


# **Community land registers for Internally Displaced Persons in South Darfur, Sudan: ICT solution**

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August, 2023

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# ABSTRACT

In many countries, the land administration system is ineffective when it lacks innovative solutions to register all land rights, including the different customary land rights. Nevertheless, it is believed that the proper role of the land administration system is to guarantee the security of tenure and dispute resolution mechanisms to provide land access. In South Darfur, Sudan, it is claimed that the customary tenure system is most affected by the poor land administration system because there is no recognition of its different land rights among all Sudanese Land Acts. Additionally, land professionals believe that the country has unofficially two land registration systems, the national land registration system that the government administrates, and the Native Administration System that tribal leaders manage in the customary land as a social council. This social institution's main role is to manage land, make justice, and improve social interaction. However, it is believed that only 1% of the customary land in the whole Darfur region is registered, and the remaining is governed by tribes. In addition, Darfur's region has experienced armed conflict since 2003 precisely in South Darfur, which has displaced many vulnerable groups. Therefore, communities in Nyala, South Darfur, have received many Internally Displaced Persons (IDPs) from other states, such as western Darfur, and returning IDPs.

In continuation, the Native Administration System lacks innovative land registration technologies because it has a paper-based system and Araf to manage the customary land and address the land tenure relation of IDPs. It plays a crucial role as a social institution to acknowledge the returning IDPs with their Housh connection (extended family house). Another significant issue is the lack of maps, historical maps records, and better land management and recordation system for the community. It has been necessary to come up with technical solutions that better improve the Native Administration System's main work. This research distinguished an ICT solution for the community land register for Internally Displaced Persons in South Darfur. The information system requirements were identified after assessing the Native Administration system's main functions, main actors, practices, and processes in addressing the land claim of returning IDPs and the Juddiya's primary work as a local land resolution mechanism. Fieldwork, interviews, and a literature review were used to conduct this research.

Moreover, the identification of the suggested ICT solution for the Native Administration System was guided by the spatial and legal framework of the fit-for-purpose land administration (FFPLA) approach. Some selected land administration tools (LA) were analysed and distinguished the alignment with the identified functional and non-functional requirements of the Native Administration system. Furthermore, the capacity of the Native Administration System was considered in analysing and determining which LA tool (s) has been experimented with in similar contexts and met the information system requirement. Based on the findings of this research, the combination of SmartSkeMa, the Field Survey App, and UAVs was found to be the best ICT solution for the requirements and the capacity of the Native Administration System in addressing the land relation of returning IDPs. SmartSkeMa shows the ability to capture different customary land use rights and the social land use restrictions that govern them through participatory hand-drawn sketches. The Field Survey App was also investigated through the analysis, and it was discovered that it could help the community collect non-spatial information about the land conflict between returning IDPs and the host community in South Darfur. The UAVs were found to be used as a supporting tool to provide affordable and updated high-resolution images, especially for advocating high sensitive land disputes within the tribal Dar. Further research is suggested in the implementation of these LA tools as the community land registers in South Darfur.

## **Keywords:**

***Community land, IDPs, the Native Administration System, Community's capacity, Post conflict situation in land administration, Social norms and Aaraf, Local land conflict resolution mechanism, ICT solution***

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## Glossary Of Terms

Hakora	The Sudanese's land for small groups.
Dar	The Sudanese's tribal land.
Housh	The Sudanese's traditional housing for an extended family.
Nazir	The highest head of the Native Administration System.
Omda	The local leader.
Sheikh	The tribal chief.
Mahkama Ahliya	The Native Administration court.
Juddyia	The council of elder people in the community.
Aaraf	Customs.
Kharag	Land products.
Shaqt	Bobaab tree areas are managed by tribal leaders.
Sinya	A land given for cattle to rest.
Marahil	Pastures.
Masarat	Pastoralist's routes.
Rakoba	A place where the community meets.

# 1. INTRODUCTION

## 1.1. Background

It is believed that the national land administration cannot be comprehensive without registering all land rights, especially rights within conflict areas and customary lands in general. In addition, one of the essential roles of land administration is to ensure the security of tenure, dispute resolution mechanisms, and guarantee land ownership (UN/ECE, 1996). However, the percentage of people worldwide who do not have access to a land registration system is estimated at 70% of the total population (Enemark et al., 2016). Also, 90% of sub-Saharan African lands are under customary tenure, which is managed and organised by customary laws through communities, tribes, and clans (Chimhowu, 2019).

Sudan is a developing country in the northeast of Africa, estimated 45.7 million population. It is claimed that 99% of lands under customary tenure in Sudan are not registered but managed only through the Native Administration System, which is also ruled by tribal leaders and communities (GLTN, 2020). Nevertheless, this system has no legal mandate to register customary rights over lands such as Hakora, Dar, Housh, and rights of vulnerable groups, especially in the Darfur region. This issue can play a role in not protecting land rights for Darfur's communities precisely when land conflicts occur, which produce Internally Displaced Persons (IDPs). Hence, land rights' issues should be considered after the end of land conflicts in the land resolution mechanism to ensure and protect rights for secondary occupancy of the land, such as that of IDPs (Todorovski et al., 2015).

Another characteristic regarding land issues in Darfur is the lack of innovative land administration solutions to tackle this issue and recognise land rights. In continuation, around 2.3 million IDPs are forced to be displaced and lived in camps (Augustinus & Tempura, 2021). It is conceivable that an ICT solution for the Native Administration System in Darfur can help this social institution deals with land disputes more effectively and provide security of tenure for returned IDPs and communities in customary areas in South Darfur in general.

This research aims to identify the information system requirements for suggesting a possible ICT solution to the Native Administration System in South Darfur, Sudan and improve land management. An ICT solution can then support communities in recording and managing their land for hosting IDPs and returned IDPs. In Sudan, particularly the Darfur region, this cannot be done without assessing the Native Administration System and how it works and functions. The assessment will help to explore and understand how leaders such as Sultan/ Nazir, Omda, and Sheikh within the community traditionally manage the processes of securing lands for IDPs and maintaining their land records. Also, this research needs to understand and explore how the different levels of the Native Administration are involved, and other additional processes occur between them.

Moreover, developing the Native Administration System capacity is required to improve community leaders' work precisely for the village level, which the Sheikh manages. The creation of land registration for the community in Darfur will help Native Administration leaders to handle issues such as land disputes over Hakora. Thus, this system would support the Native Administration's main work in land dispute resolution, especially between IDPs and the host community. Consequently, the Native Administration System leaders could refer to the well-organised and documented land record system to settle the dispute. It is not evident but knowing land administration professionals in the area claim that the GLTN had an attempt to document vulnerable group tenure rights by using the STDM approach in South Darfur.

## 1.2. Problem Statement

According to the land professionals in Sudan, the country has two parallel land administration systems, the national land administration system organised and managed by the government and the Native Administration System, managed by communities, such as tribes and clans in rural areas. The Native Administration concept refers to local government or tribal leadership, which was given this name during the colonial government and has continued to be called Native Administration since that time. It has three main characteristics: to manage lands, make justice and represent the community, and it is totally connected to land tenure. Hence, the Native Administrative leaders are considered to be not the actual owners of the lands but rather managing and administering lands (Tubiana et al., 2012).

According to (GLTN, 2020), the majority of lands in rural areas are owned and managed by communities or tribes under customary tenure. Communities in these lands perceive their land tenure as being secured since they have more access to the customary system, precisely in villages. Moreover, the Sudanese 1970 Unregistered Land Act only registered lands before 1970 and did not identify and recognise customary lands' rights but considered these land "Government Land". However, it does not consider recognising customary rights in Darfur, such as the Hakora and its ownership. This is due to the lack of historical records and accessibility to land registration offices. Therefore, it is estimated that only 1 % of customary lands in rural areas are recorded in the national land registration system. Thus, the act does not consider rights over occupiers of customary lands, and land claims issues for returned IDPs.

Furthermore, in Darfur, the Native Administration rules more than 100 tribes, and each territory is occupied by a clan. Customary land ownership rights are different in the region of Darfur. Firstly, the term "Dar" refers to each tribal land in a customary area managed by Sultan or Nazir, who has a significant role in organising the land within the Dar. Secondly, the "Hakora", another Sudanese terminology, refers to the land belonging to a small group of people. It is a piece of land that the Sultan assigns to a small group of people, a small family, and a person to use for a specific purpose, and it could be with shared use. However, it is claimed that there is a need to implement new land policies regarding Hakora and decide whether it is an awarded tribal land or ownership type. Thirdly, the "Housh" refers to traditional housing in the customary area where the extended family live. Housh is divided into several rooms used by small families and under joint ownership, as shown in Figure 1. Finally, a right belonging to an individual has several conflicts within the community areas because of a lack of proof of ownership (GLTN, 2020).

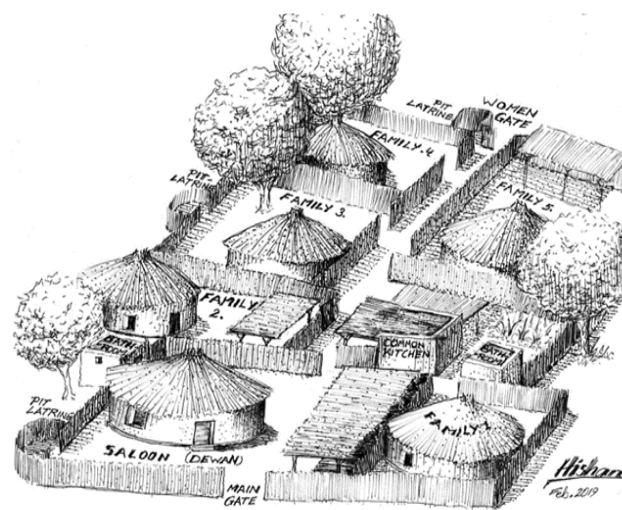


Figure 1: The Sudanese's Housh concept (GLTN, 2020)

Nevertheless, all above mentioned customary rights are not registered and recognised by the national land administration system (GLTN, 2020). The British awarded these rights to tribal leaders during the nineteenth century (Tubiana et al., 2012). Therefore, communities in rural areas do not acknowledge the national land system in Sudan via the 1970 Unregistered Land Act because they only accept the role of the Native Administration System. Also, the 1984 Civil Transaction Act illustrate that the state owns all Sudanese lands unless a person has freehold ownership, which is uncommon to find within the customary areas. In addition, the Native Administration is responsible for managing customary land records using very few papers, usually done via oral history or witnesses (GLTN, 2020). Despite that, the legitimacy of the Native Administration does not have recognition within the framework of the legal land management in Sudan. Still, instead, it is authoritative by local people in Darfur.

Around 2.4 million IDPs currently live in 174 camps in Darfur without good planning for IDP returns (Augustinus & Tempura, 2021). These camps are not suitable for living where they are three times smaller than (300-400) m square approved within the Sudanese planning law (GLTN, 2020). But the locations of these camps are just supposed to be a temporary solution. Additionally, the statutory system lacks imaginative and adaptive solutions and mechanisms to support the enormous number of returned IDPs. However, the Native Administration within the customary system could ensure tenure security for those vulnerable groups.

In continuation, the Native Administration lacks more innovative solutions to improve its capacity. Also, spatial information is needed to maintain land records and cadastre information regarding customary tenure and returned IDPs' historical tenure information. Another significant issue is the lack of registered maps in Darfur creates conflicts over land. Especially when IDPs decide to return to their lands and find other host communities occupying them. Another issue is the overlapping between different Native Administration systems due to the disputes of lands that might occur between groups of different tribes. In this case, local conflict resolution is needed to tackle this issue (GLTN, 2020).

This Native Administration System has essential roles: "signing no-conflict certificates that allow landowners to move from the customary system to the statutory system; agreeing to large-scale, land-based investments; dispute resolution, etc.". Moreover, it has another role of allocating land to foreigners or outsiders not from the same tribe. This agreement is short and temporary land use, which is called "use and go", to avoid any relationship between an individual and that piece of land and claims for it later. However, it does not have a legal mandate to register leaseholds or access land records because it is only in charge of administering customary lands (GLTN, 2020).

### **1.3. Objectives and Research Questions**

#### **1.3.1. Main Objective**

*The main objective of this research is:*

To identify a suitable ICT solution for land recordation processes for the Native Administration System, focusing on tenure relations of returned IDPs in South Darfur, Sudan.

#### **1.3.2. Sub-objectives and questions**

**Objective 1: To assess the Native Administration System's primary functions for providing returned IDPs access to land in South Darfur**

Q 1.1 What practices and processes has the Native Administration implemented to provide returned IDPs security of tenure for their claimed lands?

Q 1.2 Who are the main actors of the Native Administration System involved in the processing of ensuring land rights for returned IDPs?

Q1.3 What are the capacities of the Native Administration tribal leaders and other community members involved in addressing the IDPs' land tenure security?

Q 1.4 How does the Native Administration System mediate land conflict and internally displaced person's land tenure security?

**Objective 2: To identify the information system requirements for implementing functionalities to support the Native Administration System.**

Q 2.1. What are the functional requirements needed to develop the ICT solution for the Native Administration System?

Q 2.2. What are the non-functional requirements and constraints needed to develop the ICT solution for the Native Administration System?

Q 2.3. What kind of information needs to be collected to address the claim of IDPs for their lands?

Q 2.4. How well does the information collected from different community stakeholders in the South Darfur community agree?

**Objective 3: To establish which land administration tool (s) have functionalities that meet the information system requirements for implementing an ICT solution for the Native Administration System.**

Q 3.1. Which land administration tools has been experimented with in similar contexts that meet the system requirements?

Q 3.2. Which land administration tool can meet the capacity of the community in South Darfur?

Q 3.3. Which tool or suite of tools is recommended and can help the community to support land conflict resolution and minimise IDPs' land conflict issues?

#### 1.4. Conceptual Framework

Figure 2 shows the conceptual framework of the research. The customary tenure system will be assessed through the Native Administration System in South Darfur, Sudan. The assessment will identify and figure out the practices and processes that the Native Administration usually implements to provide security of tenure and land allocation for returned IDPs. Additionally, system requirements will be defined via the functional and non-functional requirements that the Native Administration needs to develop an ICT solution that can be able to improve their work. Eventually, an ICT solution in land administration will be identified based on the assessment and the engineering requirements.

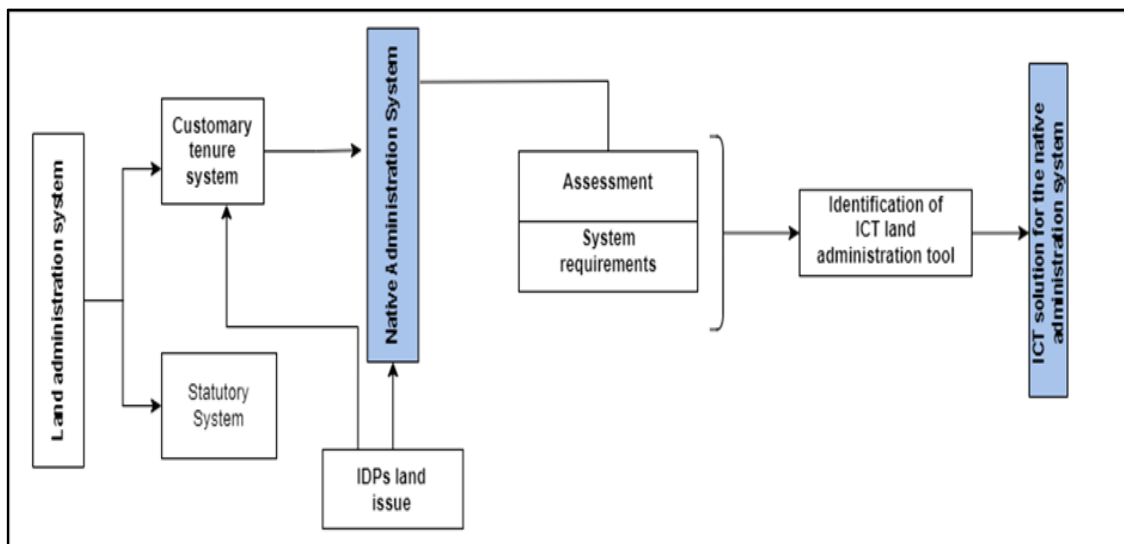


Figure 2: The Conceptual Framework

## **1.5. The structure of the thesis**

This thesis contains six chapters that are explained as the following:

### **Chapter 1: Introduction**

The structure of this chapter presents the research background, problem statement, objective and research question, sub-objectives, and conceptual framework.

### **Chapter 2: Literature Review**

The structure of this chapter reviews the concepts of land tenure, the customary land tenure system, security of tenure in the customary lands, community land registration, the Native Administration System in Sudan, Internally Displaced Persons (IDPs), IDPs in Sudan, ICT solution in land administration, system requirements, post-conflict in land administration, and the fit-for-purpose land administration.

### **Chapter 3: Research Design and Methods**

The structure of this chapter illustrates the research design and methods used to achieve the research objectives. It also describes the research details and techniques that are carried out in each stage for data collection, then data processing, analysing of the data, and the anticipated outcome. Information about the area of interest for this research is also presented.

### **Chapter 4: Result**

This chapter's structure discusses the findings gathered from both primary and secondary data. It also included answers to sub-objectives 1, 2, and 3.

### **Chapter 5: Analysis and Discussion**

The structure of this chapter analyses and discusses the results of this research.

### **Chapter 6: Conclusion and Recommendations**

The structure of this chapter concludes this study by discussing what was accomplished and achieved from the main objective, sub-objectives, and research question. Further recommendations for this research were also made.

## 2. LITERATURE REVIEW

This chapter presents the review of some concepts of land tenure, the customary land tenure system, security of tenure in the customary lands, community land registration, the Native Administration System in Sudan, Internally Displaced Persons (IDPs), IDPs in Sudan, ICT solution in land administration, system requirements, post-conflict in land administration, and the fit-for-purpose land administration.

### 2.1. Land Tenure

There are some definitions of land tenure that can be found in the literature. (M. C. D. Simbizi et al., 2014) define land tenure as the system that organises the relationship between people and the land. Therefore, a set of rules describes how land is accessible and awarded for certain rights. These rights are for the use, control, and transfer of the land.

Palmer et al. (2009) also define it as "land tenure determines who can use what resources for how long, and under what conditions." and linked with responsibilities and restrictions. It describes how complicated the relationship between people to the land and its resources is. However, vulnerable groups are not protected, with less land access than elites within any community. Also, land tenure has different systems, such as freehold refers to private ownership, registered leasehold, state, or private property; common and communal property; and the customary system that is managed by communities.

FAO (2022a) also defines the land tenure system: "How people, communities and others gain access to land, fisheries and forests is defined and regulated by societies through systems of tenure." The concept behind this tenure system is based on either written practices or unwritten traditional and customary practices. Nevertheless, it is claimed that tenure insecurity plays a key role in vulnerability, poverty, and hunger.

### 2.2. Customary Land Tenure System

Meek (1949) observes that the native authority councils in customary areas during the colonised era had a role in identifying and implementing the customary law in Sudan. Following this fact, the land is considered a property that belongs to the community and is under the management of the native council. Hence, the individual's land rights are just limited to the use of the land only, which the chief of the tribe allocates.

Fitzpatrick (2005) illustrates that customary land tenure is defined as the land that holds by a group of people, and all local and external issues are authorised and managed by customary law. It consists of complicated practices and arrangements within tribes, villages, clans, and families. Thus, the territory is considered to describe the relationship between landholders within the community.

The customary tenure system is also defined as "the land and land-based resources might consist of land that a community has occupied since time immemorial, agricultural plots cultivated by clan families, a sacred forest, or commonly shared natural resources." (UN-HABITAT, 2019). The holder of this land could be an individual, a family, a subgroup, a community, or a clan. Therefore, this customary tenure system is ruled and managed through customs, traditional laws, and norms that have been inherited over the years. Wily (2011) also defines customary land tenure, where communities in rural areas recognise themselves as the owners of their lands, including natural resources. The characteristic of these customary's lands is based on communities, clans, and a tribe.

#### 2.2.1. Security of tenure in the customary lands

UN-HABITAT (2019) claims that, in the customary lands, the security of tenure is the recognition of

individual rights to lands by the community and is protected through traditional norms and laws in customary land. The perception of land ownership in customary areas is authorised and vested through the community, groups, or tribes (UN-HABITAT, 2008a). Consequently, this authorisation restricts a community member from using only the land for specific purposes. Also, a community member is able to have a clear, accessible contract to land through customary law.

Simbizi et al., (2014) illustrate that tenure security guarantees that the community's traditions and values recognise the land rights holder. The community should acknowledge the legitimacy of land rights as the primary security source in customary areas. It also claimed that practices, norms, and values should be considered as the insurance for inclusiveness for all landholders.

In continuation, land tenure security in customary land is recognised through two different institutions, either social or public. The social institution in the customary land usually focuses more on acknowledging

assigning land for other uses without a specific duration. Another significant characteristic is that the social institution ought to recognise and protect different land rights and persons who hold these rights. Nevertheless, it might be challenging for these social institutions to acknowledge various categories of people's land rights within the customary land, such as women and vulnerable groups. Figure (3) shows a conceptual model that illustrates different entities of the land tenure system in sub-Saharan rural poor (M. C. D. Simbizi et al., 2014).

