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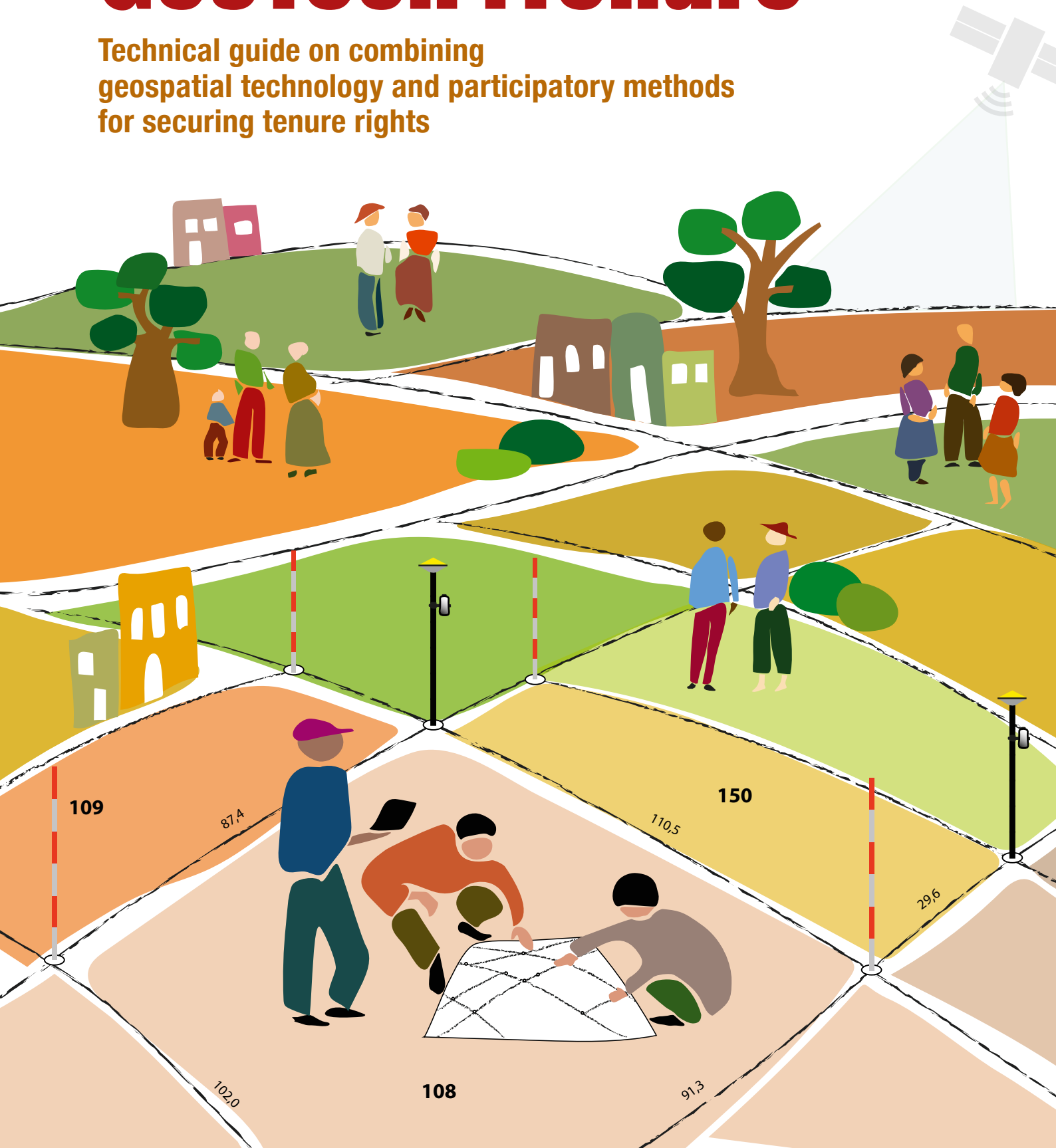
GeoTech4Tenure

Technical guide on combining geospatial technology and participatory methods for securing tenure rights



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Food and Agriculture Organization of the United Nations
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Abbreviations and acronyms

EDM	Electronic distance measurement
FAO	Food and Agriculture Organization of the United Nations
FFP	Fit-for-purpose
FPIC	Free, prior and informed consent
GIS	Geographic information system
GNSS	Global Navigation Satellite System
GPS	Global positioning system
ICT	information and communications technology
IFAD	International Fund for Agricultural Development
M&E	Monitoring and evaluation
RRR	Tenure rights, restrictions and responsibilities
SDG	Sustainable Development Goal
VGGT	Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security

Executive summary

Over the last three decades, there has been a steadily increasing number of initiatives at different levels aimed at securing customary and informal tenure rights. Key motivations include protecting the rights of the poor, supplying preventive justice and limiting the emergence of future conflicts. Only more recently has the linkage between tenure security, investment and development been identified and the risks related to insecure tenure better defined for small holders (Higgins *et al*., 2018) and large-scale investors (Locke *et al*., 2019). Today, tenure security is considered to be one of the critical enabling factors for the success of public and private land-based investments. Investors are therefore ready to address issues of tenure insecurity if required. The objective of this guide is to inform land-based investors[1] and decision-makers about what can be done to strengthen tenure rights and how geomatics technology can support these efforts.

In line with the Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security (VGGT), public and private land-based investments globally are increasingly recognizing land tenure as a key determinant for the success and sustainability of their achievements – it is now apparent how increased tenure security is tied to investment in land, environmental sustainability, strengthened resilience and livelihoods, and higher production and productivity. Land-based development investors today therefore see preventing and mitigating tenure-related issues as a necessary step to achieving their objectives. This is often achieved by clarifying and securing tenure rights in the target area using tools such as technology and community-based participatory approaches.

There is now a multitude of geomatics tools and participatory approaches to support land recordation processes, and so it is critical that decision-makers are able to navigate this array and select the options that can best serve their tenure needs and objectives in each specific context.

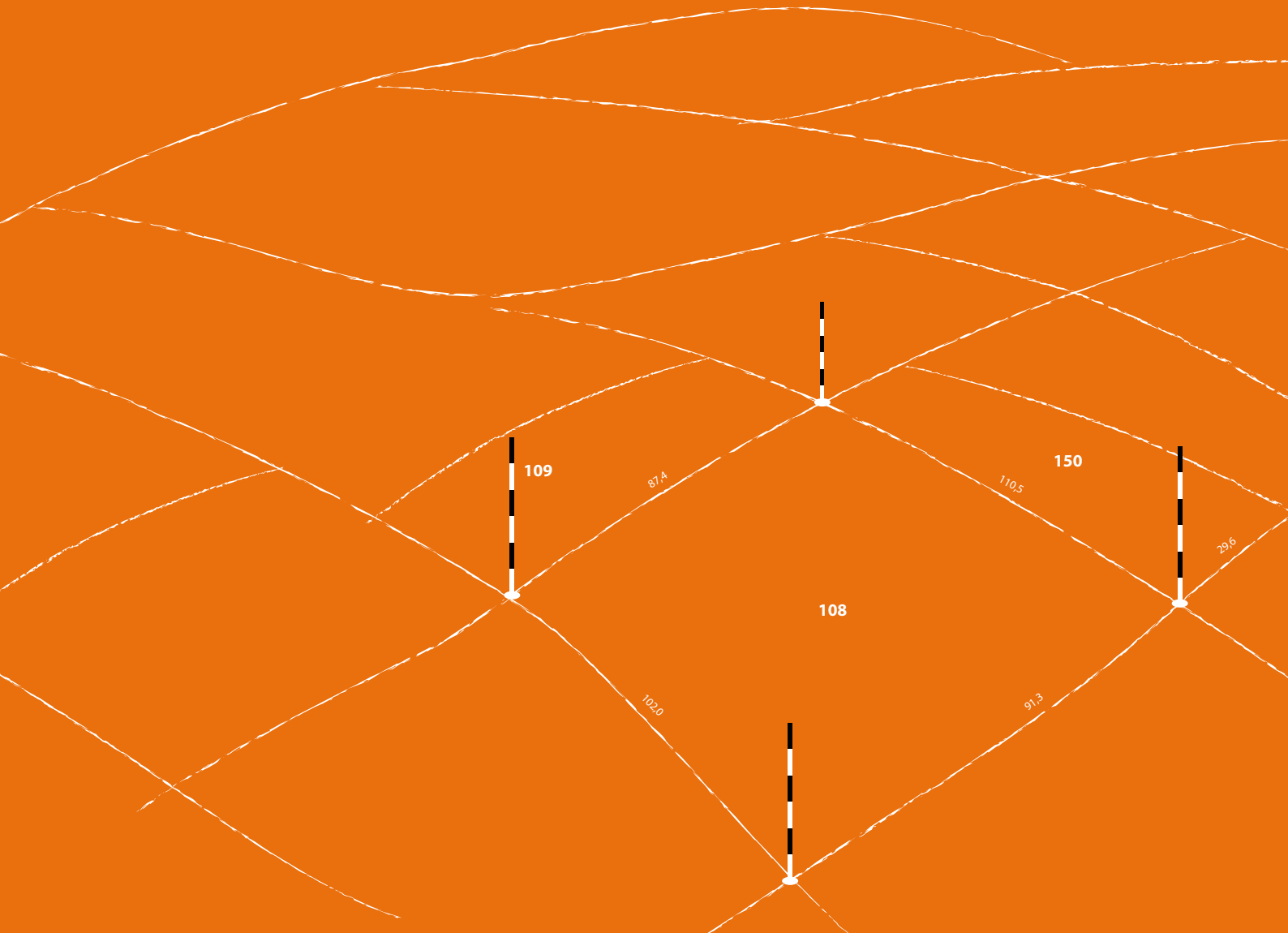
The GeoTech4Tenure guide is intended to help decision-makers and development practitioners involved in public and private land-based investments who have identified weak tenure security as a challenge, and want to know how best to support participatory actions to increase security of tenure. The objective of the guide is to inform their choices in terms of the process and use of technology to secure tenure rights.

In Chapter 1, the guide provides a basic introduction to the functional linkages between land tenure and land-based investment and explores the options for mitigating the risks of tenure insecurity. Chapter 2 illustrates the process of securing tenure rights through recordation by detailing four key activities this involves. Chapter 3 provides guidance on how to select and use fit-for-purpose technology to strengthen and support the process. This includes identifying the choices to be made in order to select the appropriate technology for each specific context. Descriptive criteria are provided that can be used to help assess a technology's readiness for implementation, its adaptability to the specific context, its sustainability over time, and the financial, human and time resources required.

[1] For the purposes of this guide, "development investment projects", "investment projects" or "projects" are all initiatives that foresee a financial investment for the development of the land.

Chapter 1
Land tenure

Chapter 1 will introduce the concepts of **land tenure**, **tenure security** and **tenure governance** and explain **how land impacts development**.



1.1 Land tenure

"All over Africa and beyond, high-tech equipment is being used to catalogue claims to land with near pinpoint precision – sometimes up to less than a foot – and often with a singular goal in mind: sustainable economic development. That is because with secure land rights, farmers and others are more likely to develop their property, plant crops with longer time horizons, or use land as collateral for bank loans to improve their standard of living. There is a wealth of evidence that secure land rights can increase food production".

(Horan, 2013)

Land is much more than just a physical or economic asset – the relationship between the people and the land lies at the heart of human history. Across different cultures, land translates as identity, culture, development, food, shelter and human security. Control of land and resources determines power relationships within most societies. Land has a determining influence on people's lives, occupations and standard of living. Secure access to land is indissolubly linked to human development and may determine the success or failure of land-based development.

What is security of tenure, and how is it achieved?

People enjoy secure tenure when they operate within a sound land governance system, they understand their rights and obligations concerning land, those rights are guaranteed by the social and institutional system of reference, and a mechanism is in place to address any dispute that may emerge.

> ▶ **Land Tenure system.** *Societies establish land tenure systems to define and regulate how people, as individuals or in association with others – as families, clans, communities, non-profit organizations, business enterprises and governments – gain access to land, fisheries, forests and other natural resources. Tenure systems determine who can use which resources, for how long and under what conditions. Tenure rights are the primary connection between which the people, the resources and the conditions of use are connected (FAO, 2015).*

Security of tenure can exist under a formal, customary or informal tenure governance system, provided that all those involved in land use and management perceive that system as legitimate. Whereas formal systems strengthen tenure security through recordation and mapping of rights, under many customary and informal systems, information on rights is not documented; instead, oral traditions are used to maintain the knowledge of who holds which rights and related obligations (FAO, 2017). The need for documented evidence becomes important as those rights become of increasing interest to others, particularly those outside the community, including the government.

> ▶ **Land Recordation.** *Recordation is the act of collecting and recording the relevant information on the land, the resources, and the rights associated with them. Recordation is composed of surveying and demarcation. The survey is the collection of all the data that needs to be recorded regarding the land rights and encumbrances and the rights-holders. The demarcation is the identification of the parcel boundaries, usually using coordinates. Mapping is a separate step that consists of depicting the collected data on a map.*

Sound land governance ensures tenure security: it enables social inclusion by defining the rights that all members should enjoy, and it promotes social stability by increasing the predictability and fairness of any dispute adjudication. Weak land governance enhances insecurity of tenure and has high costs in terms of achieving human and food security, stability, productivity and sustainability. When tenure is not secure, land becomes a source of conflict, a perpetuator of social inequalities and discrimination, and a vehicle for depleting natural resources.

Whose responsibility is it to secure tenure rights?

Although the extent to which formal registration of land rights is necessary and effective is a point of continued debate (Lengoiboni, Richter and Zevenbergen, 2018), the central importance of security of tenure for development is now widely accepted.

Traditionally, initiatives to secure land tenure rights would exclusively be the responsibility of the public sector, through formal land administration processes and techniques. However, problems of tenure insecurity, limited availability of tenure information, and recognition of the high costs of implementing comprehensive, large-scale land information systems (LIS) through public agencies or large-scale international bodies, as well as the challenges in ensuring transparency and accountability, have become insurmountable bottlenecks in improving governance of tenure in many countries (World Bank, 2016).

These challenges have led to various alternative approaches to generating and managing information on land tenure rights being formulated – with the common characteristic being that they allow a much wider range of actors, from communities to investors, to take responsibility for, initiate and participate in implementing initiatives to secure tenure rights.

Box 1. Sustainable Development Goals (SDGs)

The land-related targets under Sustainable Development Goal (SDG) 1, 2, 5, 11 and 15 focus on the importance of land access and tenure security for the achievement of sustainable development. They provide a framework for the design and monitoring of activities to secure land tenure rights.

SDG 1: No poverty

Target 1.b Create sound policy frameworks, at national, regional and international levels, based on pro-poor and gender-sensitive development strategies, to support accelerated investment in poverty eradication actions.

Target 1.4 By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance.

SDG 2: Zero hunger

Target 2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, Indigenous Peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment.

Target 2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality.

SDG 5: Gender equality

Target 5.5 Ensure women's full and effective participation and equal opportunities.

Target 5.5.a Undertake reforms to give women equal rights to economic resources, as well as access to ownership and control over land and other forms of property, financial services, inheritance and natural resources, in accordance with national laws.

SDG 8: Decent work and economic growth

Target 8.3 Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, and encourage the formalization and growth of micro-, small- and medium sized enterprises.

SDG 11: Sustainable cities and communities

Target 11.1 By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums.

Target 11.3 By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries.

Target 11.7 By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities.

SDG 15: Protect, restore and promote natural resources

Target 15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems.

Target 15.3 By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods.

Source: The 17 Goals. In: United Nations. https://sdgs.un.org/goals

The Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security (VGGT) were unanimously adopted by the Committee on World Food Security (CFS) in 2012, and subsequently won broad international recognition and support. They provide internationally agreed guidance on how to recognize, protect and support the enjoyment of legitimate tenure rights, including individual and collective tenure rights, and those held under customary systems. The VGGT identify tenure security as the central pillar for responsible land governance.

