

Participatory Mapping as a Smart Survey Technique to Support Land Rights for All: Experiences and Expectations (Nepal)

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Key words: Land Policy, Land Rights, Security of Tenure, Fit-For-Purpose Land Administration, Participatory Mapping, Social Tenure Domain Model

SUMMARY

Successive Governments after the political change of 1951 have advocated pro-poor land reforms. After the adoption of new Constitution in 2015, serious attempts have been made in this direction. The National Land Policy (NLUP) adopted in 2019 adheres to the VGGT principles and stresses on Living No One Behind (LNOB). NLUP recognizes land rights of women and vulnerable groups, rehabilitation of the landless slum-dwellers, squatters and informal tenure-holders for sustainable and improved housing, access to land and security of tenure for all including the landless peasants. A Fit-For-Purpose Land Administration (FFPLA) approach provides a blueprint for a fast, economic and good enough solution and advocated as such in the Country Level Implementation Strategy for Nepal.

To implement the land tenure security provisions of the NLUP, Nepal adopted 8th Amendment to the Lands Act, 1964 which provides for allocation of land to the landless and regularization of informal tenure up-to designated size based on different criteria of the attributes of the person and the land and the person to land relations. As such the surveying and mapping for the purpose is more than a geomatic measurement activity and entails additional factors of social, economic, cultural and environmental information collection. A Land Issues Resolving Commission (LIRC) has been established and is mandated to undertake this august task.

Whilst Nepal has a known history of adopting to land surveying technology tailored to meet the purpose the recent trend in the surveying and mapping profession was towards the use of modern tools and technology with a eye on better geometric accuracy. To address to the emerging challenges of addressing to tenure security for all under limited capacity as existing, based on the findings from the few pilots, participatory mapping and application of Fit-For-Purpose Land Administration (FFPLA) tools as a smart techniques is recommended for consideration.

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1. INTRODUCTION

Although Nepal has an established land administration system, almost 25% of land holdings are still out of the formal cadastre due to several cultural, social, economic and political reasons. Study shows some 1.3 Million families with almost 10 Million physical parcels on the ground have unsecured rights over their land (Joshi et al, 2019). Successive Governments, after the political change of 1951, have advocated pro-poor land reforms and made limited progress. After the adoption of new Constitution in 2015, serious attempts have been made in this direction. The National Land Policy (NLUP) adopted in 2019 adheres to the VGGT principles and stresses on a Living No One Behind (LNOB). This covers the protection of land rights of women and vulnerable groups, rehabilitation of the landless slum-dwellers, squatters and informal tenure-holders for sustainable and improved housing, access to land and security of tenure for all including landless peasants. A Fit-For-Purpose Land Administration (FFPLA) approach provides a blueprint for a fast, economic and good enough solution and advocated as such in a Country Level Implementation Strategy for Nepal. To implement the land tenure security provisions of the NLUP, necessary legislative reforms and an institutional framework through the formation of a Land Issues Resolving Commission (LIRC) has been established.

Nepal has a history of adopting to land surveying technology tailored to meet the purpose but the recent trend in the surveying and mapping profession is towards the use of modern tools and sophisticated tools and technology to achieve better geometric accuracy. This requires high end resources in terms of funding, knowledge and human resources which is limited in the country. As such it becomes desirable for re-consider what tools and techniques are best suited to address the emerging challenges of addressing to tenure security for all under the limited capacity as existing.

This paper provides a historical perspectives on the development of surveying and mapping tools and techniques in land administration in Nepal and dwells on how this has evolved to meet the purpose of the time and the recent trends on accuracy, standardization and geo-spatial infrastructure building. The context of land policy reform for tenure security for all and need for a Fit-For-Purpose approach is highlighted. Some pilot works on participatory mapping and application of Fit-For-Purpose Land Administration (FFPLA) tools is explained. Based on the experiences, their application as smart techniques to support land tenure security for all in Nepal is recommended.