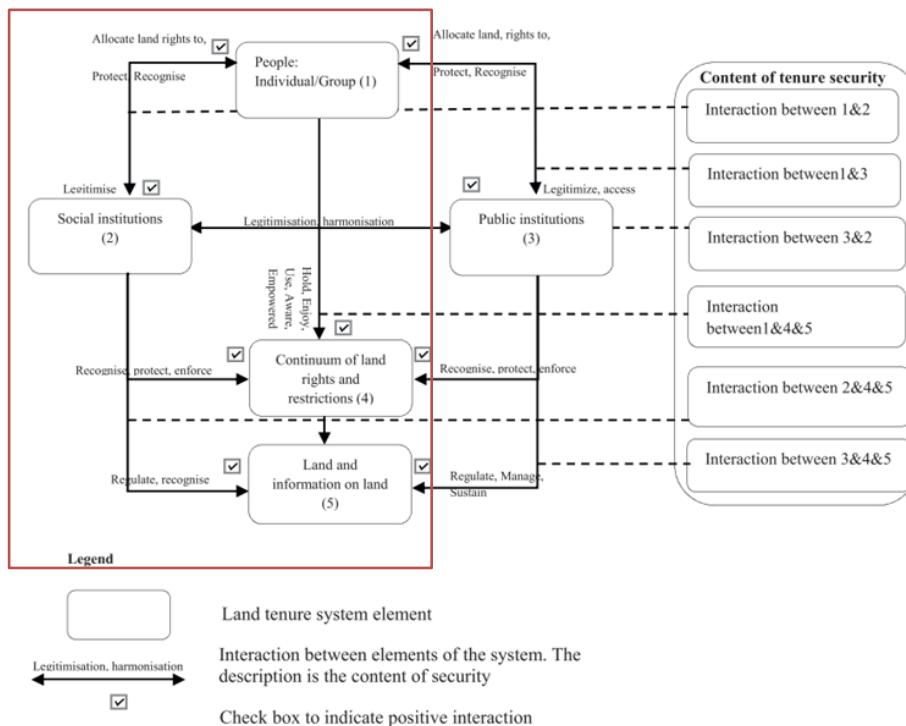


Figure 3: The conceptual model that illustrates different entities of the customary land tenure system (Simbizi, 2014). Red outline added by the present author for emphasis.

### 2.2.2. The customary land rights in South Darfur.

Customary land rights are different in the region of Darfur. Firstly, the Dar refers to each Sudanese tribal land in a customary area, which is managed by Nazir, who has a significant role in organising the land within the Dar and the Native Administration System. Secondly, the Hakora, another Sudanese terminology, refers to the land belonging to a small group of people. It is a piece of land that the Nazir assigns to a small group of people, a small family, and a person to be used for specific reasons or shared



use. Thirdly, the Housh, refers to traditional housing in the customary area where the extended family live. Housh is divided into several rooms occupied by small families and under joint ownership, as shown in Figure1. Finally, a right belonging to an individual has several conflicts within the community areas because of a lack of proof of ownership (GLTN, 2020).

### **2.3. Community Land Registration**

Globally, 75% of the world population is excluded from the formal registration system. This issue is due to the insistence of several countries to continue using conventional surveying techniques, which are not affordable (M. C. Simbizi et al., 2015). Subsequently, challenges in providing security of tenure are encountered by several developing countries through their formal processes of the land registration system. Therefore, innovative solutions are needed to recognise the relationship between people and their land tenure, especially at the community level (Lengoiboni et al., 2019). In addition, it is claimed that community land registration within the customary tenure is the key to accessing lands for vulnerable groups in Sub-Saharan countries. This cannot be achieved unless this community land registration system ensures all the security of tenure, documentation, and legal rights (UN-HABITAT, 2008b).

Moreover, governmental, and local or traditional institutions within any customary system ought to provide effective solutions for their community members to access the tenure system. This kind of tenure system should be accessible, affordable, and understandable when allocating tenure rights to all members of the community (FAO, 2022b). Consequently, the system can legally protect vulnerable groups and Indigenous people's rights by adapting the traditional law in a country, considering that these local and traditional laws are not fully recognised within the national land law.

Furthermore, community land registration can be able to capture and recognise what type of land rights and tenure exist and then improve the situation of unregistered lands in customary areas. Also, relationships of social tenure are expressed through the continuum of land rights based on the community's needs (Lemmen, 2010). Hence, in this sense, the community land registration system can ensure the legitimacy of social tenure by the society itself, which minimises land conflict issues between people (Antonio et al., 2019).

#### **2.3.1. The Sudanese Land Acts and the Customary Land Tenure in Darfur.**

In Sudan, land tenure and land management were historically undertaken through the Funj and the Fur Sultanate. However, powerful people and local administrators were granted land rights by the Turco-Egyptian authorities earlier in the nineteenth century. Additionally, the Land Registration and Disposal Act of 1925 and the Land Acquisition Ordinance of 1930 tended to ignore the customary land tenure system and its social norms and traditions during British colonization. Following that, the Unregistered Land Act of 1970 states that there is no formal legitimacy for customary tenure rights in Sudan, including Darfur. Nevertheless, the act was de facto security of tenure type and considered all unregistered land owned by the government at that time. It fails to recognize customary land rights in Darfur, such as Hakora.

In continuation, The Civil Transaction Act of 1984 emphasized and confirmed that the government owns the land. Additionally, the following acts, Physical Planning and Land Disposal Act of 1994 and Investment Act of 1999 do not recognise and acknowledge the customary tenure rights in Sudan but rather focus on physical planning and investors assuming that the government has the right to expropriate any land for public interests (GLTN, 2020).

### **2.4. The Native Administration System in Sudan**

Tubiana et al. (2012), The British colony, introduced the concept of the Native Administration System as a traditional authority that Sultans in different regions rule their communities via various leaders and

customs. The primary purpose of this traditional system is to organise and manage community lands, provide and ensure equity, and lead and represent their communities. This system plays a crucial role in eradicating issues related to land between persons or groups. Issues such as land disputes and the use of land are traditionally tackled by tribal leaders of the Native Administration System.

Furthermore, hierarchical land management is used within the Native Administration, consisting of three levels: the Sultan/Nasir at the elevated level, followed by the Omda and the Sheikh, respectively. This Native Administration manages not only community lands but also people in the community, and its leaders are coordinators of the tribe's Dar. Also, one of the main function of this Native Administration System is to keep records of land management decisions through verbal agreement and the community witness (GLTN, 2020). Those tribal leaders also are responsible for administrating the relationship with other neighbouring Dar, even in different countries. Consequently, their leading roles are explained by the following:

- "Assign large tracts of hakora land to lower levels in the Native Administration or to other groups migrating into the area from other regions."
- They represent the Dar within governmental levels.
- Urban and large settlements are managed by Omda
- Sheikhs manage villages and pastoralist temporary housing
- Assign smaller areas of lands to smaller groups by the lower level of Native Administration.
- Provide the first right of proof of owning the lands according to the customary tenure system (GLTN, 2020).

## 2.5. Internally Displaced Persons (IDPs)

In the literature, definitions could be found about Internally Displaced Persons. The guiding principle on Internally Displaced, 1998 defines it as "Internally displaced persons are persons or groups of persons who have been forced or obliged to flee or to leave their homes or places of habitual residence, in particular as a result of or in order to avoid the effects of armed conflict, situations of generalised violence, violations of human rights or natural or human-made disasters, and who have not crossed an internationally recognised State border." (UN, 1998).

Mooney (2005) also defines Internally Displaced Persons (IDPs) as: "people uprooted by conflicts, violence and persecution, that is, people who would be considered refugees if they cross the border." However, statistics are considering persons who are just displaced due to conflicts worldwide. Additionally, two elements are considered in the case of IDPs: the characteristic of the forced movement and the movement within the border of the same country. Thus, the only difference between IDPs and refugees is refugees flee outside their countries.

World Bank (2017) explains that IDPs are a group of persons who have been forced to move from their places because of conflicts or violence. Another characteristic to define those groups is the need for urgent protection, especially for those displaced due to natural disasters. However, those groups need support regarding the effect of host communities, especially finding a suitable job for an IDP. In this following thesis topic, I will choose the definition of IDPs from the United Nations, 1998.

### 2.5.1. IDPs in Sudan

Armed attacked and conflict between communities are the reasons for IDPs' issue in the whole country and precisely in Darfur (OCHA, 2022b). GLTN (2020), in Sudan, humanitarian crises have occurred in the western part of the country due to violent conflicts in the Darfur region. Thus, these violent conflicts lead to displaced persons internally as IDPs or outside the country as a refugee in neighbouring countries. In addition, the main reason behind these conflicts in Darfur is land and other natural resources, whether between two communities or farmers and pastoralists. IDPs in Darfur have problems when deciding to

return to their lands; one of these issues is land disputes between returnees. Another issue is disputes related to the land conflict between IDPs and host communities. Also, IDP lands, in various cases, are occupied and taken by other communities.

Another cause currently for displacement in Sudan is a fight between the Sudanese Armed Forces (SAF) and the Rapid Support Forces (RSF) (OCHA, 2023a). In addition, thousands of citizens in many parts of Sudan's cities, such as Khartoum, Kordofan, and Darfur states, are internally displaced. Khartoum's citizens, for example, who managed to flee from the city, went to Jazeera, Sennar and Gedaref states. Also, other states like the North Darfur, South Darfur, Central Darfur, and North Kordofan states have faced heavy gunfire and air strikes. Consequently, it is claimed that thousands of Sudanese who lived in these states are currently displaced over the country. Hence, it is believed that the main reason of this current conflict that has started in April 2023 is seeking for power and controlling over national resources.

## 2.6. ICT Soutlion in Land Administration

UNESCO (2009) defines information and communication technologies (ICT) as a "Diverse set of technological tools and resources used to transmit, store, create, share or exchange information. These technological tools and resources include computers, the Internet (websites, blogs and emails), live broadcasting technologies (radio, television and webcasting), recorded broadcasting technologies (podcasting, audio and video players and storage devices) and telephony (fixed or mobile, satellite, Visio/video-conferencing, etc.)".

Enemark et al. (2010) illustrate that sustainable development can be obtained through a modernised land administration system. Information and communication technologies (ICT) can also provide services to all stakeholders involved in land administration, which are professions, public, and land administration infrastructure for implementing e-citizens. Additionally, this process can be used at the local level to link a system with people. Thus, an ICT solution will provide the construction of basic infrastructure for the system and data accessibility for the community.

The ICT solution can support organisations working in the field of land administration for more effective and efficient operations, accessible to users and the public and kept up to date. Moreover, ICT can avoid time-consuming and much more effort to determine, record, and disseminate ownership information as well as the value and use of land. Subsequently, it offers affordable and quick reproduction of the organisation's work with high quality (Lemmen, 2006).

## 2.7. System Requirements

It is claimed that updating any existing system should be based on consultation with how the primary users identify their requirements to benefit from it (UN/ECE, 1996). A system requirement is what characteristics a specific system should have and what exactly the system should do (Dennis et al., 2012). Additionally, the system requirements are defined as "how the system should be built". System requirements are based on a particular business's needs and the purpose behind developing any system. Consequently, these requirements are identified through information, functional, and non-functional requirements.

Moreover, business requirements should be identified before creating any new system. These requirements illustrate the main reasons behind creating a system and what kind of benefits the organisation would get (Dennis et al., 2012). It also explains the system's needs, including details of what it is supposed to do and provide for users.

Capturing requirements are used to ask the main actors the right question about their system's environment and how they currently manage their primary work (Nuseibeh & Easterbrook, 2000). Thus,

this collected information will be interpreted, modelled, and later validated to identify all stakeholders. Therefore, such information will be used to understand the concept and the main functionality of the existing system in order to develop possible ICT solution designs for the community (Dennis et al., 2012). The functional requirements specify the system's capabilities by recognising the usability of the potential ICT solution for the Native Administration in Darfur and how the new system could support their work. Furthermore, the non-functional requirements define the quality of the ICT system for any organisation (Nuseibeh & Easterbrook, 2000). Thus, these requirements are needed during the designing phase, where attributes, designs, and implementation constraints are checked. Despite the system's quality, they consider other aspects related to the political and cultural characteristics of traditional law.

## **2.8. Post-Conflict in Land Administration**

Todorovski et al. (2015) explain that land administration is critical for post-conflict contexts, which needs to raise awareness about more mechanisms for peace agreements. However, such peace agreements come with issues regarding returning people to their original places and lands. More importantly, there is a need to consider issues related to lands in such agreements. Moreover, different mechanisms, approaches, and policies are needed in the situation of post conflicts, especially when a country has different culture and history related to land issues. Therefore, it is recommended that the registration of land should not be isolated from any peace agreements but rather part of the land policy (Van Der Molen & Lemmen, 2004). Nevertheless, it might be difficult and complicated to understand the situation in post-conflict areas without having a legal framework. So, it is required to have governmental and law experts from the local who can ensure and provide data as well as information needed, especially in case of document loss. In continuation, religious persons, tribal leaders, and informal communities can play a role in providing such information as a representative of their society (Zevenbergen & Van Der Molen, 2004). Hence, they might be aware of and have historical details of the conflict and the relationship between people and their lands.

## **2.9. Fit-for-purpose Land Administration (FFPLA)**

### **2.9.1. FFPLA Framework**

Enemark et al. (2014) explain that fit for purpose is based on creating and building flexible land administration systems that meet the needs of citizens in developing countries. In addition, this approach concentrates on providing tenure security and land used control than high-accuracy surveying technologies. There are elements that the FFP approach contains, which are: flexibility, inclusiveness, participatory approach, affordability, reliability, attainability, and can be upgradeable. However, countries cannot implement a FFPLA approach unless revising their legal and institutional frameworks.

Enemark et al. (2016) illustrate that guidelines are needed for less developed countries to fill the gap between the national land administration and the informal systems. Frameworks such as FFPLA can improve a country's situation by recognising the several types of social tenures. Tenures are categorised and levelled from informal and customary tenure to more formal tenure, such as leaseholds (Enemark et al., 2016). Subsequently, FFPLA can be able, through its guiding principles, to build the legal, spatial, and institutional frameworks to offer developing countries affordable, practical solutions to provide security of tenure for all. However, a spatial framework of FFPLA requires sustainable solutions through upgradable strategies that allow the integration of land information system. In this following research, the suggested potential ICT solution will focus on two aspects that fit the situation in South Darfur, considering the spatial and legal or non-spatial framework of the Native Administration System. Figure

(4) shows the fit-for-purpose land administration concept, including the spatial, legal, and institutional framework.

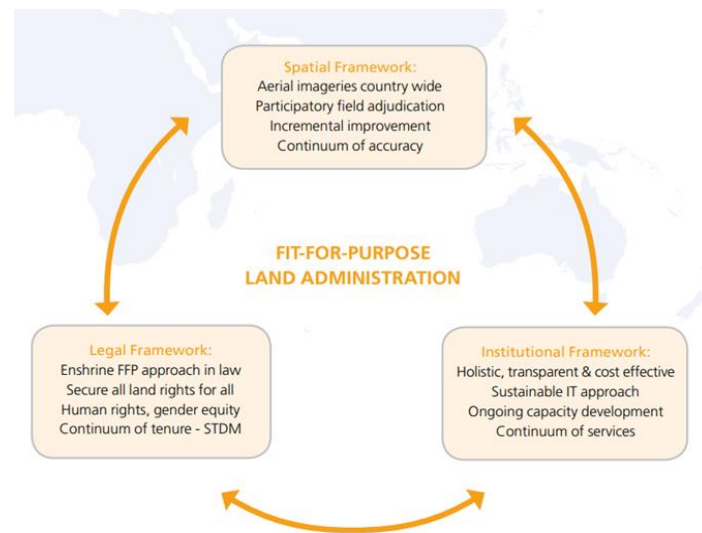


Figure 4: The fit-for-purpose land administration concept.

### 2.9.2. FFPLA Tools

Different land administration tools that fit countries' situations can be found in the literature. An example of a land tool that is derived from the fit-for-purpose land administration is pro-poor land administration tools. The main focus of the pro-poor land administration is the activities of land recordation (M. C. Simbizi et al., 2015). Thus, it is claimed that the pro-poor land administration and the fit-for-purpose land administration can ensure flexibility and affordability in recording spatial information about people to their land relations. The pro-poor land administration is designed to provide an accessible system for all community members.

Another land administration tool is the Social Tenure Domain Model (STDM). This tool can support the relationship between people to their land relations and the legal aspect of these relations (Lemmen, 2010). Additionally, it also has the ability to record different types of tenure and ensure what exists on the ground with all stakeholders in the community.

(De Vries et al., 2015) illustrate that crowdsourcing is considered an approach to traditional record practices. It aims to collect data by using the mobile application by community members or individuals to provide information about locations. It could help communities to better record and demarcate lands through local knowledge about their land relations.

One of the approaches to fit-for-purpose land administration is the usage of aerial images, either UAV or satellite images (Enemark et al., 2014). This approach uses high-resolution imagery that helps to identify land relations and ensures the community's involvement. It also supports the community in the customary area to better record and manages their social tenures. Moreover, another approach is called the SmartSkeMa approach. This approach's concept is based on hand sketching and land tenure documentation. It also uses aerial imagery, which provides and supports local communities to document their land relations through their traditional perspective (M. C. Chipofya et al., 2021). SmartLandMaps is also another land administration tool that can provide the automatic digitalization of sketches drawn by hand on the top of an existing map (Degbelo et al., 2021).

In summary, this chapter presented concepts related to this research. In the following chapter 3, the methodology used for this research will be presented.

### 3. RESEARCH DESIGN AND METHODS

This chapter explains the research design and methods that will be used to achieve the research objectives. It also describes the research details and techniques that will be carried out in each stage for data collection, then data processing, analysing of the data, and the anticipated outcome. Information about the area of interest for this research also will be presented.

#### 3.1. Study Area

This research will take place in Nyala, the capital of South Darfur state, in the southwest of Sudan. Nyala is 637 meters above sea level and is located 1200 kilometres away from the capital of Sudan, Khartoum. In continuation, this study area was selected because it is historically and currently considered a trade hub, and connecting with Chad, Central African Republic, South Sudan, and Khartoum via routes (UN-HABITAT, 2009). It is inhabited by over sixty thousand IDPs living in Kalma camp in South Darfur (OCHA, 2022a). The Kalma camp is considered the biggest IDP camp in South Darfur. Thus, the purpose behind choosing this area is that the Darfur region has recently faced armed conflicts, tribal and community conflicts since 2003. Additionally, the lack of an adequate land registration system in the whole area and the country generally plays a crucial role in not providing security of tenure for returned IDPs (GLTN, 2020). The research was conducted in Eid El Firsan's locality and one of its administrative unit called Om Ginaah, where Bani Halba's community is living. It is one of the Southern Darfur biggest tribes and Sudan's tribe as well. The Eid El Firsan's locality is one of the nine localities that South Darfur has.

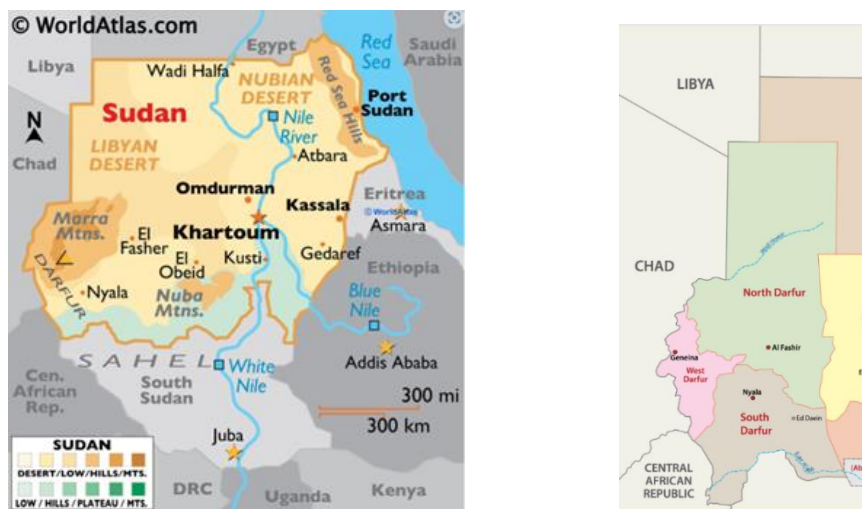


Figure 5: The study area in Nyala, South Darfur

([Sudan Maps & Facts - World Atlas](#) (Accessed on 01 June 2023))

#### 3.2. Research Methods

The research method was "a systematic process of inquiry applied in such a manner as to learn something about our social world." (Sheppard, 2021). Hence, for this research, the qualitative research approach was conducted based on semi-structured interviews (Sofaer, 2002). Consequently, during these interviews, the interviewer's task was to capture the information from different responses. After that, the collected data

was analysed and interpreted. In this following research, an inductive research approach was conducted to capture qualitative data.

Mack et al. (2005) describe that qualitative research can get certain information about specific populations through their values, culture, and social contexts. It also provides more insight into the complexity of a particular social situation. Following that, data from this research was collected through a literature review and semi-structured interviews as primary and secondary data. The primary data was collected through semi-structured interviews. The semi-structured interview was designed around open-ended questions prepared before any interview (DiCicco-Bloom & Crabtree, 2006). Thus, focus groups and in-depth interviews were used to answer the questions from sub-objective (1) of this research. Through these interviews, answers were captured about how the Native Administration in South Darfur, Sudan, ensures tenure security for returning IDPs via certain practices and processes.