The endorsement of the VGGT by the Committee on World Food Security in 2012 further legitimated the concept that all stakeholders have a role to play in improving tenure governance and securing tenure rights. It also provided incentives to geomatics technology developers to explore innovative solutions for allowing a range of actors, beyond the private sector, to take an active role in securing unregistered tenure rights, especially through land recordation.

1.2 Tenure security as a development enabler

"It is important to understand how land and property rights are tied to issues that generate more interest and attention. When people and communities do not have secure rights to the land and resources they depend on, they are less likely to invest in irrigation systems, trees, or soil conservation. Agricultural productivity and food security can suffer, and economic growth can lag".

(Boudreaux, 2020)

Tenure security is not only an end in itself, but also a powerful means of enhancing the sustainability of other development efforts and for empowering people (Liversage, 2019). Secure land and property rights for all are essential to reducing poverty because they underpin economic development and social inclusion (GLTN, 2016).

Why is security of tenure important for development?

When all members in a given society enjoy tenure security (that is, perceive rights and obligations concerning land and natural resources as legitimate), they can plan individually and as a group for immediate and future land use, leveraging land and natural resources for sustainable development. Tenure security – which can only exist within healthy tenure governance systems – is therefore a fundamental enabler for sustainable development.

Making land tenure more secure is a process, not a single event. It is also very context-specific, with no absolute standards to define tenure security (World Bank, 2016).

Although most development investments are highly dependent on the availability of land to achieve their goals, in the past, tenure issues would only be addressed and factored in for land-related projects. All other land-based projects (agricultural, forestry, mineral, irrigation, infrastructure, urban development, and so on) would disregard land tenure as being beyond their scope, too complex an issue to be addressed, or the exclusive responsibility of national governments.

This approach has been overturned in recent decades. Land is now included as part of the risk mitigation and the sustainability strategies of most development investments. It is now commonly accepted that risks such as conflict, elite capture, corruption, unsustainable use of resources, delays in implementation and so on can be prevented and mitigated by ensuring that tenure issues in the project

Table 1. Examples of land-based investments and their tenure implications

Type of investment / Tenure issue	Small-scale irrigation	Outgrowers schemes	Large-scale irrigation	Agribusiness	Infrastructure	Human settlement
Land grabbing/ dispossession/ compensation	Participants have legitimate access to their plots, and the investment does not enable infringements on primary or secondary tenure rights.		Large scale investments require access to large tracts of land for the infrastructure or the development itself, and sometimes resettlement. Identification of tenure rights enables free, prior and informed consent (FPIC) and when appropriate fair and inclusive compensation.			
Benefits sharing	The initial investment will typically support the purchase of equipment and increase the beneficiaries' capacity, which in turn raises the value of the land. Without a clear understanding of the pre-existing tenure arrangements, there is a chance of elite capture or unfair benefits distribution.		Communities whose tenure rights are not formally registered will be in a weaker position or excluded from negotiations with investors involving their land and livelihoods, which will lead to inequitable resource sharing and generate resentment.			
Sustainability	To ensure that the equipment and capacity are retained, it is critical to assess whether participants reside and settle in the areas and have legitimate rights to use the land, water and equipment.		Beneficiaries' active involvement is needed for physical, financial and environmental sustainability.	When tenure rights are not clear, the process of land acquisition takes a long time, creates significant financial losses and affects the financial sustainability of the investment. In extreme cases, local communities can become so hostile to the investment as to undermine it.		
Access to water	Water rights are often separate from land rights. Understanding how the water source is governed and who the primary and secondary users are will avoid abuses and ensure secure access.					

	Pastoralism	Land conservation/ rehabilitation
	Requires seasonal access to large tracts of land which is often unregistered or commons. Changes in livelihoods and national development priorities may leave (nomadic) pastoralists dispossessed of their grazing rights.	Land conservation and rehabilitation efforts may infringe on existing legitimate primary and secondary rights and destroy livelihoods.
	When seasonal rights (pastoralists, forest product gatherers and so on) are not taken into account, not only will livelihoods be lost, but also the state will lose the contribution these make to the sustainable use of arid and semi-arid lands (ASAL) and combating climate change effects.	
	(Nomadic) pastoralism can contribute to efforts to mitigate climate change effects and avoid desertification only when grazing routes are accessible and protected from encroachment.	If people are sure of their rights, they are more likely to take care of the resources and avoid destructive, short-term actions that result in erosion, soil degradation and loss of vegetation and biodiversity.

area are addressed. Furthermore, the sustainability of longer-term projects is linked to tenure security, because it enhances the capacity and will for sustainable development.

How does tenure security relate to land-based investments?

The relationship between land-based investments and land tenure is articulated in many different ways.

Land tenure influences and may affect the outcomes of land-based investments. To be gainful, some development investments – such as infrastructure, large-scale irrigation or agribusiness – require secure access to land, if not permanently, then at least for an extended period. In other land-based investments, such as outgrowers production or small-scale irrigation, rights to the land remain with the owners, who instead give up some of the rights related to the produce in exchange for inputs.

Investments, in turn, have an impact on the land and may weaken rights holders' security of tenure. This causal relationship is complex, but it often gravitates around the increased value and competition for land as a result of the investment. Across the board, an investment will have higher chances of success and the least risk of negatively affecting tenure rights holders when tenure security is high for primary and secondary rights holders.

What are the most common tenure challenges for land-based investments?

Some illustrative examples of land-based investments and their tenure implications are presented in Table 1.

1.3 Increasing tenure security

Before tenure issues can be addressed, they must first be identified, profiled and contextualized. Only with this understanding can options for improving tenure security be identified.

What are the options for mitigating tenure insecurity risks?

Increasing tenure security is a solution that can help address most tenure-related challenges. In the last few decades, technology developers and project managers have joined forces to explore ways of securing tenure rights by making tacit tenure relations explicit and transparent for the community or the wider public. This objective has been pursued through recording, cataloguing, inventorying and mapping tenure rights efficiently and effectively and keeping the records up to date.

Such recordation processes reduce tenure insecurity and strengthen the social fabric, which is the specific focus of this guide. However, documenting land rights is only one

Table 2. Other tools and measures for securing land rights

Civic education	In its broadest definition, "civic education" means all the processes that affect people's beliefs, commitments, capabilities, and actions as members or prospective members of communities. Families, governments, religions, and mass media are just some of the institutions involved in civic education, understood as a lifelong process. When civic education focuses on rights, restrictions, and responsibilities with respect to land, it can open space for dialogue and increase protection for specific rights.
Awareness raising	Awareness raising is a two-way street, fostering communication and information exchange in order to improve mutual understanding as well as mobilizing communities and the whole society to bring about the necessary change in attitudes and behaviour. When applied to tenure, it entails an externally driven action aimed at increasing the level of information people have access to.
Lobbying	Lobbying (also 'lobby') is a form of advocacy by individuals or more usually by lobby groups with the intention of influencing decisions made by the government; it includes all attempts to influence legislators and officials, whether by other legislators, constituents, or organized groups. When applied to tenure rights it can help mobilize champions as change agents for policy or legal reforms.
Mediation and facilitation of community dialogue	Mediation and community dialogue in the context of tenure can be effective tools to resolve existing land conflicts.
Participatory planning	Land use planning is a decision-making process that "facilitates the allocation of land to the uses that provide the greatest sustainable benefits" (United Nations, 1992). It is based on the socioeconomic conditions and expected population developments in and around a natural land unit. These are matched through a multiple goal analysis and assessment of the intrinsic value of the various environmental and natural resources of the land unit. The result is an indication of a preferred future land use, or combination of uses. Through a negotiation process with all stakeholders, the outcome is decisions on the precise allocation of land for specific uses (or non-uses) through legal and administrative measures, which will lead eventually to implementation of the plan.

Box 2. Land recordation and increasing tenure security

In the past, customary communities around the world have often been against land tenure recordation. Some of the main reasons behind this were the fear that the government would take their land away, and the assumption that the process would steer conflict and drive them away from their traditional governance system and toward single ownership.

These processes were often top-down, non-transparent, with a low level of local participation and accountability, and for many decades they did force communities to shift from more complex and diverse systems to single ownership. The traditional centralized land administration infrastructure also included built-in limitations that did not allow it to capture and protect different types and layers of rights or uses.

Today, it is apparent that the single and non-flexible individual ownership model is not always the best option for securing tenure rights and promoting investments. Many countries where statutory and customary systems coexist, especially in sub-Saharan Africa, have undertaken courageous reforms to change this situation, decentralize and diversify land administration practices, and so the number of blended/mutually reinforcing systems is increasing.

Land administration is adapting to this evolving environment and increasing the flexibility, adaptability and context-specificity of its tools.

of many ways to improve tenure security; Table 2 captures some of the other actions that can help enhance tenure security.

When may it be inappropriate to record tenure rights?

It is important to evaluate the context carefully before opting to record tenure rights using modern technology. In some instances – such as in post-crisis contexts with absentee rights-holders, returnees, occupants, existing grievances, or the possible need for restitution – rushing into the recordation of land rights may fuel conflict rather than help resolve it.

Similarly, in contexts where land rights are under negotiation and evolving, or where rights are highly variable, capturing them in a recording system may not grant the required flexibility.

What is fit-for-purpose land administration?

The acknowledgement of the critical role that tenure security plays in development has been accompanied by the realization that many land administration systems, especially in developing countries, are failing to guarantee it to their residents. Land-related services are often expensive, outdated, not accessible, or not adapted to the community's prevailing tenure system.

In fit-for-purpose (FFP) land administration, the design of the strategy to increase tenure security should be "fit" for achieving the expected outcome of security of tenure in the most efficient way. Accuracy relates to the purpose rather than technical standards. It is flexible, adapts to the range of rights and tenure systems it needs to capture in each particular context. Fit-for-purpose promotes designing the land administration systems with the explicit vision of prioritizing the people's needs and their relationships to land at a given point in time. The underlying spatial framework for large scale mapping is designed to manage land issues at the appropriate level, rather than strictly following bureaucratic and technical standards of the conventional registration systems (Enemark *et al*., 2014).

FPP promotes an incremental improvement approach to leverage capacity, accuracy, time, and investment with society's current needs and allows future evolution to more complex configurations. Incremental upgrading and improvement can occur over time in response to social and legal needs and emerging economic opportunities (GLTN, 2016). Translating the Pareto Principle in land administration terms, just 10-20 percent of the investment that would be necessary to solve 100 percent of the issues would be sufficient to resolve the more straightforward tenure issues, which cause 80-90 percent of the problems.

▶ **Pareto principle:** *the Pareto principle (also known as the 80-20 rule, the law of the vital few, and the principle of factor scarcity) states that, for many events, roughly 80 percent of the effects come from 20 percent of the causes. The principle is named after the Italian economist Vilfredo Pareto, who observed in 1906 that 80 percent of the land in Italy was owned by 20 percent of the population. This principle has become a common rule of thumb in business, for example "80 percent of the sales come from 20 percent of the clients." There have been efforts to apply the principle of 80-20 in land administration. Recently, it has been suggested that the Pareto Principle should be applied in land administration where "a minority of input produces the majority of results" and search for the type of input that will produce 80% of the results in the regularization of land tenure and in a reduction of conflicts over land.*

What can FPP land rights recordation help achieve?

Both conventional land administration systems and FPP capture the land parcels (the legal objects), the associated rights, claims and encumbrances on the land, and the subjects (legitimate rights holders) entitled to those rights.

Conventional land registration and cadastre systems use documentation of professionally surveyed land parcels as a basis for entering and certifying rights into a cadastre and land registry. The FFP approach combines mobile, often cheaper, digital geomatics technologies practised by para-surveyors and flexible digital database management tools with community-based approaches for capturing and administering tenure rights information. Ortho-rectified aerial or satellite imagery and satellite navigation tools may be used in the field to identify, delineate, and adjudicate on the visible (physical) land parcel/spatial unit boundaries. The rights are adjudicated, determined, and the data is entered directly into a digital land record by locally trained land specialists while involving all stakeholders in the verification of the outcomes (GLTN, 2016).

FPP land records, much as traditional land records, must be kept up to date. If the local communities do not address the land administration system when mutations of rights, holders, or parcels happen, the system fails. Clarity about the events that trigger updates in the database and the required process as well as the social acceptance of the local communities' mechanisms for updating them are critical to the system's success.

While conventional land administration usually has high fixed costs in terms of human and financial capacity and time, in FFP land administration priority is given to ensuring people's participation, accessibility and transparency of the processes. The specific objectives for securing tenure rights will determine the technology, spatial accuracy level, and initial investment required.

When choosing an optimal way to secure tenure rights in a specific context, it is essential to remember that in any one intervention, one cannot achieve more than two of the three usual targets: low cost, high accuracy, and short implementation time. Low cost and a short time span will imply low accuracy; high accuracy and low cost will require a long time; a short time and high accuracy will imply high costs (this rule of thumb was published by Zülsdorf, G., Şatana, S. and Evtimov, V. in a report for the WB and FAO, edited by Byamugisha, F. in 2012). A comparison of traditional land administration and FFP land administration is presented in Table 3.

When is FFP land rights recordation a good option to increase tenure security?

FFP approaches are particularly useful where formal land registration does not suffice or has failed to acknowledge the diversity of land tenure regimes (Lengoiboni, Richter and Zevenbergen, 2018).

Because of its participatory bottom-up nature, FFP recordation is proving to be an effective instrument for securing tenure rights, increasing participation in land administration and empowering individuals, families, clans and community to defend their rights better.

How can geospatial information technology (geomatics) support the process?

Thanks to the use of easy-to-refer-to images and geospatial models, and accessible land information systems, technology can bring the process much closer to beneficiaries, empowering them and building their understanding of the legitimate land rights, restrictions and responsibilities, while increasing the transparency and accountability of and participation in the process.

▶ **Geomatics** *is defined in the ISO/TC 211 series of standards as the "discipline concerned with the collection, distribution, storage, analysis, processing, presentation of geographic data or geographic information" (ISO, 2004). It includes the tools and techniques used in land surveying, remote sensing, cartography, geographic information systems (GIS), global navigation satellite systems (GNSS: GPS, GLONASS, Galileo, Compass and others), photogrammetry, geophysics, geography, and related forms of earth mapping. The definition also includes the associated hardware and software that supports data collection, storage and management.*

Geospatial information technologies – such as geographic information systems (GIS), satellite positioning systems (GNSS, Global Navigation Satellite System), electronic

Table 3. FFP vs CONVENTIONAL COMPARISON TO HELP PLANNING LAND RECORDATION

		Conventional Land Administration	FPP Land Administration
Captures	What objects	Professional licensed surveyors carry out instrumental cadastral surveys and identify parcels	Para-surveyors identify and capture essential land parcel data by mobile, affordable digital geospatial technology
	What rights	Formal rights, restrictions and responsibilities (RRR)	All locally essential legitimate RRR, access, use, others
	Who	Formally recognized land holders	Legitimate land holders and claimants
Means for data collection		Statutory prescribed survey methods, instruments, technical standards (often outdated)	FFP practical survey methods, tools, flexible standards
Accuracy		High (formally prescribed in technical standards)	Variable (flexible approach fit for the context)
Updating and maintenance		Required	Required
Cost	Financial capacity	High	Variable
	Human capacity	High	Variable
	Time	High	Variable
Inclusive process		Not necessary	Necessary
Sustainability		Variable	Variable
Legal and institutional framework		Critical	Not critical
Political will		Critical	Not critical
Local ownership		Not necessary	Necessary

distance measurement (EDM) and tacheometry, and soft-copy photogrammetry, collectively known as geomatics – plus modern Information and Communication Technologies (ICT) and database management systems, can be combined with methods of sociological inquiry such as participatory enumerations and digital engagement platforms to provide new techniques for gathering, organizing, analysing, conveying and managing information about land and resources tenure.

1.4 Addressing tenure security in project design and implementation

Addressing tenure security issues during the design and development phase of investment interventions helps to ensure that risks are appropriately identified and mitigated and so substantively increases the sustainability and benefits of investments.

What are the key elements to securing tenure rights through recordation?

