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Reconstructing Ownership and Legal Certainty of Land Experiencing Liquefaction to Protect Community Rights

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ABSTRACT

This study aims to examine the impact of liquefaction on land ownership status and the legal reconstruction strategies necessary to ensure certainty and protection of community rights. Liquefaction causes significant physical changes to land, often erasing boundaries and ownership evidence, which complicates legal recognition post-disaster. The study analyzes relevant regulations, particularly Government Regulation Number 18 of 2021, which governs the concept of destroyed land and the elimination of land rights. It also explores the role of the National Land Agency (BPN) in land reconstruction through systematic registration and redistribution processes. Additionally, the research emphasizes the importance of participatory approaches and mapping technologies in overcoming administrative barriers and preventing ownership conflicts. The findings underscore the urgent need for clear policies and procedural innovations to manage land affected by liquefaction. Practical recommendations include strengthening legal frameworks, improving the use of geospatial tools, and ensuring equitable access to land rights for affected communities. The implications of this study are significant for post-disaster recovery, as they offer a legal and policy roadmap to rebuild community trust, reduce legal uncertainty, and support sustainable land governance. These insights can assist governments, legal practitioners, and civil society in designing disaster-responsive land administration systems that uphold justice and social resilience.

INTRODUCTION

Liquefaction is a natural phenomenon that occurs when fine to medium-grained soil, especially water-saturated soil, experiences a decrease in strength and stiffness due to earthquake pressure or other seismic vibrations (Liew et al., 2020). In simple terms, liquefaction can be defined as the process of soil liquefaction, where soil that was originally solid changes into a liquid due to a drastic increase in pore water pressure due to vibrations (Desyana Pratami, 2021). This phenomenon usually occurs in loose sandy soil layers that have a high-water content below the ground surface. As a result of liquefaction, the soil loses its bearing capacity and causes the structures above it to suffer severe damage, such as tilting, sinking, or even collapsing (Amrin, 2022). In various major earthquakes, such as in Palu in 2018, the liquefaction phenomenon showed a devastating impact, causing the land and all the buildings above it to shift and disappear from their original locations.

The primary cause of liquefaction is a fairly strong earthquake with a long duration of vibrations, causing the water pressure in the soil pores to increase, reducing the bonds between soil grains. In addition, loose soil structures, high water saturation levels, and poor soil drainage conditions increase the liquefaction potential. This process begins when seismic waves pass through the soil layer, triggering repeated vibrations that force soil grains to move closer

together, but the water pressure between the grains increases faster than the water can escape from the soil so the soil becomes unstable and loses its shear strength (Dwi Rahayu, 2023). Therefore, areas with certain geological conditions, such as river deltas, coastal areas, and flood plains, are susceptible to liquefaction when a major earthquake occurs.

The impact of liquefaction on the physical condition of the soil is very significant, especially in changing the shape, structure, and existence of natural land boundaries. After liquefaction occurs, the land can shift on a large scale, experience subsidence, or even move several meters from its original position. Land boundaries that are usually marked naturally or using man-made signs as stakes, fences, or boundary plants, become lost, shifted, or can no longer be identified. These changes cause great difficulty in re-determining the location and area of land after a disaster (Fajar, 2024). In many cases, land that previously had clear ownership identification becomes unrecognizable, creating serious legal problems about land ownership and rights and increasing the potential for conflict between affected communities.

One of the main problems that arises after liquefaction occurs is the difficulty in identifying the location of the affected land. The massive displacement of land masses due to the liquefaction process causes land plots to shift from their original positions, and in some cases completely change their original shape and orientation. Land that previously had a fixed geographical location is now unrecognizable because natural boundaries such as small rivers, dirt roads, and land contours that are usually used as natural references are also damaged or shifted (Handrig, 2022). It makes it difficult for landowners, the government, and related institutions to verify the location of previously registered land plots. This difficulty becomes more complex in areas that do not yet have a complete land administration system or systematic land registration.

In addition, the liquefaction phenomenon also results in the loss of physical and administrative evidence of land ownership, which is very important in the land law system in Indonesia. Physical evidence such as land markers, fences, boundary plants, and other natural markers are destroyed or no longer in the correct position. Meanwhile, administrative evidence, such as land certificates can be lost, damaged, or even no longer relevant because the location of the land listed in the certificate does not match the physical conditions in the field (Latifaturrohmah, 2023). In many cases, land certificates or documents only list the location and boundaries based on physical signs that have been lost, causing great confusion for landowners and land agencies in determining the validity of the location and boundaries of ownership.

The loss of this physical and administrative evidence opens up great opportunities for disputes and conflicts over land ownership after liquefaction. Affected communities have the potential to claim the same land, especially in areas that have shifted significantly and lost their previous boundary markers. Conflicts not only occur between individuals, but can involve community groups, companies, or even between the community and the government. The unclear status of land ownership and boundaries may cause social tension, slow the rehabilitation and reconstruction process of affected areas, and create prolonged legal uncertainty.