Secondary data is defined as "the analysis of the data that was collected by someone else for a primary purpose." (Johnston, 2017). In this research, secondary data was obtained from the literature review of journals, books, reports, and previous works. The collected data answered questions related to sub-objective (1) and sub-objective (2) of this research. Answers were captured about the concept of the Native Administration System as customary system in Sudan, land tenure, customary land tenure, community land registration, and ICT solution in land administration. Additionally, information about post-conflict situation in land administration, IDPs, and fit-for-purpose land administration framework (FFPLA) was gathered. The data collection method is shown below in Figure 6

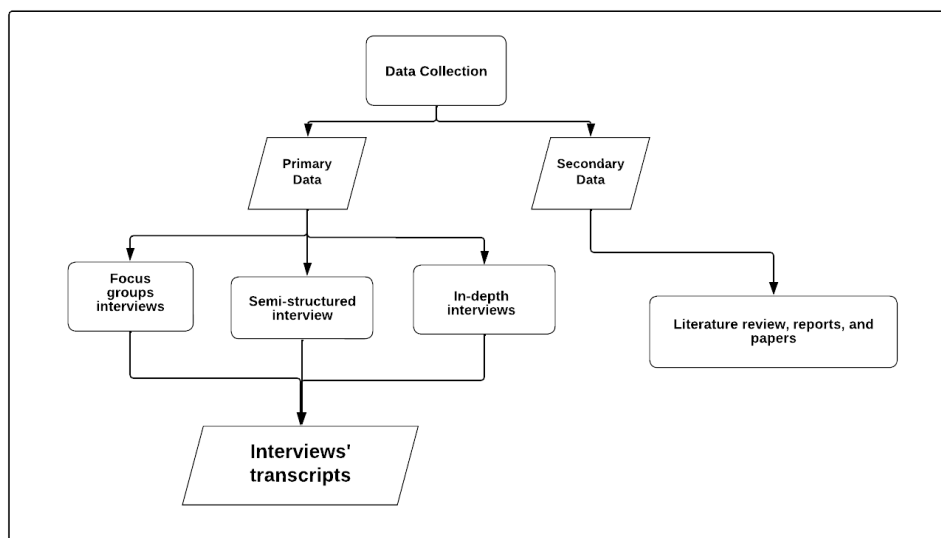


Figure 6: Data collection methods

### 3.2.1. Pre-fieldwork

#### Defining the research

The title of this research topic was defined through reading and checking some literature. After that, the background of this research was defined from literature, concepts, and theories about community land registers for IDPs. This research's problem statement was then determined with references and clear justification from the literature. Eventually, the last step was to identify the research question, main objective, sub-objectives, and support questions to be answered through this research. Also, semi-structured interview questions were developed before going to the fieldwork.

### 3.2.2. Fieldwork

This research topic used a qualitative research methodology approach through a literature review as secondary data and semi-structured interview, focus-group and in-depth interviews as primary data sources to answer the research question, see Annex 1. These methods helped to explore how ICT solutions could improve the Native Administration System's main work.

#### 3.2.2.1. Data collection method: Primary Data

##### Semi-structured interview

The semi-structured interview is one of the qualitative research methods where the interviewee is asked open-ended questions (Sheppard, 2021). Thus, respondents from the community in Darfur, Land professionals working in the governmental sector, and Sudan Land Registrar explained in their own words what they know about the practices and processes of Native Administration regarding IDPs tenure issues. Figure (7) shows a semi-structured interview with a land professional in Nyala. Another information was elicited from those respondents about what is the capacity of the Native Administration System in South Darfur and what they actually need as an ICT solution to improve their work, organising historical stories about their customs, Araf, laws, and land tenure records regarding not only the community but also returning IDPs in particular. The number of respondents is shown in Table 1 below.



Figure 7: The semi-structured interview with a land professional, in Nyala (photo credit: A. Hemoudi)

##### Focus group interview

A Focus group interview is defined as an effective qualitative method for collecting information related to social aspects where different information is captured from people (Mack et al., 2005). Additionally, data was gathered from various sources within the community and other stories about the same topic. Consequently, the purpose of this method was to collect information from the Native Administration leaders in Darfur. Tribal leaders, such as Sultan, Sheikh, and Omda, were interviewed to understand and explore who is involved and in charge of the Native Administration System's main work. Also, it provided information about who usually participates in providing security of tenure for IDPs. The number of respondents is shown in Table 1 below.



Data Collection Methods	Respondents	Location /case study area	Number of respondents
Semi-structured interview	Tribal leader (Omda)	Nyala	1
	Ministry of Physical planning	Nyala	1
	Darfur Land Commission	Nyala	1
In-depth interview	General Land Registrar	Khartoum	1
	UN-Habitat- land officers	Khartoum	2
	Sudan Land Commission	Khartoum	1
	Land Professional- land Authority	Nyala	5
	Tribal leaders (Omda & Sheikh)	Nyala	2
Focus-group interview	Community members (incl, women)	Nyala	10
	Tribal leaders	Nyala	3
	IDPs	Nyala	10
			37

Table 1: Groups of respondents for all data collection methods and their distribution

### In-depth interview

It is another qualitative method which is usually used when the interviewer wants to ask people about their personal experiences related to a specific topic (Mack et al., 2005). It is also used when more information is needed regarding a particular event. This method was used to interview IDPs about their life experiences from when they left their lands till they returned, claiming their lands. In addition, I used this method to interview Sudan's Land Registrar regarding the customary tenure system and land laws. Also, I interviewed land professionals working in the governmental land sector in Darfur to gain more information about the customary tenure system, land laws, and IDPs' land issues in general.

The number of interviewees is shown in Table 1 above. The same respondents might be interviewed more than once to get more information. Figure (8) (a) and ( b ) shows the in-depth interview respondents below.



(a)



(b)

Figure 8: The in-depth interview respondents (photo credit: A. Hemoudi)

### 3.2.3. Data collection method: Secondary data

#### Literature review, reports, and papers

A literature review method was conducted through desk research for collecting information about land tenure, the customary land tenure system, community land registration, IDPs, the Native Administration

System in Sudan, and post-conflict in land administration. It was used as secondary data from literature websites, journals, and books.

### 3.2.4. Post Fieldwork

#### Data analysis and processing

In this research, an inductive research approach was used to analyse the data, which is defined as "the researcher first observes with an open mind, identifies patterns in the observations, and finally relates them to existing theory or develops new theory" (Runeson et al., 2012). Collected data from the fieldwork was analysed to answer the research question and sub-objectives. Focus groups and in-depth interviews with the tribal leaders of the Native Administration System, IDPs, land professionals in the governmental sector, and the Sudan Land Registrar were interpreted and coded.

A Root Cause Analysis is a method that assists developers in distinguishing areas of process improvement by discovering and determining the root of the cause (Walia & Carver, 2009). It was used to analyse the input from semi-structure, focus groups, and in-depth interviews. Dennis et al. (2012) also this analysis considered understanding the actual problem and its nature before jumping directly to find a solution. It supports the idea of better investigating the cause of the issue rather than coming up with a solution that might cost a lot of money for the users. Consequently, collected information from the interviews' questions helped to figure out the actual problem that the Native Administration leaders and their communities have faced in addressing land-related issues of returned IDPs.. Therefore, based on the responses from those interviewees, an understanding of the whole Native Administration System was assessed and analysed. The UML use case diagrams were used to answer questions of sub-objective (1). Additionally, use cases were developed to describe any user requirements and what a system must do. These use cases help to understand better any changes related to business processes in terms of redevelopment of an existing system. Also, the use diagram was used to understand who is involved and who participated at the main level of the Native Administration System as well as the association relation between different actors involved (Dennis et al., 2012). Eventually, the activity diagram explained and described the general workflow activity of the Native Administration System and how they address tenure security for returned IDPs (Eriksson et al., 2004).

After collecting the information from interviews, this captured information will be analysed to identify which system requirements are needed for the Native Administration System as an ICT solution. Analysis of collected data from interviews will be extracted from the interview's transcript, and then it will be coded through interview coding (Sheppard, 2021). Therefore, these collected data will be coded based on different themes such as the Native Administration's main processes, practices, capacity, customary tenure, returned IDPs' land issues, local conflict resolution mechanisms, and information system requirements for their existing system.

A system requirements approach is used to identify several aspects before developing any ICT solution. System requirements can be able to identify the main aim of any new software system by determining and recognising the needs of all stakeholders involved (Nuseibeh & Easterbrook, 2000). Consequently, these are done through information, functional, and non-functional requirements of the information system engineering requirements (Dennis et al., 2012). Therefore, it will identify the Native Administration System's stakeholders in South Darfur, Sudan and what is needed and required to develop an ICT solution to improve their work in providing land for internally displaced people who claim it.

The selection of the suitable and recommended land administration tool (s) was supported by the framework of fit-for-purpose land administration as a guideline principle. The spatial framework of FFPLA played a role as a guideline for selecting the tool or set of tools that could support the way the

community land in South Darfur is occupied and used through inclusiveness and accessibility for all (Enemark et al., 2016). A table of suitable and available land administration tools was created in Annex 4 based on the information system requirements that were defined after the analysis of interviews. The table contained a list of land administration tools found in the literature and the survey of similar examples and contexts, aligning with what the Native Administration System is lacking in its capacity. Additionally, after the analysis of the collected information, I analysed which land administration tools among the selected tools do not fit and are highly aligned with the functional and no-functional requirements of the Native Administration system.

Moreover, the capacity of the Native Administration System leaders and other members within the community in South Darfur was considered in selecting which tool (s) is suitable for them. The proposed ICT solution should be able to improve the Native Administration System's actual work in ensuring the security of tenure for returned IDPs and better managing their tenure documentation. Hence, the land administration tool that will be recommended should help to minimise as much as it could the conflict between host communities and returned IDPs. Eventually, based on the analysis of the Native Administration System, its capacity, and IDPs' land issues, a recommendation of a combination of different LA tools was identified as the best ICT solution that is expected to suit the Native Administration System in Nyala, South Darfur.

### **3.3. Research Design**

The research design illustrates how the research topic will be conducted, considering all steps required to accomplish this research. A case study was selected to identify a suitable ICT solution for land recordation processes for the Native Administration System, focusing on tenure relations of returned IDPs in South Darfur, Sudan. The Primary data and secondary data were collected and are explicitly demonstrated in detail below. Figure 9 below shows the research design workflow.

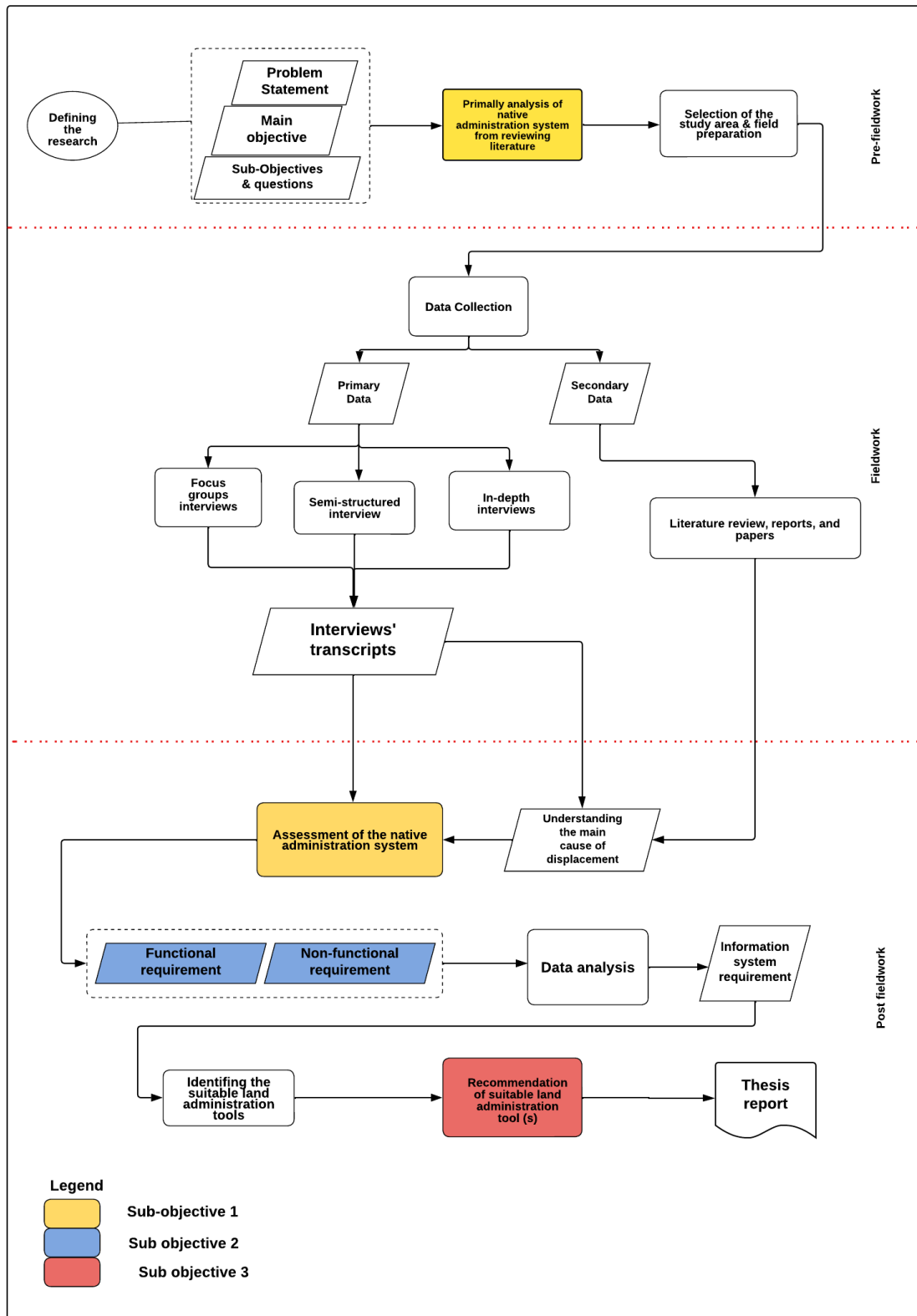


Figure 9: The research design workflow

### **3.4. Ethical Considerations and Risk**

All ethical considerations were observed before and during the study based on the Research Ethics Policy of the University of Twente. The primary data of this research was collected through semi-structured interviews, focus groups and in-depth interviews. The interviewees were community members, tribal leaders such as the Omda, and Sheikh, and returned IDPs in Nyala, South Darfur. Apart from that, the General Land Registrar of Sudan and land experts from the Land Authority and the Darfur Land Commission land professionals were also interviewed in Nyala. All respondents received an informed consent form about what types of questions will be asked, and then the interviewer will make sure to get permission to proceed with the interview after obtaining the approval either verbally or with a signature on the informed consent.

The researcher considered all ethical issues related to interviewing IDPs as part of the community by asking only specific questions about their lands. Questions were concentrated on the relationship between IDPs, tribal land (Dar) and the tribe; when did they return to the village, and did they have such land disputes with neighbours? Also, did they find someone else, a family, and a community that has already occupied their lands? In addition, questions were also asked to IDPs who moved to a village and the locality from different places and how the host community managed to allocate part of their lands for them. Finally, the researcher mixed the collected information from tribal leaders, community members, and IDPs to avoid any sensitive information and not to be traced by anyone later.

Since this research deals with a sensitive topic, I only focused on the tenure issues of IDPs as members of the community or communities who moved to the village from different tribes. I also conducted this research considering only how the Native Administration System, including tribal leaders and the community, manages their lands. Moreover, the study concentrated on identifying which information system requirements are needed for this customary system as an ICT solution to improve their land tenure processes, practices, and capacity to minimise land disputes.

### **3.5. Limitations of Research**

The research had various limitations. It was conducted in an area that belongs to part of the Darfur region, which has experienced armed and group conflicts since 2003. Discussing customary land tenure issues is considered one of the sensitive topics, and this is due to the fact that the national and public land institutions perceived that the government owns the whole land. This issue was clear from interviews and literature review that there is no proof of acknowledgement of the customary land rights. Another significant limitation of this research was that it was conducted during the current political unstable situation that Sudan has experienced since 2019, especially in South Darfur. Besides that, it was difficult due to several reasons to interview other tribes who were displaced entirely and are currently living in IDPs camp in Nyala, South Darfur. The researcher was advised to return immediately by the end of his interviews because of signs of conflict; he left Sudan on 15 April morning, just 6 hours before the current war started, taking one of the last flights from Khartoum Airport.

### **3.6. Research Matrix**

The research matrix of this study research is presented in Annex 3. This research matrix aims to illustrate the data methods used for this research and the expected outcomes for each sub-objective.

### **3.7. Summary of Chapter 3**

The structure of this chapter presented both the case study area and the research design and methods. The data collection methods used were also introduced in this chapter. In the following chapter, results from data collection methods are presented.

## 4. RESULT

This chapter presents the results and findings from the fieldwork and data collection. Data collection was performed through focus group discussions and in-depth and semi-structured interviews about the Native Administration System and the customary tenure system in South Darfur, Sudan. Interviews were conducted with the second and third levels of tribal leaders (Omda and Shiekh) who are more connected to land management, land professionals, the General Land Registrar of Sudan, land professionals in the Darfur Land Commission, and the General Land Commission.

### 4.1. Assessment of the Native Administration System's primary functions for providing returned IDPs access to land in South Darfur

#### 4.1.1. The Native Administration System's main functions, practices and processes

This sub-section presents the results from focus group discussions and in-depth and semi-structured interviews. The outcomes assessed the Native Administration System as a community council and its primary functions, practices, and processes regarding IDPs' land access in South Darfur.

#### The structure of the Native Administration System's main actors

As derived from the in-depth interview with tribal leaders, the management of the Native Administration System is under the tribal leaders, who are Sultan/Nazir, Omda, and Shiekh, respectively. The head of the Arab tribes in South Darfur, called the Nazir, compared to other Darfur regions as stated by the Omda. The Native Administrator is in charge of authorising land use planning issues within his tribe. Nevertheless, he is not responsible for any land conflict outside their Hakora's tribal boundaries. Additionally, any Nazara is managed by the Nazir, followed by many Omda (s) working under his management. The Nazir is the head and is responsible for the whole Hakora. The Nazara cannot be registered under the name of any tribe unless the Nazir has at least fifteen Omda (s) under his authority. Following that, any Omda is also in charge of many Shiekh (s) under his authority. The structure of the Native Administration System is shown below in Figure (10).

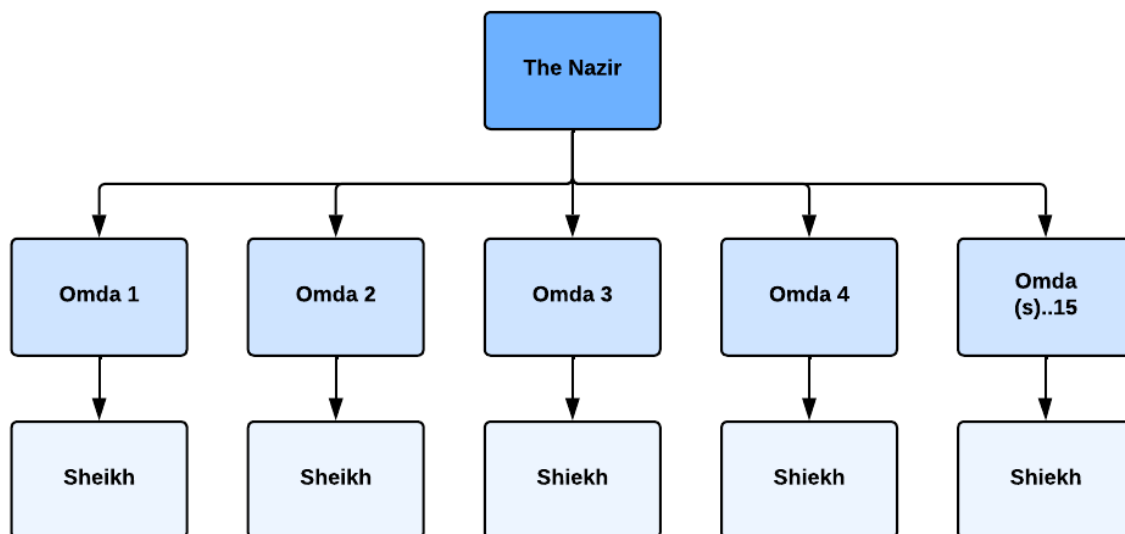


Figure 10: The structure of the Native Administration System (author construct)

In continuation, the Omda's fundamental work is to control and solve issues related to their Hakora. This Hakora has many Shiekhs who are reporting with the Omda. Shiekh collects part of the land products (Kharag) and gives them to the Omda. Consequently, any Omda and Shiekh have (Shaqa), which is a

traditional name referring to the Bobaaab tree. The Shaqat corresponds to a land under Omda and Sheikh's control and management. The “*Shaqat*” is allocated to an individual or family member by the Shiekh for land use. This process also applies to families who moved from other areas and are eager to settle in the hosting village for different land uses, such as IDPs.