As discussed previously, the risk mitigation or sustainability strategies of investment projects can include actions to

Table 4. **Key elements to securing tenure rights through recordation**

Participation	Participation is the primary element in any effort to secure tenure rights. If the process is not sufficiently inclusive, there is a high risk of disenfranchising rights holders during the recordation process. The more participatory the process, the more legitimate the outcome will be, and the fewer conflicts are likely to emerge in the future. Although ensuring participation may be time consuming and challenging, it is the pillar of any activity aimed at securing tenure rights.
Objectives	Beneficiaries must have a shared understanding of why they want to embark on an exercise to secure their tenure rights. The agreed objectives will determine roles and ensure commitment to the process and its outcomes, thus increasing sustainability.
Context	The policy and legal context will determine the extent to which the objective of securing tenure rights can be pursued. In some contexts, the existing framework allows for documented informal and customary rights to be recognized with the same level of protection as formal rights. In other contexts, formal recognition is not yet attainable and therefore the process of obtaining full legal protection of documented informal rights may be longer.
Resources	The resources necessary to secure tenure rights are primarily determined by the objectives and the context, as well as by the process and technology, the scope, and whether the exercise is sporadic or systematic. The more complex the selected process and technology, the higher the associated costs will be in terms of time, money and human capacity. The scope of the activity will also have an impact on the costs: if the scope of an intervention is small, technology costs may be considerable, and vice versa – when the scope is large, technology costs fall and the budget is consumed by human resources and logistics costs. Lastly, due to economies of scale, the unit cost will be much lower if the exercise is systematic than if it is sporadic. When undertaking such an exercise, it is crucial to be realistic about the costs of activities and factor in not only the resources available under the project but also the human and financial capacity required to ensure sustainability in the long run.
Technology	Technology can only be useful when it: is instrumental in achieving the identified objective; can be used by and/or with the participation of the beneficiaries; can record all existing legitimate tenure rights; is affordable; and is sustainable, meaning that it can be maintained with the projected available capacity.

secure tenure rights through recordation. Whether tenure activities are planned from the design phase, or emerge as a priority during project implementation, there are certain key elements that should be considered. These are presented in Table 4. Key elements to securing tenure rights through recordation.

> ▶ **Sporadic and systematic registration** *(FAO, 2003). Sporadic registration of land is the process of registering land on a case-by-case basis, usually in response to a specific trigger such as the sale or inheritance of the property or a direct threat to the right holder's tenure security. Systematic registration is a systematic approach to adjudicating, surveying and registering parcels, rights and encumbrances, and holders on an area-by-area basis.*

Land recordation budget

When budgeting for a land recordation campaign a range of different costs should be taken into account. Whereas some costs can be estimated based on global experience, others will vary depending on the context, the scale of the campaign, whether communal, individual land rights, or both are being recorded, and the extent, morphology and location of the area to be recorded.

Items that should be considered when designing a budget include, but are not limited to:

- logistics
- awareness raising and out-reach
- capacity development
- public (community) display of data for verification
- disputes resolution
- personnel (if any)
- technology, and
- formal processing fees (if any).

An accurate budget projection will enable decision-makers to appraise the investment in recordation against the possible cost of tenure-related risks, thus assessing the value for money of the activity.

Communal, individual, or communal and individual land rights?

Securing communal rights on customary land is naturally more common to rural areas in developing countries, where strong customary traditions still prevail. The need to secure individual/household[1] rights on customary land — such as smallholder farmers' rights — is greater in situations where rural inhabitants do not form strong communal entities; this is particularly true in urban or semi-urban areas, or areas of rapid socioeconomic change (such as commercialization of agriculture, rural-urban migration, rapid demographic growth, and so on). The relative importance of communal versus individual land rights varies greatly among contexts and even within countries. Within broader areas where communal and individual rights co-exist, securing communal rights can sometimes be the first step towards recognizing individual rights.

How much does communal land rights recordation cost?

The cost of improving the security of communal land rights through delimitation falls between USD 5000 and USD 10 000 (INDUFOR, 2014; p.17). Some of the factors that may influence the cost include:

- **Stage of technology implementation:** the costs of inception phases for pilot initiatives are higher, with costs likely to go down once methodologies are refined in subsequent scaling up phases.

- **Training of paralegals:** increasing people capacity can help to bring costs down and help build the community's trust in the process.

- **A systematic approach:** working with all the communities in a region is less expensive than a more sporadic approach that targets individual villages.

- **Varying logistics costs:** including transport costs and the costs of the necessary administrative steps.

- **Volunteers or paid workers dealing with disputes and outreach:** community-driven campaigns can experience substantial savings on personnel and logistics costs, though they may require longer time for training and capacity development.

How much does individual/household land rights recordation cost?

The cost of improving the security of individual land rights through recordation is typically between USD 5 and USD 10 per parcel (INDUFOR, 2014; p17). FFP technology and processes for land recordation continue to improve, allowing for further reduction of the unit costs. Some of the factors that may influence the cost include:

- **Costs per hectare** vary a lot depending on the size of the parcels.

- **Costs for urban land are usually much higher** due to the smaller size of the land parcels.

1 ***When embarking on land rights recordation it is always better to encourage right holders to register the land in the name of both spouses. In some tenure contexts that are still transitioning from communal to family-level holdings it may even be appropriate to include all household members.***

- **Recurrent costs** of the subsequent rural land administration activities after titling are relatively low.

- **Varying staff and logistics costs**, including labour costs for the required administrative steps.

- **Community-driven exercises** can experience substantial savings on personnel and logistics costs, though they may require longer time for training and capacity development.

- **Climatic and environmental conditions**, as costs may vary from area to area depending on weather conditions and environmental difficulties (demarcation in wetlands, bushes, or inaccessible areas), which may require not only more time but also additional and more specific equipment.

- **Number and intensity of existing conflicts** will have an impact on costs as more time will be needed to agree on the recordation of disputed interests or boundaries.

Box 3. Safeguards on tenure rights

Recognizing the primary role that land tenure security plays in enabling development, many public and private investors have developed safeguards policies to ensure that their investments respect legitimate tenure rights and promote improved tenure governance. Below are some examples from International Fund for Agricultural Development (IFAD), FAO and the World Bank.

IFAD – Social, Environmental and Climate Assessment Procedures, (SECAP). IFAD is committed to enhancing environmental sustainability and resilience in small-scale agriculture in the full range of its projects and programmes. Promoting a sustainable natural resource and economic base for rural people that is more resilient to climate change, environmental degradation and market transformation is at the core of delivering IFAD's poverty reduction and sustainable agriculture mandate. SECAP outlines how IFAD addresses the social, environmental and climate impacts associated with its projects and programmes by: setting a priority to adopt guiding values and principles to promote high social, environmental and climate adaptation benefits; defining the SECAP process and suitable entry points in the project cycle; mainstreaming social, environmental and climate adaptation sustainability considerations into all its activities; and ensuring effective stakeholder engagement, including a procedure to respond to alleged complaints from project-affected individuals /communities.

FAO – Environmental and Social Standards (ESS) on Land Tenure and Displacement. Necessary though they may be, land acquisition and restrictions on land use that cannot be refused by affected people and communities (involuntary resettlement) can have very serious impacts, causing them to physically relocate (physical displacement) and very often also disrupting their sources of income and/or livelihoods (economic displacement). Whenever possible, involuntary resettlement should be avoided or at least minimized. If unavoidable, appropriate mitigation measures must be planned and implemented, always bearing in mind that people's lives will be affected. The objective of FAO Environmental and Social Safeguard 6 (ESS 6) is to ensure that displacement is avoided whenever possible and recognizes that when displacement cannot be avoided, its scale must be minimized and it must be done in a way that does not increase socioeconomic risks or otherwise negatively impact a community, ensuring that affected people are compensated fairly prior to any displacement. It further addresses the issue of inconsiderate or irresponsible tenure reforms which regularize or convert tenure and/or land administration systems from customary, indigenous or traditional, to statutory ones infringing on existing tenure rights.

World Bank – Safeguards for Land Rights. Land availability and security are fundamental to fulfilling the growing global demand for food. Land tenure security promotes investments in land and facilitates its productive allocation. Secure land rights make it easier to access credit by using land as collateral. Yet, limited access to land and inadequate tenure security are crucial bottlenecks for farmers worldwide. This has tremendous consequences for agriculture. The World Bank includes as part of its projects safeguards against land expropriation and for the recognition of customary land rights.

Securing tenure rights at different project stages

Different activities can be undertaken at different stages of a project's lifespan in order to ensure tenure is appropriately factored in.

- **Design:** there are many policies on safeguards used at the project design and appraisal phases to ensure the identification and mitigation of tenure risks and the sustainability of project outputs. During this phase, it is critical that a context-specific assessment of tenure-related risks and the development of a risk mitigation strategy is performed; this will ensure that sufficient resources are allocated to address potential tenure insecurity challenges.

- **Implementation:** counteractions must be put in place to mitigate any tenure risks that might emerge that had not been appraised. Although the level of tenure security that can be achieved within a more limited timeframe will not be as high, the foundation can be laid for a process that is able to continue after the project's lifespan.

- **Monitoring and evaluation of outcomes:** tenure aspects should always be included when monitoring and evaluating the outcomes and impact of a land-based investment. A plan should be in place for monitoring and assessment of the longer-term sustainability of the FFP system that has been implemented, and its impact to date. Measuring the impact of increased tenure security is not easy. The analysis should include quantitative data related to recordation of tenure rights and the beneficiaries' use of the system, the value of the land, the proportion of women or youth and others who have secure access to land, and qualitative and quantitative data on the beneficiaries' perceived impact of the increased level of tenure security. If the activities did not allow beneficiaries to achieve legal recognition of their rights, a clear road map should be in place as to how to continue and the responsibility for follow-up should be handed over to local or national authorities.

Chapter 2
Land rights recordation

Chapter 2 lays the foundations for designing and implementing activities to secure tenure rights – who should be **involved in the process**, how to build a **shared understanding** of the issue and collectively **define the objectives** of the undertaking, and so on – with particular attention given to the role of rights-holders in **strengthening their own tenure security** and how to **enable participation** and **ensure inclusion** in the land rights recordation process.

The principles and activities of land rights recordation presented in Chapter 2 are those that always apply, irrespective of whether geomatics are used to support the undertaking; the question of how technology can be used to support them will be explored in Chapter 3.

Although each activity is tailored to the specific context and local circumstances, there are certain principles that should always guide their design and implementation. The land rights recordation process is divided into four phases, or activities, and for each of these indicates the main elements and the choices to be made. The chapter ends with a section on upkeep, sustainability, monitoring and evaluation (M&E).

2.1 Land rights recordation principles

Although every land recordation process is different, there are certain principles that should always guide the undertaking, including:

- **Inclusion and participation.** To achieve improved tenure governance and reinforce tenure security, it is critical to recognize and protect all the legitimate tenure rights that exist on the site. The key to success in land tenure recordation activities at any level is meaningful participation and inclusion of all stakeholders (beneficiaries, rights-holders, local authorities, and others). This may at times require an additional investment in empowering and capacitating those who are at risk of being left behind and vulnerable to exclusion from land governance and decision-making.

- **From general to detail.** The geodetic surveying principle of starting from the general to get to the detail very much applies in the context. Without a strong understanding of the general context leading to the existing tenure situation, it would be impossible to understand the specific bundle of legitimate rights that should be recorded.

- **Fit-for-purpose.** The type of intervention designed, the human, financial and technical costs of the action and follow-up maintenance, and the expected impact in the immediate and long term are all dictated by the specific objective pursued in securing tenure rights, as well as by the existing policy, legal and institutional frameworks. Strengthening tenure security is a progressive undertaking that allows for incremental implementation and – as tenure rights, holders and parcels are dynamic over time – requires follow-up maintenance.

Figure 1. **Principles, activities, sustainability**

Notes: IFAD. IFAD's Social, Environmental and Climate Assessment Procedures In: IFAD. www.ifad.org/en/secap; FAO. Environmental and Social Safeguards. In: FAO. www.fao.org/investment-learning-platform/themes-and-tasks/environmental-social-safeguards/en/; World Bank. Safeguards for Land Rights. In: World Bank. https://eba.worldbank.org/en/exploretopics/land.

- **Build on what exists.** A system that enjoys local legitimacy normally has enforcement and service delivery capacity which should be preserved, since the costs associated with efficient external provision of such services can be very high. When a system is in place that has local legitimacy, it is always

appropriate to seek land recordation solutions that can be implemented within or in collaboration with the existing system, rather than in competition.

- **Realistic planning.** Development investment projects have limited resources and time, and so it is critical to assess realistically what can be achieved within the given timeline and ensure that targets and budgets are realistic (see Pareto Principle above).

- **Embed sound mechanisms for dispute resolution.** Conflict is a natural element in life. Land recordation processes may at times cause disputes to surface and exacerbate tensions, but they also provide a unique opportunity for resolution. It is critical that a legitimate, accessible and transparent dispute resolution system is embedded in the undertaking in order to address and peacefully resolve emerging disputes and avoid escalation into conflict.

- **Upkeep and sustainability.** Land tenure is a dynamic domain in continuous evolution. Land rights recordation can only contribute to tenure security when the three fundamental elements recorded – the plot, the right(s) and the legitimate rights-holder(s) – are clearly specified and remain adequately accurate and precise over time. If the objective is to secure tenure rights beyond the lifetime of the investment, then human, technological and financial capacity must be in place to continuously monitor and evaluate and reflect any changes in the elements recorded.

2.2 Land rights recordation activities

"Ubi civitas, ibi jus",
(No society can exist without rules)

Latin axiom

This chapter explores the process-related aspects of land recordation that can lead to inclusive, participatory and sustainable land recordation within communities, thus increasing tenure security; the technology-related choices required for land recordation will be explored in Chapter 3.

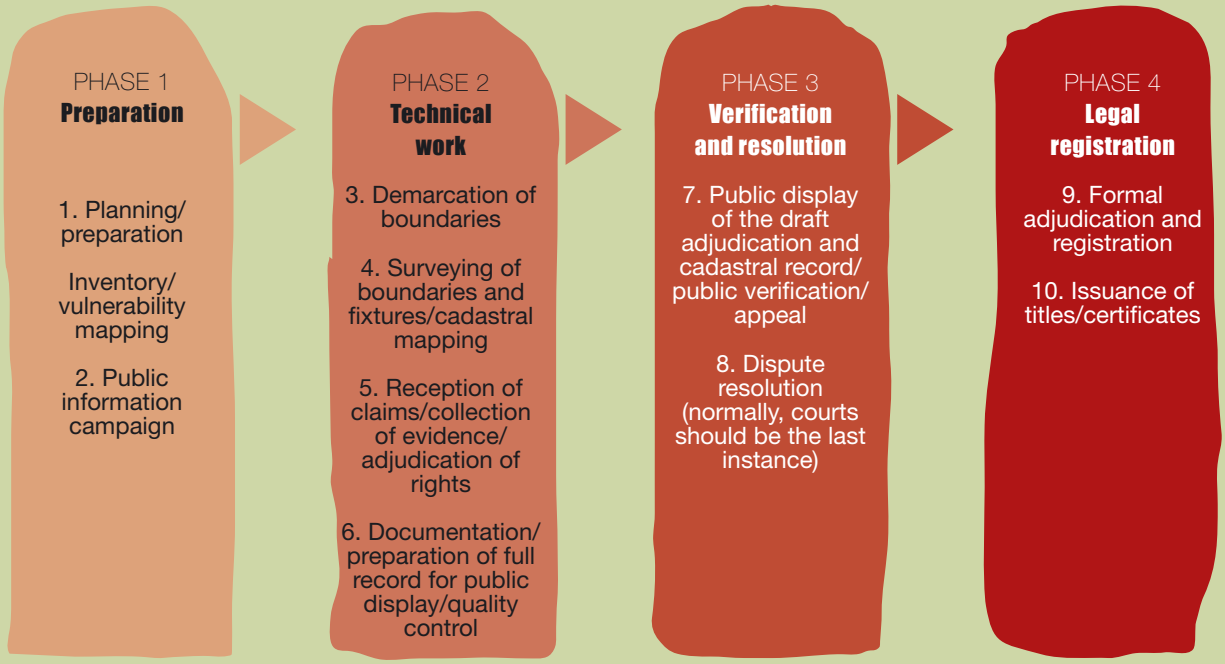
There is no single optimal strategy for recording land tenure rights across different contexts, but there are mandatory sets of activities that should be included in the process. In systematic first registration targeting regularization, there is a broad agreement that these sets consist of: preparation, technical work, verification and resolution and registration (Stanley and Torhonen, 2013). Each of these four phases in turn includes specific steps, as illustrated in Figure 2.