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2. RESEARCH METHODOLOGY

A literature study was undertaken to understand the evolution of surveying and mapping tools and technology in land administration in Nepal. Similarly, further study was undertaken to identify the tenure security issues and the policy and program of Government of Nepal to address them. Based on the two studies the gaps, contradictions and the dilemma vis-à-vis conventional surveying and mapping approach and the purpose of tenure security were analyzed.

Pilot implementation of Fit-For-Purpose tools of participatory mapping and Social Terrain Domain Model (STDM) conducted in Belaka Municipality Ward No 3 was conducted. Analysis of the methodology, time duration taken, and the cost incurred was evaluated. Further, accuracy assessment of selected parcels in comparison to the conventional techniques of total station survey by qualified surveyors and FFP approach using satellite imagery by grassroot surveyors was assessed.

3. HISTORICAL EVOLUTION OF SURVEYING AND MAPPING TECHNOLOGY IN LAND ADMINISTRATION IN NEPAL

Though the land administration is one of the oldest administration systems in Nepal with historical evidence dating back to the 5th Century (Chhatkuli et.al, 2019) little is known about the surveying and measurements system then applied. The earliest record of surveying and measurement system for land administration is from the 14th Century. As land was the main source of state revenue the quantity of land and thus the measurement technique as well related with how much the revenue should be levied and as such King Jayasthiti Malla (1382- 1395) of Kathmandu valley devised a land measurement system based on the productivity of land. Paddy field area would be designated in terms of volume of produce i.e., if a piece of land would produce 1 *muri* (a local unit) of paddy, the area would be designated as 1 *muri* and 4 *muri* would be considered as 1 *ropani*. which would then mean different quality of land designated with same unit would be of different area if having different productivity. Regarding unirrigated or non-paddy producing land the area was measured in terms of land farmed by a pair of oxen in a day. This system was measurement was retained until 1907 when the standard *ropani* as 5476 square feet or 508.74 square metres was applied both for paddy and non-paddy field land which is still in practice in the hilly region of Nepal. In the terai or the plain areas in the southern Nepal land would be measured as *dhur* with the stick of arm's length which would again not be standard. Currently 20 *dhur* termed 1 *bigha* is standardized as 72,900 square feet or 6772.41 square metres. (Regmi, 1972)

As the measurement units were non-standardized it is understood that the surveying techniques were as well non-standard- mainly eye estimates called *dekh-jaanch*. The first cadastral surveying using measurement tools was initiated in 1923 using chain, magnetic compass, and plane-tabling techniques (Adhikary et al, 2007). The political change of 1951 brought the end to Rana oligarchy and the country turned into a democratic set-up. In 1956 planned

development process was initiated with the introduction of First Five Year Plan (1956- 1961). It clearly indicated the importance of Survey, Research, Statistics, and cadastral surveys in clearing up confusions as to title of boundaries, in developing dependable agricultural statistics, and in providing a basis for equitable taxation. Recognizing the lack of trained technicians, equipment and funds which prevented the initiation of cadastral surveys Survey Department was established in 1957 (Chhatkuli, 2007). In 1964, land reform program was initiated which was designed to do away with different land-lordship based feudal land tenure system, recognition and security of tenancy rights and enforcement of designated land ceiling. For this purpose, fast, cheap and fit-for-purpose technology of surveying and mapping was adopted. Necessary legislation was enacted, training centers were established and young ‘boys’ (women were not engaged in the profession which required extensive field work, but there is a reasonable number of women in surveying in Nepal currently) with middle school education were provided with few months training and deployed to undertaken plane tabling survey using telescopic alidades. Institutional arrangements were made through the establishment of different revolving Survey offices called *Goshwara* and a permanent Survey Training Centre.

