

Prospects of 3D Cadastre in Nepal

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Key words: Land Registration, 3D Cadastre, 3rd Dimension

SUMMARY

The system of registering the features in the third dimension, especially for the registration of stratified real property in the descriptive form, was familiar in the past, though the system was not conceptualized in view of 3D cadastre. When the graphical cadastral survey was introduced as compulsory system in 1964, the system did not have any provision to survey the 3rd component. However, when occupied by a different owner the measurements of the dimensions of the floors, fully or partially as required, were included in the field book, land register and ownership certificate. Later, since the beginning of the cadastral survey of Kathmandu, the registration of stratified property has been brought into the legal framework through the Fourth Amendment, in 1978, of Land (survey and measurement) Act, 1963, which governs the first registration in the country. Though the Land Revenue Act, 1978, which governs the registration of land in the country, has not incorporated this system yet, the Land Revenue Directives 2001 has addressed the modality of the registration of stratified property.

In the mean time, in view of the growing trend of multistory buildings for residential purposes, the government has enacted Ownership of Joint Residence Related Act, 1997 (*Sanyukta Awash ko Swamitwo Sambandhi Ain, 2054*). This act aims to bring the registration of a residential unit of multistory buildings and common places within legal framework. Despite these provisions, the registration of the right of way or utility services beneath, on and above the earth surface including the areas like underground parking places, underground market places, overhead bridges, fragmentation of property within a single building, registration of overlapping or overridden one's property by others or subdividing the property in the ground and upper floors has not been completely addressed.

Furthermore, these limited juridical provisions seem to be formulated for the registration of third dimension, but the aspect of 'visualization' on a map, three dimensional measurements of aforementioned features, and necessary additional measures are still lacking to be recognized. Existing legal and technical provisions seem to be introduced to resolve then evolved problems rather being based on scientific principles of measurement science as sustainable solution. As the interest of registering the space under and above the earth is increasing to be assured of the security of property situation, 3D Cadastre is of great importance to face, overcome and tackle the foreseen challenges and fulfilling the aspirations of general public. In this context, this paper aims to present the state of art situation in Nepal with respect to 3D cadastre and its future prospects.

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1. NEPALESE CONTEXT OF CADASTRE

1.1 Historical Overview

The tradition of land recording has been adopted since Lichchhabī Era (300) in Nepal. Since then, attempts are being made for improving land recording system especially in the units and the tools of measurement during the tenure of king Mana Deva (464-505), king Jayasthiti Malla (1380-1395), king Prithvi Narayan Shah (1742-1774), Bahadur Shah (1785 -1797) and king Surendra Bir Bikram Shah (1847-1881). In 1923, the first time in history, the right to sell and mortgage Raikar (private lands) lands was recognized by law (Regmi, 1978; Upadhyay, 2011). Land registration used to take place on deeds based on verbal descriptions of the property with respect to its boundary and area. In other words, all the reasons of buying and selling and new registration were written in deeds as descriptive registration, also in 1923, cadastral maps were prepared under army to establish fiscal and register but these maps were not used in land transaction processes (Regmi, 1978).

After the democracy in 1951, government paid attention to replace obsolete land records in different units by new tax registers. In the beginning, land administration and cadastral survey was under the Ministry of Finance. Land (survey and measurement) Act was enacted in 1963 for the first time. The preparation of new land records (with maps and records i.e, cadastre) was started in 1965 with the main purpose of launching Land Reform Campaign, and the records are still working. This campaign was governed by the Land Act and Rules 1965 and the Act had made the provision to impose land ceiling on land ownership, security of tenants' rights and collection of systematic land tax. Land-parcel-records with the maps were adopted for a variety of development activities related to human and land. The system of cadastral survey covered all the cultivated land in the country because whole efforts on improving land administration may be wasted and might be a cause of suffering from injustice if the records are not complete, open and time relative (Shrestha, 1999).