Fit-for-purpose land recordation always includes Phases 1, 2 and 3. Phase 4 does usually entail issuing a certificate to rights holders, but its legal value may vary, depending on whether a mechanism exists to formalize recorded tenure rights. The order of the steps and their relevance within each phase may vary depending on the characteristics of the individual campaign (sporadic or systematic, driven by government or community, and so on). In general, it is preferable to carry out adjudication, surveying and mapping simultaneously to increase the

Box 4. The "nested" land administration systems approach

In a "nested" land administration system, the national land administration body delegates land administration powers to regional or local authorities (such as city councils or traditional chiefs) to administer land within their jurisdiction. Such authorities act as the agent of the national land administration body within their territorial perimeters, which are registered in the national land administration system as a single parcel managed and administered by the local authority. This creates local land administration systems "nested" within the national one, thus bringing land administration closer to the customer, better responding to local demand and reducing the pressure on the system at the national level. On the one hand, this enables a specific, local approach to increasing tenure security, which is legitimate for the local communities and allows incremental improvement within prioritized jurisdictions within a national land administration system. On the other hand, such nested systems pose challenges when it comes to maintaining common national standards for land administration services. A reasonable and balanced compromise should always be sought.

Figure 2. Systematic land registration phases



Notes: **Stanley, J. & Torhonen, M. 2013.** ***Towards Spatially Enabled Land Administration; Improving Systematic Registration.*** **Washington, World Bank.**

efficiency and transparency of the process. All the above steps should be taken into account when planning and implementing land recordation activities.

Not all steps will be explored in this guide. Instead, attention will be focused on those steps within the four phases that are most relevant to ensuring a fair, transparent and sustainable process and outcome when using fit-for-purpose technology. These areas of focus have been clustered under four activities: understanding the context, mapping land dynamics on the ground, planning participatory recordation and mapping, and participatory land mapping.

Most of the activities considered here happen before the adjudication, surveying and mapping and validation. In fact, the success and sustainability of any land tenure rights recordation activity is determined long before these activities take place and is closely related to the level of participation and inclusion in the process.

Activity 1: Understanding the context

In order to foster a space for dialogue, there is a need to ensure participants have a common understanding of the context, the rules that regulate interactions between people and the land, and their evolution over time. This will help them to understand the existing level of tenure insecurity, quantify its impact on the risk for development investments, and inform the design of a mitigation strategy.

What is the objective of this activity?

The objective of this activity is to:

- **Analyse the land tenure governance context** in order to understand the rules that regulate access to land and natural resources and the particular characteristics of the local tenure system.

- **Assess the effectiveness of the rules,** in terms of whether and how the application of these rules enables people to enjoy the benefits of tenure security and establish a baseline for future progress assessment.

Box 5. Measuring tenure security – Prindex

Tenure security is not necessarily dependent on the level of formalization of the land rights, but is contingent on a wide range of factors which combine in a flexible way depending on the context.

Prindex is an advanced tool for measuring tenure security. It collects data through interviews with a representative sample of randomly selected individuals over the age of 18 from each country, including primary and secondary rights holders, men and women, and young and old people, and comparing their situations. This differs from some surveys and censuses on property rights which interview the head of each household and report findings at household or property level. It further collects a range of additional data on individuals' tenure situations, as well as key individual and household characteristics. The global dataset currently includes data on perceptions of property security in more than 140 countries.

Prindex assesses the respondent's perceived tenure security via a central question about their home, land and any additional property, focusing on perception rather than legal status. Perceptions determine behaviour and make accurate comparisons of property security under different legal frameworks possible.

Source: **Prindex. 2020. *Prindex.* Cited 14 March 2022. www.prindex.net**

- **Understand where the set boundaries are between public and private interests** in the framework of the applicable tenure governance system (statutory, formal and informal). This understanding will inform the design of the land recordation and determine what should be recorded.

Box 6. Cash crops – a potential catalyst for tenure system change

To be effective, tenure systems need to evolve as interests and needs change. For example, cash crops often require secure access to the same piece of land over an extended time in order for the investment to be profitable. In contexts of customary communal tenure, cash crops have therefore been one of the common causes for shifts in tenure patterns. For example, in the late 1800s the introduction of cocoa into Nigeria and Ghana as a major cash crop initially faced a lack of access to the land because of the difficulty in achieving a level of tenure security adequate for a tree crop. The system gradually adjusted to this changed need by allowing private ownership, including sale and mortgaging of the tree, and over time, of the land itself.

What types of tenure systems are there?

Tenure systems are dynamic and highly diverse. They can be broadly categorized into four main types: formal, customary, plural and informal – each with specific associated implications.

- A **formal (statutory) tenure governance system** is the result of the application of legal and policy provisions designed by the state to regulate and protect access to land and natural resources. It is regulated and enforced by statutory authorities. The statutory tenure system typically includes rules for expropriation and compensation and the definition of those instances where the public interest should supersede private or group interests in the land and natural resources. The formal tenure system can be overlaying or integrated with physical and land use plans.

- A **customary tenure governance system** refers to an established, traditional pattern of norms that can be observed within a particular sociocultural setting (Thompson, 1991). Resources under customary systems can be managed communally, by groups or individuals. The system is regulated and enforced by customary authorities. In most cases, customary systems entail a strong aspect of land use planning, whereas the norms for present and future access to and use of land and natural resources are based on principles and aspirations shared by the community and have been negotiated and agreed. The flexibility of these systems and the fluid and more direct dialogue they allow for often increases their adaptability to changing circumstances.

- An **informal system** is a spontaneous system that occupies a legal and physical space that is beyond the scope or enforcement capacity of the formal and customary systems in place, and is regulated by temporary rules agreed among occupants. Informal systems are typically found among newly formed communities that have come together haphazardly since people have moved away from their places of origin. In informal systems, individual and group needs often supersede community interests and the aspects of land use planning are often lacking.

- In a **plural land tenure system**, formal and/or customary systems coexist in parallel. They may be harmonized and mutually reinforcing, or conflicting. In harmonized plural systems land administration functions are allocated among systems and well defined. In conflicting plural systems land administration functions are overlapping and conflicting.

What are the implications of each tenure system on tenure security?

There is no fixed correlation between the formality or informality of a tenure system and the level of tenure security it generates or can grant. However, single systems (formal or customary) and harmonized plural systems (blended/mutually reinforcing) tend to guarantee a higher degree of tenure security than parallel/conflicting plural systems and informal ones.

In single systems, governance speaks with one voice, and rules tend to be clearer and understood by everyone, increasing legitimacy, predictability in decision making, and potential for transparency and accountability.

In contexts which have plural systems, the highest grade of tenure security is typically granted by harmonized, mutually reinforcing systems. In such instances, the statutory framework recognizes the customary framework(s), and clear rules establish how the different systems relate to each other, clarifying competencies, functions, and hierarchies for decision-making. Systems thus integrate statutory and customary governance into one structure so that they complement each other, building on respective strengths, instead of competing.

Plural systems that are not harmonized tend to provide limited tenure security. When statutory, customary and/or informal institutions and rules enforce governance in parallel, they undermine each other, increasing uncertainty about what rights are legitimate and fostering forum-shopping.

▶ **Forum-shopping**. *The practice of choosing the court in which to bring an action from among those courts that could properly exercise jurisdiction based on a determination of which court is likely to provide the most favourable outcome.*

How should the quality of a tenure governance system be assessed?

To assess the quality of a tenure governance system, the analysis must evaluate to what degree the system(s) in place:

- recognize and protect all existing primary and secondary legitimate tenure rights
- guarantee and protect the tenure rights of women and vulnerable groups
- set transparent rules and safeguards for allocation, acquisition, transfer, expropriation and compensation
- are understood and perceived as legitimate by people/the community
- have the capacity to address disputes and enforce decisions on the ground
- are efficient and accountable in providing services.

Such analysis will identify the system's strengths, which can be used as entry-points for building its capacity, and the weaker areas where additional capacity reinforcement is required.

This assessment will not only help identify the system's weaknesses that have led to the existing situation of tenure

Box 7. How do governance quality criteria relate to one other?

Quality criteria are not always directly related and must be looked at individually. For example, there is no fixed correlation between the formality or informality of the system and the degree of tenure security: formal systems with limited record keeping and implementation capacity may be weaker than customary systems based on entirely oral tradition with a high degree of local legitimacy. A system may be perceived as highly legitimate and have the capacity for management and enforcement of rights, yet discriminate against vulnerable groups. It may not allow for owners to sell their land, yet grant users a very high degree of security. It may have a high degree of local legitimacy and enforcement capacity, but not constitute an enabling environment for agribusiness expansion and risk-free investment, because land use agreements are informal, short-term regular (seasonal or annual), irregularly intermittent (like nomadic grazing rights) or based on crop-sharing arrangements and open to contestation.

insecurity, but also assess the margins for improvement within the existing policy, legal and institutional framework. This will help set realistic targets and objectives for the land rights recordation activity.

What is the history of land and tenure in the area?

Understanding how the tenure governance system has evolved in the area, and how resilient it is to shocks and changes that may have affected its capacity to protect people's tenure security or to provide services, will allow the tenure governance context analysis to better inform the design of sustainable solutions.

Some examples of information that may help contextualize the history of land in a given area include:

- land institutions and authorities on site
- current, past and projected land values and reasons behind any changes
- topography, land cover, soil characteristics, fertility and suitability, climatic characteristics, water availability and other agriculture-related data which may show effects of climate change
- rural-urban migration trends and other voluntary or forced migration phenomena
- history of conflicts, including level and intensity and their evolution
- economic and demographic statistics
- levels of competition between different land uses and in the land markets, and how these have changed/are changing.

This part of the analysis will also help to identify existing tensions and conflicts, so that an appropriate strategy can be developed to address and mitigate them.

How do you carry out a context analysis?

A context analysis can be informed by a combination of rapid desk-based policy and legal review, and on-the-ground participatory mapping and perception surveys. Particular attention should always be paid to marginalized groups (ethnic minorities, women, youth) and secondary rights holders who are usually the most vulnerable.

All information should be validated on the ground to finalize the analysis and identify possible gaps between the policy and legal framework(s) and the reality at grass-root level.

▶ **Participatory mapping** *is a general term used to define a set of approaches and techniques that combines the tools of modern cartography with participatory methods to record and represent the spatial knowledge of local communities. Also referred to as "community mapping", it is based on the premise that local inhabitants hold accurate knowledge of their customary (and otherwise usually unrecorded) tenure, as well as expert knowledge of their local environments which can be expressed in maps which are easily understandable. Maps created by local communities represent the place in which they live, showing features communities themselves perceive as important, such as customary land boundaries, how they use resources, sacred areas, areas for public use and so on. It is a powerful tool that allows remote and marginalized communities to represent themselves spatially, bringing their local knowledge and perspectives to the attention of governmental authorities and decision-makers (Mapping for Rights, 2020). Participatory mapping can be a building block towards recordation.*

Activity 2: Mapping land dynamics on the ground

After completing the context assessment (see Activity 1: Understanding the context) and before commencing any effort to record tenure rights, it is crucial to identify the typology of legitimate interests (rights and claims) to the land and natural resources and agree on how emerging tensions and conflicts – that may surface during the process – should be adjudicated.

Mapping tenure relations not only provides spatial information about the land and landscape of natural resources, their use, tenure and ownership, but also maps the sociopolitical relationships underlying this environment and the institutional structures that govern the land and natural resources. Mapping is an exercise through which tacit knowledge, as embedded in people's spatial memory, is converted into explicit and externally usable knowledge. Herein lies the usefulness of mapping as a tool for empowerment, but also the risks it entails (ILC, 2008).

What are the objectives of this Activity?

The objectives of this Activity are to:

- **Identify all the holders of primary and secondary rights, the typology of tenure rights, restrictions and responsibilities (RRR) and actual or potential land claims.** Stakeholders will include all those individuals and groups whose land rights are affected by the recordation process. It is important to enquire about the possible existence of absentee rights holders.

- **Map the factual relationship between the land and the people**. Land can be part of the identity, culture, or history of specific individuals or groups, while also being a socioeconomic asset. The relationship between people and the land will help explain what value people attach to the land, how the land is related to their livelihoods and what their fears and aspirations are regarding its management and development, and this will often determine the decision-making criteria related to present and future allocation and use of land and natural resources.

Why is it essential to invest in mapping land dynamics?

Tenure security is the foundation for sustainable development, and it stems from within the community. This identification of interests, when performed accurately, will mitigate risks and increase the legitimacy and sustainability of the land rights recordation process. It provides a unique window of opportunity to resolve land disputes and harmonize conflicting claims, mitigate the risks of conflicts emerging at a later stage, and strengthen tenure security within the community. When the process leads to solid recordation of the rights, rights holders, and land units (parcels), it will also increase tenure security and resilience against external threats and adversities, as well as the capacity to negotiate with third parties.

Under customary and informal systems, this activity also entails an aspect of analysis of existing land use and planning rules in order to understand in what instances the community interests and vision should prevail over individual and groups interests and needs.

To take full advantage of these opportunities, the process of identifying interests as well as the recordation itself must be participatory and inclusive. All stakeholders that will be directly or indirectly affected, as well as decision-makers who may not have a direct stake but are responsible for or may influence the process, must be in a position to actively participate. The reason for undertaking recordation must be agreed and clear (for example, specific threat to tenure security), and the selected method for recordation must be adapted to the specific objective (fit for purpose).

How to map land dynamics?

This part of the process is carried out on the ground, with participation of and in collaboration with all stakeholders. Information can be collected through focus group discussions or key-informant interviews. Techniques such as walk-throughs, community meetings, meetings with specific groups (women, youth, elders, and others) may provide better insights on unequal rights, power unbalances and overlapping or conflicting rights and claims.

Civil society, local government, and other authorities, including traditional leaders, should be consulted in addition to primary and secondary rights holders. The findings can be contextualized and triangulated with the context assessment.

As usual, when dealing with tenure, there is no one-size-fits-all template as to how to structure the process, what questions to ask during the engagements, and what groups to engage. In part, questions will emerge from the context assessment. The focus in this phase is not on identifying the precise boundaries of the plots, but rather on identifying the range of rights and claims that exist and are perceived as legitimate by the community and, in the case of customary or informal systems, to understand what the community vision is concerning its land and natural resources.

Sample questions that can guide interactions include:

- What is people's perception of their tenure security?
- Who participates in decision making on land tenure?
- Who is excluded, and why?
- Is there anybody else who is not able to participate and should be factored in?
- Is there a clear understanding of tenure-related concepts?
- Is there a clear understanding of existing regulations for recognition of tenure rights, adjudication of land, land and natural resources use?
- Is there a clear understanding of their own interests / rights / responsibilities / restrictions over the land?
- What are the reasons and objectives of the exercise?
- How can a realistic level of ambition in terms of tenure security be set in the given context?
- Is there an agreement as to where the boundary is between the community's interests and individual or § groups' interests?

The outcome of this phase should be captured in a short write-up stating the findings of the context analysis and identification of rights and claims, the identified threats to tenure security/the agreed objectives of the land rights recordation exercise, the main rules governing access to land and security of tenure in the area, and the community commitment to contribute and maintain the land rights repository that will be created. The write-up will become the foundation for the subsequent activities and must be validated with all rights-holders.

Activity 3: Planning participatory recordation and mapping

What are the objectives of this activity?

The objectives of the activity are to:

- **Enable meaningful participation by all stakeholders** in the land rights recordation**,** thus preventing future conflicts, achieving greater project outcomes, contributing rural prosperity and resilience and strengthening the tenure governance system.

- **Identify the most efficient methodology and set realistic targets** for the land rights recordation activity.

- **Embed an accessible and transparent mechanism for land disputes resolution** to address tensions and emerging conflicts.