As derived from the in-depth interview, the Sheikh’s primary duties within the Native Administration System are to take care of his community's land and assign land for his community members. He also has other responsibilities, such as solving land disputes, land use issues, and improving social interactions. However, a person cannot be called Sheikh unless he has various families living in a specific location under his authority. Also, the Sheikh has another role in collecting particular kinds of traditional taxes on behalf of the Nazir. The Sheikh is responsible for admitting that land is free of conflicts, especially when an individual wanted to register their land within the governmental system. After the approval signature from the Sheikh, Omda should sign the certificate and, lastly, be approved by the Nazir. Nevertheless, due to their perceptions, many citizens do not accept any kind of ownership rather than being within the customary tenure system. Figure 11 shows an in-depth interview with two of the Native Administration System’s tribal leaders, the Omda in (a) and the Sheikh in (b).



Figure 11: In-depths interview with tribal leaders (photo credit: A.Hemoudi)

### The customary tenure system in South Darfur

Land professionals claimed that it is estimated that only 1% of the territory in the customary tenure system in Darfur is registered as leaseholds. The perception of customary landholders and occupiers is based on the fact that these lands belong to them. However, the national land administration system is not recognized legally for these customary rights, but rather, in 1970, the government perceived owing all the land through the Unregistered Land Act. Also, the Civil Transaction Act of 1984 modified the Unregistered Land Act of 1970 but didn't give people the right to own ownership. It supports only the use of land and provides compensation when the government decides to take the land for public use.

However, this law has generated a lot of issues till now, which is the need to recognise customary land rights. It also needs to acknowledge historic land rights and allow IDPs to return freely to their original places (GLTN, 2020). In addition, it is claimed that different customary land rights can be determined; the Dar is the land that describes the tribal land, such as Dar Beni Helba and Dar Fur. Another customary land right is Hakora, which assigns to a group of people. Also, the Housh is considered a living area for extended family, and there is land that allocates for individuals either for living or different land uses, as presented in subsection 2.2.2.

As from the in-depth interview with a land professional from the Darfur Land Commission, lands in the customary tenure system in Darfur are administrated by Aaraf (customs) sounds like "Uraf". These customs are responsible for managing land by allocating different land use and settling land conflicts within the tribe. They are considered a traditional legal framework in the customary land in South Darfur. These customary' social norms are written by the Nazir/Sultan, Omda, or Shiekh, which show, for example, the boundary of the community's land or an individual plot of land. These boundaries are traditionally known through natural landmarks that are hardly changed, such as valleys, water streams, and mountains that naturally demarcated the Hakora's boundaries. Making the accuracy of the measurements in such areas is hugely law, particularly if the urbanisation expanded to different land used by the community. Hence, everyone within the tribe respects these customs. They are also recognised as the traditional working framework for local land conflict resolution. Figure 12 shows the customary tenure system's three elements.

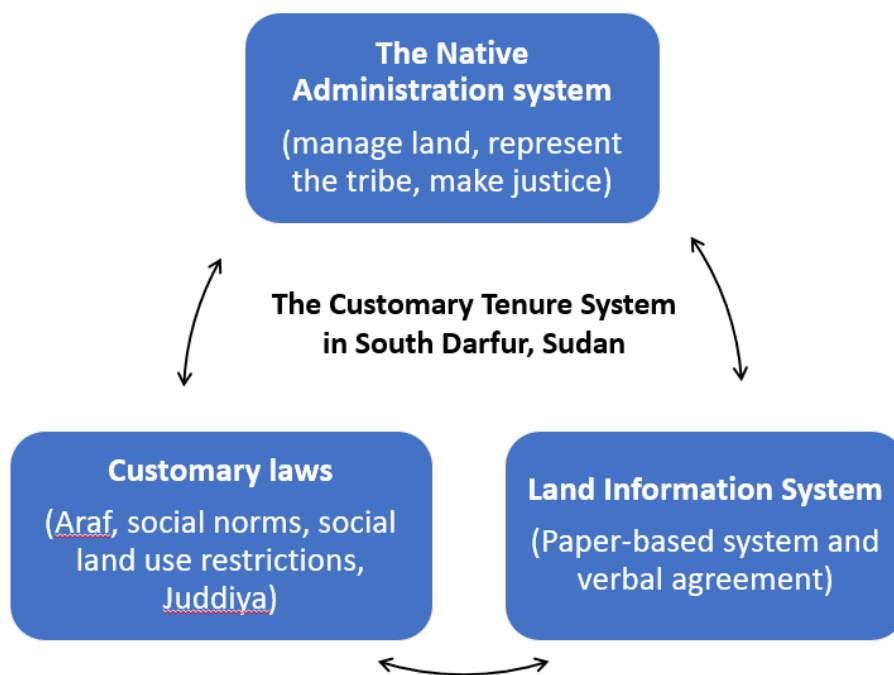


Figure 12: The customary tenure system in South Darfur (author's construct)

In continuation, since 1916, when Darfur officially joined Sudan. Nazir/Sultan is the head of the tribe who grants lands (Hawaker) to clans, tribes, communities, or individuals. Additionally, all these Hakora (s) are under the authority of the Nazir/Sultan. During the British colony, it kept the system of the tribal leaders as the head of their communities to help manage the land. This system is called the Native Administration System, which is responsible for any land-related issues and improving social interactions. Nevertheless, tribal leaders are only accountable for solving land issues within their Hakora's geographical boundary.

As also found from group discussions and in-depth interviews with tribal leaders, community recognition plays a role in acknowledging people's relation to their land and the tribe in South Darfur. It is believed that the Native Administration System as a community council is in charge of recognizing their community land rights through tribal connections. Furthermore, community members, such as neighbours of the landholders, can ensure the relationships of individuals to their land rights, especially in case of a land claim. Figure 13 below shows the conceptual framework that illustrates different entities of the customary tenure system in South Darfur.



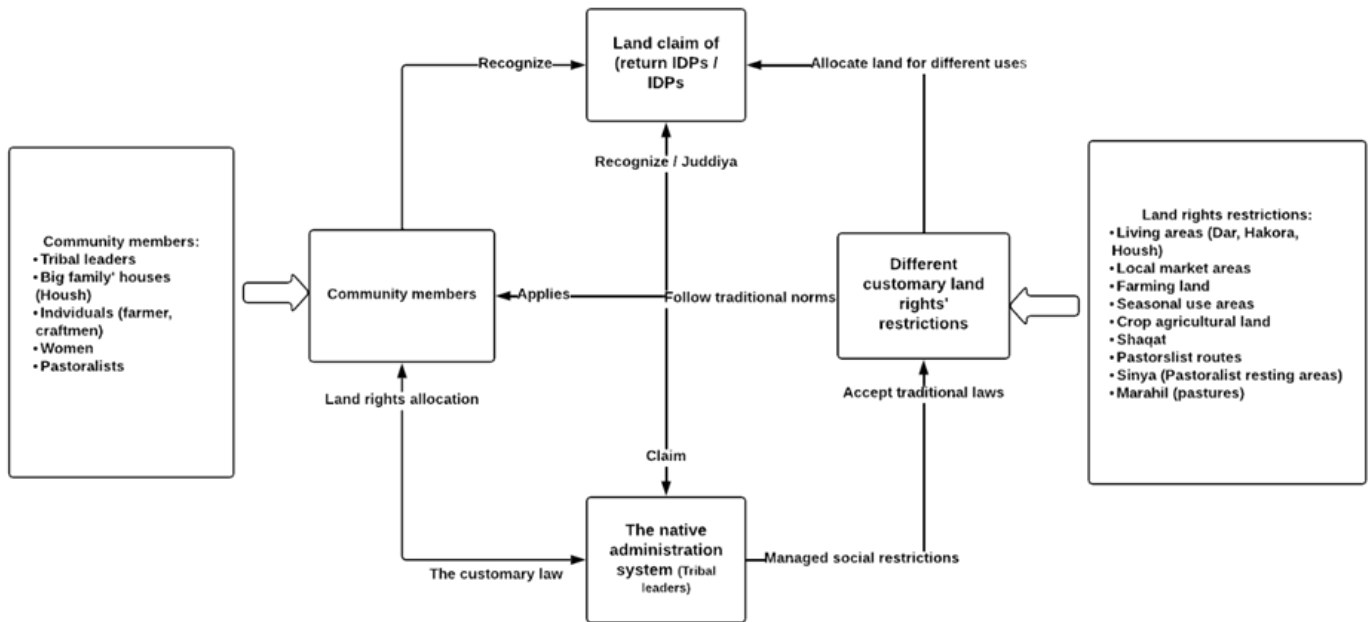


Figure 13: The conceptual framework that illustrates different entities of the customary tenure system, South Darfur (author's construct based on the model of Simbizi, 2014)

### Land use rights in the customary land, South Darfur

As obtained from the semi-structured interview with the Omda, every community member has a specific area within his tribal land allocated by his Omda through his Shiekh. This land is used for different purposes, such as agriculture and grazing. Additionally, the community land is distributed into Sawani and Marahil (pastures) to avoid conflicts between a farmer and a shepherd. Masarat (pastoralist's routes) is also allocated with specific sizes from Om Ginaah to Central Africa and Bahr El Arab River in Sudan. Sinya is also a land for cattle to rest during their journey, located five kilometres from their village.

Moreover, if a community member is looking for land, for example, for agricultural purposes, Omda will write a letter to Shiekh to start the process. The Omda will write his decision, including his stamp, and then the Shiekh will allocate appropriate land for a community member within Shagat's area. The Shiekh will be directly responsible for protecting the holder and his land rights from threats regarding land conflict. Therefore, the Shiekh should directly inform Omda about the issue, as stated during the interview with the tribal leader- The Sheikh.

This process also applies to IDPs, who will be treated the same as other community members within the tribe. Figure 14 below shows the activity diagram for allocating land for grazing purposes for an IDP. There is higher resolution figure in Annex 4.

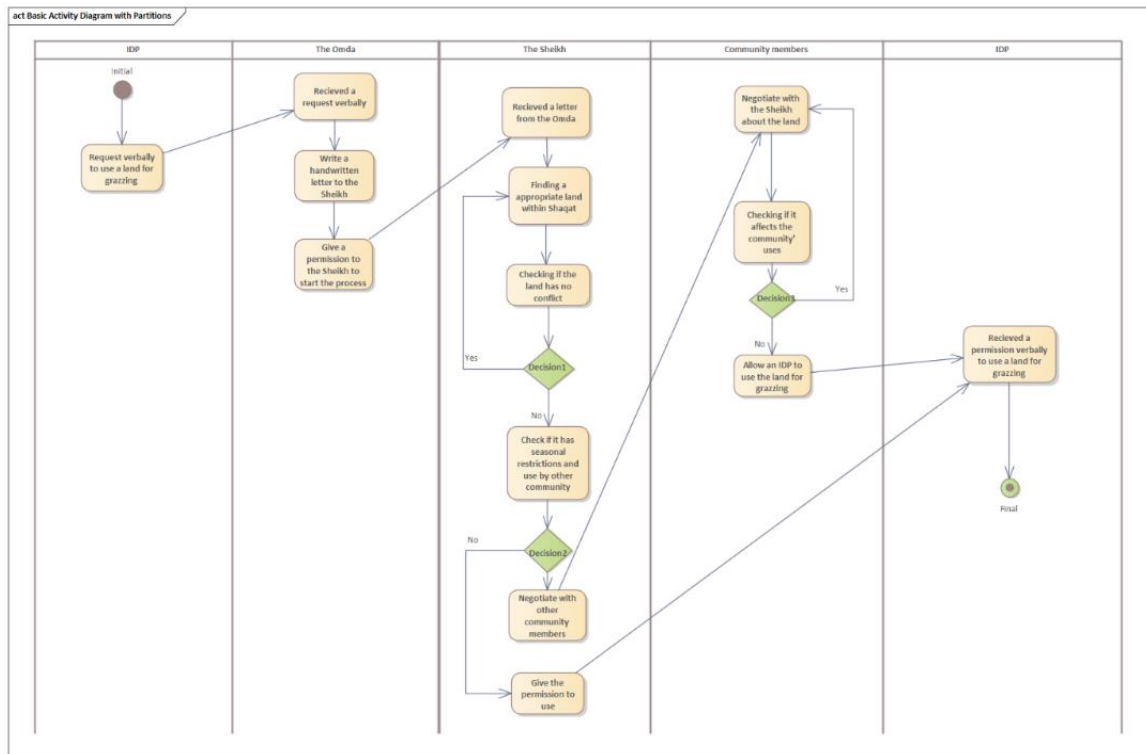


Figure 14: Activity diagram for allocating a grazing land for IDPs (author’s construct)

## Vulnerable groups and land rights

### IDPs and the host community

In continuation, to date, around 2.5 million citizens have been recently internally displaced since the fight started between SAF and RSF. Also, it is observed from the recent literature that around 7 % of the total number of IDPs have been internally displaced from South Darfur (OCHA, 2023b).

Based on the findings from the interviews with tribal leaders, it is evident that IDPs do prefer to either return back or move to Eid El Firsan’s locality and Om Ginaah. In recent years, especially since the conflict started in Darfur generally, many IDPs have returned and moved to this locality. Host communities, such as the study area of Eid El Firsan, received thousands of IDPs and have lived in this locality for more than ten years. They were welcomed by host communities and the Native Administration System, although they were initially from different regions of Darfur, such as the western part of Darfur.

The Native Administration System allocated lands for IDPs either for housing or other land uses. In Om Ginaah, IDPs were given part of the host community's land for agricultural use, dwelling, crop production, agropastoral, and grazing. In addition, it is found that IDPs have entirely integrated with the host community's livelihood by adapting to their different way of life. Also, IDPs managed to learn from the host community how to grow crops in the autumn season. On the other hand, the host community claimed that they didn’t have the knowledge and skills to grow vegetables until IDPs arrived to their areas. Based on an in-depth interview with a representative of IDPs, Eid El Firsan’s locality is currently hosting different tribes that are living together in the same land. Many intermarriage cases between IDPs and the host community led to more integration. Another significant measure discovered is that the livelihood of the host community has been changed gradually. Consequently, there are some lands currently used by IDPs for different land purposes which were not used before. Figure 15 below shows an in-depth interview with a representative of IDPs.

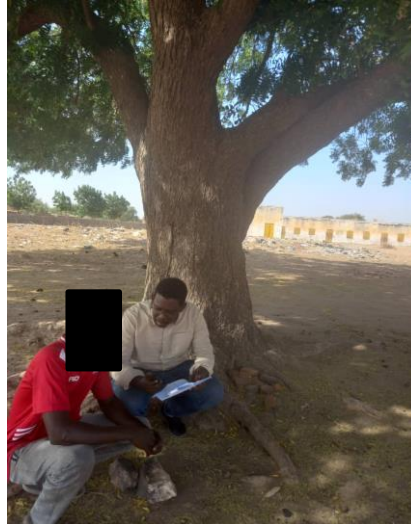


Figure 15: In-depth interview with a representative of IDPs (photo credit: A.Hemoudi)

### Women and land rights

As obtained from the focus discussion with women in Nyala, South Darfur, they claim that they have weak contributions to their societies and this is due to customs and tradition. It was found from interviewing some women that they only have access to a small part of their community land so as to feed themselves and their children. This is due to the lack of knowledge about their rights, the lack of the community's knowledge about their importance to their societies, and the lack of their investment.

Moreover, as from an interview with women, women are not able to grow and cultivate the whole year because they are denied by the tribe from accessing significant lands. However, they are only permitted to produce their crops at specific times of the year and in small areas surrounding their houses (kitchen's garden). Women can only grow short times crops such as beans, and they can't grow, for example, vegetables, such as okra, because they need a lot of investment and water. Also, women do not have the physical ability and financial capacity to cultivate tremendous lands by themselves.

Furthermore, while interviewing other groups of women in Nyala, South Darfur, it was clear that there are inequalities and injustices regarding their access to land. The interview also found that they do not have the right to have significant lands compared to men, who are prioritized to be allocated lands for agriculture and grazing. In addition, the majority of lands in the customary land tenure in Nyala are held and used by men. Nevertheless, it is traditionally believed that men can have better investments and management over land. Subsequently, women only have a seasonal right for agricultural use. Also, in case of inheritance, lands will be transferred due to customs and norms to men rather than women, to their husbands' families or their brothers. Thus, they don't make use of their inherited land by themselves.

#### 4.1.2. The main actors of the Native Administration System are involved in the processing of ensuring land rights for returned IDPs.

As derived from the in-depth interview with the Omda, the Native Administration System allocates land for IDPs, either families or individuals. The Omda assigns a task to a specific Sheikh to collect information about IDPs and their origins. This information is used for further communication later if they want to connect with their tribe. Following that, the Omda guides the Sheikh and orders him to communicate with landholders to take part of their land and give it to IDPs. Figure 16 shows the main actors involved in allocating land to IDPs.

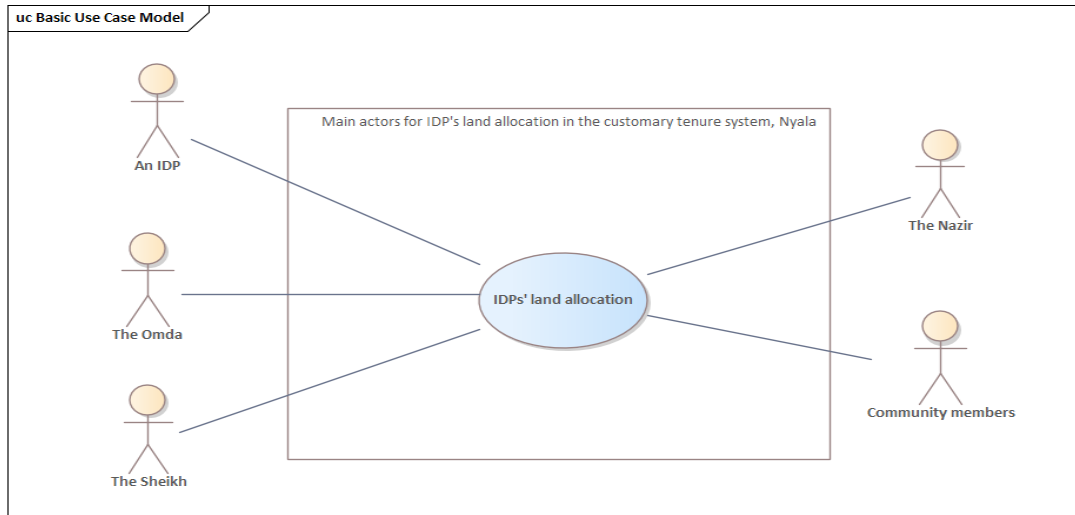


Figure 16: Main actors involved in allocating land for IDPs (author construct)

In addition, IDPs are only allowed to use the land temporarily until the situation on their lands is stable. This temporary permission is called (kol, and goom), which means eat and go, i.e. plant, cultivate, then leave. So, the IDP is not allowed to own the land under the customary tenure system within the land of their hosting tribe. The IDP can bring his family whenever he feels that he is secured and protected by the hosting tribe. Figure 17 shows the activity diagram for allocating land for an IDP. There is higher resolution figure in Annex 5.