In primary land recording since 1965, lands were registered as compulsory registration from state lands to private, public, government and guthi (trust lands) lands although the ownership might have established from various sources. Land recording and/or registration could be established by *transfer* (buy-sell, inherit, gift), *judicial decisions* or ownership established by *the government*. Before 1965, when land records were not based on cadastral maps, lands were recorded by the agents called *Jimindars*, *Talukdars*, *mukhyas* and *Patawaris*. The Deeds or the transactions were not compulsory to be registered (Regmi, 1978). Written informal documents were sufficient for transactions and were valid until 1978. Land (survey & measurement) Act 1963 has established adjudication of land (ascertaining existing right on land) resulting modern cadastre with fiscal purpose. The system has gradually been moved towards legal and multipurpose cadastre and still functioning (Shrestha, 1999).

1.2 Main Characteristics of Nepalese Cadastre

Nepalese cadastre has following characteristic features (Acharya, 2009):

1.2.1 The Completeness

All land in Nepal has been divided into parcel properties. All land parcels and transfers (around 25 million parcels) must be registered according to Land Revenue Act, 1978. Each parcel has a unique identity, which is common to both registers (and to the revenue files as well). This means that the registers are based on the parcel designations and not deeds plan and others. A parcel does not exist legally before it has been registered in the land register. All transfers of real property must be registered in the land register. Land may be transferred through buy, sell, inheritance, gift and others, like ownership established from judicial decision as well as by the government decisions. Cadastre has covered the entire country. According to Land Revenue Act, 1978, the land revenue office should register all categories of lands as:

- *Government lands* in the name of Nepal Government.
- *Public lands* in the name of the community or Nepal Government including its use.
- *'Raikar' lands (private lands)* in the name of the owners.
- *'Guthi' lands (trust lands)* in the name of concerned *'Guthi'* or Trust

1.2.2 The comprehensiveness

The Land Revenue Act, 1978 explicitly states that all piece of land should be registered. Right that have been put on land register are backed by the government but the rightful holder of rights do not receive any compensation, if there is any loss of interest due to error or fraud or forgery in the register. Land registration is compulsory in Nepal and is based on Deeds Registration System.

1.2.3 The updating procedures

The maps and registers are continually updated, whenever there is a transaction affecting the land data/information. The registration and changes on ownership is carried out by district land revenue office and the boundaries changes or mutation or division, such as subdivisions are carried out by district survey offices. The changes in land register and parcel register entirely depend upon the owner's signing of the transfer deeds. Not only the provision of subdivision of the land parcel exists but also amalgamation of the parcel has been allowed but due to technical reasons it is assumed that this lacks very accurate delineation of field boundaries.

1.2.4 The relation to cadastral/parcel maps and land registers

The land register includes cadastral map/plan. Large scale cadastral maps are prepared by graphical method based on general boundary principle of land surveying. The maps are operated at present using traditional techniques of plane-tabling, now being slowly replaced numerical survey using total station theodolites. The cadastral map are in different scales such as 1:500, 1:1250, 1:2500 depending the land value, parcel size and density. The old series of cadastral maps are in the scale of one inch to 200 ft and one inch to 400ft. Parcel numbers bridges the maps and registers. The free parcel numbering system has been adopted for parcel identification.

1.2.5 The basis for security of loans (Mortgages)

Mortgaging is a very old tradition in Nepal. Land is becoming the prime asset for mortgages and loans. These days land is commonly used for collateral which has raising economic activities in the country. In the past personal mortgaging was the main scene and this practice exists even today to some extent but almost all mortgages are now handled by banks and other credit institutions. This one is the legal provision for the security of loans.

1.2.6 The basis for government revenue

In early days land registration fee and the land revenue (land tax) were the major sources of national treasury. The registration fee is 2% of the transaction price mentioned in the deed in the rural areas and 4% in the urban areas. The transaction price quoted in the deed cannot be below the minimum land value fixed for registration purpose.

1.2.7 The basis for land use and other planning and environmental policies

The basis for environmental management of natural resources, physical infrastructure and housing is land information which incorporates the demands of environmental protection and sustainability of development agendas at local, regional and national level. Cadastre in Nepal form the basis for spatial planning, land use planning, land acquisition, land pooling and other planning including environmental policy.