How can vulnerable and marginalized groups be empowered?

Once the assessment has identified vulnerable and marginalized groups being excluded from decision-making in tenure governance, it is necessary to promote their meaningful participation by fostering an enabling environment and empowering them.

Exclusion may be rooted in one or more different circumstances, which commonly include:

- **Structural sociocultural barriers.** For example, societies where only older men have decision-making power over the land.

- **Specific gender norms.** For example, women are considered subsidiary to men and access land and natural resources through male relatives.

- **Traditional land inheritance and ownership patterns**. For example, only firstborn sons inherit the land and own it, women and youth only have user rights.

- **Level of capacity and education**.

Understanding the source(s) of exclusion will inform the strategy to overcome it and enable realistic targets to be set for enhancing inclusion.

Strategies aimed at creating spaces for meaningful participation for those who have been excluded from tenure governance must pivot around the three elements of knowledge, means and enabling environment.

"Ipsa sciencia potentia est"
(Knowledge is power)

Sir Francis Bacon, Meditationes Sacrae (1597)

How can meaningful participation be supported?

Groups that are excluded from decision-making typically do not have access to the information required to make informed decisions and do not have the capacity and means to engage with decision-making processes.

Knowledge management is a critical element to any process aiming to secure tenure rights. It ensures all stakeholders have access to the information they need to participate meaningfully. It enables all stakeholders to contribute to setting the rules of the exercise. It increases their awareness about their rights and obligations (RRR), and about how they can contribute to, and engage in the process and how to peacefully address their grievances.

Knowledge management elements in this context include:

- **Identifying and addressing systemic information gaps.** The context analysis should provide a conclusive overview of the tenure governance and tenure security situation in the area, and the related threats and opportunities. All rights-holders should have access to this information to improve their decision-making capacity. Information needs of individual stakeholders' groups may have emerged as a result of the previous phases, and such groups should be tackled individually.

    - **Mobilization, outreach and awareness-raising** *is not only a matter of producing the information and making it available; it is also about ensuring that the information reaches the intended audience. This may entail targeting vulnerable and marginalized groups specifically and helping them bridge the information gap that often exists with decision-makers in their communities. In such instances, the medium and packaging of awareness activities are particularly important because it must be adapted to meet the specific audience needs (i.e. language, medium such as radio or community meeting, time of day, and so on).*

How can inclusion be promoted?

When promoting inclusion, tensions may arise between maintaining respect for customary norms and institutions and being able to reach those considered to be irrelevant by the mainstream community. Including marginalised groups can be very challenging but is absolutely necessary, and therefore resources should be earmarked for this task (FAO, 2016).

Land rights recordation processes provide a unique window of opportunity to renegotiate the tenure governance rules, especially in the aspects related to the inclusion of all rights holders. Whether the specific objective of the recordation exercise is to increase tenure security or to access investment funds, there is an incentive for people to ensure that the process moves forward.

The recordation process, especially when supported by technology, implies a new and different way of doing business concerning land. By giving each stakeholder group a voice, such processes tend to make people more open to dialogue, even in very traditional contexts where for example customary rules may have remained unchallenged for centuries.

Additionally, when recording, there is an opportunity to move towards alignment between customary and statutory land rights, to increase tenure security further. It typically entails an increased space for recognition of women and vulnerable groups' rights.

Mobilization activities can ensure buy-in from the community and inclusion. It is essential to invest the required time and resources and find the most appropriate means to reach each stakeholder group in the community. Mobilization is the foundation for the entire land recordation process, and it will continue throughout the exercise.

Strategies such as recording all household members' names during the recordation process, or positive discrimination actions such as providing incentives for women, youth and other vulnerable groups representatives to engage in the process will further increase their representation and voice. It can be achieved through the process itself, for example by training specifically women and youth as local facilitators, or through the investment, for example, providing incentives for land-based investment when the owner or documented user is a woman.

Building vulnerable groups' capacity alone and providing them with means for participating (through capacity development and positive discrimination) will not suffice to increase their ability to participate in tenure governance. It is necessary to engage the rest of the community and the tenure governance authorities and lobby for change and inclusion to happen. Often communities are more open to change than what could be expected merely looking at their traditions and, as mentioned earlier, if the community commits to the exercise and understands its urgency and necessity, they will be more open to change.

Box 8. He4She initiative, Sierra Leone

In 2018 and 2019, with the financial support of the German and Irish government, FAO implemented two twin projects to strengthen the capacity of rural women to understand their land rights and to self-advocate for the protection of their customary land rights and to provide evidence to support the elimination of discriminatory barriers to gender-equitable land rights administration reforms. In this context, the He4She initiative was launched to engage male traditional authorities to become change agents. Paramount Chiefs of four chiefdoms (Paki Massabong, Selenga, Kandu Lekppiama and Bureh) were trained on Gender and Land Rights and finally decorated as "He-4-She" Gender Champions.

How can disputes be prevented and addressed?

One strategy often adopted when approaching land recordation is to request communities to resolve their internal disputes before they can proceed with the exercise. Rights holders can use whatever internal mechanism they find legitimate to adjudicate on existing disputes and resolve them. Only more complex disputes will then remain to be adjudicated at a later stage. This initial process will make the recordation process and subsequent mapping more efficient and effective.

Land conflict is common, and dispute-resolution mechanisms need to be in place. Many communities have traditional, local or alternative dispute-resolution mechanisms that generally complement a formal court system and include the use of negotiation, mediation, conciliation and arbitration. The advantages of these mechanisms are flexibility, low costs, lack of complex procedures, mutual problem solving, preservation of relationships and they are familiar to people. Some communities might not have existing mechanisms, or mechanisms may exist that are not perceived as legitimate, and a dispute-resolution system may need to be set up. It is vital for an inclusive tool that the dispute-resolution system is affordable and accessible to all in the community (GLTN, 209).

During adjudication, most of the (dormant) conflicts will emerge and should be settled, and fewer conflicts will emerge after such an adjudication exercise.

An inclusive and facilitated dialogue will lead the community to agree on which forum should address unresolved disputes and disputes that could emerge during recordation. It will depend on local conditions as to whether the community goes through a systematic adjudication or deals with disputes on a sporadic basis. The level of formality and type of forum can vary, ranging from tribunals to very flexible alternative dispute resolution mechanisms, but some principles should be observed, including:

- **The land disputes resolution mechanism must be accessible to all and follow a transparent process.** People must know where it is and how to access it, it must be in close proximity, affordable, and in a language understood by everyone.

- **The criteria for adjudication must be transparent and have local legitimacy.** This will increase the predictability of decision-making and decrease the number of fictitious disputes.

- **To increase neutrality and accountability, the adjudicating or mediating body should be highly representative.** It should include representation of all rights holders including for example, women, youth, minorities, and others.

- **Proceedings and decisions should be properly documented.** This will strengthen their legitimacy across time and fora.

Box 9. Example: adjudication of disputes before registration, Uganda

Kasese was the first district in Uganda to pilot in 2014 the registration of Customary land. Before the pilot could start applicants interested in obtaining a Certificate of Customary Ownership were asked to resolve their open disputes. Over a total of 325 disputes identified at the beginning of the process, more than 80 percent of the disputes were successfully resolved through this mechanism.

Activity 4: Participatory land mapping

Clarifying existing rights and claims and generating a shared vision for the management of common resources within a community is a necessary step when moving towards tenure rights recordation and mapping. The need is even more impellent when the expected result of the process is a formalisation of rights. Incomplete recordation will legitimise only part of the existing rights, creating injustices, grievances and exclusion. Overturning the negative effects of incomplete recordation is complex, time-consuming and expensive. To prevent them, it is sufficient to invest adequate time and resources in the participatory mapping process.

Many different strategies exist to carry out participatory land mapping, and the specific objective of the undertaking will help identify the most appropriate one. Participatory land mapping can include:

- **Direct mapping with the participation of the stakeholders**. Fit-for-purpose methodology and participation in the mapping exercise and throughout the entire process.

- **Indirect mapping with the participation of the stakeholders.** For example, with the use of ortho-photos printed and shared with the communities as a basis for discussion.

- **Collaborative mapping** (through the delivery of collected information: plans, imagery, shared for validation)

What are the elements of participatory land mapping?

The land mapping exercise does not only provide an opportunity to clarify and legitimise existing tenure rights and claims, but it also enables the community to agree on a shared vision on the management of common resources such as forests, water, land for grazing, roads and services, or community land which is not being used. In some contexts, the community has absolute freedom to plan for the use and development of shared resources; in others overarching national planning rules provide the framework for local processes.

The mapping process includes therefore different levels of detail, starting from the macro-level with the identification of the community land boundaries, the rights holders, the resources, the uses, and the definition of a vision for the future; to the micro-level of the recordation of individual parcel boundaries.

Each level is composed of three interdependent elements: recordation (identification, demarcation and surveying), adjudication and mapping.

In the absence of a shared vision, the micro-level mapping will not be sustainable. Boundaries and

Box 10. What is land use planning and how does it relate to land tenure?

Land use planning is a decision-making process that "facilitates the allocation of land to the uses that provide the greatest sustainable benefits" (Agenda 21, paragraph 10.5). It is based on the socioeconomic conditions and expected developments of the population in and around a natural land unit. These are matched through a multiple goal analysis and assessment of the intrinsic value of the various environmental and natural resources of the land unit. The result is an indication of a preferred future land use, or combination of uses. Through a negotiation process with all stakeholders, the outcome is decisions on the concrete allocation of land for specific uses (or non-uses) through legal and administrative measures, which will lead eventually to implementation of the plan.

Land use planning is a fundamental component of good land governance, especially in those contexts where layers of rights coexist. In contexts of customary systems, where the land use planning function is traditionally embedded within the tenure governance function, proceeding with land rights recordation without considering the land use planning aspects would delegitimize the existing system and create conflicts. In many customary systems resources are managed communally and the interests of the community and its future generations (the public) often supersede individuals and groups' interests. In plural systems, the customary governance system's land use planning will have to be harmonized to statutory physical and land use planning requirements.

Overlooking planning aspects in the tenure context can similarly translate into very high costs for investments, in terms of accessibility of the land or resources developed, in terms of infringement of existing primary or secondary rights, or in terms of delays due to emerging disputes.

Box 11. Irrigation projects in context of unclear tenure rights

A government launched a multibillion dollars investment project, covering the development of a huge dam and artificial lake, sizeable gravitational irrigation scheme for intensive agriculture, large industrial agro-processing facility, numerous commercial and smallholder farms reallocated in the newly irrigated areas, and healthy housing with homestead gardening plots for resettlement of the local communities of direct beneficiaries. However, the project design failed to consider a multitude of land tenure implications, thus undermining the project outputs, and causing poor tenure security and loss of livelihoods for the project direct beneficiaries. The territory affected by the project was under customary tenure. There were several communities which had to be resettled from the area flooded by the artificial lake to nearby areas, where new, healthy brick housing with water supply and sanitation was developed for the resettled communities. Issues of compensation for the land and housing assets flooded, and titling of the newly allocated farm and household land were not considered in the initial project design. The fact that land tenure would be converted from customary to statutory, with no constitutional mechanism for eventual reversal to customary tenure if elements of the project failed, was strongly underestimated. Gender aspects of tenure were not addressed, the land titling targeted predominantly male household heads. Livelihoods issues for pastoralists, who were a sizeable part of the community members, were also not addressed by the project. Pastoralist families were not keen to change their livelihoods, even though they were allocated some irrigated farmland for subsistence farming; their loss of pastoralist livelihoods due to the resettlement was not compensated, while land tilling families in the community were fully compensated with appropriate new irrigated farmland plots, which improved their livelihoods. This created inequality and tension between pastoralist and farming families in the resettled communities, degrading the project outputs. While customary land and housing were not commercialized, the newly titled farms and housing were easily tradeable, and many beneficiary household heads wanted to sell and migrate to nearby urban areas, which additionally undermined the project outputs. Finally, some of the community members who were allocated land in the customary community system were not citizens of the country, but of a neighbouring country, so the state had no clear mechanism to pay the compensations to non-citizens.

All these project design shortcomings could have been avoided if land tenure aspects had been addressed from the very beginning of project design.

individual or family rights will have to be renegotiated every time priorities regarding common needs change, or new priorities emerge. When land mapping and contextual recordation are implemented in contexts of high land fragmentation without previously defining a shared vision and planning accordingly, people may find themselves with land that is not accessible, or not suitable for the intended purposes.

Which is the optimal methodology for participatory land mapping?

Participatory land mapping methodologies range from simpler community-led processes to processes that require external support and facilitation. Many methodologies have been developed and are widely available, as the Participatory Village Mapping, Participatory Rural Appraisals (PRA), Participatory Negotiated Territorial Development (PNTD or Green Negotiated Territorial Development - GreeNTD), to more complex models leading to formal Resource Sharing Agreements in the context of investment.

The choice of methodology will depend primarily on the objective pursued by the community, and the strength of the tenure governance system. There are two main categories of objectives for pursuing recordation of tenure rights: **promoting investment** and **protecting tenure security**.

- **Recordation for promoting investment.** In the absence of any immediate threat to tenure security, a community may, for example, decide to document tenure rights to promote investment when a minimal level of formal recordation is required to access funds, or when the planned investment is expected to increase land values in the area.

- **Recordation for protecting tenure rights.** A community may opt for recordation to strengthen tenure security when existing or projected threats exist. Tenure insecurity can originate from:

  – **within the community** when rights are infringed upon by other community members. This may be the case, for example, when the rights of certain individuals or groups (vulnerable, absentees,

underclasses or others) are not perceived as legitimate and/or when the tenure governance system does not have the capacity or will to protect them.

– **outside the community** when external stakeholders have the capacity to take over the land without the consent of the legitimate rights holders, either illegally or through formal acquisition.

The objective and the source of the specific threat to tenure security then determine the level of detail that the participatory undertaking must achieve in terms of mapping and planning at the macro and micro level, as summarized in Table 5 below.

When some community members feel tenure insecure despite a sound tenure governance system, it means that the system does not recognize their rights as legitimate. The activity should focus mainly on an internal process to negotiate increased tenure security for them and the boundaries and rights recordation within the community boundaries.

When the tenure governance system is internally perceived as sound and legitimate, and the threat to tenure security is coming from the outside, the community may decide to maintain its customary and undocumented land administration and management system internally and only document and map the overall community land external boundaries (the perimeter).

In instances of weak tenure governance systems – regardless of whether the threat comes from outside or within the community – both overall and individual processes should be planned for.

▶ **Land tenure reforms** *are reforms that change the property rights systems themselves; they usually start with a policy and entail an overhaul of the legal, institutional and administrative framework.*

Additional factors that may influence the choice of methodology include the value of the resources at stake and the existence of long-standing conflicts. The higher the value of the resources at stake, the more detailed the participatory mapping and planning process will need to be at the community level. The more severe the conflict within the community, the more effort will have to be invested in the participatory mapping and planning process at both community level and individual/groups level.

If the selected participatory land mapping methodology is not able to address the underlying conflicts or injustices, alternative solutions to the mapping of individual/family rights should be pursued. If tenure rights are not under immediate threat, more time should be invested in facilitating dialogue. If tenure is insecure due to external threats, the overall community claim could be documented and mapped while the dialogue continues about how to address internal claims.

Table 5. Threats to tenure security

Threat to tenure security / Tenure governance system	Internal threat	External threat
Sound tenure system	Minimal participatory mapping of rights and uses + planning process at the community level Detailed boundaries and rights recordation within the community	Minimal participatory mapping of rights and uses + planning process at the community level Minimal/no boundaries and rights recordation within the community Detailed external community boundaries recordation
Weak tenure system	Detailed participatory mapping of rights and uses + planning process at the community level Detailed boundaries and rights recordation within the community Detailed external community boundaries recordation	

2.3 Upkeep, sustainability, M&E and evidence-based policy dialogue

The issue of sustainability has a critical role to play when discussing how to increase tenure security in the framework of development investments. The investment's impact and long-term sustainability is often dependant on beneficiaries' security of tenure.

