settlement, which indicates a more open society, also impacts the way of thinking about family formation. While families were previously built to form closed/nuclear families, the subsequent development created a regulation that prohibits endogamous marriage while providing privileges to women as landowners with the condition that married women are not allowed to leave the settlement. This case can be seen in *ToKaili*'s customary rules on inheritance law.

On the development of settlements, it is explained that the *ToKaili* start from the nomadic to hierarchical permanent settlements: began from a house (*sou*) and developed into *boya* (houses that belong to the family groups), then to become a *Ngata* or a settlement of several families, and finally the *Ngatabete*, a collection of several *Ngata* with a complete government. This government system was based on their needs at the time: a *Ngatabete* is divided into zones based on currently required expertise. A *Ngatabete* thus can be called a *patanggota* if it is divided into four zones based on four different expertise, or *Pitunggota* if it has seven zones. Inhabitants with similar

expertise would live in the same area; for instance, those with medical expertise (*Balia*) will inhabit the same zone.

The formation of new settlements always pays attention to the disaster aspects that *ToKaili* often experiences. The *ToKaili* knowledge about disasters tends to be recorded in prescriptive form as they do not have written tradition. The experience of disaster events is recorded with symbols such as toponyms attached to the disaster locations as a precaution. It is a simple device, easy to remember, and attached permanently to the location for future use.

The naming of past disaster locations is carried out as a kind of codification in the customary law of *Pengataa* that regulates the selection for settlement locations. Based on past experiences, the *ToKaili* select the ideal settlement locations in the middle realm and define areas that need to be avoided, such as the positive forbidden zone (the upper realm) and the negative forbidden zone in the lower realm. The designation of the middle realm as a residential zone does not mean they are free from disasters because rivers, swamps, and lakes also exist in this realm. Moreover, part of settlements in the oma zone is bordering with rivers, swamps, and lakes, so they are closely related to water, which is believed to be the medium for the emergence of disasters. The concept of *Pengataa* then can be interpreted to serve three rules including: 1) suitable settlement location; 2) Settlement distance and levelling based on the level water bodies; and 3) The size of settlement based on community form and size.

When the *Pengataa* prohibition is violated, or a specific prohibited area is needed to be used, *Totua* conducts customary deliberations to seek a solution and that they would need collective approval. If the review fails to convince the *Totua* to agree with the proposed location, the settlement must be moved to another location that meets the requirements.

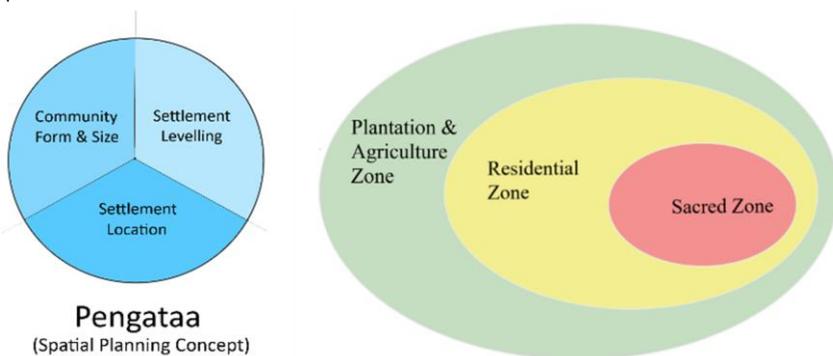


Figure 9. Pengataan Concept and Space Zoning in *ToKaili* Settlements

With the existence of customary rules regarding settlement arrangement, and with the growing number of settlements as they avoid prohibited areas, the settlements tend to be scattered. Consequently, the settlement pattern adopts a design that divides the territory into three zones: the core (sacred) zone, filled with ritual activities such as disaster prevention, and with religious buildings such as *Lobo*, *Baruga*, and *Duhunga*. In the second outer zone, the 'semi-public' zone, there are the residential areas; and the third zone, the public zone, is allocated for productive areas such as croplands as a food source (see Figure 9). Within this zone, a part of the area is also earmarked for the source of protein, namely grazing area (locally known as *pangale*, and the source of housing material called *pahawa pongko*).