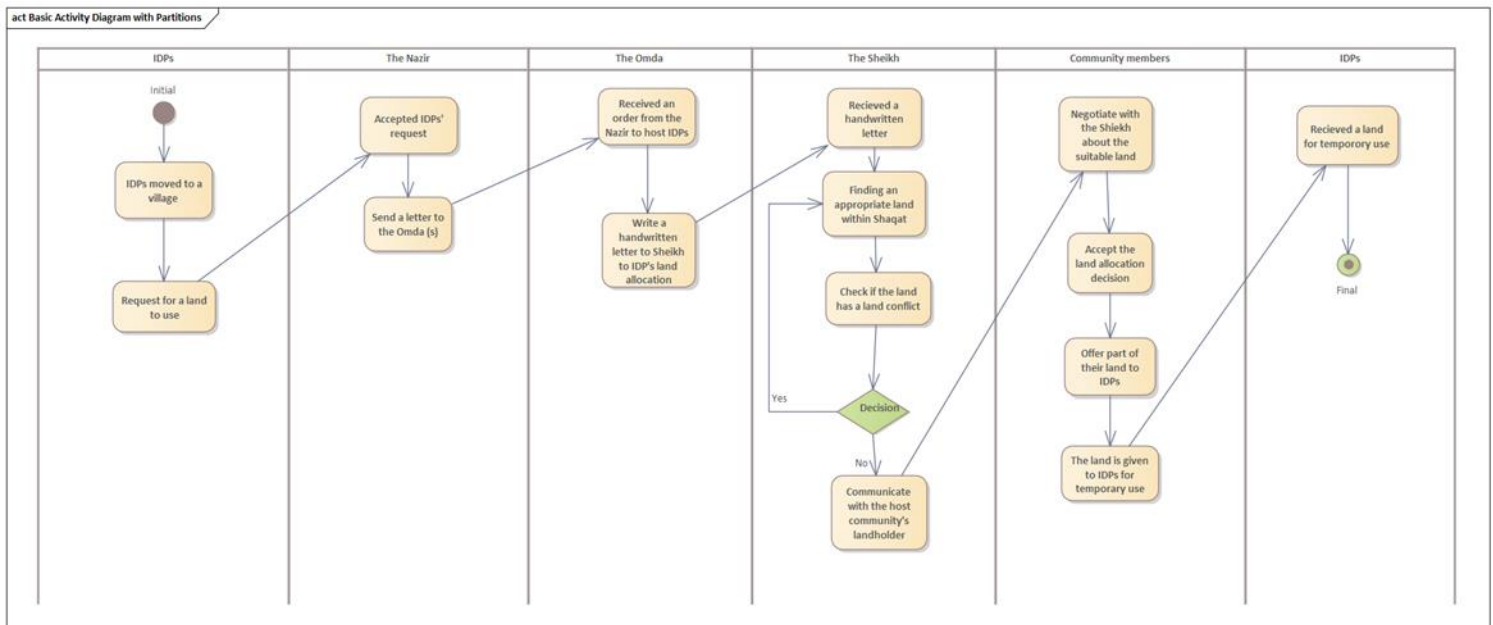


Figure 17: The activity diagram for allocating land for IDPs (author's construct)

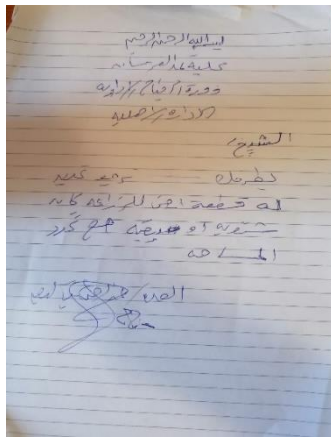
#### 4.1.3. Capacities of the Native Administration tribal leaders and other community members involved in addressing the IDPs' land tenure security

##### Land recordation within the Native Administration System

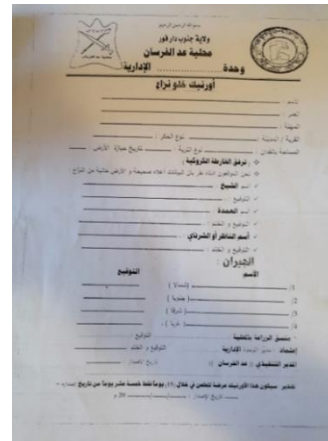
As derived from the in-depth interview with the Omda, tribal leaders within the Native Administration System in Om Ginaah, Nyala, use verbal agreements and traditional paper-based systems for their land

records. They use a cover letter from Eid El Firsan’s locality, where the Nazir leads the Native Administration System for communication and administrative work. This cover letter is a kind of traditional official communication between Nazir and his fellow Omda (s).

Communication between the Omda and Sheikh (s) is done through internal handwriting letters to allocate lands for community members or IDPs. The Omda usually writes a letter asking one of his Sheikhs to start the land allocation processes. Figure 18 (a) shows an example of a handwritten letter from Omda to one of his Sheikhs. The Sheikh then will receive the letter signed and stamped by the Omda to allocate an individual or a family with the land through different Shaqat. After that, the Sheikh will start the process and check which land is suitable to be allocated for a community member or IDP. In addition, Sheikh, under the Omda’s supervision, will ensure that the land is free of conflicts. Figure 18 (b) shows an example of a “Free of Conflict Certificate” cover letter.



(a)



(b)

Figure 19: Examples of the handwritten and cover letters used by the Native Administration System

Furthermore, important information is collected by tribal leaders in Om Ginaah, Nyala, to keep their traditional land records about their Dar. Personal information, such as the landlord's name and his family members, will be collected. Additional information, such as his neighbours' names and a description of his land located within the tribal Dar, are also important. The names of the landlord’s neighbours are important for verifications within the tribe. However, further detailed information will be gathered for extended families about his children’s small families with their names. Extended families live together in the Housh, as shown in Chapter 1, figure 1. Thus, all this information is kept with the Sheikh and The Omda. Land could be allocated for different land use purposes. The Sheikh is the one within the Native Administration System responsible for managing people's social interactions and their land issues. All community members appreciate and preserve all these arrangements for land allocation. In addition, tribal leaders govern the use of lands for different land rights with their community members. This is through agreements based on their traditional laws, whether verbally or written by hand. The Native Administration System uses verbal agreement as records for seasonal land use, grazing, and agriculture.

**The Native Administration System’s user requirements, Nyala, South Darfur**

As obtained from group discussions with tribal leaders, it is claimed that tribal leaders within the Native Administration System in Om Ginaah, Nyala, claim that there is a need for having different ways for land records. They also believe that the current paper-based system used is not secured due to conflicts and the lack of suitable storage. Another significant factor in looking for a different solution to improve their land records is the unexpected death of their tribal leaders and older adults who memories the historical

rights. This is because tribal leaders and elders are responsible for managing their historical agreements, conflict resolution decisions, and verbal agreements.

It is derived from group discussions with the Omda and Sheikh, that also believe there is a lack of maps representing their community boundaries. In addition, there is a lack of historical maps that shows the border with other tribes' land to avoid any future land conflicts. It was discovered that the Native Administration System in Nyala lacks maps for newly allocated lands for IDPs and their different locations. Tribal leaders only rely on their traditional ways to describe their current location due to the enormous land that the community have. Another factor that was found is that tribal leaders still rely on handwritten letters and verbal arrangements and agreements for land management. It was found that tribal leaders have various issues as a result of lacking advanced documentation methods, and some of these agreements were lost during conflicts. It is also claimed that tribal leaders lost some historical written agreements due to this poor and traditional land record system.

Moreover, it was discovered that collecting personal information about community members as well as IDPs in the customary tenure system in Nyala is tremendously challenging. Updated information about community members' location and the current location of IDPs within the community land is highly needed by tribal leaders. Personal data, especially for IDPs, such as names, number of family members, tribe's name, where exactly they came from, and previous location before returning to the village and surrounding neighbours. Additionally, it was recognised that there is a need for a better system for the Native Administration to manage the different land use rights. Tribal leaders usually allocate land for seasonal crops and for a certain period of time. They also assigned areas for small grazing to their community members for their cattle; this allocation needs a better tracking system for who uses the site and for how long.

In the case of IDPs, they were given land only for temporary use (kol, and goom), as it is mentioned before. Consequently, tribal leaders requested to have a way to provide them with traditional land security proof to avoid any kind of land disputes in the future. On the contrary, these allocated lands are part of the host community's land, which also needs a guarantee that their lands will be returned back to them.

In continuation, from a semi-structured interview with land professionals in Nyala, they claimed that the community did experience drawing sketches by hand on the top of a satellite image in some parts of Nyala, including Om Ginaah's administrative unit. It was presented to the researcher some examples of mapping activities for a few villages during our discussions. Nevertheless, land professionals argued that those hand-drawn maps were not used again since the pilot project ended by GLTN. This pilot project was not documented, but the researcher was told that the GLTN had an attempt to document vulnerable group land tenure rights by using the STDM in South Darfur. Figure 20 shows an example of a hand sketch map drawn by the community in South Darfur.

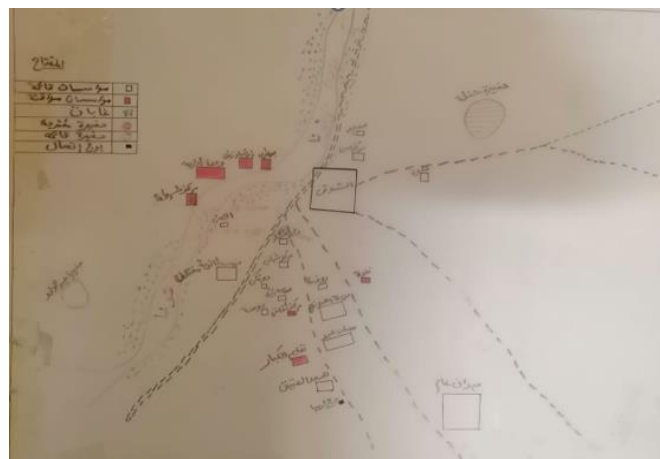


Figure 20: An example of a hand sketch map drawn by the community in South Darfur

### **Darfur Land Commission's initiatives**

As derived from a semi-structured interview with a land professional in Nyala, the Darfur Land Commission did many initiatives and projects to acknowledge all historical and traditional rights, customs, norms, and Aaraf. The purpose is to include all these rights within previous land laws. Another thing to be considered is to deal with lands in Darfur in a different way, where customary law is powerful. This is because many citizens of Darfur still hold customary historical proof since the British colony. In addition, they believe that Hakora still belong to them and the land they occupy belongs to them traditionally due to the recognition of their tribe. Therefore, no force can take their lands from them unless their tribal leaders convince them to use the land for different purposes within the community and, of course, against compensation. Another issue is the lack of education and knowledge within the Native Administration and the community in general. Because they still believe that the traditional proof that they were given by the Native Administration System many years ago is still valid.

### **Community land registration in Nyala, South Darfur**

As obtained from the in-depth interviews with tribal leaders and land professionals in Nyala, a community member can register his land in the governmental land registration system. This official request is called free of conflict request. The process should go through different steps and agreements from many stakeholders, including the Native Administration System. It also includes representatives from the Ministry of Agriculture, the Ministry of the Forest, the ministry of physical planning, and the radio station in Nyala. A community member will request to register his land. Then, the Sheikh will receive this request and check if the land is free of any land disputes and historical conflicts. After that, the sheikh will communicate with his Omda about this request, and they will do another check on Omda's land records. Subsequently, if all information is confirmed, the Omda and the Sheikh will sign in front of their names and send it to the Nazir for his signature.

In continuation, tribal leaders will sign in front of their names, and then the request will be sent to the Ministry of Agriculture to ensure this land is not within the conservative grazing areas or seasonal pastoralist routes. After this check is done, the request will also be sent to the Ministry of Forest to ensure that this land is not within conservative forest areas and is free of conflicts. Then, the request will again be sent to the radio station, and this process is essential to send a message to all community members about this registration request via the radio. This will take around two weeks to wait if one of the community members claims the same land or has a previous land conflict with the landholder. So, in case no person appears within this period, the request will be sent to the land registration office in the Ministry of physical planning to complete the registration. Important information is needed for this request. Information such as the landholder's name, age, job, name of the village, area in hector, and type of tenure are required for this request. Also, it includes information about the name of the Native Administration System's tribal leaders and their signatures. Names of his/her neighbours in the fourth direction, the north, the south, the east, and the west, as well as their signatures.

The customary land in Nyala is described by the four directions: North, South, East, and West as well as the names of its neighbours. The Native Administration System provides specific certificates called Free Conflict Certificates. The purpose of it is to provide complete information on the land by the Omda and Shiekh. It contains information about its location within the community land, any conflicts, free of disputes, and if its within preservative forest areas. Once the Shiekh confirms all mentioned information, he will sign this certificate and then send it to Omda for his signature and stamp. Figure 21 shows the activity diagram for registering land through the Native Administration System. There is a higher resolution figure in Annex 6.

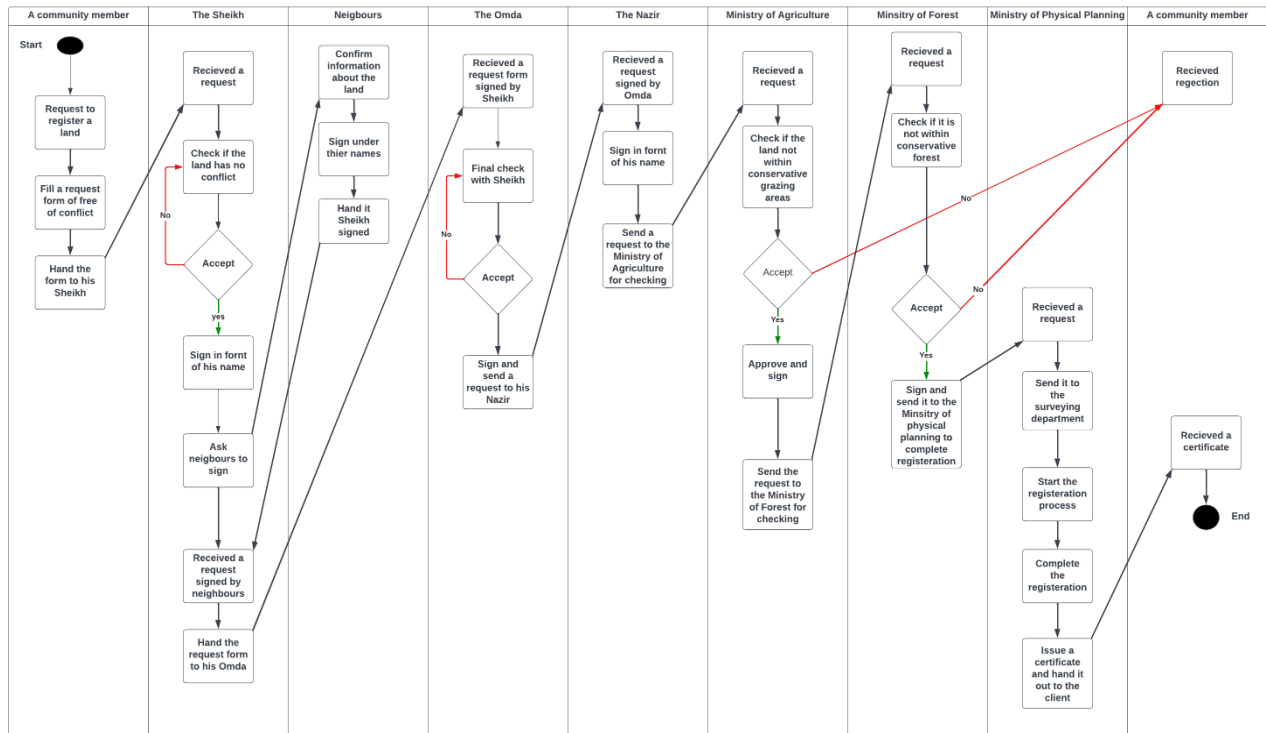


Figure 21: The activity diagram for registering land through the Native Administration System (author construct)

**4.1.4. The Native Administration System’s land conflict resolution between the host community and internally displaced person's land tenure security**

**Post-conflict in land administration, South Darfur**

The leading cause of conflict in Darfur is Land. This conflict is due to many reasons, such as conflict over natural resources like grazing areas and land. Subsequently, this conflict forced many people in Darfur to move from their lands to other areas. Most people live now in camps because of these land conflicts.

**The Native Administration System’s conflict resolution mechanism (Juddiya), South Darfur**

As derived from the group discussions with tribal leaders, land disputes and conflicts are only solved through the Native Administration System. The solution is via a local land conflict resolution mechanism called Juddiya. This Juddiya is not only for land-related issues but also it is for solving other issues related to people's social interactions. Rather than getting into solving traditional community conflicts, the government's conflict resolution tends to accept and verify the decision made by Juddiya. Because all these traditional issues, for example, land disputes, are only managed by customs, local laws, and norms. Even though the government claims all land according to its laws, in reality, those laws are not acceptable and acknowledged by people in the customary areas in Darfur. That means the Native Administration System's work is recognised and accepted by people in South Darfur. Figure 22 shows the main actors of the conflict resolution mechanism, Juddiya, as shown below.



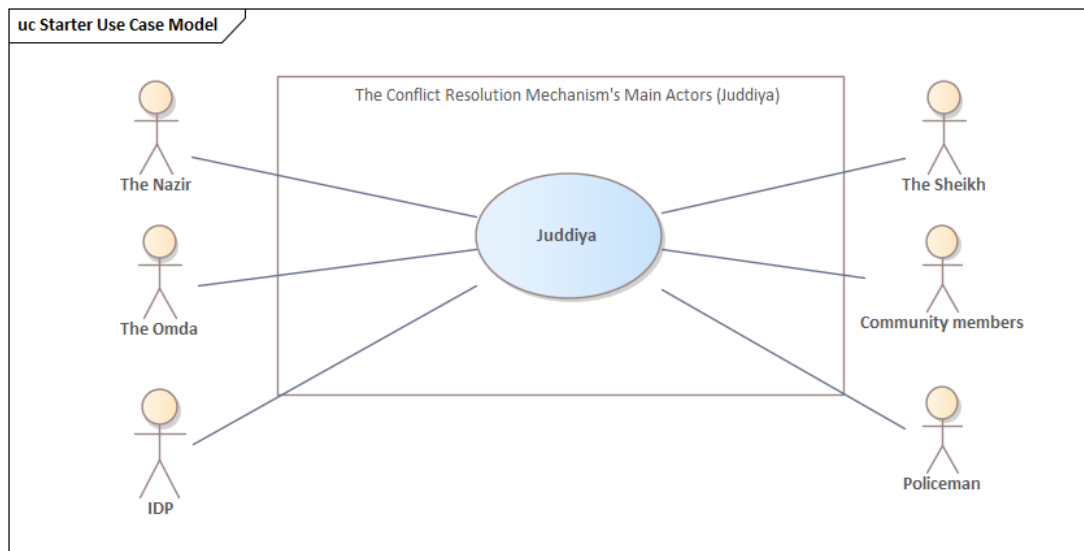


Figure 22: The main actors for the conflict resolution mechanism, Juddiya (author construct)

Most land dispute issues are caused by neighbours, where one of the neighbours enters and uses part of his neighbour's land without permission. Another cause of land conflict in Darfur is that an individual or family have occupied land for many years because the actual holder was displaced due to conflicts. This cause has two scenarios; firstly, the current user occupied a considerable part of his neighbour's land because he was not around. Secondly, he occupied land because he didn't have land to hold before. Another significant cause of land conflict is cattle entering someone or a family's land for grazing without permission.

A local committee for solving issues between a farmer, a shepherd, or a pastoral exists. The primary purpose of this committee is to evaluate the damage that cattle caused due to their access to a farmer's land without permission and eating from it. After the evaluation is completed, Omda will call for a gathering meeting in Rakoba. Rakoba is a place where the community meets to eradicate and solve their issues under a specific big tree. The Omda will make sure that there is no biasing towards one of them. During this gathering, the committee will decide the amount of compensation. This compensation is not entirely given to the farmer, but part of it will be put in the Rakoba as customs (Aaraf).

Consequently, all the issues mentioned above are solved through Juddiya by the Native Administration System through Juddiya. One of Juddiya's solutions is to give an occupier a notice to leave the land. The Native Administration System will assign another land for an IDP to avoid potential conflict. Another way of solving such issues is that the Sheikh might ask the occupier to compensate the actual landholder. Figure 23 shows a use case diagram that illustrates a land claim initiated by an IDP.

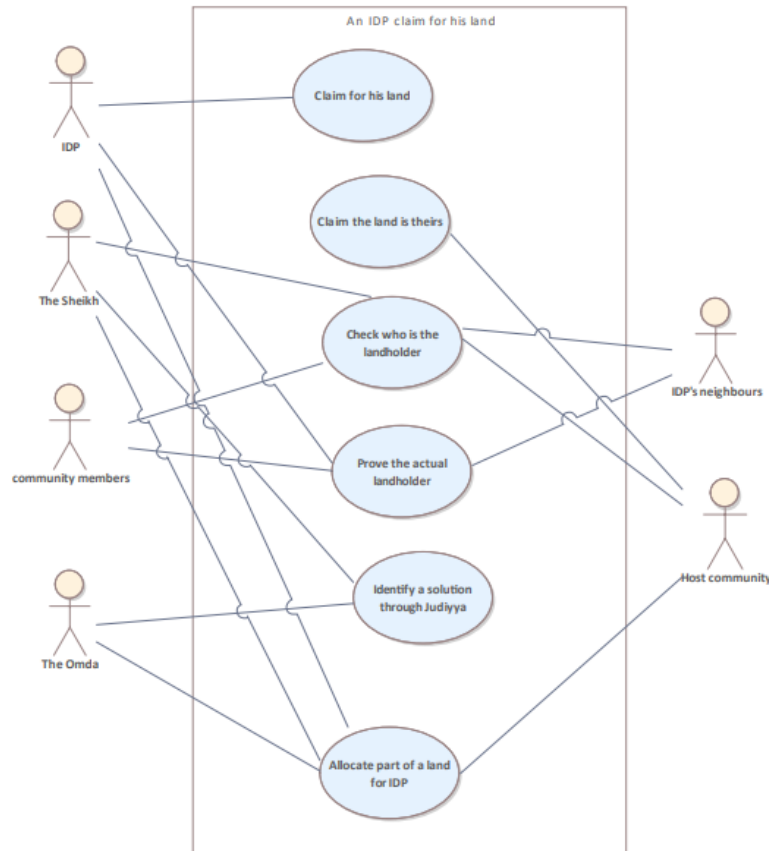


Figure 23: Initiate a land claim by IDPs

#### 4.2. The information system requirements for the Native Administration System

This section presents the results synthesising the information system requirements derived from focus group discussions and in-depth and semi-structured interviews with tribal leaders and community members in Nyala, South Darfur. The outcomes identified the functional requirements, non-functional requirements, collected information requirements, and stakeholders' collected information agreement. These requirements were obtained from the findings about the Native Administration System's analysis in sub-section 4.1.

##### 4.2.1. Functional Requirements

The sub-section synthesises the results of the functional requirements obtained from assessing the Native Administration System's main functions, practices and process regarding addressing the land relation of return IDPs, as explained in section 4.1. These functional requirements will determine the capabilities of the suggested ICT solution and how the system should work. Table (2) below shows the functional requirements of the Native Administration System.

