Restoration of Land Parcels using Land Consolidation & Readjustment: A Case of Resilience after Flood Disaster

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ABSTRACT

Millions of people are affected from natural disaster leading to loss of land tenure around the world. People affected from the disaster leading to loss of land tenure are often excluded from post disaster assistance. The parcel boundary may change or obliterated because of disaster or also from some infrastructure development. Re-establishing of the cadastral boundary is very crucial and challenging task to re-establish the tenure rights and other cadastral details. This paper focuses on the restoration of land parcels after flood. Paper highlights the impact of flood in parcel boundary and proposes a concept for restoration of those obliterated parcels of Melamchi bazar, Sindupalchok, Nepal which was affected from the flash flood on 15th June 2021. The model for restoration of land parcel using the concept of land consolidation and re-adjustment has been recommended focusing on land pooling, creating a regular shape of the parcel. This paper also evaluates the current legal provisions for restoration of land parcels after land use change due to flood.

1. BACKGROUND

Millions of people are affected from natural disaster around the world. According to Internal Displacement Monitoring Centre, 32.4 million people were displaced due to natural disaster according in the year 2012 only (Yonetani, 2013). The affect is seen more in South Asia. Among different disasters, flood bounces multiple effects like; people are prevented from access to land because of extended flooding period, damage to buildings, infrastructures, crops which impact on the livelihood of the people (Mitchell, 2011). Effect of natural disaster lead to displacement of human settlement including arable land leading to loss of land tenure. Thus, without the legal proof of land rights, people are often excluded from post disaster assistance and other services.

Disaster recovery activities in different region to restore land tenure shows that land is foundation to build disaster resilience where disaster hit-people can get back in their feet rebuilding the house and the livelihood (Ochong, 2019). Most of the relief activities focus on the group or community with documentation of land ownerships and ignore those who lack documentation (Caron, *et.al*, 2014). Post disaster assessment shows that land tenure insecurity, weak formal land administration system, outdated land records increases the difficulty in restoring land or other

property (Caron, 2009). The study of Shrestha *et al*. (2016) also highlighted about the weak land governance that can effects the informal settlements in post disaster. The different case study was mentioned in which informal settlements being excluded from various post disaster intervention related to reconstruction. Not only in the case of disaster recovery, this issue also effects in infrastructure development as well. Permanent inundation of land due to sea level rise is legally referred as obliterated land in Indonesia which creates uncertainty or loss of the former land ownership of the people and hence creating disputes during land acquisition for road construction (Pinuji, *et. al.,* 2023).

Disaster response as well as recovery require information about land tenure which are not up to date in most of the cases and as a result of this, vulnerable groups are often passed over by the government during risk management activities (Unger, *et al.,* 2019). Land information tells in detail about what, who, where, how much, and other key attributes of a property, the information without which, is almost impossible for cities and communities to develop proper disaster response (Wellenstein & Torhonen, 2018). At present there exists no dedicated tool for supporting land tenure recordation of all people-to-land relationships for the purposes of disaster risk management (Unger, *et. al*., 2019). Despite of this shortcoming, delineation of the cadastral boundary to identify the land right is basic and crucial step towards restoration of the cadastral data in affected area. According to the Pinheiro Principles, displaced people have the right to return to their lands when the emergency response is completed and each person should have rights to land that are at least as good as the situation prior to the disaster (Mitchell, 2011).

Community led participatory mapping was conducted in Aceh, Indonesia after 2004 Tsunami to reestablish cadastral boundary where neighbors' boundary is identified on the reference of other neighborhood which are then after digitization, shared to the communities, reviewed by each community and finally formalized by national land agency (Caron, *et. al.*, 2014). UN-HABITAT (2007) also recognized the community-based approach to re-establish tenure security, said that the government organizations should be sufficiently capable of replacing records through provisional certificates with reference to other records such as land tax payments and electricity bills on the basis of strong legal background. Mitchell (2011) consider cadastral maps as the basis for restitution of cadastral boundary through adjudication and verification process.