Due to the absence of geodetic control network the earlier cadastral surveying were conducted without control called “free sheets” which necessitated the surveys to be done “from part to the whole” contrary to the basic surveying principles. After the establishment of Trigonometrical Survey Branch in 1969, some efforts to commence cadastral survey based on national geodetic control points was made. However, the need for a quicker completion of cadastral survey surpassed the progress geodetic control surveys. It is reported that by 1994, the first cadastral survey covering cultivated areas with legal rights and excluding several densely built-up village blocks, public and governmental land was completed (Adhikary, 2007). As mentioned earlier the mapping technology was plane-tabling and 38 districts out of the then 75 (currently 2 districts have been mutated bringing into a total of 77) districts were mapped without geodetic controls.

The full assessment of accuracy of cadastral surveys undertaken by plane tabling and the telescopic alidades throughout the country is not reported, however some studies (Kohli et al, 2018) indicate their accuracy as challenging and more so when the maps are so called “free sheets” without geodetic control. The demand for more accurate cadastral maps for legal purpose is hard to be addressed by the current cadastral maps (Dangol et al, 2013). The cadastral survey map and copy provided by Survey Office do not tally as per the land existing in the field and as well with the Land Ownership Certificate (Koirala, 2019).

As such the modern concept of Survey Department and the surveying and mapping professionals in Nepal is to improve on the surveying and mapping technology to achieve greater geometric accuracy. Survey Department initiated adoption to the digital surveying technology with the use of total stations beginning 2005 (Adhikary, 2007).

4. SECURITY OF TENURE AND LAND RIGHTS TO ALL

The existing land tenure system and the key components of National Land Policy 2019 are highlighted herein. The informal land tenure with socially recognized but legally unrecognised land rights are not covered irrespective of the reporting that the first cadastral survey completed in 1994 covered cultivated areas with legal rights and excluding several densely built-up village blocks, public and governmental land considered as non-formal land holdings.



Figure 1: Summary Land Tenure System in Nepal

A large area of land under informal tenure is still not covered by the cadastral survey. It is estimated that 25% of the cultivated area operated by some 1.3 million households and estimated 10 million physical parcels on the ground are still not covered with the cadastral maps and

without legal documents which would mean without security of tenure (Joshi et al, 2019). After the political change of 1951 and essentially after the promulgation of new Constitution in 2015 a gender-responsive and pro-poor land reform was advocated. The 1964 land reform which was considered beyond success (Willy et al, 2009) and there were social, economic and political conflicts as heightened by the decade long armed conflict (1996- 2006), The Constitution of Nepal guarantees access to food and shelter for all and land to the landless *dalits*. In the meantime, it provides for state policy on pro-poor and scientific land reforms. In 2019, a National Land Policy was adopted by the Government of Nepal which is also in consistence with key global and regional frameworks such as the Sustainable Development Goals (SDGs), the Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests (VGGTs) and the New Urban Agenda (NUA). It intends to address the issue of land

administration and land management reforms under six major and key pillar objectives including Security of tenure, and Access to land.