Within the framework of Indonesian national law, Government Regulation Number 18 of 2021 concerning Management Rights, Land Rights, Apartment Units, and Land Registration provides an important legal basis for regulating land rights that have changed due to disasters,

including liquefaction. PP No. 18 of 2021 is an implementing regulation of Law Number 11 of 2020 concerning Job Creation, especially in the land sector. One of the significant things regulated in this regulation is regarding destroyed land and the elimination of land rights. Based on Article 134 paragraph (1) of PP Number 18 of 2021, it is stated that: "Land rights are lost because the land is destroyed." What is meant by destroyed land as explained in the explanation of article is land whose boundaries due to natural or certain events can no longer be recognized or can no longer be used according to its designation. Liquefaction, which causes the ground to shift and deform massively, clearly falls into this category (Meiske, 2021).

The concept of destroyed land in Indonesian land law emphasizes that if a plot of land experiences a condition where its boundaries and physical location can no longer be identified due to events such as earthquakes, tsunamis, or liquefaction, then the rights to the land are considered to have been lost. This provision is clarified in Article 135 of PP No. 18 of 2021 which reads: "If land rights are lost because the land is destroyed, the loss of said land rights is recorded in the general register at the land office." Thus, in the context of liquefaction, lands that experience significant location changes and whose boundaries can no longer be ascertained will have their rights lost, and the land will return to the state (Pandey, 2020). This is done to maintain legal certainty and order in post-disaster land administration. Landowners whose rights have been lost can apply for new land rights in a suitable location or based on applicable provisions.

In post-liquefaction situations, the National Land Agency (BPN) plays a vital role in registering new land, reconstructing rights, and protecting community ownership. Based on Article 139 of PP No. 18 of 2021, it is stated that to restore land conditions due to natural disasters, "the Central Government and/or Regional Governments carry out systematic land registration." The registration is carried out through the Complete Systematic Land Registration (PTSL) program to re-identify land plots, verify existing rights, and issue new documents by post-disaster field conditions. Besides, the BPN is tasked with re-determining land plots through re-measurement activities, mapping, and identification of entitled legal subjects, while still paying attention to justice for all affected parties. This process can also involve the formation of a joint verification team with the local government and the community to ensure that no party is harmed by the reconstruction of the land administration (Rachmadyta, 2024).

Providing legal certainty to landowners affected by liquefaction is an urgent need to maintain the social and economic stability of the community after a disaster. Legal certainty means ensuring that land ownership rights are recognized, protected, and can be restored fairly, even though the land has changed its physical condition due to liquefaction. Without legal certainty, people will face uncertainty about the existence and status of their land, which can ultimately lead to social tension, disputes between citizens, and the potential for arbitrary loss of land rights. In this context, the state has a constitutional responsibility to be present and ensure that every citizen receives fair legal recognition and protection for their property rights as guaranteed in Article 28H paragraph (4) of the 1945 Constitution (Rahmanda, 2019).

Through a systematic land re-registration policy, land re-arrangement, and issuance of new certificates based on field verification results, the state can provide a sense of security, clarity, and justice to affected communities. In addition, protection of the rights of communities who have the potential to lose their land rights due to liquefaction is becoming increasingly

important to prevent marginalization of vulnerable groups and structural injustice. Land is not only an economic asset, but also an integral part of the social, cultural, and survival identities of the community. Therefore, the loss of land rights is not just a loss of property, but also a loss of the right to live decently. This protection needs to be translated into concrete steps such as prioritizing the granting of new land rights, resolving disputes fairly, and enforcing the principles of proportionality and justice in the redistribution of land that has changed. The state, through legal instruments and land institutions, must ensure that in the process of reconstructing land rights after liquefaction, community rights are not neglected, but are prioritized to be restored and protected to rebuild public trust in the national legal system (Rifqo, 2022).

The strategy for reconstructing land ownership after liquefaction must be carried out through a re-registration or land redistribution mechanism based on the principles of justice and legal certainty. In this context, the state through the National Land Agency (BPN) needs to carry out a complete systematic land registration (PTSL) in areas affected by liquefaction. Re-registration is using technical approaches such as re-surveying land areas, using remote sensing technology, matching historical data, and verification based on community witness statements. In addition, if the land cannot be returned to the original owner due to the loss of the original location, it is necessary new land redistribution policy by prioritizing legal subjects who have rights based on affirmative principles. Challenges that often arise in reconstruction are limited initial data, loss of physical evidence, and community resistance to new restrictions (Suhail, 2023). Therefore, solutions that must be sought include transparency of the re-registration process, active community involvement in data verification, the use of modern technology such as GPS and satellite imagery, and the existence of special regulations that accelerate and facilitate the process of granting new rights in disaster areas.