The core or sacred zone is an area where the impact of natural disasters is minimal, while the residential zone still allows for potential disaster impact. Hence, it is

necessary to determine potential disasters to be avoided with the customary rules derived from past collective experiences. Local knowledge of previous disasters has become a source for the customary rules relating to environmental management.

4.2.4 Disasters Reduction Risk by Pengataa Concept

Nalodo, – a local term for the co-occurrence of four types of hazards: earthquake, tsunami, liquefaction, and landslide – Hit three districts in Central Sulawesi Indonesia (Palu, Sigi Biromaru, and Donggala) On 28 September 2018. The tragedy claimed thousands of lives and severely damaged half of the buildings in the affected areas. This tragedy should not happen as *ToKaili* has repeatedly undergone some combinations of hazards in the past. It should be expected that *ToKaili* must have an awareness of disaster reduction impact from the previous experience and local wisdom.

They have settled around *Palu*, the capital city of Central Sulawesi, which is traditionally protected and has toponyms that reflect past disaster experiences. For instance, *Duyu* or *Naduyu* in local language means landslide, *Kaombona* (located in the *Talise* sub-district) had experienced land subsidence ('bona' in local language) due to tsunami in 1938, or Long *Tagan* that means 'a sinking place' or an area of liquefaction. In addition to these, other toponyms surrounding the city also reflect recurring hazards, namely: *Tondo*, which means "the edge of a landslide, where a landslide collapsed part of the flat area; *Biromaru*, "rotting reed grass, otherwise known as the swamp. These toponyms are intended to warn residents of potential disasters and that these locations are to be avoided for future settlements (interview with *Totua*).

These experiences, which have been realised as local wisdom, are able to minimise the disaster risks. *ToKaili* has also avoided areas with specific features for their settlements, such as locations in the damp area or those close to water bodies such as swamps, lakes, and rivers (more below). Again, this has not been the case recently as local knowledge is clearly neglected. For example, the disaster impact by liquefaction in *Balaroa* occurred due to negligence in traditional knowledge, as the location is a water catchment area that turned into a settlement. A similar disaster occurred in *Petobo*, where a damp area was also converted into a settlement.

The *ToKaili* is the largest ethnic group in Central Sulawesi Province, inhabiting about half of the province area. Figure 10 below shows the Map of the distribution of Kaili villages as of 1917. The *ToKaili* occupy *Donggala* District and most Poso District (Kaudern, 1925). Today Donggala is divided into several regencies: *Donggala*, City of *Palu*, *Sigi Biromaru*, and *Parigi Moutong*; while *Poso* is divided into the regencies of *Poso*, *Tojo Una Una*, *Morowali*, and *Morowali Utara* (the last two regencies are not shown in the Map as it only depicted the *afdeling* (regency) of *Donggala* and *Poso*). The borders of the two original *afdeling* have not changed since the depiction and only divided, and most of the villages (kampung) depicted on the Map are similar to today but only called *Desa* (also means 'village' originated from the Javanese language). As the largest ethnic group in the province, *ToKaili* consists of 12 sub-ethnics, including *Kaili Ledo*, *Kaili Unde*, *Kaili Edo*, *Kaili Tara*, *Kaili taa*. These sub-ethnic of *Kaili* share a good amount of similar vocabularies with the same meaning and a number of the exact words with different meanings.

The tragedy of 2018 *Nalodo* shows that there were mistakes in land use by the community and past government policies that allowed the use of space that could potentially cause disasters. The mistake was caused by policies that did not consider the local wisdom that existed since their ancestors. The experience of the ancestors of *ToKaili* has given signals about earthquake events. Some examples are tectonic earthquakes that led to the formation of Lake *Lindu* in *Sigi*. The subsidence earthquakes include the formation of the location of the earth's centre in *Donggala* so that a lake is formed on the shore and the formation of a lake in *Balesang* district *Donggala*. Several

earthquake events have also occurred with cycles that show recurrence in the short, medium, and long term.