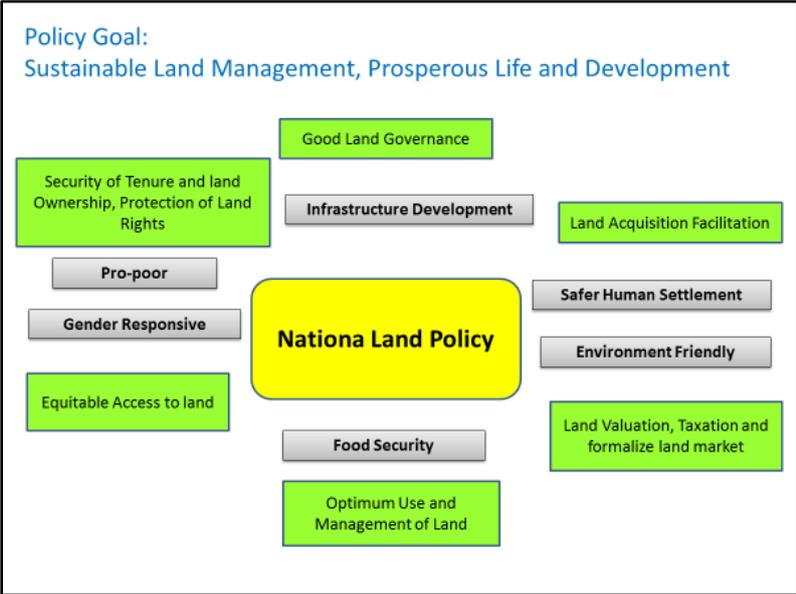


Figure 2: Key Components of National Land Policy, 2019

It is underpinned by a strong inclusive agenda that considers the issues affecting the land rights of women and vulnerable groups that includes: Rehabilitation of landless, squatters and informal tenure-holders for improved housing, Access to land and security of tenure, Tenure security for landless peasants for farming, Women’s access to land ownership, and optimum use of land for sustainable housing (GLTN, 2019). Additionally, the 15th Plan (FY 2019/20-2023/24) categorically

enunciates to ensure the rights and access to land for marginalized communities including landless *Dalits*, farmers, squatters, tenants, and *Guthi* farmers (NPC, 2020).

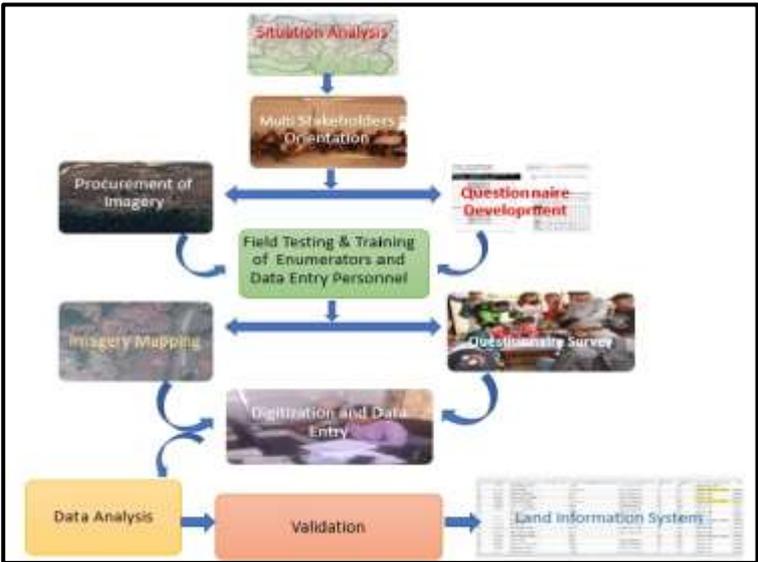
To implement the provisions of the National Land Policy, the parliament passed 8th Amendment to Land Act, 1964 which has come into effect in 2020. The Act provides for allocation of land to the landless *dalits*, landless peasants, *sukumbashi*, slum dwellers up-to designated size of parcel. The Act also provides for regularization of land under informal holding up-to designated size. The Act defines landless as a persons or household having no registered land within the country and without formal employment with income status which would not enable to procure a piece of land on own. Informal tenure-holder is defined as a person or household having some registered land elsewhere within the country and operating the land for more than 10 years. A landless person or household will be provided with title of the presently occupied land if possible or if this falls in a negative list necessitated for Government of public use would be relocated to a new location free of cost. In case of informal tenure-holder as defined above the land title will be granted with payment of cost calculated under different criteria like the economic capacity of the person or household and the type of land. If the land falls in a negative list necessitated for Government of public use such informal-tenure occupant will be displaced. In 2020, under the authority of the 8th Amendment Land Act, Land Issues Resolving Commission formation order was passed, and the Commission was appointed. The Commission is delegated with necessary authority of the land registrar officer and the survey officer with respect to survey, land registration and land administration to facilitate titling of land to the landless and regularization of informal tenure. The Commission has a four-tier framework at the federal, provincial, district and local levels. All surveying, data collection, validation and

planning of land allocation and regularization is conducted at the local levels. While the Commission has been provided with a tight timeframe of 3 to 5 years and the local levels scattered in 753 urban/ rural municipalities throughout the country do not have adequate human and knowledge resources to conduct the work, the beneficiaries have high expectations and there exists a high political will from all parties. As such a Fit-For-Purpose Land Administration approach (Enemark et al, 2016) becomes necessary. A Country Level Implementation Strategy was already discussed (MOALMC, 2018).