Correction of each land boundary was proposed so that there is no discrepancy in land record at the registry office and the ground situation (Sekine & Nanjo, 2012). The paper recognized two different methods for cadastral map correction. One is the block correction where several locations have irregular movement in a block. In this method block points are surveyed and each boundary point in a block are corrected as Helmert conversion. Another method is the cadastral map regeneration where every boundary has moved irregularly. In both of the method regeneration of cadastral map is done rather than readjustment. Cities like Osaka and Edo were rehabilitated after war and fire by expanding roads accompanied by changes in land ownership (Yanase, 2018) which is in line with the concept of readjustment. Marije, *et. al.*, (2022) also recognized land consolidation as a land management instrument used for management of agricultural development based on the formation of regular shape parcels which lead to the concept of readjustment. Land consolidation was conducted in the Netherlands to protect the community from river flood problem where total number of parcels were reduced from 2415 to 718 (Hoeksema, 2006). Charoenkalunyuta (2011) conducted the study on elements on resilient from land tenure perspective after flood in the case of Nepal and concluded that land consolidation is not feasible since land came under the river permanently. Hence, land

readjustment method can be an alternate solution. This is the process of reorganization, rearrangement and readjustment of land parcels rather than just a consolidation process of titles (De Souza, 2018b)

According to FIG, one of land policy instrument consider spatial developments in a coherent and comprehensive approach, integrating various sectorial policy domains is called Land consolidation. Land consolidation plan focus on the new layout of land parcels, related land rights and the right holders. it is a planned readjustment and rearrangement of fragmented land parcels and their ownership.

Land consolidation is often carried out in rural areas with fragmented land holdings, where small land parcels are difficult to manage and inefficient for agricultural production. The process can also help to reduce land degradation, improve the environment, and enhance biodiversity by promoting sustainable land use practices. It consists of a range of activities, including the physical realignment of land parcels, the creation of access roads and other infrastructure, the improvement of soil fertility and water management, the establishment of new property rights, and the provision of support services to farmers

Land readjustment is basically used to redefine the parcel boundary where existing or former land boundary has some issues and the restoration of parcel with improved tenure security (Hong & Brain, 2012). This is cheaper than gathering all required land by purchasing or by expropriation for land development (Yomralioglu, *et.al.,* 2018) This also gives out the urban development pattern as per desire, increase land value, distribute the value to the involved ones and also limits displacement (Hong & Brain, 2012). Land ownership is altered but not expropriated and public infrastructure, road access is developed in land readjustment (Linke, 2018). In land readjustment case of India, 40% of land was used for road network and public infrastructure and remaining 60% is allocated for land owners where no any land owners are deprived from a piece of land (Manohar, *et. al*., 2018). The concept in Japan started centuries back with the objective to reorganize agricultural land and develop transport facility and irrigation channel to improve productivity (Matsui, n.d.). Later on, land readjustment is considered for controlling urban sprawl, development of new town, urban rehabilitation, development of urban infrastructure and disaster reconstruction (Hosono, 2018). This is also considered as the public-private partnership where government and public bear cost and benefit by replotting the land to change location, size and format of land (De Souza, 2018).

Land readjustment in Angola was implemented after civil war reduced land conflicts where informal settlements were also incorporated in formal urban plan (Cain, *et. al*., 2018). In Bhutan, this concept was implemented for urban development with taking in consideration of: preserving interest of original land owners, incentive based urban management, participatory, environment protection and conservation of cultural heritage (Wangmo, 2018). In case of Nepal and Sweden, with the concept of land pooling, individual plots are combined into one single estate, road layout is planned, then after the estate is subdivided rationally with contribution from land owners for open space, road and finally including the facility of drinking water pipes, drainage system and electricity (Joshi & Shrestha, 2018, Osterber, 2018).

Land consolidation and readjustment (LCA) is a process that involves the rearrangement of land parcels to create larger, more efficient land holdings that are better suited to modern agricultural practices. The primary goal of LCA is to increase the productivity and profitability of agricultural land by reducing fragmentation and improving the quality of the land.

However, literature shows that most of the development activities in land readjustment is focused on urban development. This paper basically focused on the land consolidation and readjustment for effective parcel restoration after natural disaster.