The importance of research on reconstruction and legal certainty in the context of liquefaction is not only motivated by academic reasons but also practical needs in the field. From an academic perspective, this research contributes to the development of land law, especially in responding to the dynamics of natural changes to civil rights. The research enriches the theory of property rights protection, the principle of social justice, and the effectiveness of land regulations in emergencies. In practice, the research results are expected to provide concrete solutions for the government, BPN, and affected communities in building a fair and implementable land ownership reconstruction system. The study also seeks to strengthen the legal basis so that the state can provide maximum protection for disaster-affected communities, prevent protracted disputes, and ensure that disaster area recovery is fast, orderly, and fair. Thus, this analysis is crucial as part of efforts to build a national land law system that is responsive to disasters.

Previous studies have highlighted the physical and legal impacts of liquefaction (Desyana Pratami, 2021; Fajar, 2024), but most focus on the geotechnical or emergency response aspects, rather than post-disaster legal frameworks. The gap lies in the absence of a structured normative legal analysis on how land rights can be reconstructed, revalidated, or redistributed after liquefaction, especially within the context of Indonesian agrarian law.

This study aims to fill that gap by analyzing the legal implications of liquefaction on land rights and proposing reconstruction strategies through a normative juridical lens. The novelty of this research lies in its synthesis of national land regulations and post-disaster recovery

mechanisms, offering a prescriptive framework for safeguarding community rights. The objective is to examine how current laws address destroyed land and to recommend actionable legal pathways for the government and the National Land Agency (BPN) in re-establishing ownership.

The practical benefits of this study include policy guidance for disaster-prone regions, legal clarity for BPN in implementing land re-registration, and justice restoration for affected communities. In this way, it contributes to building a responsive and equitable land governance system capable of withstanding the realities of natural disasters in Indonesia.

METHOD

This study uses a normative legal research method, namely legal research conducted by examining primary, secondary, and tertiary legal materials to examine legal norms governing the reconstruction of land ownership after liquefaction. The approaches used in this study include a legislative approach and a conceptual approach. The legislative approach is carried out by examining relevant laws and regulations, such as Law Number 5 of 1960 concerning Basic Agrarian Principles, Law Number 11 of 2020 concerning Job Creation, and Government Regulation Number 18 of 2021 concerning Management Rights, Land Rights, Apartment Units, and Land Registration. Meanwhile, the conceptual approach is used to understand the legal concept of destroyed land, the elimination of land rights, and the principles of legal certainty and protection of land rights in the Indonesian legal system.

The data sources in this study consist of secondary data, namely primary legal materials in the form of laws and regulations, secondary legal materials in the form of literature or legal doctrine, and tertiary legal materials such as legal dictionaries and encyclopedias. The data collection technique is conducted by library research to identify and review relevant legal materials. To enrich the analysis, primary data in the form of interviews with legal practitioners or land officials are used as a complement. The data analysis technique uses the analytical descriptive method, namely analyzing legal materials collected systematically, and then interpreting and drawing legal conclusions based on applicable principles and principles to provide solutions to the legal problems studied.

RESULT AND DISCUSSION

Legal Regulations Regarding Land Experiencing Liquefaction in the Indonesian Land Law System

Liquefaction is a geological phenomenon that occurs when granular soil, such as sand or sandy soil, loses its supporting strength due to external shocks or pressures, such as earthquakes, which cause the soil to act like a liquid. In the context of land, liquefaction has a major impact on physical changes in land, including shifting land boundaries, changing landforms, and the potential loss of stability of land previously used for agriculture or settlement. Land that experiences liquefaction not only shifts and deforms, but in some cases, the land can sink or become unusable for any purpose, leading to the loss of land ownership status or land rights. The impact on the land system is significant, because land affected by liquefaction often loses its identifiable physical boundaries, making it difficult to map and verify administratively. It may cause complications in recognizing land rights and trigger land

disputes because there is no longer physical evidence or boundary markers that can be used as a reference in determining land ownership claims (Abidin, 2005).

Regarding land experiencing liquefaction, the relevant legal basis in Indonesia lies in several laws and regulations governing land management and ownership, as well as procedures for land recovery or reconstruction after a natural disaster. One of the main foundations in Indonesian land law is the Basic Agrarian Law (UUPA) No. 5 of 1960, which regulates various matters related to land rights. Although UUPA does not explicitly regulate land affected by natural disasters such as liquefaction, the basic principles regarding land rights and the state's obligation to regulate land control remain relevant. Article 1 of UUPA stipulates that "Land is the surface of the earth and the objects contained therein, which belong to the state and are regulated by the state for the benefit of the people." In the event of drastic changes to the land caused by natural phenomena such as liquefaction, the state can ensure that the land can still be managed fairly, such as by eliminating land rights that can no longer be used or maintained (Adam, 2020).