With the legislative and the institutional framework in place a more elaborate pilot study on the spatial framework was necessary.

5. PARTICIPATORY MAPPING IN BELAKA WARD NO 3: PILOTING OF A SPATIAL FRAMEWORK FOR TENURE SECURITY

As explained earlier, the surveying and mapping required to implement tenure security policy



required information on the person or household, on the land under informal tenure and the land to person or household relations. This is best done using the Social Domain Model (STDM) concept. And as required by the municipalities to collect such information and undertake spatial information a participatory mapping tool in line with the FFP approach was considered to be explored as a suitable option. This Section explains the methodology and the findings from the pilot project. Key process as shown in Figure 3.

Figure 3: Key Process Flow Diagram (Source: Antonio et al, 2020)

5.1 Study Area

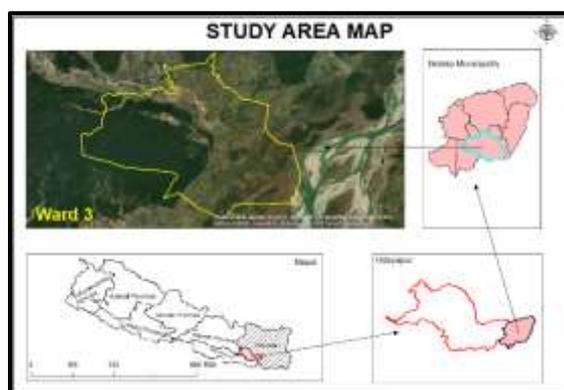


Figure 4: Location map of Study Area
(Source: Outline map of Nepal Survey Department)

The study area is in Ward No 2, being one among the 9 lowest administrative units of Belaka Municipality called Ward, falling in Udayapur district of Province No 1 in Eastern Nepal. Belaka is relatively new, underserved and an emerging municipality with most of the people still engaged in agriculture. It falls in the inner terai with relatively fertile land mostly habituated by migrants from the hilly areas in the north of Udayapur district. As such most of the land is still under informal tenure without land registration documents.

5.2 Methodology

The study project was undertaken jointly by Community Self Reliance Centre (CSRC) and Belaka Municipality under technical supervision and guidance of UN-Habitat and Ministry of Land Management Cooperatives and Poverty Alleviation (MOLMCPA) of Government of Nepal under a joint MOU. The Field Coordinator, Surveying and Data Collection personnel and Data Entry personnel were selected among CSRC and Municipality staff and few recruited new for the project. The following key steps were undertaken:

- 1) Acquisition of satellite imagery of study area.
- 2) Orientation to elected representatives, local beneficiaries and CBOs of Belaka municipality on the objectives and methodology of the pilot project.
- 3) MOU between Belaka Municipality, CSRC, MoLMCPA and UN-Habitat.
- 4) Preparation of data collection and survey questionnaires, validation and approval from Municipality executive committee.
- 5) Selection of 10 Enumerators (including 9 Female) and their training/ orientation on questionnaire survey, participatory mapping, and application of STDM concept.
- 6) Formation of Support Committee from among the elected Ward officials and local stakeholder. Their orientation on participatory mapping and STDM and their role in local support for reliable and authentic data and information.
- 7) Mobilization of enumerators for data collection for Household level questionnaire survey and mapping of land parcels using satellite image maps. Hands on training was provided in the beginning by a qualified Surveyor and the STDM expert.
- 8) Selection of 2 Data Entry personnel (1 Male and 1 Female). Elaborate training on STDM tools to equip with knowledge and skills on how to use STDM Software for data entry and map digitization.