## Functional requirements

### 1. Land recordation

- 1.1 The system will allow the Native Administration System to capture different customary land tenure rights.
- 1.2 The system will allow the Native Administration System to capture different land uses.
- 1.3 The system will be able to map different customary land rights.
- 1.4 The system will record the approximate location of land disputes between community members.
- 1.5 The system will record the new land allocation for IDPs and returning IDPs.
- 1.6 The system will record different community land use restrictions.
- 1.7 The system will allow the mapping of the tribal land boundary.
- 1.8 The system will capture verbal stories and descriptions about land.
- 1.9 The system will allow capturing other social information about the land (tribal relations).
- 1.10 The system will allow the recording of individual and communal rights.
- 1.11 The system will allow capturing social obligations towards using the land

### 2. Land management

- 2.1 The system will allow managing the information about different customary land rights records.
- 2.2 The system will allow the Native Administration System to maintain land requests between tribal leaders and community members.
- 2.3 The system will keep records of historical land agreements.
- 2.4 The system will allow for maintaining records about conflict resolution decisions (Juddiya).
- 2.5 The system will allow to keep mapping records.
- 2.6 The system will record a community member request.
- 2.7 The system will record the community's land claims.
- 2.8 The system will allow the Native System to keep information about conservative lands
- 2.9 The system will support the Native Administration System to have their own community maps.

### 3. Solutions for conflict resolution (Juddiya)

- 3.1 The system will allow the retrieval of the approximate location of land disputes between community members.
- 3.2 The system will allow the Native Administration System to minimize conflict between the host community and IDPs.
- 3.3 The system will allow Omda and Shiekh to implement customary law in their decisions.
- 3.4 The system will allow tribal leaders to codify the araf, norms, and customs in their decisions.
- 3.5 The system will allow visualising of land disputes.
- 3.6 The system will allow visualising of the resolved land disputes.
- 3.7 The system will enable the creation of a report of historical land records.
- 3.8 The system will support Dar's conflict with other tribal boundaries.
- 3.9 The system will allow visualizing land disputes regarding pastoralists' routes with other tribes.

### 4. Technical and Operational

- 4.1 The system should have a list of options that differentiate customary land tenure rights to select, such as:
  - The Dar- tribal land.
  - The Hakora- a small group of people's land.
  - The Housh- extended family house.
- 4.2 The system should have a list of options to select different land uses, such as:

- Living/ dwelling.
  - Farming/ crop production.
  - Framing/ vegetable production.
  - Temporary living for IDPs
  - Grazing
  - Pastoralist routes (Sineeh)
  - Agropastoral.
  - Women-kitchen garden
  - Temporary farming land for IDPs (kol, goom)
- 4.3 The system should support capturing information about landholders, such as
- Name of the landholder.
  - Age of the landholder.
  - Marital status of the landholder.
  - Names of other family members.
  - Names of neighbours.
  - Description of land's location.
- 4.4 The system should support the Native Administration System and the community to draw sketches to identify their customary tenure rights by themselves, such as:
- The Dar
  - The Hakora.
  - The Housh.
- 4.5 The system should offer the Native Administrative System the ability to map fuzzy boundaries for:
- Tribal land's boundary
  - Pastoralist routes
  - Grazing areas.
  - Small farms.
  - Seasonal water streams.
  - Reserved forest.
- 4.6 The system should support the connection with internet data.
- 4.7 The system should support the ability to distinguish who is using the land, such as
- An individual
  - A group
- 4.8 The system should have a list options of social restrictions regarding using a land.
- 4.9 The system should capture historical verbal stories about people to their land relations.
- 4.10 The system will allow the Native Administration System to view the status of their tribal land uses.
- 4.11 The system will allow the community to capture their maps by themselves.

Table 2: The functional requirements for the Native Administration System

#### 4.2.2. Non-functional requirements

The sub-section presents the analysis results of the non-functional requirements obtained from assessing the Native Administration System's main functions, practices and process regarding addressing the land relation of return IDPs, as explained in subsection 4.1. These non-functional requirements will determine the quality of the suggested ICT solution of the Native Administration System in Nyala, South Darfur. Table (3) below shows the non-functional requirements of the Native Administration System.

Non-functional requirements
<p><b>1. Security</b></p> <p>1.1 The system should be accessible by tribal leaders and their assistants from the community.</p> <p>1.2 The system should protect personal information about IDPs.</p> <p>1.3 The system should specify who grants the rights to use lands for IDPs</p> <ul style="list-style-type: none"> <li>-The Nazir.</li> <li>-The Omda.</li> <li>-The Sheikh.</li> </ul> <p>1.4 The system should have restrictions regarding accessing the data agreed by the community members.</p> <p><b>2. Performance</b></p> <p>2.1 The system should support the mapping of parcels at different levels of accuracy.</p> <p>2.2 The system should support capturing different land use rights fast.</p> <p>2.3 The system should provide different precision regarding different customary land uses.</p> <p>2.4 The system should allow displaying a map on mobile screens or tablets.</p> <p>2.5 The system should allow different sizes of data.</p> <p>2.6 The system should be able to run on computers and mobile phones (Android).</p> <p>2.7 The system should support providing updated maps for newly allocated land for returning IDPs.</p>

Table 3: The non-functional requirements for the Native Administration System

In summary, the synthesised findings of these functional and non-functional requirements presented in Tables 2 and 3 will be analysed to establish which land administration tool or suite of tools can align with these requirements in Chapter 5. Consequently, the analysis will help to figure out which land administration tool (s) can meet the community's capacity and minimize

#### **4.2.3. What kind of information needs to be collected to address the claim of IDPs for their lands to the Native Administration System leaders**

As from the interviews with tribal leaders and understanding of the customary tenure system in South Darfur, it is apparent that there is essential non-spatial information needs to be gathered. This collected information would help tribal leaders and communities to address the IDPs' land claim better. The Native Administration System as a social institution in South Darfur plays a crucial role in recognizing the relationship between returned IDPs and the host community (tribe). The recognition is through community members and neighbours of the IDP as well.

The community relation is one of the information that needs to be collected, which checks from which Housh (extended family's house) the returned IDP belongs. Personal information and family relation are important to prove this community relationship. The Native Administration System will collect information from neighbours to verify and confirm the IDP's land relation. In addition, the Sheikh and Omda will investigate where the second occupier used to live before the conflict. The tribal leaders, especially the Sheikh, will check if the claimed land has any social use restrictions, for example, grazing, seasonal crop production, and farming. Subsequently, Juddiya will play a role in solving land disputes between an IDP and the second occupier. Furthermore, the approximate location of the claimed land is also required to address the land claim. The claim land's place is basically through verbal descriptions of how far from one of the natural resources within the community land, such as mountains, water streams, pastoralist routes, grazing areas, Sinya, and Shaqat. Information about neighbours is also required to address the land claim.

**4.2.4. How well does the information collected from different community stakeholders in the South Darfur community agree**

The collected information is checked and agreed upon by different stakeholders within the community in Nyala to address IDPs’ claimed land. It was found that representatives from the community, neighbours of an IDP, vulnerable groups, and tribal leaders, especially the Omda and the Sheikh, always set community meetings to investigate and discuss the land claim issue. After that, they will check all information gathered through discussion and consultation. Consequently, information will be agreed upon based on the decision made by all stakeholders. However, in case of disagreement, tribal leaders will find another land to allocate those vulnerable groups. Also, land dispute issues are managed and solved by Juddiya.

**4.3. To establish which land administration tool (s) have functionalities that meet the information system requirements for implementing an ICT solution for the Native Administration System.**

**4.3.1. Root Cause Analysis**

The root cause analysis was used to better understand and analyse the actual problem of the Native Administration System as a social institution in addressing the land tenure relation of return IDPs. The findings from section 4.1 show that the Native Administration System lacks innovative solutions for land recordation. One of the main causes of this community land recordation failure found in subsections 4.1.1, 4.1.2, and 4.1.3 is that it uses verbal agreement and a paper-based system for managing its land records. Additionally, it also lacks the following; a solution to maintain historical maps, capturing different customary land use rights, and documentation of local land restrictions. In addition, it is also apparent that the community lacks an ICT solution to minimize land disputes, as explained above. In addition, it is also apparent from the results that undocumented tribal social relations, lack of neighbours' recognition, and lack of community recognition are considered a failure for this system in South Darfur to ensure the security of tenure for IDPs. Subsequently, it is evident from the literature found in subsection 2.5.1 and results in subsection 4.1.1 that armed conflict has also played a role in internal displacement since 2003, which has created land claim issues of return IDPs. Figure 24 presents the Root Cause Analysis for the community land recordation for vulnerable groups who have been just internally displaced.

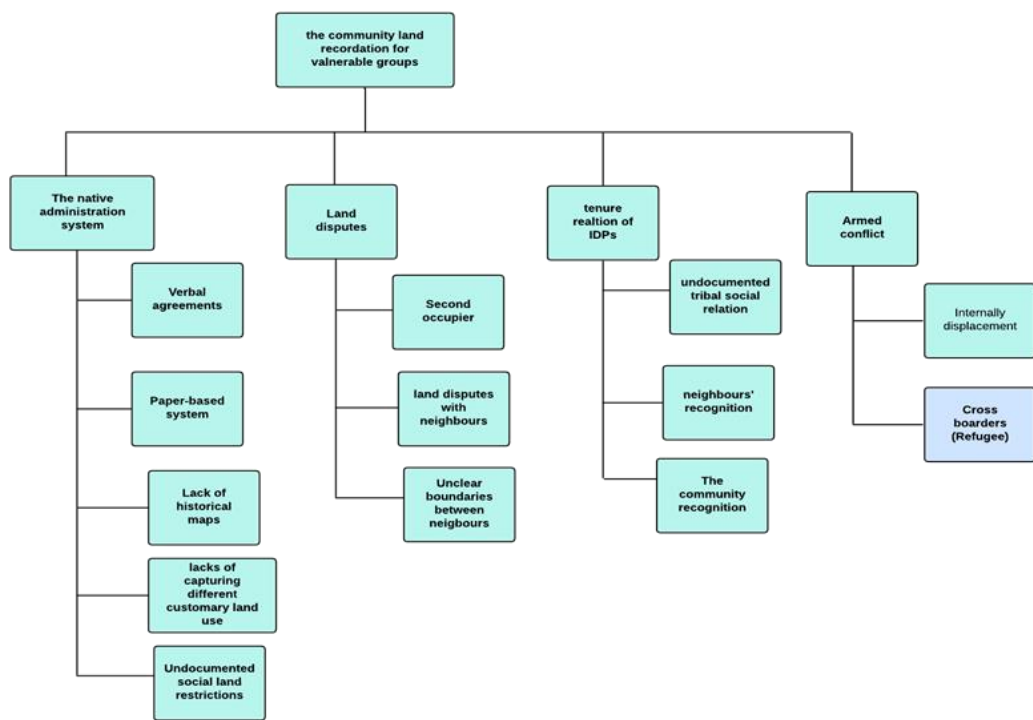


Figure 24: The root cause analysis of the community land recordation for returning IDPs (author's construct)

Further analysis and discussion about this root cause analysis of the community land recordation system for returning IDPs is explained in detail in sections 5.1, 5.2 and 5.3 in Chapter 5 below.

#### **4.4. Summary of Chapter 4**

This chapter showed the results from the fieldwork findings regard sub-objectives (1) and (2) and their questions. The following chapter will analyse and discuss the presented results of the first two sub-objectives and how this analysis will help answer the question of sub-objective(3). Consequently, the detailed analysis will show how the results answer the research question.

## 5. ANALYSIS AND DISCUSSION

The structure of this chapter analyses and discusses the result shown in Chapter 4. The results are concentrated on the first two sub-objectives of this research. The synthesis of the fieldwork findings for these sub-objectives resulted in identifying the functional and non-functional requirements of the Native Administration System in section 4.2. Subsequently, those findings will be discussed and analysed to investigate which land administration tool (s) can meet the information system requirements of the Native Administration System and answer sub-objective 3 at the end of this chapter.

### 5.1. Assessment of the Native Administration System's primary functions for providing returned IDPs access to land in South Darfur

This section intends to analyse and discuss the assessment of the Native Administration System, the customary tenure system in South Darfur, the land recordation in the customary system, and the tenure relation of returned IDPs.

#### 5.1.1. The Native Administration System's main functions, practices and processes

In South Darfur, Sudan, the result from subsection 4.1.1 found that the customary land tenure rights are only managed by tribal leaders through the Native Administration System. The Native Administration System is a community and social council with three administrative levels of management within a tribe. The Nazir administrates any Nazara as the highest head of the tribe, followed by Omda (s) and Shiekh (s) – also shown in figure 10. In addition, it is derived from the result that the primary function of this community system is to organize land, make justice, and represent the community where needed. However, the Native administrator manages only the land use planning within his tribal land. It is also believed that all community members accept this social paper-based system rather than the national land system because it is accessible to them. Hence, it is found from the literature in subsection 2.4 that the community, through their customary tenure system, recognizes people to their land relation, as shown in Simbizi's framework in Figure 2. In Nyala, South Darfur, it is also evident from the illustration of the customary tenure system's framework shown in Figure 3 that the Native Administration System is responsible for acknowledging customary land rights relations, administrating land allocation and different land rights restrictions. Therefore, It manages its tribal lands through Aaraf and custoamey land law.

#### Customary tenure system in South Darfur

Regarding the customary tenure system in South Darfur, one of its main characteristics is that the land is administrated by Araf (social norms). It is evident from subsection 4.1.1 that these norms manage lands and land disputes within a tribe. In addition, these customs are described in written documents, for example, the boundary of the community or individual community land. Subsequently, it is believed that these social norms are considered the main reason for the stability, respected by all community members, and as a traditional framework for local land conflict resolution. Respondents from the South Darfur community believe that the land belongs to them and respect the way that their tribal leaders manage the land.

On the contrary, from a Sudanese Land Acts perspective presented in subsection 4.1.1 that the government owns the land in Sudan according to the Unregistered Land Act 1970, as shown in 2.3.1. It also contradicts the findings from subsection 4.1.1 that 99 % of this customary land is unregistered but managed by the Native Administration System, and communities who live within this system are highly appreciative and accept this customary land system because it is accessible to them and protects their land rights.



Concerning land grants within the tribe in the customary tenure system in Nyala, South Darfur, the findings from subsection 4.1.1 found that the Nazir is believed to be responsible among all tribal leaders for granting lands. He can award lands (Hawaker) to clans, tribes, communities, and individuals. Therefore, all these Hakora (s) have been under his management since the British colonial times, when the Native Administration System was established as a social and community council. On contrast, land professionals believe that there are two land administration systems in Sudan, one is managed by tribal leaders in the customary land and another one is managed by the national land administration institutions. It is claimed that the Unregistered Land Act, 1970 considers granting the land through the government. However, based on the results from interviews with tribal leaders, community members, and land professionals in Nyala in subsection 4.1.1 this act can not acknowledge the customary land tenure rights and Aaraf (social norms) that manage them. Therefore, the community in the customary tenure system in South Darfur claim that there is a need for a land administration tool that recognizes different customary land tenure rights, such as Dar, Housh, and Hakora, and acknowledges its social land restrictions towards managing them.

On the other hand, it is believed that Sudan has two land administration systems. The first is the national land administration system, which is managed by the government but doesn't recognise all land tenure rights and considers all land belongs to it. While tribes, clans, and communities administrate the other system within the customary tenure system and through the management of the Native Administration system. Land professionals in the country believe there is an urgent need for the public institutions and the National Land Act to recognise the customary tenure system, considering its different land rights, land use rights, social restrictions, and the customary law or Aaraf that manages it.

### **Land use rights in the customary land, South Darfur**

Observing the management of land use rights in the customary land in Nyala, it is found many traditional practices are happening for different customary land use allocation, management of social land restrictions, and their community recognition, including vulnerable groups. Looking at the customary tenure system in South Darfur, it is obvious from a review of the literature in subsection 2.4 that the Native Administration System as a customary council plays a role in allocating land for different purposes. It is acknowledgeable that these customary land practices are administrated through social norms and traditional laws by tribal leaders, especially at the Shiekh's level, and respected by all community members. However, it is evident that the Native Administration's tribal leaders and community recognition is charge of allowing a community member to have the customary right to use a land through social restrictions, as shown in Figure 12. In addition, it is believed all these diversity of customary land use rights and their social restrictions presented in subsection 4.1.1 don't have any official recognition within the national land administration.

On contrary, land professionals in Nyala claim that there were some positive initiatives via the Darfur Land Commission to better capture, recognize, and manage the customary land laws and araf that administrate these land rights. On the other hand, the fit-for-purpose land administration approach is believed that can be able to better capture different land use relations of communities in customary land, considering all social norms that manage different land use allocations in South Darfur. Therefore, it is claimed that the Native Administration System requires more innovative land administration solutions for better customary land registration system.

### **Vulnerable groups and land rights**

Discussing the vulnerable groups' land relations against the customary tenure system in South Darfur, it is clear that many vulnerable groups, such as IDPs and returning IDPs, including women, have been facing issues regarding their customary tenure insecurity. Focusing on the main issue of IDP land relations in Nyala, it is evident that roughly around 2 million have been displaced due to armed conflict since 2003

and the current fight between SAF and RSF, as shown in subsection 2.5.1. Moreover, it is very optimistic that the Native Administration System and the community play a role in acknowledging their land tenure relations, as shown through their tribal and social relations in Figure 13. It is also positive that the Native Administration System through tribal leaders is responsible for allocating land for IDPs and solving land-related issues between IDPs and the host community, as presented in 4.1.1 by using a paper-based system and verbal agreement.

In contrast, it is apparent that the Native Administration System relies on community recognitions and social land use restrictions to assign those vulnerable groups to the land. Also, for those who moved to Eid El Firsan's locality, it is found that they can only use the land temporarily. However, it is also obvious that there is a desire from tribal leaders and the community to have a better customary land management system for land allocation. Therefore, it is believed that the fit-for-purpose land administration approach can empower the Native Administration System with an ICT solution for land use allocation that could improve their primary work in a post-conflict situation, primarily when a peace agreement occurs.

In summary, Figure 3, in Chapter 2, Simbizi (2014) explains that how both the social and public institutions can be able to acknowledge people relation to their land. However this research only considers the social institution's recognition. In addition, Figure 13, in Chapter 4, illustrates how the Native Administration System as a social institution and other different entities recognize returning IDPs with their land relations, which shows the adopted current study under investigation. Consequently, combing findings and analysis from Figures 3 and 13, the researcher concludes that the situation of the customary tenure system might be better if there is acknowledgement from both the public institutions and the National land acts regarding the customary tenure practices, and land rights of vulnerable groups in South Darfur through different interactions. The following Figure 25 below demonstrates public and customary institutions that acknowledge the customary tenure system and its community land relation in South Darfur. It describes how the situation could be better with these recognitions.

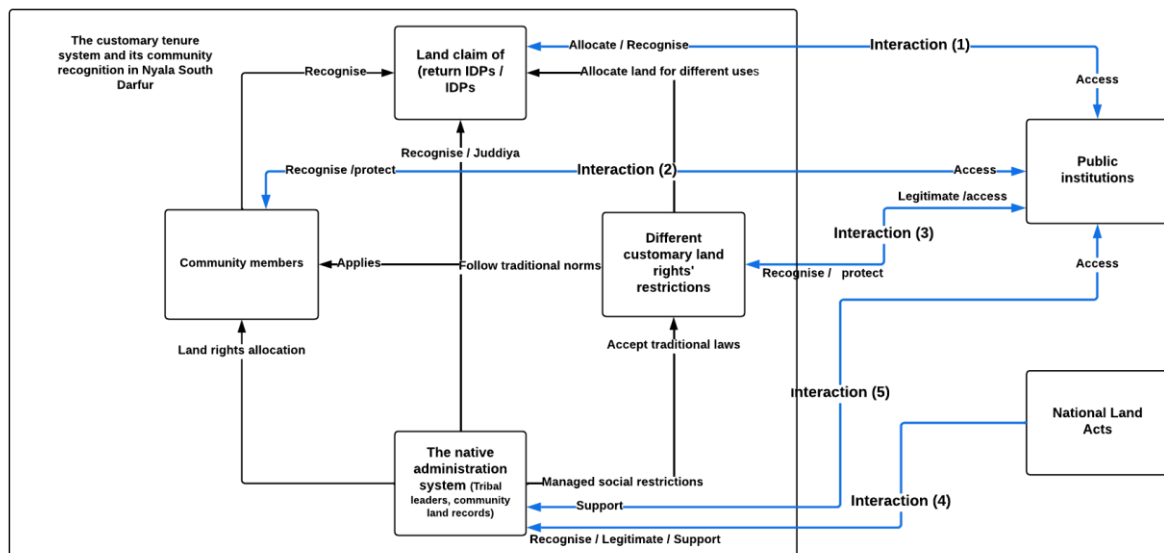


Figure 25: The public and customary institutions that acknowledge the customary tenure system and its community land relations (author's construct adaptation of Simbizi's (2014) model of tenure security).