1.2.8 The organizational provisions

Ministry of Land Reform and Management is responsible for almost all land related activities in the country. Land Reform and Management Department, Survey Department, Land Information and Achieve Department, Land Management Training Center and Land Use Project are the major departments and projects of the Ministry. Regarding trust land, there is *Guthi* Corporation which deals with trust land religious activities. There are 83 district Land Revenue Offices for Land Registration, 21 Land Reform Offices and 83 Land Survey Offices for cadastral survey and updating. Department of Land Information and Archive is responsible for computerization of land records and maps. There are discussions going on regarding issues on the co-ordination of the departments and their mandates. Since the departments and district offices are concerned for the common goal and achievements of maintaining cadastre, all these institutions must be under one umbrella to avoid overlaps of the functions, crisis of reliability, shifting responsibility and accountability. Therefore, restructuring of the departments and its organizations is crucial and is under study.

1.2.9 The legal provisions

There are more than 60 acts and regulations concerned in some way to land but the most prominent ones are: Civil Code, Land Related Act & Rule, Land Measurement Act and Rule, Land Revenue Act and Rule, Trust Corporation Act, Land and Building Act and Rule, Forest Act and Rule, Ownership of Joint Residence Related Act and Rules, Local Governance Act and Rules, Land Acquisition Act etc. These many acts and rules have created overlapping and evading accountability and responsibility making cadastre more complicated. Therefore, formulation of an integrated Land Act has also been seen as a priority so as to avoid the lack of accountability and evading ownership of all responsibilities, lack of co-ordination of the departments and their mandates.

1.2.10 Improvement on cadastre technology

There is high realization and growing awareness on geo-information and communication technology (Geo-ICT) in cadastre. Since the serious lack of innovative approach in cadastre research, there seems reluctance in using the new technology in cadastre in Nepal.

2. 3D CADASTRE

2.1 3D Cadastre around the world

Tremendous pressure on scarce land because of increasing population and consequently infrastructure development activities on, above and below the land surface are main driving forces for emergence of 3D cadastre. Complexity in registration of such various land objects in existing 2D environment triggered development of 3D cadastre. To cope with the situation, many countries around the world have initiated registering the land objects in its 3rd dimension. In many countries, a complete solution of 3D cadastral registration is not found. The complete description of 3D property in vector format is not maintained yet. In some countries, a 2 or 3D plan is maintained and attached with legal land register whereas in some countries, only description of the 3D property is kept with Cadastre. Some reviews of available literature reveal the following scenario in selected countries.

In Netherlands, the building apartment rights are registered as separate 3D property units in administrative part of the cadastral registration. But still the real situation above or below the ground surface is not shown properly in cadastral registration with the help of 3D physical drawings (Stoter, 2004).

In Denmark, an individually owned apartment units are described in the title and accompanied with the drawing in the legal land register. But in complex situation, this kind of information cannot be assessed from the land registers (Stoter, 2004).

In Norway, the 3D property units are established and maintained in the land registers but the surveying and mapping to acquire 3D volume information is not carried out. Hence the accurate geometry of the volume parcel cannot be obtained from land registration. However, in administrative part of cadastral registration, the 3D property units exist. The construction property above the surface are maintained as 3D property units, in most of the cases, by the municipalities under Oslo methods whereas the 3D building properties are governed under separate Apartment right. (Valstad, 2003)

In Victoria, Australia, 3D property information is shown in drawing of subdivision in the land registry but the 3D properties are not reflected in Cadastral maps and digital cadastral database (DCDB). For the purpose of 3D constructions such as tunnels and bridges, Land Victoria provides a limited representation of 3D data in the DCDB. (Aien, et.al, 2011)

In Russia, a project is currently going on to study 3D cadastral model for data generation, storage and distribution of information about 3D properties, generating prototype (and access portal), evaluation of the prototype for objects of a pilot region and prepare strategy and action plan for proper institutional embedding. This includes the preparation of legal and

organizational guidelines for the long-term development of 3D cadastre in Russia. (Vandysheva, et.al, 2011)