- 9) Frequently coordination meeting with partners organization to share progress, learning and challenges. Experts from UN-Habitat and MOLMCPA provided casual monitoring, reviews and feedback.
- 10) Data validation notice issued by Belaka Municipality. The ward office of Ward No 3 provided seven days to validate data for local people and asked application if any data need to be amended.
- 11) Final Review and Reflection meeting of major stakeholders- MoLMCPA, UN-Habitat, CSRC and Municipality/ local government, Chief District Officer of Udayapur. Lessons learnt and issues for consideration and points to be incorporated on the Guidelines for scaling up discussed.

5.3 Satellite Data and Identification of Parcels through Participatory Mapping

Very high 50cm resolution cloud-free Pleiades imagery dated November 24, 2017 was used. Four-Band Natural Color Pan Sharpened Ortho-rectified image map in UTM projection and WGS-84 Datum was used for printing of map and identification of visual boundary on the ground. Due to relatively large agricultural land parcels in plain area visual boundary could be identified.



Figure 5: Participatory Mapping for Identification of Parcels

5.4 Database Creation and Development of Land Information System

STDM plug-in in QGIS developed by Global Land Tool Network (GLTN) was customized for entry of attributes data collected through questionnaire, digitization of parcels boundaries through comparison with the map enumerated on the ground and created database and the land information system for further analysis to identify landless and informal tenure-holders.

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Such information could then be used by the authorities for allocation of titles and/ or regularization of informal tenure land holdings.

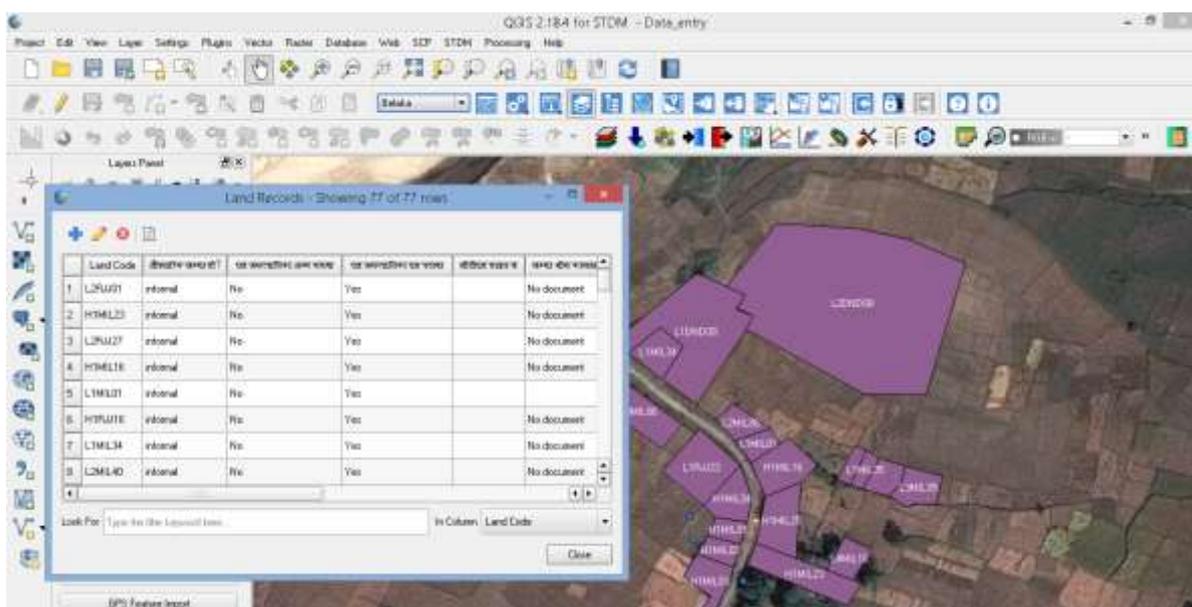


Figure 6: Example of Data and Land Information in the Customized STDM System

5.5 Cost and Time

The total Households surveyed during the pilot project was 1783, and the number of parcels 3607 totaling to a total area of 1065.68 Ha. Additional to the cost of data collection and data entry several pro bono costs were incurred by the implementing partners UN-Habitat, CSRC, MOLMCPA and the Municipality/ local government in terms of computer hardware, customization of STDM software, training, data analysis, technical guidance and monitoring etc. which could not be fully accounted. In light of the above direct cost for data collection and data entry was estimated to be in the range of USD 6 per HH and USD 10 per Hectare.