Apart from that, Government Regulation Number 18 of 2021 concerning Management Rights, Land Rights, Apartment Units, and Land Registration is a regulation that regulates in more detail the management of land affected by disasters, including land that has experienced liquefaction. Article 134 paragraph (1) of PP No. 18 of 2021 states, "Land rights are lost because the land is destroyed." It refers to land that has lost its physical boundaries, has shifted, or whose existence can no longer be ascertained due to natural events that drastically change its physical condition. The concept of destroyed land is important in post-disaster land, where land that cannot be recognized or reused will have its rights revoked, and the land will return to the state (Azis, 2019).

When land is declared destroyed, Article 135 of PP No. 18 of 2021 stipulates that "If land rights are lost because the land is destroyed, the deletion of said land rights is recorded in the general register at the land office." This registration is an important administrative step to ensure that land that has lost its existence is no longer treated as legal land, and thus prevents unclear ownership claims. It also protects parties who may be affected by changes in land boundaries caused by liquefaction and provides legal certainty for affected parties in undergoing the reconstruction process. (Jaya, 2017). Furthermore, the National Land Agency (BPN) has the authority to manage and regulate post-disaster land, under Article 139 of PP No. 18 of 2021, which states that "The Central Government and/or Regional Governments carry out systematic land registration." This systematic land registration is critical in post-liquefaction reconstruction, to ensure that all affected land areas can be remapped, verified, and identified as legal subjects. The Complete Systematic Land Registration Program (PTSL) is expected to be an effective instrument in helping communities regain land rights or obtain new rights that are by existing conditions (Khasanah, 2021).

In addition, if the land affected by liquefaction cannot be returned or restored in the same way as before, the state can redistribute the land. This regulation includes granting new rights to land for residents affected by the disaster, taking into account aspects of justice and public interest. Article 140 of PP No. 18 of 2021 states, "If the destroyed land cannot be returned to the previous owner, the government can redistribute the land." It provides space for affected communities to obtain replacement land so that they can continue their lives while still having access to natural resources that are vital to their welfare (Lestari, 2021).

In the Indonesian land law system, the status of land affected by liquefaction is regulated through legal principles that refer to provisions regarding destroyed land. Land affected by liquefaction can be considered destroyed if the event causes significant physical changes so that the land can no longer be identified or utilized as before. It is by the provisions in Government Regulation Number 18 of 2021 which stipulates that destroyed land will result in the termination of rights to the land, and the rights to the land will return to the state (Article 134). Land destruction in this context refers to the loss of boundaries of land affected by liquefaction, either due to shifting, sedimentation, or other severe damage that makes the land untenable or unrecognizable. However, if the land is still recognizable despite experiencing physical changes, then the land may not be considered destroyed but only has undergone changes that require reconstruction of its status (Ratode, 2021)

The administrative procedures applied to land affected by natural disasters, including liquefaction, are regulated to provide legal certainty regarding the status and rights of the affected land. After a disaster, land that has undergone physical changes or has been destroyed must go through a verification and remapping process by the National Land Agency (BPN) to ensure that the recorded land data remains accurate. This involves steps such as field surveys, verification of proof of ownership, and re-registration of changes in land boundaries. In the case of land that is destroyed or can no longer be recognized, this administrative procedure will lead to the recording of the elimination of rights to the land in the land register managed by the BPN, following the provisions of Article 135 of PP No. 18 of 2021. This aims to avoid disputes over land ownership claims whose status is unclear after a natural disaster (Taqwaddin, 2012).

The National Land Agency (BPN) has an essential role in post-liquefaction land management, especially in re-registering and verifying the ownership status of affected land. The main task of BPN in this context is to reconstruct land data, which includes re-registering land affected by the disaster to ensure that all land rights in the area are properly recorded and by the conditions that exist after the disaster. The reconstruction process involves modern technology such as satellite imagery, mapping using GPS, and field documentation involving the community and landowners to provide the necessary information related to changes that occur due to liquefaction. BPN also functions to provide administrative instructions regarding the status of land that has been destroyed or changed and to ensure that this procedure is carried out transparently and by applicable legal provisions (Tarigan, 2015).

As part of its duties, BPN also runs the Complete Systematic Land Registration (PTSL) program, which is a step to register land comprehensively throughout Indonesia, including land affected by natural disasters such as liquefaction. In this context, land that has experienced shifting or physical damage due to liquefaction will go through a re-registration process that includes field inspections and verification of accurate land data. These steps to restore land ownership status also include making new certificates or renewing old certificates based on data verification and reconstruction carried out by the BPN. This procedure is carried out to ensure that legitimate landowners can re-access their rights to the land or receive new rights that are adjusted to post-disaster conditions. This systematic land registration also aims to prevent potential land disputes that could arise due to the unclear status of land affected by liquefaction, as well as to provide a sense of security for affected communities. Thus, the BPN plays a crucial role in providing legal certainty for the community and implementing existing legal instruments to address land problems after natural disasters.