Further explanation of Figure 25 above that public institutions is expected to be able to support the Native Administration System actual work in managing the allocation processes of returning IDPs, as explained via interaction (5). They are also estimated to have more responsibilities to recognise land claim of returning IDPs, community members land relation, and different customary land rights' restrictions as

presented through interactions (1), (2), and (3) respectively. In contrast, the National Land Acts should be able to recognise, legitimate, and support the Native Administration System as social institutions in assigning lands, making justice, managing social restrictions, as seen in interaction (4), as shown above in Figure 25.

### **5.1.2. The main actors of the Native Administration System for ensuring land rights for returned IDPs**

Identifying the main actors of the Native Administration System for returning IDPs land allocation and the good hierarchy of the tribal leaders with their specific responsibilities found that has a practical impact on ensuring this process (subsection 2.4). As in subsection 4.1.2, it is obvious that there is adequate participation among all tribal leaders, including the Nazir, Omda, and Sheikh, to assign land for IDPs. However, starting from accepting the movement of those vulnerable groups to Eid El Firsan's locality by the Nazir till completing the land allocation processes, an innovative ICT solution is highly required. For instance, the Omda starts allocating those vulnerable groups' land by ordering one of his Shiekh (s) to find suitable land within Shaqat when they return to their villages, as explained in subsection 4.1.2. Regarding those land allocation steps, tribal leaders' main roles might be improved if there is a tool that can keep their verbal agreements, decisions, land records, maps of land use, and non-spatial information about vulnerable groups and the host community. Subsequently, the researcher believes that any suggested solution should consider the personal capacity of the tribal leaders and their essential roles in ensuring the IDPs' customary tenure security in South Darfur.

### **5.1.3. Capacities of the Native Administration tribal leaders and other community members involved in addressing the IDPs' land tenure security**

#### **Land recordation within the Native Administration System**

Discussing the current customary land recordation system against the FFPLA approach in Nyala, South Darfur, it is apparent from the result in subsection 4.1.3 that the Native Administration System uses a paper-based system and verbal agreement for their land use allocation records. Also, Aaraf and customary law in Eid El Firsan, Nyala are considered to be the customary legal framework that governs this current customary land recordation system. It is also evident that social land use restrictions are used by tribal leaders for assigning land for community members and vulnerable groups throughout the year, and for different land use purposes, as presented in subsection 4.1.3. Looking at the Native Administration System as a customary system, it was found regardless of the lack of any technical support, tribal leaders are performing well in addressing land tenure security for IDPs by having limited capacity as shown in 2.4 and 4.1.3.

Nevertheless, the challenge is that tribal leaders have to collect personal information, such as the landholder's name, family members, neighbours' names, and description text about the land location within the tribal land for community recognition. Another challenge is that the absence of proper land recordation system for the Native Administration System will make customary tenure security for returning IDPs more fragile, especially if one of the community's stakeholder is absent due to the conflict. On the other hand, it is also proven from discussions with land professionals in Nyala that the community in Om Ginaah had experienced sktech mapping, which is considered so beneficial in implementing any LA tools that supports the FFPLA approach, as shown in Figure 20. Therefore, having a better customary land recordation system that ensures even IDPs with tenure security, the FFPLA approach is promised to support this system technically through the continuum of rights, services, and accuracy, as shown in Figure 4.

#### **Community Land registration in Nyala, South Darfur**

Concerning the community land registration in Nyala, South Darfur, it is evident from the result in subsection 4.1.3 that a free-of-conflict certificate can be issued through the Native Administration and other stakeholders in Nyala. Tribal leaders claim that a community member is able to register their land but

under specific social restrictions. These social restrictions govern the land that should not be allocated for any common use, such as grazing, pastoralist routes, and seasonal use. It is also believed that a community member is not able to register his land if it is within a conservative forest area. Consequently, it is positive that this process is done through different stakeholders' agreements, including the signature of tribal leaders, neighbours of the landholder, community members, the Ministry of Agriculture, the Ministry of Forest, and the Ministry of Physical Planning, as shown in Figure 21.

In contrast, concerning the spatial framework of the FFPLA, it is claimed that this approach could support all the stakeholders mentioned above in the customary tenure system in Nyala for registering their customary land the way they perceive it (subsection 2.9.1). Capturing different customary land tenure rights, such as the Dar, Hakora, and Housh will only be possible with the continuum of land rights of FFPLA. Supporting that, various customary land use rights, such as temporary land for IDPs, as shown in 4.1.3, can be captured with the same spatial framework. Thus, the researcher believes that the community should consider implementing FFPLA as a guideline for allowing the community to register their customary land under social restrictions and approval.

#### **5.1.4. The Native Administration System's land conflict resolution between the host community and IDPs' land tenure security**

Concerning land conflict within the customary tenure system in Nyala, South Darfur, it is evident that many land disputes are happening between IDPs and the host community, such as land issues with neighbours, second occupiers, farmers, and pastoralists (subsection 4.1.4). Internal displacement is a main cause of any land conflict between communities due to armed conflict since 2003 in South Darfur (subsection 2.5.1). From discussions with tribal leaders and community members, it was obvious that the Juddiya is a local land conflict resolution mechanism that is charge of solving such land-related issues. Another positive characteristics about this Juddiya is considered to have tremendous impact towards solving land conflict issues since it is based on Aaraf and the customary law through all the stakeholders, and it is respected by all community members in South Darfur, as shown in Figure 22.

Nevertheless, community members in South Darfur believe that this Juddiya's main work is limited because of the lack of land records, maps, non-spatial information about communities, and better documentation for Juddiya's decisions, especially at the Shiekh levels. Consequently, the researcher believes that an ICT solution guided by the spatial framework of the FFPLA approach could make the Juddiya functioning and make better decisions.

## **5.2. To identify the information system requirements for implementing functionalities to support the Native Administration System**

This section intends to analyse and discuss the information system requirements after identifying the functional and non-functional requirements of the Native Administration System. It also analyses and discusses essential information that needs to be collected and how all stakeholders within the community in South Darfur agree about this collected information.

### **5.2.1. What are the functional requirements needed to develop the ICT solution for the Native Administration System?**

Regarding the functional requirements, Table 2 in subsection 4.2.1 shows the identification of the functional requirements of how the suggested possible ICT solution of the Native Administration System will operate. The researcher believes these results of functional requirements identified from discussions with tribal leaders, community members, and land professionals in Nyala can apply to similar cases in the five Darfur regions. It is estimated that these functional requirements will determine the capabilities of the suggested ICT solution and how the system should work.

**5.2.2. What are the non-functional requirements and constraints needed to develop the ICT solution for the Native Administration System?**

Concerning the non-functional requirements, Table 3 in subsection 4.2.2 shows the identification of non-functional requirements of a suggested potential ICT solution for the Native Administration System in South Darfur. It is evident from discussions with tribal leaders and community members about what kind of system's qualities are required. Tribal leaders claim that the system should offer extra security and performance functionalities as a quality of the potential ICT solution for the Native Administration System.

**5.2.3. Which kind of information needs to be collected to address the claim of IDPs for their lands?**

About collected information that is needed for addressing IDPs' land claim, it is evident from discussions' findings with tribal leaders that community recognition plays a role in identifying the relation to the tribe. The results from these interviews in subsection 4.2.3 intend to ensure that information neighbours of IDPs also can recognize the relationship between vulnerable return groups and their tribes. It is also evident that personal information, the Housh's relation (extended family house), any social restriction of claimed land, and the approximate description of claimed land's location is essential information to be collected. The researcher believes that this social investigation through the Native Administration System and community members can help to capture important information about the land claim matter. Consequently, community recognition is essential for addressing the land claim of return IDPs.

**5.2.4. How well does the information needs to be collected from different community stakeholders in the South Darfur community agree?**

Concerning the stakeholders' agreement, it is apparent from discussions in subsection 4.2.4 with tribal leaders and community members in South Darfur is done through community meetings. It is evident that agreement about collected information is done through investigation and consultation among the following stakeholders, representatives of prominent families' houses (Housh), neighbours of IDPs, and vulnerable groups.

**5.3. To establish which land administration tool (s) have functionalities that meet the information system requirements for implementing an ICT solution for the Native Administration System**

This section intends to analyse and discuss identifying a suitable land administration tool (s) that meet the findings of the functional and non-functional requirements of the Native Administration System presented in subsections 2.7, 4.2.1, and 4.2.2.

**5.3.1. Which land administration tool (s) has been experimented within similar context that meets the information system requirements?**

**5.3.1.1. Characteristics of existing land administration tools**

The comparison of some existing and available land administration tools currently used in the land administration field was made based on the findings from 4.1.3. The selected LA tools were chosen through a literature review and because they have been experimented with before in the customary land tenure within similar contexts. This comparison was conducted through a literature review through desk research for collecting information about some existing land administration tools that support the fit-for-purpose land administration approach. Parameters that ensure the spatial framework of fit-for-purpose land administration as a guideline principle are: functions, target users, previous implementation, the accuracy of data, time performance, ease of use, spatial and non-spatial and availability in the market. This comparison is found in Annex (4)

**5.3.1.2. The alignment of selected LA tools with the information system requirement.**

Concerning identifying a land administration tool, the findings of the information system requirements of the Native Administration System presented in subsections 2.7 and also in Tables 2 and 3 in Chapter 4 are used to figure out what land administration tool can meet these identified requirements. These requirements are evident from discussions with all stakeholders in the customary tenure system, including tribal leaders, community members, and land professionals in Nyala, South Darfur. A comparison of some existing land administration tools was made through a literature review shown in subsection 5.3.1.1 and Annex 7 based on specific parameters. In continuation, a scoring system was used in this research to determine which land administration tools can meet the information system requirements of the Native Administration System in Nyala, South Darfur. The following scoring scheme was used to rank the tools for each of the requirement types listed in tables 2 and 3 in Section 4.2:

1. High (H) - the tool meets at least two thirds of the requirements.
2. Medium (M) - the tool meets between one third and two thirds of the requirements.
3. Low (L) - the tool meets less than one third of the requirements.

Table (4) below presents the scoring table based on the information system requirements aligned with some land administration tools. The last column represents the aggregation numbers of the highest alignment with requirements.

<b>Functional and functional requirements</b> <b>LA tools</b>	Functional requirement (Land recordation)	Functional requirement (Land management)	Functional requirement (conflict resolutions)	Functional requirement Technical and operational	Non-functional requirement (Performance)	Non-functional requirement (Security)	Number of higher alignment
STDM	H	M	M	M	H	H	3
UAV	M	M	M	M	H	L	1
SmartLandMaps	H	M	H	H	H	H	5
SmartSkeMa	H	M	H	H	H	H	5
Cadasta	H	M	M	M	H	H	3
Smartphone Esri collector	M	M	M	L	H	L	1
Field survey app	M	H	H	M	H	H	4

Table 4: A score table based on the information system requirements aligned with some land administration tools

From the above score table, it is obvious to identify which land administration tool aligns more with these functional and non-functional requirements. It is derived from the analysis in Table 4 that LA tools such as the SmartLandMaps, SmartSkeMa, and the field survey app met a high degree of alignment with requirements as shown in this analysis. However, SmartLandMaps and SmartSkeMa share similar characteristics and functionalities compared to the Filed Survey App and other LA tools.

### **The smartLandMaps, SmartSkeMa, and Field Survey App against the requirements**

Concerning the SmartLandMaps and the SmartSkeMa, as LA tools with higher alignment with the requirement and by looking at the land recordation as a functional requirement, shown in Table 2, the analysis shows that both tools met all its sub- functional requirements. Both tools will have functionalities to support the Native Administration System in capturing different customary land tenure and use rights, mapping different land rights, the approximate location of land disputes, the community land use restrictions, mapping the tribal land boundary, and the social land obligations through sketches drawn by the community. It is very positive that the community can draw some sketches, as shown in Figure 20, subsection 4.1.3.

However, both tools can't meet the requirement of capturing verbal descriptions of stories about the community land, which is considered a very important requirement that the community in South Darfur relies on for describing their land. In contrast, the Field Survey App is believed to have medium alignment with this requirement compared to the SmartLandMaps and SmartSkeMA, and the difference is that the Field Survey App can't support offering any mapping activities or mapping visualization unless uploading an aerial or satellite image on it, which requires another LA tool for mapping.

Regarding the land management functional requirement, the analysis illustrates that both SmartLandMaps and SmartSkeMa have a medium alignment with this requirement. Both tools can help the community to manage different land records, maintain records of land claims and conflict resolution decisions, keep information on conservative lands, and map records. In comparison, these two tools can't offer the community some sub-requirements, such as maintaining the tribal land requests, historical land agreements, and community members' land requests. On the contrary, the Field Survey App showed a higher alignment with this requirement by having an additional bonus supporting the records of the community request.

About solutions for conflict resolution (Juddiya), as a functional requirement, the analysis shows that the three LA tools have a similar higher alignment with this requirement. They showed that they have functionalities that could assist the community in addressing conflict between the tribal Dar with another tribal boundary, visualizing land disputes with pastoralists' routes, minimizing land conflict between IDPs and the host community, and visualizing the resolved land disputes. They are considered a critical requirement that the Native Administration System and the community are willing to address and eradicate through Juddiya, as presented in (subsection 4.1.4). In contrast, these three LA tools are very negative to support the implementation of the customary law in Juddiya's decisions.

Discussing technical and operational as a functional requirements, the analysis presents that these three LA tools have medium alignment with this requirement. Looking at these tools' capabilities, it is found that the SmartLandMaps and the SmartSkeMa could support the Native Administration System in having options to select different customary land tenure and uses rights, capturing non-spatial information, drawing sketches, mapping fuzzy boundaries, recognizing who is the current landholder, and the status of the land. Nevertheless, The Field Survey App can't support any mapping activities in visualizing the land dispute unless uploading a map. In contrast, they failed to meet sub-requirements such as capturing verbal stories that tell stories about people to their customary land relation in Eid El Firsan, South Darfur.

On the other hand, concerning performance as a non-functional requirement, the analysis suggests that all three LA tools have higher alignment with this requirement. Looking at their functionalities from Annex 7, it is found that they have functionalities that will allow the Native Administration System to do activities, such as mapping parcels at different accuracy, precisions, and size of data, which supports the community need. However, the Field Survey App needs a map to be installed on it; then, the user can map the boundary of a plot. Also, their functions will help the community to display produced maps on desktop screens or tablets.

Regarding security as another non-functional requirement, both LA tools SmartSkeMa and SmartLandMaps have met higher alignment with this requirement. The analysis in Annex 7 shows that SmartSkeMa for example has restrictions to access the data by the community, which requires users to write a query to recall specific information when a particular scenario occurs, and also needs a database technology, as stated in Annex 3. Moreover, SmartLandMaps also suggests that it requires spatial data infrastructure for securing the data, as also shown in Annex 7. Their characteristics could help the community in South Darfur to specify who can access their land records, protect personal information, and recognize who within the community and tribal leaders is responsible for granting the land. This could be done through enhancing the design having well established data and system access security tool. It is highly knowledgeable that both tools are able to fulfil this non-functional requirement and protect sensitive information of returning IDPs and other community members. In contrast, the Field Survey App, the data will be accessible only to data collectors among the community and the Native Administrators, such as Shiekh can control its accessibility based on the community agreement.

### **Comparing STDM and Cadasta with the SmartLandMaps, SmartSkeMa, and the Field Survey App**

The following LA tools, the STDM and Cadasta, are highly aligned with the information system requirement by only three total groups of requirements, such as land recordation, performance, and security. Looking at the land recordation as a functional requirement, shown in Table 2, the analysis illustrates that both tools have functionalities to support the Native Administration System in capturing verbal stories and descriptions about the land compared to the SmartLandMaps, SmartSkeMa, and the Field Survey App. However, both tool, STDM and Cadasta can't offer the community sketches drawn by the community hands like what other mentioned LA tools do because they require highly accurate satellite images. On the other hand, all have functionalities to identify different customary land tenure and use rights, the approximate location of land disputes, the community land use restrictions, and the social land obligations. Nevertheless, drawing some sketches by hand is a bonus point for SmartLandMaps and SmartSkema, which offers more community engagement, as being able to accurately distinguish customary land realtions.

Regarding the land management functional requirement, the analysis also shows that both STDM and Cadasta have a medium alignment with this requirement. However, Both tools require highly accurate satellite images for mapping the customary land, handheld GPS instrument for identifying locations, and high technical training compared to the SmartSkeMa, SmartLandMaps, and the Field Survey App. In addition, about solutions for conflict resolution (Juddiya), as a functional requirement, the analysis represents that both LA tools have a similar medium alignment with this requirement. It is very helpful that they can support including descriptions of the Aaraf and customs for Juddiya's decisions compared to other LA tools. Nevertheless, they showed that has a negative side, which would not be able to visualize land disputes and resolve of land disputes unless they have higher satellite images from another LA tool compared to other tools.

Discussing technical and operational as functional requirements, the analysis suggests that STDM and Cadasta have medium alignment with this requirement. Looking at their functionalities, it is found that both tools could not help the Native Administration System in sketching their customary land tenure and use rights unless they have a satellite image uploaded in the user interface compared to other tools.

On the other hand, concerning performance as a non-functional requirement, the analysis presents that both LA tools have higher alignment with this requirement. Looking at their capabilities, it is apparent that they have functionalities that will allow the Native Administration System to perform activities, such as mapping parcels at different accuracy, precisions, and size of data, which supports the community's needs. So, both LA tools have similar functionalities that support this requirement with SmartLandMaps and other LA tools. However, the STDM and Cadasta require high-accurate satellite images.



Also, regarding security as another non-functional requirement, The STDM and Cadasta tools have met higher alignment with this requirement. STDM shows on the need for open software that helps accessing the data. However, it requires better database tool such as Postgres and expensive software like ArcGIS especially when the users start dealing with big data, which will enhance the design having well established data and system access tool. Their characteristics could help the community in South Darfur to specify who can access their land records, protect personal information, and recognize who within the community and tribal leaders is responsible for granting the land. Nevertheless, both are built as models with connected entities that require a user interface for using them compared to other assessed LA tools in Table 4.

### Comparing the UAV against other assessed LA tools

Concerning all the requirements shown in Table 4, this analysis shows that the UAV as a LA tool has a medium alignment and has the least number of the total requirements. Based on the assessment of LA tools in Annex 7, it is positive that UAVs can support the community in South Darfur with affordable aerial images compared to other assessed LA tools. Nonetheless, it requires a trained pilot (could be a land surveyor from the state) and a GPS RTK instrument for generating georeferenced and orthophoto images. In conclusion, it is considered in the case of the returning IDPs and their land relations in South Darfur as a supporting tool for providing aerial images to the Native Administration System and reliable partners. The UAV high resolution imagery is considered in such conflicted situations as an advocacy for visualizing land disputes between vulnerable groups and the host community, which leads to better decisions by Juddiya.

### 5.3.2. Which land administration tool can meet the capacity of the community in South Darfur?

Regarding the capacity of the community in Nyala, South Darfur, three elements can play a role in identifying a suitable tool, which are the information system requirement (subsection 4.2), the assessed LA tools in Annex 7, and the capacity of actors in the Native Administration System. It is apparent from the results in subsections 2.4 and 4.1.3 that the Native Administration uses verbal agreement and a paper-based system to manage their land records and solve the land conflict. In this subsection, synthesis of the results in subsection 4.1.3 and Annex 7 is used to analyse and find out which LA tool can meet the capacity of the community.

The findings from subsection 4.1.3 illustrate in detail what kind of capacity strengthening that the community need to address the security of tenure for IDPs and returning IDPs. It was evident that the community lacks maps of their customary land, weak land recordation system, using paper-based system for land management, verbal agreements for Juddiya's decision, differentiate different customary land use rights within a better system, lack of trained land professionals, and there is a need for better recognizing the social land restrictions. Therefore, Table 5 below shows the score table for the capacity of the community with some land administration tools by using classes that was derived from the finding in subsection 4.1.3. A binary scoring system is used to classify the LA tools into those that meet the capacity of community to apply them in the Native Administration processes. A tick mark (✓) means that the LA tool meets the community's capacity and an x-cross mark (×) means that it does not.

The table below also shows that the capacity of the community has different categories based on the findings from subsection 4.1; for example, land management refers to the current paper-based system that the community uses. The customary land tenure rights are another category corresponding to the Dar, Housh, Hakora, and individual land rights. Different customary land use rights also refer to various rights of land uses, such as farming, dwelling, grazing, pastoralist route, and seasonal use. Land disputes, refers to different kind of land disputes, land agreement records correspond to a lack of records, lacks maps refer to there being no kind of mapping records, the lack of technical support means that there is no technical support for customary land tenure recordation, and the lack of trained land specialist also refers to the fact that the community does not have land professionals.