2. STUDY AREA

Sindhupalchowk district is a part of Bagmati Province and one of the seventy-seven districts of Nepal, with an area of 2,542 km^2. There are 3 municipalities and 9 rural municipalities in this district. Among 12 local levels Melamchi is a municipality having total area of 160.63 km^2. The study area selected in Melemchi Bazar, the periphery of Melachi and Indrawati River damaged by the flood in 14 June 2021.

Flash flood hit this region which resulted in erosion and debris sedimentation. Damage of the arable land of this area due to sedimentation made the land unusable. More than 16m of sediment was accumulated in the Melamchi Bazar (WB & GFDRR, 2022). It also seems that the land cannot be rehabilitated and hence the damage looks like permanent leading to loss of land within the land holdings.

Melamchi flood is not from the single cause but a set of different process including heavy rain, snowmelt, glacial deposit erosion, old and new landslide triggered by earthquake to some extent, river bank erosion, debris deposition and inundation and with combination of all these factors, scale of damage was amplified (Maharjan, *et. al.,* 2021). Huge area of agricultural land, human settlement and their livelihoods, infrastructures like bridges, roads, hydropower, and electric poles were damaged. Numbers of people were dead along with 337 houses fully damaged and 525 families displaced (Maharjan, *et. al.,* 2021). Implementation of land readjustment adhering to the land use policy will help in successful and sustainable implementation of the concept (Viitanen, 2018).

Figure 1: Map of study area

Figure 2: Melamchi bazar before and after flood: (Source: WB & GFDRR, 2022)

The Melamchi river course before flood and cadastral parcels can be shown with following figure.

Figure 3: Pre-flood river course and the cadastral plots.

3. MATERIAL AND METHODS

3.1. Data source

Satellite images and the cadastral data of the study area are the primary data for the study. Freely available google image is used for analyzing pre and post flood scenario. Cadastral maps were collected from the survey office.

3.2. Data processing and information generation

Parcel information were generated by digitizing the paper maps collected from the survey office. Cadastral data and satellite images were overlaid for identification of flood damaged area. The legal provision for parcel boundary restoration study and development of new modality for restoration of the parcel boundary was carried out. The cadastral parcel layer and post flood image were overlaid to identify the number of parcels and area damaged by the flood. The restoration plan is based on consolidation of parcels of same owner within flood area and preservation of area of government land. The total number of parcels damaged by the flood was 270 and after restoration total number of plots were 145 Designed. The concept is based on the area of government land is placed as it is, and course of river was restored as in pre-flood course with making regular shape with minor modification from cadastral map.

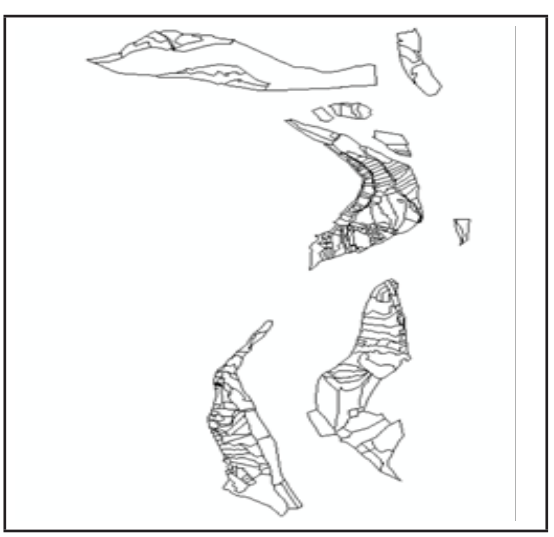

Figure 4: Parcel damaged during flood.

The conceptual framework of this study is based on change analysis during flood as following steps.

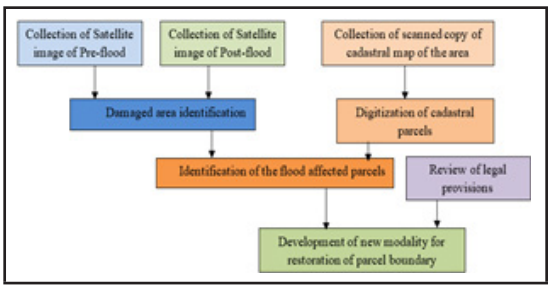

Figure 5: Conceptual framework.