Legal Consequences Arising from Land Rights Affected by Liquefaction Based on Applicable Legislation

In Indonesian land law, destroyed land refers to a condition in which land can no longer be recognized or used as it should because it has undergone very significant physical changes, such as those caused by natural disasters, including the phenomenon of liquefaction. The liquefaction process can cause land that was previously stable and used for various purposes, such as agriculture or settlements, to become unstable, lose its boundaries, or even sink. According to Government Regulation No. 18 of 2021 concerning Management Rights, Land Rights, Apartment Units, and Land Registration, Article 134 paragraph (1) stipulates that if the land is destroyed, the rights to the land will be revoked, and the land will return to the state. This regulation provides a legal basis that land that can no longer be maintained or recognized after a natural disaster can no longer be an object of property rights, either individual property rights or other rights such as lease rights or use rights so that no owner can claim the land as his property.

The consequence of the elimination of rights to destroyed land is the return of the status of the land to the state to be managed again by applicable policies. Land that is destroyed and loses its physical existence will be managed by the National Land Agency (BPN) to ensure that the land rights are removed from the registered land register and no further claims can be made on the land. This aims to prevent land ownership disputes that may arise due to the unclear status of land that has undergone drastic physical changes. In addition, this regulation opens up the possibility for the government to redistribute or grant new land rights to those affected by the disaster to restore social and economic stability in the area. This legal process is an important step in post-disaster land recovery, by ensuring that land rights remain guaranteed and are managed fairly by applicable land law principles.

When land affected by liquefaction is considered destroyed, the legal consequence that arises is the elimination of land rights previously owned by certain parties. This is due to drastic physical changes that make the land no longer recognizable, usable, or maintained in its original form. Government Regulation Number 18 of 2021 stipulates that in the case of land that is destroyed, the rights to the land are removed and the land returns to the state (Article 134 paragraph 1). This process ensures that no party can claim ownership of land that has lost its physical boundaries or has changed significantly due to liquefaction. Therefore, the state through the National Land Agency (BPN) will take steps to ensure that the rights to this destroyed land are legally removed from the land records.

The administrative procedure applied to remove rights to land that has been destroyed due to liquefaction begins with field verification by the National Land Agency (BPN) and other related agencies. At this stage, the BPN team will conduct a direct review of the location to determine whether the land has really been destroyed or has only experienced temporary physical changes that can still be restored. If the land is proven to be destroyed, the BPN will record the removal of land rights from the land list recorded in the land system. This is regulated in Article 135 of PP No. 18 of 2021, which states that destroyed land will be removed from the land register and will no longer be considered an object of property rights. After this process is complete, the status of the land will be returned to the state, which can then manage or allocate the land by applicable policies, including the possibility of land redistribution for those affected

by the disaster. This administrative procedure is important to provide legal certainty, avoid land disputes, and ensure that destroyed land can be managed fairly after a disaster.

Land that is affected by liquefaction and considered destroyed, following the provisions of applicable land law, can no longer be transferred or given to other parties as property rights because the status of the land has returned to being owned by the state. When land experiences liquefaction with physical changes that cannot be restored or recognized, the rights to the land will be considered lost and removed from the list of property rights or other rights. It is because the land can no longer be used or utilized for any purpose. However, if the land is not destroyed, but only experiences damage or temporary physical changes that can still be restored, then the process of transferring rights is still possible. In this case, land affected by liquefaction can be transferred through redistribution or granting new rights to affected communities, to restore social and economic balance, and provide opportunities for the recovery of the lives of communities affected by the disaster.

The process of transferring rights to land affected by liquefaction through land redistribution or granting new rights to affected communities is a step taken by the state to address the losses experienced by the original landowners. Based on existing land policies, the government can redistribute land as an effort for post-disaster recovery, by granting new land rights to residents who lost land due to the disaster. This redistribution process can be carried out through a mechanism for granting land rights taken from state land, unused land, or land that has been declared destroyed and returned to the state. Government Regulation Number 18 of 2021 regulates redistribution and granting new rights to affected communities, with the aim of returning land ownership to those entitled after a natural disaster, including liquefaction, so as to create social balance and ensure that community rights are protected.

After a liquefaction disaster that causes damage to land and loss of physical boundaries of land, renewal of land ownership status must be carried out through a re-registration or reconstruction procedure of land status by the National Land Agency (BPN). In this case, BPN will start with field verification to ensure that the land affected by the disaster has been recorded correctly, both in terms of ownership status and the physical condition of the land. BPN will also carry out systematic land registration as part of the post-disaster recovery process, where all land affected by liquefaction and experiencing physical changes will be re-registered to ensure that land rights are recorded. This systematic land registration is carried out to avoid unclear land status that can lead to disputes or overlapping rights. In this process, parties affected by the disaster, such as land owners who previously lost their rights due to liquefaction, will be allowed to obtain new land rights or make claims on land whose boundaries have been reconstructed by BPN. This process aims to provide legal certainty and ensure that land status is properly recorded in the Indonesian land system.