Basic principles guiding the design will ensure that interventions to strengthen tenure security are sustainable:

- **A baseline** needs to provide a point of reference to measure progress towards the intended objective and inform changes in the objective or the scope. Even after a careful context analysis followed by design, it is important to assess, after some time, whether or not the outcomes are exactly what was intended.

- **Capacity to collect and up-date the land information** needs to be in place. Recordation of land rights is only useful to strengthen tenure security if it is up-to-date, adequately accurate and precise. When establishing any land information management system in support of land administration, it is critical to identify what will trigger mutations in the data of land units, rights holders and RRR, who is going to update it, how often, in what capacity, through what process, how will the mutations of the records be validated and publicised, and with what means during the project and after its completion.

- **Capacity to use and manage land information** needs to be in place (data storage, maintenance, sharing, publication). When land information is managed responsibly and transparently, it can be used:

  - To better inform decision making by third parties and increase transparency of the land sector for the benefit of vulnerable groups.
  - To improve efficiency in land administration and save up-front investment costs in instances of open source technology and free licensing and pricing mechanisms.
  - To clarify, document and safeguard customary land rights through participatory demarcation, (including youth and women).
  - To increase local understanding of land use and land rights (including women's rights).
  - To empower traditional authorities and communities to carry out the process of self-governance.
  - To include local knowledge in governance processes by opening up "mental maps" of local community members.

- **Monitoring, Evaluation and Learning.** The maps produced can further be a useful tool to monitor the effects of the activities to strengthen tenure security, and their impact on the beneficiaries' livelihoods and resilience assessed periodically.

- **Evidence-based policy dialogue**. If stakeholders agree to share the process outputs and produced maps, these can

Box 12. Monitoring land recordation impact

In general, it is difficult to evaluate the impact of land-related interventions due to the possible impact of other factors, including increased "modernisation" (such as through mobile phones, migrant workers), increased pressure on the land in the area (such as outside large-scale land-based investment, conservation projects, the discovery of minerals, urbanization) or other interventions, such as subsidies for terracing, tree planting or fertilisers.

Nevertheless, research on, and the practical implementation of suitable land indicators is increasingly being undertaken, particularly increasing the focus on local perceptions of land tenure security and monitoring land-related targets for several of the Sustainable Development Goals (primarily via Indicators 1.4.2 and 5.a). Among others, benefits attributable to improved cadastral or geospatial information can include reduced boundary disputes, and enhanced inter-community harmony as a result of specifying seasonal land-use patterns. However, in a M&E context, these impacts are difficult to measure (Zülsdorf, Şatana and Evtimov 2011).

The indicators also need to include the contributions of land recordation to empowerment at local, national and international levels. It includes the degree of the improved individual and collective basis for dialogue and negotiation over the protection of and access to land, in households and communities, but especially in land use planning processes in contexts of rapidly changing land use. Obviously, the actual impact depends on the level of inclusiveness of land governance in the area, both at local and at national government level.

further contribute as evidence to the local and national policy dialogue and to others at regional and global level (Heinemann and Phillips, 2017). In contexts where plural systems are not harmonised, the findings for the activities to strengthen tenure security could feed into and inform the policy dialogue. In harmonized plural systems, the findings could help improve the system's efficiency and accountability (Heinemann and Phillips, 2017).

Box 13. How the International Fund for Agricultural Development (IFAD) uses participatory methods for community self-analysis of challenges and solutions

In order to promote the engagement of communities in decision-making concerning their own socioeconomic development, IFAD-supported projects make systematic use of a community-based, participatory methodology. Participatory mapping tools are a core component of community-driven development.

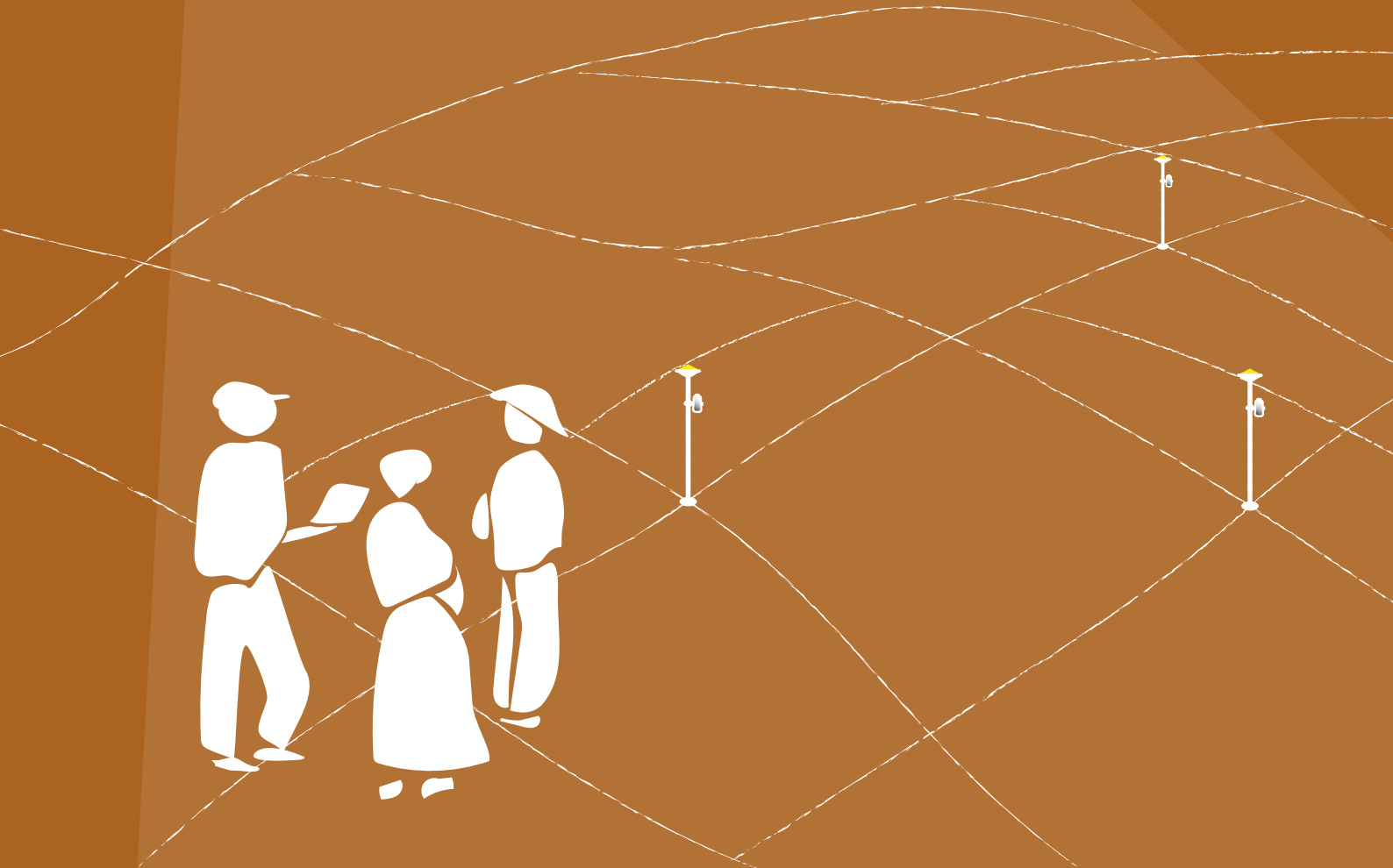
Participatory mapping has been used in IFAD-supported projects for a variety of purposes, including to improve land tenure security and resource entitlements, thus resolving existing conflicts and inequalities in access to resources; better manage natural resources and climate adaptation; geographic and intra-community targeting by addressing intersectional inequalities and power structures based on gender, age, ethnicity, caste and socioeconomic conditions; strengthen local governance institutions and land-related decision-making.

- In Bolivia, the Economic Inclusion Programme for Rural Families and Communities in the Territory of the Plurinational State of Bolivia, funded by the Adaptation for Smallholder Agriculture Programme (ACCESOS-ASAP) uses geo-referenced community maps to increase awareness about climate change issues and develop adaptive capacity. By bringing together science and traditional community knowledge it identifies key issues and adaptation priorities and ensures the inclusion of women in the process as well as the prioritization of adaptation options with good potential for women's empowerment.
- In Sudan, the Butana Integrated Rural Development Project (BIRDP) used a series of mapping tools to empower communities and poor agro-pastoralists to analyse the livelihoods and resource use of local farmers and herders and strengthen the governance of natural resources, while promoting customary land use rights and relying on local tribes' traditional knowledge in resolution of conflicts over shared resources and water management.
- In Peru, hands-on "talking maps" are traditionally used to enable communities to reflect critically on past, present and future opportunities to increase the value of their assets, both tangible (natural, physical and financial) and intangible (human and social), and translate their visions for change into sound development plans for natural resource management and economic development in their territories.
- In Rwanda, the Kirehe Community-based Watershed Management Project (KWAMP) has adopted a poverty-focused approach based on the participatory restoration and management of degraded watersheds. Participatory mapping provided a process to delineate existing problems and establish a road map for implementing solutions. This enabled prioritization of actions for soil and water conservation on farmland and marshland protection measures in response to annual floods, as well as providing a tool for participatory monitoring and evaluation.
- In India, IFAD-supported projects have used village-based participatory mapping and planning as a key process to strengthen the resource entitlements and livelihoods of more vulnerable and excluded tribal groups, especially women and the particularly vulnerable tribal groups. Under the Jharkhand tribal empowerment and livelihoods project, the planning process involves an intense and inclusive participatory assessment of community resources, which maps and analyses the physical, natural and human resource endowments of the village. Participatory wealth ranking also help communities identify and address the resource and livelihood needs of the particularly vulnerable tribal groups and of women.
- In Laos, a project by the Global Agriculture and Food Security Program is currently implementing a participatory land use mapping and planning process to help communities improve their environmental and natural resource management practices and governance system. This includes forage establishment for livestock, soil improvement and the development of community fish conservation zones.

Chapter 3
Technology

Chapter 3 explores how geomatics technology can be used to support initiatives to **increase tenure security** through participatory recordation of tenure rights. It analyses the opportunities and **risks associated** with technology use and provides criteria to **inform the selection of technologies**, based on the **expected objective**, **context** and **available resources**.

The objective of this chapter is not to rank existing technologies or enable the development or adaptation of land recordation software, but to provide decision-makers with a framework to help them identify the **type of technology** that can best serve their purpose, with some examples of available technology.



For the purposes of this guide, "technology" refers to geomatics and other information and communication technology (ICT). However, it is important to remember that geomatics and other ICT are not crucial ingredients for land recordation. Land objects, land rights and landholders can be recorded (documented) using conventional means (pencil) on conventional media (paper), using a range of simple technologies and surveying instruments such as measuring tapes, ropes, a plane table.

The first question decision-makers should ask themselves is whether using geomatics and ICT for land recordation is the optimal choice in a specific context. This decision should be based not only on circumstances such as the level of literacy, computer literacy, information technology capacity, technology perception and accessibility in the area; it should also take into account more practical factors – such as how susceptible a specific technology is to heat, glaring light and dust, as well as lack of electricity and internet coverage – in order to reduce the risk of unnecessary costs or time delays.

Technology is not a silver bullet – it is not in itself a solution to ensure participation and inclusion, and it will not improve a faulty policy or unwieldy process – and so hi-tech solutions may not necessarily be the optimal choice in a given context.

However, in conjunction with a sound (inclusive and participatory) policy and well-designed process, using the appropriate technology for land recordation can have a powerful impact. It can address procedural issues and optimize steps, thus minimizing transaction costs, human error, and potential for duplication. Technology can help to organize land information more efficiently, make it more accessible and transparent, boost interoperability and ensure safe storage.

Geomatics and other ICT lower costs and their high accessibility provides the opportunity to decentralize land administration processes and lower the barriers to para-professionals and lay people applying them, including in land recordation and services based on these records.

Technology in land recordation, the critical path for decision-making

The critical path for decision-making for land rights recordation interventions is described in Chapter 2. Figure 3 summarizes how the path will lead to one of three options: no recordation; recordation for the community, lobbying and advocacy; and recordation for regularization.

Once an option for securing tenure rights has been selected, it is time to select the most appropriate technology to support the recordation process.

3.1 Technology and tenure

Information and communication technology (ICT) in support of land and natural resources administration and management are at an unprecedented point. Land and geospatial information is improving in terms of scope, availability and affordability. Major fundamental technologies – digital information management, the world wide web (www) and Internet, the Global Navigation Satellite System (GNSS) and the relevant Geographic Information Systems (GIS) – are converging and creating tremendous opportunities to manage land and natural resources using ICT and geomatics in much more thorough, inexpensive, efficient and effective ways.

Geospatial information technologies such as GIS, GNSS, and soft-copy photogrammetry – known collectively as geomatics – have become more affordable, more accessible and more user-friendly, allowing an ever-growing number of non-professionals and ordinary people to take an active role in securing their tenure rights.

Tremendous progress has been made in many areas of technological innovation directly or indirectly related to land administration, moving from establishing new systems and processes, to improving them and making them more accurate and more affordable with each iteration. Some of these innovations benefit the land sector and create opportunities that did not exist before for people to participate in securing their own rights (Graglia, 2017) (see Box 14).

Opportunities and risks

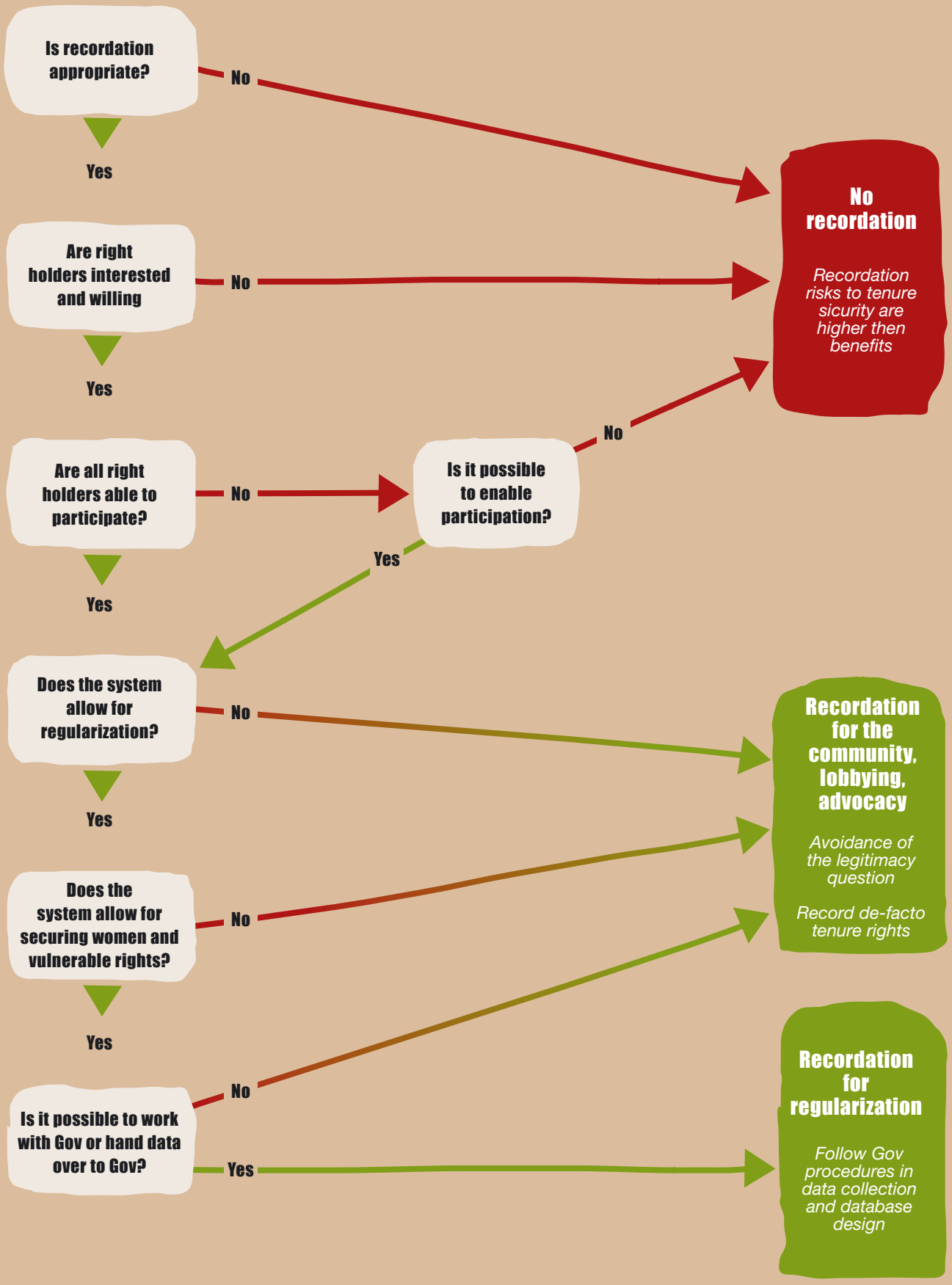
"The first rule of any technology used in a business is that automation applied to an efficient operation will magnify the efficiency. The second is that automation applied to an inefficient operation will magnify the inefficiency."