4. RESULT AND DISCUSSION

The total parcel area damaged by the flood has been studied with using satellite image after flood. There are total 6 patches affected by the flood having 270 Number of parcels. The smallest and largest parcel area is 6.13 m^2 & 298383.78 m^2.

Figure 6: Damaged parcel over the google image.

4.1. Proposed Solution

It is seen that due to flood, all the parcel boundaries are obliterated at the study area. While referring to the cadastral maps, it shows that almost all the parcel boundaries are not in regular shape. Since there is no parcel boundary after flood, land use of all the parcels seems to be same. Hence, it is better to divide land parcels in regular shape with agricultural purpose road facility which is the concept of land consolidation and readjustment. Land readjustment involve transfer of land ownership to new parcels in replace of former parcel with some facility and the land registration is also revised according to the transfer of the ownership (Yanase, 2018). Objective of arable land readjustment everywhere doesn't mean urban planning but also could be to improve productivity by consolidating irregular and scattered parcels into the area with regular shape and access to road and irrigation system (Yanase, 2018). Same concept is proposed for this study area as well. Nominal percentage of land from land owner is deducted and used for agricultural purpose road development. This can be treated as land consolidation and land readjustment with an objective of agriculture purpose not only instead of settlement. Land value need to be considered for readjustment in order to control the conflicts. Cadastral records including information about land use and infrastructure information can support assessing the value and use of land (Charoenkalunyuta, 2011). With all these considerations, 145 cadastral plots were developed with consolidation two or more parcels assuming those having same ownership (Figure 4). This result is from the study of small portion of the affected area.

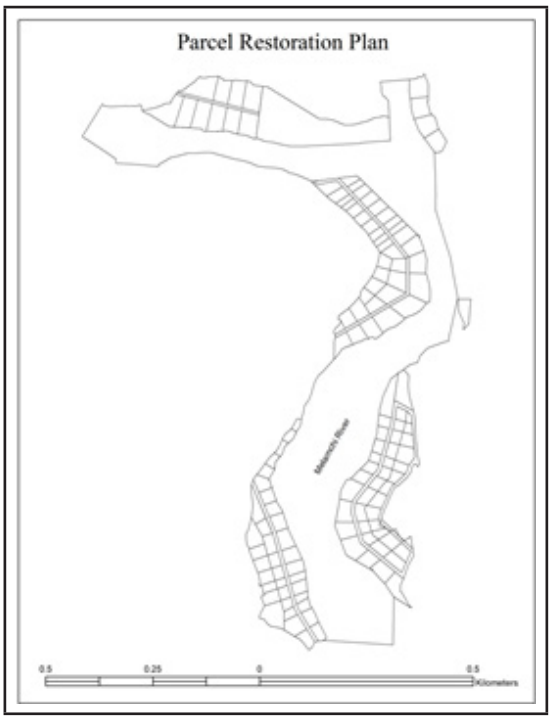

Figure 7: Land Parcel restoration plan for the affected area.

Steps for restoration of land parcels based on consolidation plan in ground.

1. Identification of Control point (or base boundary which was not damaged during flood)
2. Layout of the River boundary as in proposed plan
3. Layout of the planed road and Blocks
4. Demarcation of the planned parcels

4.2. Land Administration System

Land administration system should be good enough in terms of records and information in order to face less land dispute in post disaster scenario (Charoenkalunyuta, 2011) which will support in resilience of community after disaster. Nepal follows improved deed registration system. Cadastral survey, adjudication and first registration is conducted by survey office and after that attribute information about the land owner is transferred to land revenue office and cadastral maps and field books are kept in survey office. The land record includes all detail information about the

area, location, adjoining parcel, land owners, tenant's information and land use as well. All the land administration system is guided by major six acts and rules viz. Land (survey & measurement) Act & Rules and Land Revenue Act & Rules and Land Related Act & Rules. Besides these Acts and Rules, recently Nepal government formulated Land Use Act and rules which defines the major responsibility of local government to implement land use plan and policy. Hence while implementing land readjustment plan, there need to be strong coordination between the central government and the local government.