Land regulations in Indonesia serve to provide legal certainty for landowners affected by natural disasters, including liquefaction, through clear and structured legal procedures. One of the main steps taken is land registration and verification of ownership status after a disaster occurs. Based on Government Regulation Number 18 of 2021, land affected by natural disasters, such as liquefaction, must go through a field verification process carried out by the National Land Agency (BPN) to ensure legal ownership status. After a disaster, if the land is declared destroyed or unrecognizable, ownership rights to the land will be revoked and the land will return to the state. However, if the land can be restored, a re-registration or reconstruction

of rights process can be carried out to ensure that the rightful owner remains protected. It supplies legal certainty that land owned by residents remains registered and their rights will be recognized by the state.

It is important to protect the rights of people who lose land due to natural disasters, especially in situations such as liquefaction. The state through the National Land Agency (BPN) and related policies, such as land redistribution, is responsible for providing replacement land or new rights to people who lose their land. Through Government Regulation Number 18 of 2021, the state can allocate state land or unused land for redistribution to those affected. In addition, the rights of people who have lost land can be restored by providing management rights to new land or even full ownership rights if they meet legal requirements. This process aims to ensure that people do not lose their basic rights to land due to natural disasters that occur suddenly and cannot be predicted.

After a liquefaction disaster, land ownership disputes are very likely to occur due to the unclear status of land affected by the disaster. Land that has undergone significant physical changes, such as the loss of physical boundaries or sinking, can cause confusion between the old owner and other parties who may claim the land. Some factors that can exacerbate disputes are the loss of documents administrative, such as land certificates or boundary markers that serve as legal proof of ownership. In this case, landowners affected by the disaster have the right to file a claim through a legal process involving the land court or BPN. Landowners can use existing evidence, such as statements or witnesses that can support their claim to the affected land. This process aims to provide a fair settlement for all parties involved and ensure that no party is harmed due to the loss of legal land rights.

The state's responsibility in handling land issues after natural disasters, such as liquefaction, is very important for the social and economic recovery of affected communities. The state, through clear policies and supporting regulations, must ensure that land lost or destroyed by natural disasters does not become a source of conflict or dispute in the community. The state must also regulate the process of land redistribution or granting new rights to those who have lost land. This process involves policies supported by the BPN and the Ministry of ATR/BPN to verify, measure, and re-register land. In addition, the state must ensure that the existing land system can accommodate the needs of affected communities by granting new rights or restoring lost rights. Government regulations and policies in this regard, as stipulated in Government Regulation No. 18 of 2021, are very important in ensuring justice and protection of land rights to restore social and economic stability post-disaster.

Post-Liquefaction Land Ownership Reconstruction Strategy to Ensure Legal Certainty and Protection of Community Rights

The main objective of land ownership reconstruction after a liquefaction disaster is to restore the rights of communities affected by the disaster. Land affected by liquefaction often experiences significant physical changes, so boundaries are lost and ownership status becomes unclear. This reconstruction aims to ensure that legitimate landowners can obtain legal certainty over their rights, either by re-registering the affected land or through land redistribution from other sources, such as state land. Without a systematic reconstruction process, communities that lose their land can be marginalized, and their rights can easily be ignored or not recognized by other parties who may claim the land. In addition, land ownership reconstruction also aims to create socio-economic balance after a disaster, by ensuring that

affected communities receive replacement land or equivalent rights to support their economic recovery. The success of this reconstruction is crucial for restoring social structures and improving the welfare of communities affected by the disaster.

In addition, land ownership reconstruction also plays a crucial role in preventing land disputes after natural disasters, especially those related to the loss of land boundaries or ownership documents. Without obvious reconstruction efforts, the confusion can open up a gap for land conflicts between individuals or groups who feel they have rights to the same land. The loss of boundary markers, land certificates, or other physical evidence that shows ownership status can lead to multiple claims to the same land, which in turn has the potential to cause social or legal tensions. Therefore, a proper and organized reconstruction process is necessary to address this problem and ensure that land rights are recognized and respected by all parties involved.

The mechanism for reconstructing land ownership after liquefaction involves a series of technical steps that must be followed by the National Land Agency (BPN) and related agencies to restore the status of the affected land. The first step in this reconstruction is land re-registration or verification of the status of land affected by liquefaction. This verification is carried out to ensure that the affected land can still be used or has undergone changes that make it unusable. If the land can still be used and has economic value, the BPN will continue the registration process to ensure that the land rights are recorded in the Indonesian land system. In this case, the procedure applied is systematic land registration, which aims to identify affected land, ensure legal ownership status, and restore physical boundaries of land that may have been lost due to the disaster.