The total time duration for the pilot project was 7 months and direct person-days for data collection and data entry was estimated as except 734 which would exclude the time contributed by officials as mentioned above and the members of Support Committee.

5.6 Accuracy Assessment

Some quick assessment of accuracy of mapping through comparison of areas of few parcels as digitized from the participatory mapping of visible boundary with the use of satellite

imagery against the area from Total Station survey and the direct ground measurement was made.

Table 1: Accuracy of Total Station Survey and Satellite Image Mapping Area (study by Sijan Dhakal and Bishaz Shiwakoti)

Parcel	Ground Survey (Area sqm)	Total Station Survey (Area sqm)	Difference Ground Survey vs TS Survey (Area sqm)	Difference Ground Survey vs TS Survey (Percentge)	Satellite images (Area sqm)	Difference Ground Survey vs Image Map Survey (Area sqm)	Difference Ground Survey vs TS Survey (Percentge)
Parcel 1	1051.00	1087.18	- 36.18	- 3.44%	1136.43	- 85.43	- 8.12%
Parcel 2	1105.00	1025.74	+ 79.26	+ 7.17%	1081.27	- 23.73	- 2.14%
Parcel 3	967.61	1001.46	- 33.85	- 3.49%	1047.44	- 79.83	- 8.25%
Parcel 4	375.37	384.48	- 9.11	- 2.42%	392.97	- 17.60	- 4.68%
Parcel 5	533.17	513.26	+ 19.91	+ 3.73%	543.08	+ 9.910	- 1.85
RMSE %				4.36%		5.72%	

While RMSE of area calculated from Total Station Survey is 4.36% RMSE of area extracted from digitized map from participatory mapping using high resolution satellite image mapping is slightly lower 5.72%. Calculation was as well made on the RMSE of area calculated from Total Station Survey and area extracted from digitized map from participatory mapping using high resolution satellite image mapping and came out to 4.20%.

5.7 RESULTS AND IMPACT

The result of the pilot study was the testing of a fast, cheap and good enough methodology of surveying and mapping of landless and informal tenure holdings as a spatial framework to achieve a quick solution as envisaged in the legislative and institutional framework for tenure security for all in Nepal. Some earlier work on application of FFP approach (Unger et al, 2019) was implemented in a different context. This pilot provided more systematic results with the official engagement of all concerned parties including the federal and local government bodies and their full participation and ownership.

The impact of the pilot study is reflected in the technical guidelines and working procedures developed by the Land Issues Resolving Commission which takes lessons from the Belaka experience (LIRC, 2020)

6. CONCLUSIONS AND RECOMMENDATIONS

Participatory mapping and application of open-source tools like STDM is considered a fast, cheap and good enough solution to address the colossal task of tenure security of more than 1.3 million households in Nepal. A strong political will is reflected with the adoption of necessary legislation and formation of a Land Issues Resolving Commission. Even stronger will is reflected by considering 3 to 5 years to resolve this big task. Even using FFP approach piloted in this study, the time stipulated might be too short, but using the conventional technology it will be next to impossible. Surveying professionals in Nepal are hard pressed to apply technology for improved geometric accuracy, but it is about to make a smart choice- a choice which fulfils the purpose and is fast, cheap and good enough with a possibility for constant improvement. As discussed in the beginning on the historical evolution of surveying and mapping in Nepal, it has always been purpose-oriented, and it is yet another time to adopt technology and devise methodology which fulfils the purpose.

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BIOGRAPHICAL NOTES

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