Bill Gates

The application of fit-for-purpose approaches in land administration has pushed geomatics technology beyond its traditional boundaries, allowing the recording and registering of different land interests (RRR) in different ways, adapting to the specific objective pursued, the context and the human, financial and time resources available.

Technology is increasingly accessible and affordable, offering the potential to make land administration from

Figure 3. Securing tenure rights through recordation, critical path for decision-making



local to national level easier, cheaper, more transparent, more accountable, more effective and more efficient.

The "social dilemma" embedded in the use of technology primarily concerns what information is collected, who can access it, and how it is used. In the context of land recordation, it is essential to evaluate whether the potential advantages – that is, the increased tenure security that recordation will help achieve – are worth the potential risks of the information being used inappropriately.

Embedding geomatics technology in the land recordation process provides great opportunities and some risks which need to be factored in and managed. When the risks are not managed, the activity could result in a detriment to land tenure rights (Lengoiboni, Richter and Zevenbergen, 2018).

What are the risks involved in applying technology for recordation?

There are specific areas of the process and outcomes of recordation that involve additional risks when technology is involved.

Technology design: Technology development is today progressing at a faster pace than land policy and law development. Community-led land recordation has the potential to be an effective tool to address many challenges related to tenure insecurity. Still, in a context of weak tenure governance without clear policies and values informing the technology development, the principles of participation and inclusiveness can only be attained as a result of deliberate effort. The less the recordation process is anchored in the national legal and policy framework for land administration, the more effort must be invested in understanding the values of reference for land recordation and implement them through the technology.

Digitalization and automation: Digitalization and automation can significantly contribute to increasing efficiency of any recordation exercise through higher speed and ease of data collection compared with paper-based records, more efficient data management, or through recording a plurality of land rights (informal and customary, temporary land uses, and negotiated access to land), as well as rights as per statutory law. Like any paper-based recordation process, digital recording affirms captured land rights information and increases

Box 14. Examples of technological innovations that can benefit tenure

1. **Imagery from satellites complete with geo-referenced data** is a faster and more affordable option than securing the services of land surveyors. Satellite imagery used to be expensive and complex to use due to licensing issues, but there is an on-going effort to make them more accessible, providing fresh images of the whole planet as often as daily, at ever better resolution.

2. **Imagery from drones** can also provide high quality, low-cost images of areas to be mapped within a few hours or days. This technology has rapid turn-around time at a relatively low cost and can be instrumental for community-driven land recordation exercises which need to be completed within a limited time frame.

3. **Mobile applications on GNSS-enabled phones** can facilitate geo-tagged boundary demarcation, and other information needed to assert a claim to land and help a family increase the security of their land rights.

4. **Digitization of records.** ICT and Geomatics technology and processes for land administration are continuously evolving, providing opportunities for innovation. Some of the fundamental advantages they have brought to land administration, include:
   - Digital records/registries rather than manual "pencil and paper" registers and maps.
   - Public access to, and transparency of land records, registry and spatial planning information.
   - Standardized land information (models).
   - Optimized and simplified, streamlined administrative procedures.
   - Wider participation of non-government actors in the processes of securing tenure rights (private, community, lay people and paraprofessionals).
   - Radical reduction of costs/increased affordability of the land administration services.

5. **Geodetic place codes and digital postal addresses** are another innovation that can simplify the future of property rights.

their legitimacy, potentially increasing tenure security. Yet, if the process is not inclusive, it can produce the opposite result, leading to dispossession. Similarly, there are risks involved when the data is supposed to be handed over to a government that does not have the necessary infrastructure in place to store and keep it.

- **Digitalization.** *Digitalization is the use of digital technologies to change a business model and provide new revenue and value-producing opportunities; it is the process of moving to a digital business (Gartner, n.d.)*

- **Automation.** *Automation is the technology by which a process or procedure is performed with minimal human assistance (Groover, 2014).*

Information management (data storage, maintenance, sharing, publication). The ability to make information readily available is both the opportunity and the risk provided by technology in land recordation.

Information can be used for many different purposes, ranging from monitoring to supporting policy dialogue, to providing evidence-based inputs to communities facing similar challenges (see Chapter 2.3). However, recordation surveys also include in-depth information on rights-holders and resources, such as information on their socioeconomic status, available natural resources, strength of the claims, and so on. There are risks involved with the potential use of such information. The more informal the entity managing the data, the fewer resources and less effort will typically be invested in (cyber-) securing the information management system, and so the higher the risks of misappropriation and misuse of information.

Sustainability. Technology available to communities and institutions today enables them to start recordation with minimal human, technical and financial resources and to adopt an incremental approach. But as the scale and ambition of the exercises increase, so will the number and type of services for which local organizations managing information are responsible, the quantity of data they must handle, and the resources required to design and maintain the system. Without an option to link recordation to the formal system and make the land information system management sustainable, gains in the area of tenure security may be short-lived and raise false expectations among rights-holders.

3.2 Technology for land rights recordation

Geomatics and ICT can enhance the efficiency and results of participatory mapping and ascertain rights by gathering, organizing, analysing, maintaining and conveying information about the tenure of community land and resources. Participatory methods solicit detailed information about tenure status, which can be complex and dynamic, and about resources conditions not ordinarily captured in land information records or cadastral systems. Furthermore, the recordation of rights and interests in land or resources in automated systems that are recognized by groups outside a community may bolster tenure security for the community or individuals, if appropriate access and system security mechanisms are part of the system (IFAD, 2016).

How can technology support the enactment of land recordation principles?

Although technology can help to strengthen and support land recordation processes, it is important to remember that technology alone will not make for an inclusive process, prevent abuse, or increase tenure security.

Technology is a very powerful tool, but it is only a tool. A tool will not follow social norms, pursue the public good, or protect vulnerable populations unless it is explicitly designed to do so, and it will not lead to a successful and sustainable land recordation process without participation, local ownership, and sufficient capacity in place to make it responsive to local needs and to sustainably manage it over time.

Recognizing the enormous potential and significant risks linked to technology development, the international community has agreed on some guiding principles that should be applied in technology-enabled programmes (Principles for Digital Development, n.d.). The land recordation principles can be translated into digital terms through digital development principles, and the selected technology should support their implementation; this will be imperative in contexts of weak tenure governance.

Table 6. How land recordation principles relate to digital development principles

Land Recordation Principle	Principle for digital development	Questions
Inclusion and participation	Design with the user	What are the mechanisms embedded that will ensure that all legitimate rights holders can participate in the process?
From general to detail	Design for scale	What is the level of detail and verification required for each data entry recorded? What is the needed level of accuracy and precision?
Fit-for-Purpose	Understand the existing ecosystem Use open source standards, open data, open source and open innovation	Does the tool respond to the envisaged objective, existing context and available resources? Is the tool able to facilitate existing open data policies, where in place?
Build on what exists	Reuse and improve	How does the tool reflect the existing, legitimate tenure governance system? Is it aligned with existing functions and responsibilities? Does it capitalise on existing capacity? Does it make effective use of all available land data / records / sources?
Embed sound mechanisms for disputes prevention and resolution	Be collaborative	How does the tool ensure compliance with established land disputes resolution mechanisms?
Realistic planning and upkeep and sustainability	Build for sustainability Be data driven Address privacy and security	How ready is the tool? What is the expected timeline for implementation? What kind of human, financial and time resources does it require? What are the projected costs for the up-keep of the system? Who will bear these costs? How can the effects of the action be monitored?

How can technology be instrumental for increasing tenure security?

Various geomatics and ICT can support or automate the land recordation process in its different stages. Table 6 presents an overview of which activities can be strengthened or made more efficient through the use of technology.

What is the cost of technology?

If the magnitude of the target area is sufficiently large (economy of scale), and if there is sufficient technological infrastructure (which is rarely the case in development contexts), the technology costs of FFP land recordation are typically contained. This is a significant difference with any other type of GIS-aided mapping that may use remote sensing, even without field collection/ interpretation of the data.

Rough estimates indicate that technology costs may be less than 10 percent of the overall investment cost in securing tenure by recordation. Therefore, regardless of whether distances are measured using a rope or callipers, or geodetic GNSS, EDM, total stations or backpack mapping instruments, the total investment cost in securing tenure by land recordation will not be significant.

Examples of available technology

A range of technologies is available today to support tenure recordation exercises. The list presented in Table 8 is not exhaustive because innovation in this domain is continuous, but it includes some of the best-known technologies available.

Technology can similarly support other activities that may be instrumental/preliminary to land recordation and increasing security of tenure, such as outreach and awareness raising, stakeholders mapping, participatory mapping, monitoring and even informing decisions about the technology itself. (see Table 8).

Table 7. **How technologies can support activities**

	How can technology support
Activity 1: Understanding the context & Activity 2: Understanding land dynamics on the ground	It can help create maps that compile and help analyse the findings of the context analysis, help stakeholders visualize them during validation and inform the definition of the activities' specific objective. It can facilitate and expedite outreach and stakeholder mapping.
Activity 3: Planning participatory recordation and mapping	It can be customized and automated to enforce participation – for example, by recording all household members' names during the recordation process rather than recording only the household head, or household head and spouse(s). It can be customized to enforce participation of community representatives to increase the local ownership and transparency of the process.
Activity 4: Participatory land recordation and mapping	It can increase the automation, speed, transparency, participation and accountability of the recorders' processes thanks to the use of mobile apps in the field that integrate the use of imagery, GIS, GNSS in a database instead of capturing and managing data on traditional "paper and pencil" media. It can produce maps that overlay agreed boundaries with other datasets that may be relevant (soil, land use, common areas, infrastructure, and others), allowing the entire community to build a shared vision of its territory. It can support monitoring of tenure security and systematize periodic data collection.

Table 8. Examples of technology available to support tenure recordation

SOLA **Open Tenure**	SOLA and Open Tenure are open-source software to help protect tenure rights and support the implementation of the VGGT. These tools include two groups of products. Group 1: Solutions for Land Administration (SOLA), comprising SOLA Registry, SOLA State Land and SOLA Systematic Registration; and Group 2: Community Tenure Recording (Open Tenure), comprising an Open Tenure mobile application for field collection and Community Server for processing the collected field data and registering claims.	https://www.fao.org/tenure/sola-suite/en/
MAST	Mobile Application to Secure Tenure (MAST) is a suite of innovative technology tools and inclusive methods that uses mobile devices and a participatory approach to efficiently, transparently, and affordably map and document land and resources rights.	www.land-links.org/tool-resource/mobile-applications-to-secure-tenure-mast
STDM	The concept of the Social Tenure Domain Model (STDM) is to bridge this gap by providing a standard for representing 'people – land' relationships independent of the level of formality, legality and technical accuracy.	http://stdm.gltn.net/
Cadasta	Cadasta develops and promotes the use of simple digital tools and technology to help partners efficiently document, analyse, store in a dedicated cloud-based server, maintain and share critical land and resources rights information.	https://landportal.org/partners/legend/cadasta
Meridia	Meridia is a cloud platform and mobile application that puts mapping in the hands of the landowner. It allows users to map their land and confirm their claim through the "Crowd-Validation" process. This greatly speeds up registration while reducing costs.	https://www.climate-kic.org/success-stories/meridia/
Aumentum Open Title	Aumentum Technologies simplifies the way governments manage land information and property tax revenue.	https://tax.thomsonreuters.com/aumentum/opentitle/
CaVaTeCo	The Community Land Value Chain (CaVaTeCo) Approach enables land rights holders to approach their own local association to obtain a document proving their rights, and use it to defend those rights, to raise credit or receive agricultural inputs, or to underpin the establishment of formal contracts with third party suppliers or buyers.	https://thetenurefacility.org/projects/scaling-up-the-community-land-value-chain-cavateco-approach-in-mozambique/
CRISP	Open source software named "Cadastre Register Inventory Saving Paper" (CRISP). CRISP is a software tool for collecting and editing land use and land user information by means of a variety of surveying and database techniques.	www.fig.net/resources/proceedings/fig_proceedings/fig2019/papers/ts07g/TS07G_becker_10221.pdf

Innola	Innola is a modern, fully web-based professional open software framework for registering, managing and distributing real property objects and related data.	http://innola-solutions.com/#our-services-section
MEDEEM	MEDEEM provides an innovative and affordable, private-sector driven solution to formalizing land rights for the world's poor. MEDEEM's mission is to bridge the legal empowerment gap between informal land holding and formal land registration.	http://medeem.com/
Mapping for Rights	MappingForRights (2011) is a new approach to participatory (or 'community') mapping, developed by the Rainforest Foundation UK (RFUK) on the back of 15 years' experience of supporting indigenous and traditional communities of the Congo Basin rainforest in their efforts to fulfil their rights to land and livelihood.	www.mappingforrights.org/
GeoODK	GeoODK provides a way to collect and store geo-referenced information, along with a suite of tools to visualize, analyse and manipulate ground data for specific needs. The mobile App (Collect) is derived from the Open Data Kit developed by University of Washington with the addition of an online and offline mapping component and some addition spatial widgets, as well as a developer option for deploying surveys with the app.	http://geoodk.com/

3.3 Choosing the appropriate technology

Although the selection of the appropriate technology for land rights recordation should be informed by the challenges and opportunities of the specific context, it can be difficult for decision-makers to orient themselves among the many technology options available. This section therefore describes criteria to guide decision-makers in their selection.

Technology selection criteria

Geomatics tools for land recordation continue to multiply and advance rapidly, providing decision-makers with a wide range of options, each with its own advantages and challenges.

To help distinguish between these tools, a number of criteria have been identified, focused on some of the aspects that are critical to consider when selecting geomatics and ICT to support land recordation processes. The selection criteria help to ascertain the technology's readiness for implementation, its adaptability to the specific context, its sustainability in time, and the financial, human and time resources required (see Box 15).

Each of the proposed criteria is considered independently, allowing decision-makers to determine the weight of an individual criterion based on the needs of the specific context. In some contexts, the investment required for recordation (that is the cost) may be the most binding criterion because resources are limited. In others, it may be that the community values participation and local ownership as most important. In other settings, it may be imperative to carry out recordation within a limited timeline, making readiness the most important aspect. The priorities dictating choices for land tenure recordation in each specific context must be identified and inform how decision-makers use the criteria.

This section explores each criterion individually within its category and provides descriptors of what the technology should be able to do in order to obtain a low, medium or high rating.

How ready is the technology?

The readiness assessment pivots around the criteria: suitability; level of alignment to government processes and potential for formalization; interoperability; and accuracy and technical standards requirements.