As part of this process, the BPN can also re-mark land boundaries or re-verify lost ownership documents. If proof of land ownership, such as certificates, boundary markers, or other administrative documents, is lost due to liquefaction, the BPN will try to collect other valid evidence, such as witnesses who can provide information regarding the status of the land before the disaster. This step is significant to ensure that land rights are respected and returned to the rightful owners. In addition, if the affected land cannot be restored or the land has been declared destroyed, the BPN can redistribute land as part of the land recovery policy. This redistribution is one solution to restore the rights of people who have lost land, by delivering replacement land from other sources, such as unused or reclaimed state's land.

In addition to re-registration and verification of land status, land redistribution is an important mechanism in the reconstruction process after natural disasters, including liquefaction. Land redistribution refers to the government's policy of providing new land to residents who have lost land due to disasters. The government through the BPN, will redistribute land based on the principles of social justice and restoration of community rights. This redistribution is regulated in existing laws and regulations, including Government Regulation Number 18 of 2021, which allows the government to provide land rights to residents affected by disasters, whose land has been destroyed or is no longer recognizable. The redistribution process aims to avoid social inequality that may occur after a disaster by providing equal rights for those affected.

The provision of replacement land also aims to reduce the potential for disputes and improve economic welfare for communities that have lost their main resource, namely land. In this case, land redistribution not only serves to improve the physical condition of the land, but

also to ensure that communities that have lost their land receive new rights that can be used for agriculture, settlements, or other purposes. This redistribution mechanism is expected to increase public trust in the land law system and provide legal certainty regarding their land rights. With redistribution, communities affected by the disaster will feel safer and have a strong legal basis for the land they manage, thus supporting overall social and economic recovery.

The National Land Agency (BPN) plays a central role in reconstructing land ownership after the liquefaction disaster. As an institution responsible for managing land administration in Indonesia, BPN conducted various important functions in verifying and re-measuring land affected by the disaster. The process aims to ensure that the status of land ownership that is lost or changed due to liquefaction can be restored through legal procedures. This verification involves re-identifying land boundaries, collecting evidence of ownership, and re-arranging land administration data that may have been damaged or lost during the disaster. One of the steps taken is re-registering land, which is carried out through a systematic land registration system that ensures that all land affected by the disaster is registered correctly and accurately. In addition, the BPN is also tasked with resolving land disputes that may arise due to confusion regarding the status of the affected land, thereby maintaining legal and social stability in the community.

In addition to the land verification and registration process, the BPN also plays a role in recovering land documents, such as certificates that may have been lost or damaged due to the disaster. To support the systematic post-disaster land registration process, the BPN utilizes digital data and geospatial mapping systems to re-map affected areas and ensure that land boundaries can be identified more accurately. This technology is useful in ensuring that land re-measurement can be carried out efficiently and that the data obtained is more transparent and accurate. The use of mapping technology also helps reduce the potential for disputes arising from incorrect identification of land boundaries, as well as speeding up the reconstruction process of affected land. Overall, the BPN serves as the vanguard in restoring land rights for communities affected by natural disasters, while ensuring that the process is carried out by appropriate legal provisions.

The process of reconstructing land ownership after liquefaction faces several complex challenges. One of the biggest challenges is incomplete administrative data caused by damage or loss of land documents due to the disaster. Many landowners have lost certificates, markers, or even other physical evidence that identifies their land. In addition, physical damage to the land caused by liquefaction can also cause permanent changes to the shape of the land, making it difficult to determine the exact boundaries of the land. This condition exacerbates the uncertainty about who has the right to the land, given the loss of legal proof of ownership. Other challenges are related to socio-economic issues, where many communities affected by the disaster cannot meet the administrative costs of re-registering land or do not even understand the procedures that must be followed to restore their rights to land.

To overcome these challenges, one solution that can be implemented is more effective data collection through information technology and geospatial mapping that can facilitate the identification of land boundaries and minimize errors in reconstruction. In addition, a participatory approach involving local communities in the reconstruction process is essential to ensure that the data obtained truly reflects the conditions that existed before the disaster.

Communities can play an active role in providing information related to the condition of their land, which can be valid evidence to speed up the verification process. Modern technology such as satellite-based mapping systems or mobile applications can also help remap lost land boundaries, speed up the land registration process and reduce the potential for post-disaster land disputes.

To protect the rights of landowners affected by liquefaction, the government has developed various legal mechanisms that provide certainty over post-disaster land ownership rights. One of the steps taken is to provide convenience for people who have lost land or related documents to apply for new land rights through a land redistribution process. When their land cannot be restored or is declared destroyed, people can be given compensation or new land rights as part of the land recovery policy. It aims to ensure that land rights that have been lost or disrupted due to a disaster are still respected and returned to their rightful owners. The legal protection also includes resolving disputes that arise due to confusion over land status, which can be resolved through transparent legal procedures and existing regulations.