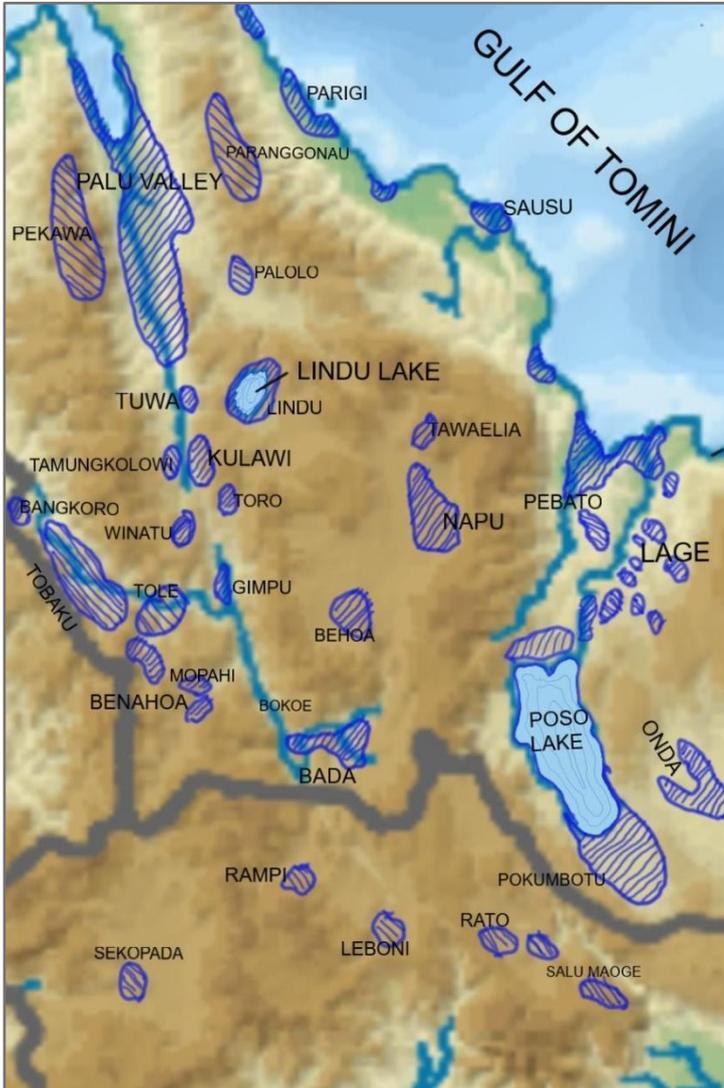


Figure 10. Traditional Settlement in Central Sulawesi as Implementation of Pengataa (modified after Kaudern, 1925).

The experience after experience of the *ToKaili* tribe gave birth to various local wisdom related to how *ToKaili* minimised the impact of the earthquakes they regularly experienced. One of the local wisdoms possessed by *ToKaili* is the wording – *ToKaili* procedure determines the place to live and the conditions for building a house— which at the time of deciding to grant a land-use permit did not consider local wisdom such as naming the location as a hazard marker. The existing land conditions, for example, *Balaroa* was called this way because the land was mushy and was a water catchment area in the past, *Jono Oge* means a place that is soft all year round because it is watery so that it was only used for planting, not function as a settlement and this concept has

been proven to be accurate by 2018 *Nalodo* disaster (Figure 11).