Table 9. Examples of technology to support awareness-raising about security of tenure

Mapping for Rights www.mappingforrights.org	MappingForRights (2011) is a new approach to participatory (or 'community') mapping, developed by the Rainforest Foundation UK (RFUK) on the back of 15 years' experience of supporting indigenous and traditional communities of the Congo Basin rainforest in their efforts to fulfil their rights to land and livelihood.
Maptionnaire https://maptionnaire.com	Engages participants through mapping to collect survey data. Users make a map-based data collection and can transform the data into tangible insights and develop deeper understanding of the results. Incorporate data collected using Maptionnaire into plans and designs.
Borealis www.boreal-is.com	Platform for managing all stakeholder engagement activities with additional modules to strengthen all areas of environment, social and governance. It centralizes all stakeholder-related data, keeping it instantly accessible to team members from any location or device.
Social pin point www.socialpinpoint.com	Mapping tool that allows participants to show exactly where their feedback, ideas, and concerns relate to
Common place https://bristolbugbears.commonplace.is	Online consultation platform gives quality and depth of engagement needed to increase reach, build trust, and get buy-in from local communities. Allows users to set up a website to provide information and updates about a project, while receiving comments about areas that need improvements or feedback on the proposed designs
Community remarks https://communityremarks.com	Platform that allows to plot comments on a Google map. Shows improvement projects and illustrates pertinent project details to get informed feedback. Crowdsource comments during the visioning process, then present plans for feedback.
Placespeak www.placespeak.com	A geo-verification process connects participants' digital identity to their physical location and make comments on projects. Existing participants are automatically notified of new consultations in their community based on their interests.
Borealis www.boreal-is.com	Manages all aspects of stakeholder engagement from a single tool. Centralizes all stakeholder-related data, geo referencing it and keeping it instantly accessible to team members from any location or device. Add additional modules help manage specific areas of corporate social responsibility.

Box 15. Assessing the readiness, adaptability, sustainability and costs of a technology

Readiness criteria
- suitability
- level of alignment to government processes and potential for formalization
- interoperability
- accuracy and technical standards requirements

Adaptability criteria
- adaptability
- inclusion and participation
- land disputes resolution
- local ownership

Sustainability criteria
- scalability
- sustainability
- resilience to shocks and adversities

Cost criteria
- human and technical resources
- financial resources.

1. **Suitability:** this criterion captures the technology's suitability for the specific context, including the range of RRR that it needs to capture, the legal and policy frameworks, language of the user interface, complexity of the language and so on. The more suitable the technology is for the context, the less customization it will require, and so the easier it will be to implement.

   – *Low:* the context and envisaged process are so unique that it will require customization and timelines will only be clearly devised through a pilot.

   – *Medium:* it has been applied before in similar contexts, and, although it requires some customization, the projected resources and timelines for implementation are expected to be comparable.

   – *High:* it has been successfully applied before in one or more instances with similar objectives and context and will therefore require only minor adjustments.

2. **Level of alignment to government processes and potential for formalization:** this criterion helps evaluate what can realistically be achieved with the technology in terms of longer-term tenure security through regularization of land rights. The more detached the recordation process is from the formal system, the less sustainable the gains will be in terms of securing tenure rights.

   – *Low:* "avoidance of the legitimacy question" (Lengoiboni, M., Richter, C. & Zevenbergen, J. 2019) external to land governance processes and policymaking; focusing on specific, temporarily bounded project needs.

   – *Medium:* records more diverse tenure rights than those recognized by the law for dialogue/ lobbying on recognition of rights and for future issuance of official documents.

   – *High:* follows government procedures in data collection, data models and database design to provide the tenure data to the government for issuance of official documents.

3. **Interoperability:** this refers to the ability of a system to work and exchange data with, or use parts of, another system. Land administration is often distributed among a host of government units. Efficient administration calls for the interoperability of information – for example, in order to be able to apply the "once-only principle" of e-governance and public information sharing. Usable standards reduce data exchange costs (Lemmen, Stubkjær and Oukes, 2020). In the domain of geospatial information, interoperability is the cooperation or compatibility of an information system to run, manipulate, exchange and share the data of different organizations related to spatial information on, above, and below the Earth's surface (Kalantari *et al*., 2005). Examples of international standards developed to promote interoperability include those of the Land Administration Domain Model, or the European Union's INSPIRE Directive.

   – *Low:* the database model is compatible with very few, if any, international, regional (or national) standards and so data exchange with existing systems will require complex revisions.

   – *Medium:* the database model is compliant with international, regional (or national) standards, allowing data exchange with existing systems with minimal adjustments.

   – *High*: the database model is compliant with international, regional (or national) standards, with multilingual user interface; the system is modular and can be expanded to support organizational, semantic and technical interoperability with minimal interventions.

4. **Accuracy and technical standards requirements:** this refers to the level of accuracy that the technology aims to achieve, as compared to the level of accuracy that may be required by the formal system in order to regularize land rights and the technology's capacity for the data collected to adapt to the regional accuracy standards.

   – *Low:* complies with the minimal level of accuracy, sufficient for the achievement of the specific recordation objectives within the existing system.

– *Medium:* complies with the level of accuracy and information required to potentially achieve land rights recognition and protection once the system is reformed, compatible with external geospatial and data infrastructures for adaptation to regional and national accuracy and standards.

– *High:* complies with the level of accuracy and information required to achieve the intended level of land rights recognition under the existing land administration system; compatible with external geospatial and data infrastructures for adaptation to regional and national accuracy and standards.

How well can the technology adapt to the specific context?

The adaptability assessment focuses on the technology's capacity to bend to the specific context needs and to promote inclusion and participation, embed dispute resolution mechanisms and foster local ownership.

5. **Adaptability** refers primarily to the technology's capacity to expand the range of RRR it captures based on local needs. The more adaptable a technology is, the easier it will be to make it reflect and correctly model the field reality and respond to local recordation needs.

   – *Low:* can only capture the pre-set information regarding rights to land and natural resources, right holders and plots.

   – *Medium:* has a set number of variables regarding primary and secondary rights and right holders which can be customized within a given range.

   – *High:* records multiple subjects and current and future interests in the land as well as secondary rights that the community deems relevant.

6. **Inclusion and participation:** this criterion assesses the technology's capacity to enforce positive action to promote inclusion and participation.

   – *Low*: it can only capture primary land rights and rights holders.

   – *Medium:* it is able to capture a pre-set range of rights and rights holders.

   – *High:* targets specifically individuals or groups; requires the presence of witnesses during the recordation; includes mechanisms at different levels to verify claims; admits a variety of means of verification.

7. **Land dispute resolution:** this criterion measures the technology's capacity to embed land dispute resolution. The more the land recordation process can be harmonized with land dispute resolution, the fewer and less intense any disputes will be that emerge after the first recordation.

   – *Low:* there is no linkage between recordation and disputes resolution.

   – *Medium:* linkages are established between processes and outcomes of recordation and land disputes resolution.

   – *High:* it does not allow the recordation process to move forward if an objection to the claim has been recorded and not adjudicated. Decisions are subsequently considered in higher forums.

8. **Local ownership** measures how much of the information management and system management and maintenance responsibilities remain with the community. The less involved the community, the more detached they risk becoming from the land administration service provider after the initial recordation. The more actively involved the community is, the greater the level of ownership the community has over the process and the more resources need to be in place at the local level to ensure sustainability.

   – *Low:* the community only participates as the beneficiary of the recordation; all services related to data collection, management and maintenance are outsourced to government, nongovernmental organizations or private entities.

   – *Medium:* the community participates in the design of the recordation process and the recordation itself; the management and maintenance of the system are outsourced thereafter to government, nongovernmental organizations or private entities.

   – *High:* the community plays an active role in the recordation design and builds up adequate capacity to master the process and information management and services thereafter.

How sustainable is the technology in the medium- to long-term?

The sustainability assessment focuses on the durability of the achievements obtained using the technology and the capacity for them to be maintained and upscaled over time.

9. **Scalability** refers to the capacity of the technology to incrementally handle growing amounts of data and/or include more modules or functionalities. The higher a technology's scalability, the higher its replicability and potential to be used systematically across a territory.

   – *Low:* designed for sporadic recordation and less effective for systematic recordation; over time, cannot handle growing amounts of data effectively or include more modules/functionalities.

   – *Medium:* designed for sporadic or systematic recordation; able to handle growing amounts of data effectively or to include more modules/functionalities, but with no linkages to the formal system.

   – *High:* designed for sporadic and systematic recordation in line with existing requirements for formal registration of customary or

informal claims; able to handle growing amounts of data effectively and/or to be enlarged in order to include more modules/functionalities.

10. **Sustainability** refers to the data management and system maintenance responsibilities, their costs and how these can evolve over time. Sustainability also refers to the longevity and flexibility of the technology itself and its ability to benefit from experience and innovation to evolve over time.

    – *Low:* private license requires continuing external technical support, data is maintained and stored externally by a third party or locally but with no linkage to formal land information systems. The software is fully developed, not widely used and no updates will be made available.

    – *Medium:* free/open-source licence, technical capacity can be established locally to collect and maintain data. Storage is external or local but with no linkage to formal land information systems. Its open-source nature allows for further development.

    – *High:* free/open-source licence, technical capacity can be established locally to collect data and maintenance and storage can be handed over to government. Its open-source nature allows for further development.

11. **Resilience to shocks and adversities** refers to the degree of risk for the technology, human capacity and records to collapse or be compromised as a result of natural- or human-induced disasters and fault actions.

    – *Low:* the technology, human capacity, and records (information) are not specifically protected and are highly vulnerable.

    – *Medium:* the technology, human capacity and/or records (information) are protected and backed up and foreseeable damage or loss of tools, storage media, records or human capacity are unlikely.

    – *High:* the technology, human capacity and records (information) are secure, well protected and backed up, and foreseeable damage will not cause serious disruptions or collapse of the services.

What are the financial, human and time costs involved with implementation?

The cost assessment helps estimate the amount of human, technical, financial and time resources that may be required for the land recordation exercise based on what technology is selected.

12. **Human and technical resources** refer to the technical capacity required to customize and maintain the technology; the human capacity required to set-up and implement recordation and system maintenance; and the tools required to run the system.

    – *Low:* simple and common technological requirements; requires little or no customization; can be implemented and maintained by the community through available technology with minimum human resources capacity development.

    – *Medium:* some innovative technological requirements; requires initial customization but can be implemented and maintained by the community with some human resources capacity development (for example, by engaging the youth, as paraprofessionals).

    – *High:* complex and/or expensive technological requirements; requires substantive technical and financial capacity to be implemented and maintained; unrealistic for the community to afford to develop adequate human resources capacity.

13. **Financial resources:** this criterion analyses the financial investment required to set up the system and to maintain it as well as its financial sustainability. When the system set up is driven by an external investment, it may be acceptable to have higher initial costs provided maintenance costs are affordable for the community. In instances where the community is driving the recordation, there may be a need to opt for technology with lower start-up costs.

    – *Low:* initial investment is affordable to the community and services pay for maintenance thereafter.

    – *Medium:* high initial investment must be external, but services pay for maintenance thereafter.

    – *High:* substantial investment is required at all stages of implementation.

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Glossary

Automation. Automation is the technology by which a process or procedure is performed with minimal human assistance (Groover, 2014).

Digitalization. Digitalization is the use of digital technologies to change a business model and provide new revenue and value-producing opportunities; it is the process of moving to a digital business (Gartner, n.d.)

Forum-shopping. The practice of choosing the court in which to bring an action from among those courts that could properly exercise jurisdiction based on a determination of which court is likely to provide the most favourable outcome.

Geomatics is defined in the ISO/TC 211 series of standards as the "discipline concerned with the collection, distribution, storage, analysis, processing, presentation of geographic data or geographic information" (ISO, 2004). It includes the tools and techniques used in land surveying, remote sensing, cartography, geographic information systems (GIS), global navigation satellite systems (GNSS: GPS, GLONASS, Galileo, Compass and others), photogrammetry, geophysics, geography, and related forms of earth mapping. The definition also includes the associated hardware and software that supports data collection, storage and management.

Land tenure reforms are reforms that change the property rights systems themselves; they usually start with a policy and entail an overhaul of the legal, institutional and administrative framework.

Land tenure system. Societies establish land tenure systems to define and regulate how people, as individuals or in association with others – as families, clans, communities, non-profit organizations, business enterprises and governments – gain access to land, fisheries, forests and other natural resources. Tenure systems determine who can use which resources, for how long and under what conditions. Tenure rights are the primary connection between which the people, the resources and the conditions of use are connected (FAO, 2015).

Land recordation. Recordation is the act of collecting and recording the relevant information on the land, the resources, and the rights associated with them. Recordation is composed of surveying and demarcation. The survey is the collection of all the data that needs to be recorded regarding the land rights and encumbrances and the rights-holders. The demarcation is the identification of the parcel boundaries, usually using coordinates. Mapping is a separate step that consists of depicting the collected data on a map.

Mobilization, outreach and awareness-raising are not only a matter of producing the information and making it available; it is also about ensuring that the information reaches the intended audience. This may entail targeting vulnerable and marginalized groups specifically and helping them bridge the information gap that often exists with decision-makers in their communities. In these instances, the medium and packaging of awareness activities are particularly important because it must be adapted to meet the specific audience needs (that is, language, medium such as radio or community meeting, time of the day, and so on).

Participatory mapping is a general term used to define a set of approaches and techniques that combines the tools of modern cartography with participatory methods to record and represent the spatial knowledge of local communities. Also referred to as "community mapping", it is based on the premise that local inhabitants hold accurate knowledge of their customary (and otherwise usually unrecorded) tenure, as well as expert knowledge of their local environments which can be expressed in maps which are easily understandable. Maps created by local communities represent the place in which they live, showing features communities themselves perceive as important, such as customary land boundaries, how they use resources, sacred areas, areas for public use and so on. It is a powerful tool that allows remote and marginalized communities to represent themselves spatially, bringing their local knowledge and perspectives to the attention of governmental authorities and decision-makers (Mapping for Rights, 2020). Participatory mapping can be a building block towards recordation.

Pareto principle: the Pareto principle (also known as the 80-20 rule, the law of the vital few, and the principle of factor scarcity) states that, for many events, roughly 80 percent of the effects come from 20 percent of the causes. The principle is named after the Italian economist Vilfredo Pareto, who observed in 1906 that 80 percent of the land in Italy was owned by 20 percent of the population. This principle has become a common rule of thumb in business – for example, "80 percent of the sales come from 20 percent of the clients." There have been efforts to apply the principle of 80-20 in land administration. Recently, it has been suggested that the Pareto Principle should be applied in land administration where "a minority of input produces the majority of results" and search for the type of input that will produce 80% of the results in the regularization of land tenure and in a reduction of conflicts over land.

Sporadic registration (FAO, 2003). Sporadic registration of land is the process of registering land on a case-by-case basis, usually in response to a specific trigger such as the sale or inheritance of the property or a direct threat to the right holder's tenure security.

Systematic registration (FAO, 2003). Systematic registration of land is a systematic approach to adjudicating, surveying and registering parcels, rights and encumbrances, and holders on an area-by-area basis

Corrigendum

Page	Location	Text in printed PDF	Text in corrected PDF
Pg. 39	Example n. 5	Landmapp Landmapp is a cloud platform and mobile application that puts mapping in the hands of the landowner. It allows users to map their land and confirm their claim through the "Crowd-Validation" process. This greatly speeds up registration while reducing costs. https://www.climate-kic.org/start-ups/landmapp-2/	Meridia Meridia is a cloud platform and mobile application that puts mapping in the hands of the landowner. It allows users to map their land and confirm their claim through the "Crowd-Validation" process. This greatly speeds up registration while reducing costs. https://www.climate-kic.org/success-stories/meridia/
Pg. 60	Back cover text	States should provide systems (such as registration, cadastre and licensing systems) to record individual and collective tenure rights in order to improve security of tenure rights. States should strive to ensure that everyone is able to record their tenure rights and obtain information without discrimination on any basis.	In line with the Voluntary Guidelines on the Responsible Governance of Tenure (VGGT), public and private investments globally are increasingly recognising responsible land governance as a determinant for the success and sustainability of their achievements. Investment managers understand that preventing and mitigating tenure related issues is a necessary step to achieve their objectives. While a wide range of tools, community-based participatory approaches, and technologies are available to help clarify, protect and secure tenure rights, navigating this landscape requires expertise which is often not available to investment projects. This guide provides readers with a basic understanding of the functional linkages between land tenure and land-based investments. It illustrates the process of protecting and securing legitimate tenure rights through recordation, describes how to use fit-for-purpose technology to strengthen / support the process, identifies choices in selecting the appropriate technology based on objectives and context, and provides clear criteria to inform the choice.

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