2.2 Existing cadastral recording in Nepal

Measurement of land parcels, buildings and the other objects are carried out in two dimensions (2D) in Nepal and the attributes are recorded accordingly. Constructions and infrastructures under and above the surface are not registered but the characteristics are shown on the maps by symbols and their properties are written in words in the field book, land register and in the deeds when land transaction takes place. The parcel boundaries contain geographical data sets with parcel numbers, outlines of buildings, streets names but not house numbers. All topographic real world objects are not incorporated but transport, buildings, water bodies and socially prominent objects like temples are included. Therefore, Nepal's land administration system comprises the textual and spatial components of 2D information. A parcel plan is used to show the subdivision and layout of the land and building. The necessary information of changes is shown when and only when the plan is reutilized. The shortcomings of cadastral map and parcel plan seem as:

- Vertical information only exists sparsely in cadastral map and does not exist in all subdivision plans (building subdivisions).
- Determination and measurement of dimensions and area from these maps and plans are not always as accurate as the clients' aspirations.
- Rights, restrictions and responsibilities cannot be spatially represented in the plans. Restrictions and responsibilities are even not mentioned in the title.
- Paper-based plans cannot represent 3D structure and do not support 3D analysis.
- There is no any provision of visualization of the 3rd component on the cadastral map.

2.3 Existing types of rights

The rights over a piece of land and buildings are governed by the type of tenure. In Nepal, mainly two kinds of tenure are in practice: *raikar* (private land) and *guthi* (trust land). The real owner of *raikar* land normally possesses the right of absolute ownership. Some private lands still possess dual ownership; one being property owner and the other being tenant. The tenant becomes rightful claimant for the fifty percent of the property (Land Related Act, 1965; Land Revenue Act, 1978)

Rights over *guthi* land to an individual depend upon the type of *guthi*. In some cases, the owner only possesses the right to use and pays some amount in return. In some cases, the owner can exercise almost the rights of an absolute ownership (Trust Corporation Act, 1977). Right of easement is ensured by the civil code of Nepal (Civil Code, 1964). The other rights that are commonly exercised in the country are the right to leasehold, rent, mortgage, and dispose.

Apart from the above rights, exclusive use of space above the ground of the parcel, ownership of the earth layers beneath it and ownership of the buildings and constructions forming a permanent part of the land have to be addressed. Though laws in Nepal do not define the objects attached to land as separate entity or part and parcel of land itself, but used to treat as house and land. The courts sometime have established right of superficies. That is why, the

user/owner in practice, can use above and below the surface of the parcel. The civil code and land related laws have not explicitly defined the way of possessing ownership in 3D.

2.4 Existing provision for 3D cadastre in Nepal

Concept of registering stratified property (especially different apartment or floors or rooms of a building) in Nepal is not new. Its need was realized in 1978, when the provision of registering such property units was included in the 4th amendment of Land (survey and measurement) Act. However, it is realized that this legal framework is not sufficient to address all the relevant issues. Some existing legal provisions and shortcomings for joint ownerships and ownership on the ground floor and upper floor are as follows:

- 1) In land administration process, Land Revenue Act has not incorporated registration of 3D component. In spite, Land Administration Directive 2001(LAD), part 1 directive number 36 states that an owner among the joint ownership can transfer his/her individual right with or without the consent of other owners and if he/she does so, the land register is maintained in a similar joint ownership by including the name of the right holder and excluding the name of the right giver and not preparing the separate land register. But if the right is transferred to a new owner separate register is maintained and new ownership certificate is prepared or the name of the new owner is added to his/her old certificate if exists.
- 2) According to section 5, subsection 5(*kha*) of land (survey & measurement) Act 1963, when surveying the land and house of the ground floor or upper floor or on the same floor having different ownerships, land and house with different ownership should be registered in the name separate land owners according to the prescribed format provisioned by land (survey & measurement) rules 4. Though this act incorporates the possibility of registration of distinct ownership on the floors or apartments, the format of the land register and the ownership certificate do not have the provision of registering or providing the ownership certificate of an apartment/flat. The existing format of land register and the certificate indicate that the ownership on the land parcel, on which the building is erected, remains with the owner of the ground floor, but not with the owners of the other floors. The “land administration directive” (LAD), part 1 and directive number 38, part 6 and directive number 157, 158, 165 clarify it as:
 - If the ground floor belongs to one owner and the upper floor has other owners, details of land parcel is written in the register of ground floor and the description of the owners of upper floor is written in its remarks. The length and breadth of the house in square meters is written in the register of upper floor and the parcel number of the ground floor is written in its remarks. But having house in the underground land, land parcel details are written in the register of underground land.
 - When selling a portion of the ground floor subdivision of the parcel is carried out.
 - LAD does not address the registration of the apartments/flats on a floor. The owner of the ground floor can sell a part of his/her property but the directive remains silent about the subdivision of the property in the upper floor.