As mentioned before, *ToKaili* does not have a written tradition, so their rules and customs are manifested as oral traditions. Earthquakes that often occur demand the *ToKaili* have various local knowledge in dealing with the impact of the hazards. This traditional knowledge results from generations of trial and error to find the best way to minimise the impact of disasters. However, the current impact of the catastrophe suggests that this local wisdom needs to be given more attention. One of this local wisdom, namely *Pengataa*, can be a basis for planning and reducing the impact of future disasters caused by *Nalodo*. *Pengataa* is a customary rule prohibiting people from using a specific location or area as a settlement.

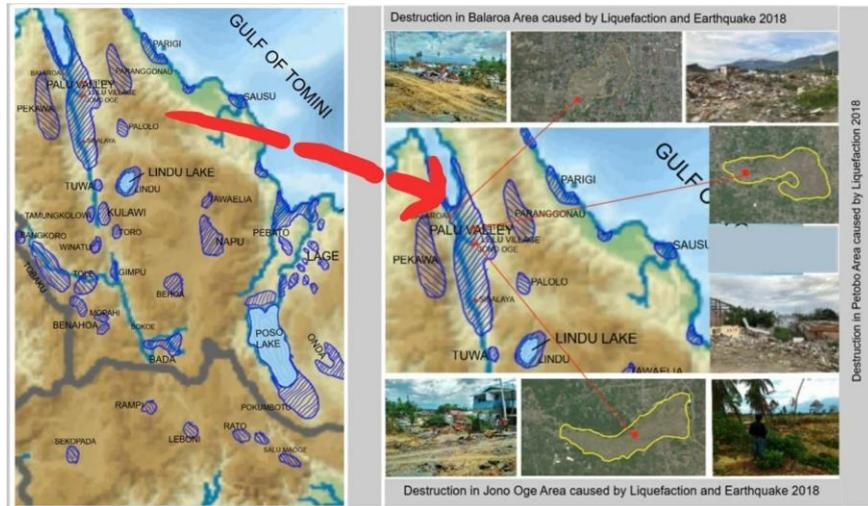


Figure 11. The Settlement Area Which is Destroyed by Landslide, Liquefaction and Earthquake

5. CONCLUSION

The study underlined those initiatives and innovations in *ToKaili* lives produce various kinds of local wisdom that as the basis for customary rules. The customary rules extend towards the philosophy of life, creating a harmonious life manifested in *ToKaili* community in the past. Their customary rules regarding *Pengataa* are focused on maintaining the environmental equilibrium and minimising the impact of disasters, including earthquakes, landslides, liquefaction, and floods. *ToKaili* with his experience has produced wisdom that will enable them to be ready to overcome the earthquake cycle that will occur.

The ever-changing era caused various local wisdom to be seen as irrelevant. Hence, imparted knowledge and signs given by *ToKaili* ancestors is being ignored. As a result, significant damage brings to lives, properties and the environment, such as those that happened in the 2018 *Nalodo* disaster (Figure 8). The *pengataa*—spatial planning concept— offered by *ToKaili* indigenous wisdom is proven to be true when *Nalodo*/great disaster happened on 28 September 2018, where Balaroa, Petobo and Jono Oge areas became the most destroyed area impacted by earthquake and liquefaction. Thus, adaptation of *pengataa* concept into today's spatial planning policy is worth to be considered.

Currently, the development of the era is starting to move from modern to postmodern; it requires reconsideration because at this time in several regions of the world have entered the postmodern era well, this is due to the ability of knowledge and

technology resources that allow, while in other parts of the world, including the postmodern ToKaili modern is still in the stage of vernacular and traditional development towards neo vernacularise and neo-traditionalism and Regionalism which is one part of postmodern development.

Entering neo-vernacularism, neo-traditionalism, and Regionalism needs traditional vernacular. Regionalist concepts, so local wisdom for the local scope is critical to be developed so that it is accepted in the development of the postmodern era (neo vernacular, neo-Traditional, and Regionalism). And of course, with this in mind, it is hoped that the disaster cycle at the Palu Koro earthquake fault can be minimised.

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