4.3. Legal Provision

The process of restoration of parcel boundary according to 'Land (Survey and Measurement) Regulation, 2001' can be listed as below;

1. The rule 33 states that the land owner has to apply for demarcation of his parcel boundary in Survey office with paying the charge.
2. The provision for charge is mentioned as "Any person or agency making survey or establishing mark for their own private purpose shall have to submit the amount as follows: –
    i. The amount equivalent to the daily and travel allowance of the employee and assistant deployed (assigned) for the survey of a land,
    ii. Fifteen percent added amount on the amount mentioned in Clause (i) for paper,
    iii. The amount prescribed by the Director General as for the rent of the equipment which shall be used for survey work."

After acceptance of application with demarcation charge, Survey office provides the date for demarcation and gives letter to local level for presence of their representative at the time of parcel demarcation.

The parcel demarcation is carried out by the surveyor apportioned by the office in the presence of land owner (applicant), land owner of surrounding parcels and representative of Local Level. After completion of the work the surveyor has to submit their report in written at the office. The base for demarcation of parcel is based on the cadastral map. Since there are no any boundary marks at the flooded area, this process is almost not possible. In this shortcoming of land survey rules, the issue can be undertaken by town development act.

The main features as discussed by the act are:

1. The parcel allocated is of regular shape
2. Each parcel has facility of agricultural road.
3. Numbers of parcels of same owner are consolidated and provided single parcel.
4. Land owner needs to contribute certain percentage of their land for development of road.

But the Town Development Act, 1998 is focused on urban development rather that arable land readjustment. Re-survey according to land survey and measurement act also cannot solve the problem as the Act directs to verify the existing cadastral maps and present parcel boundary and since there is no parcel boundary at ground, verification cannot be done. Hence, land consolidation and readjustment is proposed as good solution for the issue.

Land readjustment in Japan was only successful because of strong legal background i.e. "enforcement of replotting" defined by Arable readjustment act enacted in 1989 (Yanase, 2018). Germany also enacted law to enforce expropriation and land readjustment to reconstruct the city of Hamburg after the fire in 1842 (Yanase, 2018). Different legal frameworks were defined before implementing land readjustment. Table 1 shows the list of countries which formulated legal framework before implementing land readjustment. Western Australia enacted Town planning and development act 1984, Sweden approved Joint land development act 1987, Finland

redefined procedure of land readjustment in Real property formation act 1995, Thailand promulgated Land Readjustment Act BE 2547 in 2004, Law on Urban Reform-1989 & Law on Urban and Territorial Development-1997 addresses the readjustment concept in Sri-lanka, Bhutan adopted Land pooling rules in 2009, Netherlands formulated Land law in 2016 to address urban land readjustment (De Souza, 2018b). These are only some of the examples to show that land readjustment should only be conducted only on the basis of strong legal background. Hence, as stated in some of the examples above, provision of readjustment of the land need to be addressed in Land (Survey and Measurement) Act besides land consolidation.

5. CONCLUSION

Flood and landslides are major disaster in mountain area, which damages the land parcel boundaries. According to Land (Survey and Measurement) Regulation, 2001 those damages parcels boundaries are restored based on the Cadastral Map, while owner request with application and depositing required fee for restoration of land parcel boundaries. After flood, all land parcels are of same categories without any boundary and hence it is better to use land consolidation and readjustment tool which helps to restore parcels with regular shape and facility of agricultural road. For this land consolidation and readjustment of agricultural/rural area there is lack of legal provision in Nepal. In case of Urban Development, the Town Development Act, 1998 can be used. In this paper it is suggested to include legal provision for land consolidation and readjustment for restoration of land parcels after flood on agricultural area. This need to be in line with Land (Survey and Measurement) Act, 1963 and Land Use Act, 2019. The concept of land consolidation and readjustment for arable land after disaster may face uncertainties and challenges. Despite of this, the concept definitely offers another option for policy makers to consider for post-disaster reestablishment of the affected community. Similarly, the concept of reshaping arable land can contribute in saving resource and effort for restoration land parcel after flood and other disasters.

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