In dealing with land disputes that may arise after a disaster, landowners have the right to file a lawsuit or dispute resolution with the court or relevant institutions. This dispute resolution process is vital to ensure that the rights of landowners are not neglected and that no party takes advantage of the situation to take advantage of the uncertainty of land status. The government through the BPN and related agencies plays an active role in mediating or negotiating to find a fair solution for the disputing parties. In addition, the available legal mechanisms can also provide compensation guarantees for communities whose land is declared destroyed and unrestored. With this legal protection, communities affected by disasters will feel safer and receive justice in obtaining their land rights and ensuring faster and more effective socio-economic recovery.

In dealing with the damage caused by the liquefaction phenomenon, the government needs to formulate a comprehensive policy strategy for restoring land rights affected by disasters. One policy that can be implemented is land redistribution, where lost or destroyed land can be replaced with new land for affected communities, on condition that the redistribution process is conducted under the principles of social justice and transparency. This policy can also include granting new rights to those whose land cannot be restored or lost due to liquefaction. It is important to ensure that community rights remain protected, even though previously owned land has undergone significant physical changes or has even been destroyed. Government policies should focus on social justice, namely giving back land rights to affected communities according to their needs, as well as seeking legal certainty to reduce the potential for land disputes in the future. In addition, land rights restoration policies must ensure that disaster-affected communities obtain land and sustainable socio-economic welfare, which can reduce their burden after the disaster and increase their resilience in facing future challenges.

Technology plays an important role in accelerating and improving the accuracy of post-liquefaction land reconstruction. One of the most crucial technologies in this regard is the geospatial information system (GIS) and digital mapping which allows for efficient and accurate monitoring, mapping, and verification of land status. The GIS can accelerate the re-registration and verification of disaster-affected land, by utilizing spatial data to determine the boundaries of land affected by liquefaction. In addition, satellite-based mapping technology allows for faster and more accurate identification of physical changes in the land and can

provide a clearer picture of changes in land topography caused by the disaster. By using this technology, the National Land Agency (BPN) can carry out land verification and reconstruction more transparently and measurably, which ultimately minimizes the potential for errors in the reconstruction process and reduces land disputes.

Besides, the new technological innovations are also important to increase transparency and accountability in the entire land reconstruction process. For example, a digital platform or mobile application that allows the public to access information related to their land status, make reports, and check reconstruction procedures directly. This not only increases efficiency but also strengthens community participation in the land recovery process. The use of technology in land reconstruction not only focuses on administrative accuracy but also provides space for the community to be more involved in decision-making regarding their land rights. Technology thus has great potential to support social justice and legal certainty in post-disaster land recovery while minimizing the potential for administrative errors that can harm communities.

CONCLUSION

In dealing with the impact of liquefaction on land, it is critical to understand that this phenomenon not only causes physical changes to the land but also poses major challenges in land ownership and management. Liquefaction can cause land to be destroyed or lose clear physical boundaries, thus disrupting the legal status of land ownership. Therefore, the Indonesian government, through the National Land Agency (BPN) has a critical role in ensuring legal certainty and protecting community rights. Policies based on social justice, such as land redistribution or granting new rights, as well as sophisticated technology in land registration and verification, are crucial in post-disaster land reconstruction. In addition, the restoration of land rights must pay attention to the socio-economic welfare aspects of the affected community, by ensuring that the community not only regains land rights but can also rebuild their lives after the disaster. From the results of this discussion, it is recommended that the government further strengthen the implementation of geospatial technology and land data digitization to facilitate post-disaster land reconstruction and re-registration. The more sophisticated technology, such as satellite-based mapping systems, can accelerate the verification of affected land and ensure the accuracy of re-registration. In addition, a more participatory approach is needed by involving communities in the land reconstruction process, to ensure that the data obtained is the reality on the ground and can minimize land disputes. The government must also accelerate land redistribution for communities who have lost their land rights, and ensure that there is a fair compensation mechanism for those whose land cannot be restored. These policies must be implemented with the principle of social justice, paying more attention to fulfilling the rights of disaster-affected communities to promote comprehensive and sustainable recovery.

In conclusion, the liquefaction disaster has caused severe legal and physical disruptions to land ownership in Indonesia, especially through the destruction or displacement of land boundaries, which undermines legal certainty for affected communities. Therefore, the government, through the National Land Agency (BPN), must ensure the reconstruction of land rights with an emphasis on justice, transparency, and legal protection. This includes conducting systematic land re-registration (PTSL), prioritizing land redistribution, utilizing geospatial technology, and involving communities in the verification process to avoid disputes and marginalization. Moving forward, it is recommended that the government establish a special

legal framework for disaster-affected land, provide accessible legal aid services in affected areas, and develop an integrated land information system to ensure faster and more accurate recovery. These steps are vital not only to restore property rights but also to rebuild community trust in the legal system, ensure socio-economic resilience, and prevent the prolonged legal vacuum in post-disaster recovery.

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