An example is given to clarify the above provisions. Suppose a person named “A” has parcel number 11 with the area of 100 square meters of land and it consists of 4 storey building. The owner A has three sons named B, C, and D. When their *Ansabanda* (deeds of division of

inherited land and property) took place, the ground floor belonged to A, first floor to B, second floor to C and third floor to D. The land register is maintained as:

- The register of A is maintained by writing the parcel no 11 and the area of the parcel 100 sq m and the ownership of B, C and D in the first, second and third floor is also mentioned in the remarks.
 - To maintain the register of B, the length and breadth of the house is written instead of area of the parcel in the column of parcel number 11 and the ownership of A, C and D in the ground, second and third floor is also mentioned.
 - To maintain the register of C, the length and breadth of the house is written instead of area of the parcel in the column of parcel number 11 and the ownership of A, B and D in the ground, second and third floor is also mentioned.
 - Similar process is followed to maintain the register of the D as well.
- 3) When the ownership of land is one's and the house made on this land belongs another person, then the register of land owner is maintained by writing the parcel number, area and including the name of the house owner. Similarly the register of the house owner is maintained by writing the length and breadth of the house and including the name of the land owner. (LAD number 39)
- 4) Ownership of Joint Residence Related Act 1997 controls and regulates the permission for construction, sale, ownership and transfer. Some concerned legal provisions are listed as follows:
- Apartment can be constructed by the permission of concerned authority legally. The apartment can be sold, rented or given to use through other means by legal founder person (having permission to build apartment) according to the act.
 - The apartment owner can transfer right or sell the apartment with the permission of founder. The registration will only possible if the dues and obligations according to law are fulfilled.
 - Although the provisions of rights, restrictions and responsibilities have been included, it does not address the way of their registration.
- 5) The existing technical and legal system does not incorporate the issues of the property overridden by other owner(s), property of different owner's overlapped in different floors, underground parking, overhead bridges, underground market places and underground cable and utilities.
- 6) The legal provision of adjudication and documentation of real estate is lacking. Existing legislation for 3D registration or third dimension on the paper-based plans of subdivision cannot fulfill the current demands.
- 7) The technical matters of 3D data capturing, representation, visualizing, updating and modeling of cadastral objects has not provisioned by existing laws. Therefore, some technical obstacles to development and implementation of the 3D cadastre will remain.

3. PROSPECTS OF 3D CADASTRE IN NEPAL

3.1 Issues to be addressed

Recently, the concept of 3D cadastre has not emerged as such in Nepal but has whispered only to those new geomatics professional community who have advanced education aboard and had access to these debates. This is a good sign of professional development in the country

like Nepal where land has significant economic and social value in the society. The public sector is oriented towards developing 3D cadastre but private sector has not even thought of it. 3D cadastre and property management could be important and strategic components of Nepalese land registration, planning and development. In densely populated and closely clustered settlements areas in Nepal, traditional houses have joint ownership and also individual ownership floor wise or part of the floor as well. In the present context, following issues have to be addressed to develop 3D cadastre system in the country:

- Inheritance of property in Nepal is a very sensitive issue. Different rooms of a house can be inherited by different individuals. In some cases, especially in Kathmandu Metropolitan areas, there are some places the ground floor of a building is used by a community whereas the upper floors are owned by different owners. In some districts, especially in remote hilly districts like Jumla, the houses are built in such a way that the roof of a house owned by a family is used as courtyard by the owner of the house built in the upper terrace of the ground (Bhatta, et.al, 2005). These are some issues that have not been well addressed by the existing registration system.
- With the growing population and dramatically increasing trend of migration towards urban areas, there is no other solution than going to the high rise residential buildings. In the last decade, the urban centers have witnessed huge investment in the construction of such buildings. Mid income level families are attracted towards the purchase of apartments in such buildings. However, there is hesitation in investment due to lack of clarity about the security of ownership over such apartments. Existing legal provisions do not clearly mention about the right of the owner of each unit of a multistory building over the common space areas. People are not clear about the future consequences, if the building gets damaged, and if they have any rights over the land on which the building stands and so on. Therefore, there is a strong need of clear legal provision in this respect.
- Urban centers in Nepal are getting densely populated day by day. As a result there is no space available for building adequate transportation and utility infrastructures. To meet the need of growing population, such infrastructures are necessary to get expanded, for which, there is no other solution than going below or above the land surface. The space below and above the earth surface will be needed to acquire from the owners of the belonging parcels. Without proper system of registering such cases, it will not work efficiently and hence it necessitates the need of 3D cadastre.
- To register the overriding interests of different entities over a single piece of land, current legal framework does not seem supportive. This can be possible only in the presence of 3D cadastre system.

3.2 Legal reform required

To deal with the above mentioned issues, current legal provision does not seem sufficient. Therefore, there is a need of legal reform. Basically, the rights on common properties, security of ownership, sustainability issues of the property, among others should be well addressed in the reformed legal provisions. The legal reform should be made such that it focuses on establishing strong legal base for 3D cadastre addressing to legal, technical and administrative aspects of adjudication, measurements, data quality, standards, documentation, publicity and appeal.

3.3 Adequate capacity is required

In order to introduce modern concept of 3D cadastre, adequate capacity is needed. In this context, smart institutional and organizational strengthening is required. Recruitment of technically qualified human resources and continuing professional development is very crucial. The public sector should closely work together with private sector so that private sector can also be encouraged to support 3D cadastre through Public Private Partnership model.

3.4 Possible technical solutions for visualization:

First of all measurement of 3D property units through actual measurements of the all the dimensions, including the 3rd dimension, should be taken for the properties that have to be brought into the scope of 3D cadastre. The visualization of the 3D aspect is challenging issue. Any one of the following technical solution can be useful for the purpose of proper visualization:

- 1) Until now, no any proper technical solution has been identified or followed for the visualization of 3rd dimension of any property. Since the cadastral system of Nepal is still analogue, we can find an easier solution in analogue environment. For this purpose, the plan of the 3D property should be prepared mentioning the actual measurements of its linear dimensions. The documents should be descriptive in such a way that one can easily identify the property unit. Such documentation should be included with the deed document and should be provided as an annexure of the title issued to the property owner.
- 2) The advancement in computer technology has provided an option to visualize the 3rd dimension through computer modeling. Model should be developed showing each property unit of the stratified property. Such models would help identify the property units. Accurate measurement of all the dimensions of 3D property is required for getting accurate modeling.

4. CONCLUSION

Existing legal, institutional and technical provisions are not sufficient to address the issues of 3D cadastre, as these provisions were formulated without paying attention to the principle of 3D cadastre rather to regularize the activities related to land administration. Growing trend of constructing high rise buildings in urban centers, development of underground and over-ground utility services, increasing value of jointly owned properties, registration of overriding interests of different entities over a single piece of land, etc. have brought challenges to the existing system to ensure security of tenure/ownership. Therefore, there is a need of functional 3D cadastre system in the country by carrying out reform in existing legal system, and strengthening organizational and human capacity. The core part of 3D cadastre system is the visualization of 3D property unit, for which proper method should be adopted. Two ideas have been proposed in this respect; documentation of 3D property units with accurate description attached to the annex of the deed document, or visualization through computer modeling.

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BIOGRAPHICAL NOTES

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