LA tools	The capacity of the community										
	Land management (paper-based)	Customary land tenure rights	Different customary land use rights	Customary land law (Aaraf)	Land disputes (neighbours, farmers, shepherds)	Land agreements records	Lack of maps	Social land use restrictions	Lack of technical support	Lack of trained land specialist	Number of checked boxes
STDM	✓	✓	×	×	×	×	×	✓	×	×	3
UAV technology	×	✓	✓	×	✓	×	✓	✓	✓	×	6
SmartLandMaps	×	✓	✓	×	✓	×	✓	✓	✓	✓	7
SmartSkeMa	×	✓	✓	✓	✓	×	✓	✓	✓	✓	8
Cadasta	✓	✓	×	×	×	✓	×	✓	×	×	4
Smartphone-Esri collector	×	✓	✓	×	×	×	×	✓	✓	✓	5
Field survey app	×	✓	✓	×	×	×	×	✓	✓	✓	5

Table 5: the score table for the capacity of the community with some land administration tools

From the score table, table 5, the analysis shows that one land administration tool has the highest checked scores and is aligned with the capacity of the community in Nyala, South Darfur, which is the SMartSkeMa. This tool proves that can be able to support capturing the customary law and gives statement made by the community members, whenever needed. Followed by SmartLandMaps, which met seven of the community’s capacities. After that the UAV tool with six and then the Smartphone Esri collector and the Field survey app, respectively. In contrast, the STDM and Cadasta tools showed the lowerest alignments with the community capacity in South Darfur, among others. However, it is obvious to recognize that SmarSkeMa and SmartLandMaps are mapping tools that have functionalities to support mapping activities but lack management of land records and storing customary land laws, norms and Aaraf (customs) presented in subsections 2.7 and 4.1 of the community in South Darfur. Hence, these could be valid indicators to consider selecting a combination of mapping and land recordation suite of tools for the customary tenure system in South Darfur, Sudan.

### 5.3.2.1. Capacities of reliable external partners

Considering the participation and collaboration with other external partners, it is evident from discussions with land professionals in the Ministry of Physical Planning in Nyala and UN-Habitat land experts that there was a pilot project conducted by UN-Habitat regarding mapping some villages in the Darfur region, including South Darfur (see section 4.1). It is not evident that this project was documented. However, based on discussions with tribal leaders in Om Ginaah that it was very optimistic that they were happy as a community to collaborate with land professionals in Nyala in mapping part of their tribal land by hands on the top of a satellite image as a test as shown in Figure 20. However, it was apparent from the fieldwork that this sketch map was put as portrait on the office without making use of it. In addition, It was also positive that three land professionals who have some basic knowledge of supervising any potential mapping project in the Eid El Firsan locality. The researcher also believes other private institutions, such as ISTIDAMA, for Land Governance, where he is currently working, can play a role in conducting, supporting, and supervising land-related projects to help the Native Administration System better recording their customary land, especially in addressing the land relation of vulnerable groups.

**5.3.3. Which land administration tool or suite of tools is suitable for minimising IDPs' land related issues and supporting land conflict resolution decisions?**

About minimizing land conflict issues, supporting land conflict resolution mechanisms, and based on the findings from subsections 2.5.1 and 4.1.4, it is evident that the community in the customary land system in Nyala, South Darfur needs innovative solutions to address land-related issues of IDPs. It is also believed that Juddiya, as a local conflict resolution mechanism lacks an ICT solution that can support tribal leaders, especially the Omda and the Shiekh levels, in finding ways to recognize land disputes in different parcel accuracies between neighbours through mapping. In addition, tribal leaders believe that Juddiya requires a tool that can support collecting non-spatial information about the claimed land and document Juddiya's decisions.

By Linking the results of IDPs in subsection 4.1.1 and with the analysis of two Tables 4 and 5, the Native Administration System would be benefit by using a combination of these LA tools, which are the SmartSkeMa SmartLandMaps, and Field Survey App. LA tools such as SmartLandMaps and SmartSkeMa are highly aligned with five categories of requirements shown in Table 4, including of the land conflict resolution requirement. In addition, these tools are believed to have functionalities in sketch mapping and can recognize different customary land uses and land disputes through community participation, as mentioned in subsection 2.7. However, the analysis of LA tools in Annex 7 shows that SmartSkeMa has the functionality to recall statements made by community members and apply logical reasoning if a violation against the community occurs. It also shows that it has a higher alignment with eight community capacity groups, as presented in Table 5.

In addition, it is also apparent from the analysis of the tools in subsection 5.3.2 that based on the capacity of the community, a LA tool such as the Field Survey App could be used by the Native Administration System for collecting non-spatial data about the host community and vulnerable groups. Since the livelihood in the customary tenure in South Darfur is dynamic, this LA tool is believed to have a positive impact along SmartSkeMa for gathering updated information about the current land occupiers; different landholder uses throughout the whole year and information about the temporary location of returning IDPs within the Dar (tribal land).

On the Other hand, it is evident from the results in subsection 4.1.3 that the community had experienced hand-sketching techniques on the top of a satellite image. It is believed that the SmartSkeMa requires the community to develop their skills to sketch through drawing symbols that refer to their different customary land uses, land disputes, and customary land rights and transform them using their local knowledge and perceptions. Hence, the researcher claims that the community in South Darfur would be able to map their land disputes after developing their mapping skills.

SmartLandMaps is claimed to require the community to know how to print, sketch, and scan maps. This process could be conducted and supervised by external reliable partners as stated in subsection 5.3.2. Moreover, the Native Administration System and their assistants from the community should be able to learn how to install the Field Survey App on their smartphones or ones provided by reliable partners. Therefore, it is concluded that through training on how to use the app, it would be easier to collect information about land disputes between the host community and returning IDPs.

**UAV as a supporting tool:**

On the contrary, against the above selection, it is apparent from the analysis in subsection 5.3.2 that the UAV met six categories of the community capacity in Table 5. At the same time, it mainly met a medium alignment with most of the categories of the requirement in Table 4 and the lowest alignment among all LA tools presented in Table 4. However, it concludes that UAVs can strongly assist the Native Administration processes by providing affordable maps that the community of South Darfur can use for

addressing land issues. Therefore, providing high-resolution maps for this conflicted situation is needed to avoid any land issues between returning IDPs and the host communities. Additionally, the community is still facing displacement issues due to the current fights in Sudan, as stated in subsection 2.5.1, and IDPs are estimated to continue returning or moving to other tribes' land. Therefore, it requires, in some cases, high-resolution images along with the implementation of these tools, SmartSkeMa, SmartLandMaps, and the Field Survey App, for advocating serious land dispute issues within the tribal Dar. It could support the Native Administration System for better land use allocation, avoiding potential land disputes, and better decisions for Juddiya, especially for cases with pastoralists, farming lands, and pasture areas. The researcher concludes that reliable external partners can play a role in collecting aerial images by using a UAV tool. The challenge might be that these UAV aerial images could be used against the tribe if it is mismanaged.

#### **5.4. Summary of Chapter 5**

This chapter analysed and discussed the assessment of the Native Administration System that supports its work in addressing the land relation of IDPs in the customary land in South Darfur. It also analysed and discussed the information system requirements identified after the assessment of the Native Administration System. Moreover, the identification of suitable LA tools for the Native Administration System was analysed and discussed based on the alignment with the distinguished functional and non-functional requirements and the capacity of the Native Administration System. Some selected LA tools were compared based on the spatial and legal framework of the FFPLA approach. LA tools such as SmartSkeMA, the Field Survey App, and UAV were found suitable for the Native Administration System in South Darfur. They could capture customary land rights, customary land use rights, Aaraf, and social land use restrictions as an ICT solution.

## 6. CONCLUSION AND RECOMMENDATIONS

This chapter represents the conclusion and recommendations derived from this study. The main objective of this study is to identify a suitable ICT solution for land recordation processes for the Native Administration System, focusing on tenure relations of returned IDPs in South Darfur, Sudan. This chapter summarizes the findings from each sub-objective presented in Chapter 4. In this following chapter, recommendations, limitations of this study, and potential further research are also announced.

### 6.1. Conclusion

Regarding implementing alternative solutions for the Native Administration System in addressing land relations of IDPs and returning IDPs, this research concluded that the combination of SmartSkeMa, the Field Survey App, and UAVs tools are appropriate for the customary land recordation processes in South Darfur.

**Objective 1: To assess the Native Administration System's primary functions for providing returned IDPs access to land in South Darfur.**

*Q 1.1 What practices and processes has the Native Administration implemented to provide returned IDPs security of tenure for their claimed lands?*

The findings of the Native Administration System's primary functions, main practices, and processes were gathered through a literature review, semi-structured interviews, focus groups and in-depth interviews. The main structure of the Native Administration System was identified as a social institution administrated by tribal leaders. Its role focused on managing land, making justice, and improving social interactions. The process of assigning land use for returning IDPs was found through various social recognitions, such as the Native Administration System and community members. It was also found that assigning land is based on the social land use restrictions that govern the processes by tribal leaders.

*Q 1.2 Who are the main actors of the Native Administration System involved in the processing of ensuring land rights for returned IDPs?*

The outcomes of this research question found that tribal leaders such as the Nazir, Omda, and Sheikh are the main actors within the Native Administration System for ensuring the land rights of returning IDPs. Additionally, it was found that community members play a crucial role in securing land access for those vulnerable groups.

*Q1.3 What are the capacities of the Native Administration tribal leaders and other community members involved in addressing the IDPs' land tenure security?*

From the researchers' fieldwork and literature review, few paper-based systems and verbal agreements were discovered to be the only land information system currently used by tribal leaders in South Darfur. It was also found that handwritten letters were being used for communication between Native Administrators. Additionally, the lack of historical maps and other spatial information systems is considered as the gap that the capacity of the Native Administration System is lacking in securing land access for returning IDPs. The research generally found that there is a need for an ICT solution to support the tribal leaders' capacity.

*Q 1.4 How does the Native Administration System mediate land conflict and internally displaced person's land tenure security?*

The research found that there is a local conflict resolution mechanism that the community practices in Nyala called Juddiya, which is used to solve their land issues. It also discovered that this Juddiya solves land-related issues between returning IDPs and the host community as well as any land disputes between other community members, such as farmers and pastoralists. It is proven that all community members appreciate this Juddiya's decisions because it applies their traditional law, social norms, and Araf.

**Objective 2: To identify the information system requirements for implementing functionalities to support the Native Administration System.**

*Q 2.1. What are the functional requirements needed to develop the ICT solution for the Native Administration System?*

The outcomes of this research's interviews with tribal leaders and community members helped to identify the functional requirement of the Native Administration System in Nyala, South Darfur. These functional requirements show how the proposed Native Administration System with an ICT solution is expected to work. They focus on four different groups of requirements, including land recordation, land management, conflict resolution mechanism, and technical and operational.

*Q 2.2. What are the non-functional requirements and constraints needed to develop the ICT solution for the Native Administration System?*

From the analysis of this research interview, non-functional requirements of the Native Administration System were distinguished. These non-functional requirements will show the quality of the proposed new Native Administration System with an ICT solution. These requirements were categorized based on two set of requirements, which are the security and performance requirements.

*Q 2.3. What kind of information needs to be collected to address the claim of IDPs for their lands?*

The outcome of this research question found that the Native Administration's recognition, relation to the tribe, and IDPs neighbours' recognition are considered the most important information to be gathered. Other non-spatial information such as the name of the returning IDPs, the relation to specific Housh, the previous location of the second occupier before the conflict, neighbours' names, and descriptions of the claimed land location are also required by tribal leaders to be collected. This research can conclude that this information is highly required to address the claim of IDPs in South Darfur.

*Q 2.4. How well does the information collected from different community stakeholders in the South Darfur community agree?*

The research discovered that the whole community agrees upon collected information through traditional investigation among them. It was found that all community members, including tribal leaders and representatives of extended families (Housh), play a role in confirming this collected information.

**Objective 3: To establish which land administration tool (s) have functionalities that meet the information system requirements for implementing an ICT solution for the Native Administration System**

*Q 3.1. Which land administration tool (s) has been experimented with in similar contexts that meets the System requirements?*

The research study analysed some selected LA tools, see Annex 7 that have functionalities that could improve the Native Administration System's main work in addressing the security of tenure of IDPs and returning IDPs, as explained in Chapter 4. Table 4 was created to analyse which LA tool or suite of tools that has higher alignment with the functional and non-functional requirements; see Tables 2 and 3 in Chapter 4. This analysis concluded that the SmartSkema and SmartLandMaps met the higher alignment with this information system requirement of the Native Administration System.

*Q 3.2. Which land administration tool can meet the capacity of the community in South Darfur?*

The outcome of this research question found from the analysis in subsection 5.3.2, above in Chapter 5, that SmartSkeMa got the highest alignment with the different categories of the community's capacity. Following that, the Field Survey App and UAVs got the second and third place alignment with the community's capacity, respectively. This analysis concluded that SmartSkeMa proved that it could improve the community's skills in mapping by using hand-drawn sketches and capturing Aaraf and social land use restrictions associated with their customary land right. It also figured out that the Field Survey App could support the community in collecting non-spatial information on the ground. UAVs showed the ability to provide high-resolution images as a supportive tool in addressing any land disputes between IDPs and the host community, especially for very critical conflict situations.

*Q 3.3. Which tool or suite of tools is recommended and can help the community to support land conflict resolution and minimise IDPs' land conflict issues?*

This research question identified and came up with the conclusion that the combination of SmartSkeMa, the Field Survey App, and the UAV is the most appropriate ICT solution for the Native Administration System in Nyala, South Darfur. This conclusion was based on the analysis and discussions from the findings in subsections 5.3.1 and 5.3.2 in Chapter 5.

## **6.2. Recommendations**

This study investigated the potential of identifying a suitable ICT solution for land recordation processes for the Native Administration System, focusing on tenure relations of returned IDPs in South Darfur, Sudan. This research concludes by suggesting some recommendations as following:

### **6.2.1. Short-term recommendations**

Based on the findings and the analysis of this research in Chapters 4 and 5, the outcomes of this research suggest implementing the combination of SmartSkeMa, the Field Survey App, and the UAVs as LA tools. Those LA tools, as explained in Chapter 5 above, showed the capability to support the Native Administration System to improve better their work in allocating IDPs and returning IDPs with land access to their tribal Dar. The results and analyses above suggest that some of the steps required to implement these tools in Nyala include:

- 1-Capacity strengthening of the community to participate in the implementation of these suggested LA tools in South Darfur based on the characteristics of these selected tools, as explained in 5.3.1.1 and Annex 7.
- 2- Capacity strengthening of some land professionals in Nyala as an external reliable partner for supporting the implementation of these recommended LA tools.

### **6.2.2. Recommendations for further research**

The outcome of this research suggests the implementation of these combined LA tools; SmartSkeMa, the Field Survey App, and UAV. Since this research just only investigated that these selected LA tools met most of the requirements, therefore further research is recommended as the following:

- 1-Since this study focused on identifying the information system requirements for the Native Administration System, it is necessary to take further steps to assess the practicality of implementing these suggested tools.
- 2- To investigate whether these recommended LA tools could be integrated, for example, SmartSkeMa helps uses hand-drawn sketches, the Field Survey App provides solutions for land adjudication, and the UAV offers affordable images for settling highly sensitive land disputes if they occur, as shown in subsections 5.3.2 and 5.3.3 above.

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***Annex 1: Semi-structured interview, focus group and in-depth interviews***

**Interview protocol (consent form)**

I would like to thank you for accepting and giving part of your time to participate on this research interview, titled “Community land registers for Internally Displaced Persons in South Darfur: ICT solution”. I am *Ahmed Babiker Mohamed Hemoudi*, a second-year master-student at Faculty ITC, University of Twente, the Netherlands. The main purpose of this research is to identify a suitable ICT solution for land recordation processes for the Native Administration System, focusing on tenure relations of returned IDPs in South Darfur.

Kindly note that collected information will be treated based on the on the Research Ethics Policy of the University of Twente, and only for academic purposes.

I would like to ask you for permission to start recording the interview. Nevertheless, if you don't like, we can still continue with the interview without recording.

**Semi-structured interviews**

(General Land Registrar, National land commission, Darfur land commission)

- 1- Does the national land registration acknowledge the customary land tenure, and how?
- 2- Does the national land registration in Sudan recognise customary land rights, and how?
- 3- From which perspective does the National Land Registrar consider the customary tenure within the national framework?
- 4- Does the existing National Land Framework recognise the role of the Native Administration System?
- 5- How does the national land registration acknowledge the role of the Native Administration in addressing land disputes within the customary areas?
- 6- Which initiatives have been done to involve the Native Administration System and community participation to better record their land relations in customary tenure?
- 7- Which kind of support -if any- does the General Land Registrar provide to the community in customary areas to ensure returned IDPs' security of tenure? What role can the General Land registrar play in this context?

***Questions- semi-structured interview-land professionals***

- 1- What procedures do land professionals in the governmental sector in South Darfur usually do to support the Native Administration System's main work in ensuring customary land recordation?
- 2- What actions have the land authority in S. Darfur implemented so far to allocate returned IDPs with their lands?
- 3- Is there any collaboration between the Land Authority and the Native Administration System regarding returned IDPs' tenure relations issues?
- 4- What kind of technical support would the Land Authority or any other government authorities do for the proposed land administration tool for the Native Administration System?

**In-depth interviews**

**Questions-In-depth interview (Tribal leaders)**

- 1- Who are the main actors of the Native Administration System, and who manage their community lands?
- 2- What is the role of each actor within the Native Administration System (Nazir, Omda, and Shiehk)?

- 3- In which perspective do communities in South Darfur consider the ownership of their lands (Watatti)?
- 4- How do tribal leaders manage land use, ownership, lease practices within your communities? Such as pastoralists, small women farmers, and seasonal farming lands?
- 5- How does an individual gain access to land for different land uses:
  - 5.1- Dwelling/Living
  - 5.2- Crop production/Farming
  - 5.3- Pastoral grazing/other animal husbandry
  - 5.4- Other productive activities such as craftsmen's or manufacturing workshops
- 6- Who within the community does grant land rights? And when is a land user considered to be the owner of a piece of land?
- 7- What social obligations derive from the holding or use land?
- 8- In which cases of land possession can land be alienated and what restrictions apply to such actions?
- 9- Which actors or institutions can allocate or take away land from other community members who are
  - 9.1- Owners
  - 9.2- Non-land owning users
- 10- Do family, clan, or tribal relations/identities play a role in accessing land? If yes, what role do they play
- 11- When can we say that a community member is owning the land that he/she is using?
- 12- What are the practices that the Native Administration System does regarding land tenure relations, conflict, and infrastructure of managing information ?
- 13- How do tribal leaders and communities keep their land-people relation records, and who is responsible for maintaining them? Updated and historical records?
- 14- What practices that the tribal leaders do in addressing conflict resolution? And what are the main sources of land conflict? Ownership, use, boundaries, etc?
- 15- What is the local conflict mechanism that the Native Administration System applies to solve land issues? Do you think of an alternative conflict resolution mechanism? If yes, what exactly do you face concerning land conflict?

In comparison to the government conflict resolution system (courts) how do you evaluate the local mechanism : efficiency, effectiveness, sustainability. Etc
- 16- What are the processes that the Native Administration System usually does to ensure returned IDPs with their tenure relation?
- 17- How the Native Administration System guarantees and recognises the tenure relation between returned IDPs and their local community
- 18- What difficulties that the Native Administration System does face in recording land tenure relations?
- 19- what mechanisms the Native Administration follow to eradicate the land disputes between host communities and returned IDPs?
- 20- How does the Native Administration System manage its historical land information?
- 21- what is your role in regulating and/or facilitating the use of land as well as the social, religious, and legal obligations of land owners or users.
- 22- What are the steps that the Native Administration System (tribal leaders) do when they received IDPs? Please explain in details
- 23- Which additional support that the Native Administration System needs to record their land tenure relations better?
- 24- What kind of technical support is the Native Administration System need? Mapping tool? Or a recordation tool and techniques?

- 25- What kind of tool or better ways that the Native Administration System needs to manage their historical records and oral witnesses?
- 26- What is the technical capacity of the Native Administration System? And what do they need to improve the allocation of returned IDPs?
- 27- What kind of technical support or another solution precisely the Native Administration System needs to improve the land relations recordation ?
- 28- If I suggested a tool to help the community land recordation, what characteristics does this suggested tool should meet?

**Questions- In-depth interview (Omda/Shiekh)**

- 1- What verifications do you need to ensure the relationship to land when IDPs return? Or with IDPs from different villages.
- 2- Which process do Omda and Shiekh need to allocate returned IDPs with new lands? Do you consult community members in this process? Please explain in details
- 3- If returned IDPs are an extended family, do you allocate land to build their new Housh?
- 4- If returned IDPs are individuals, how will you allocate and assign land for them?
- 5- Do you consult other community members to ensure land and community relations of returned IDPs?
- 6- In the case of land disputes between host communities and returned IDPs, how do you ensure justice when IDPs claim the same land?
- 7- In case of IDPs from different villages and tribes, how do Omda and Shiekh allocate land for them? Explain in detail.
- 8- How do the IDP get the land for agricultural practices? Does he/she own it or rent the land?
- 9- Are there any challenges and land disputes between IDPs and the hosting communities? Please explain
- 10- How did returning IDPs and IDPs from different tribes affect the livelihood of the hosting community?
- 11- How did the livelihood of returned IDPs and IDPs from different tribes affect the livelihood of the hosting community and tribe? Any changes?
- 12- Do communities has=ve the desire to receive more IDPs? And why?

**Focus-group interviews:**

**(Community members)**

- 1- How do community members consider the role of the Native Administration System in land management?
- 2- From which perspectives do the community perceive their tenure relations?
- 3- What kind of practices does the community participate in addressing tenure relations?
- 4- How does community involvement have a major role in providing tenure security to returned IDPs?
- 5- How do the community become involved in solving land disputes between returned IDPs and host communities, and neighbours ?
- 6- How do communities participate in solving land disputes between returned IDPs and host communities?

**(Focus group interview-women)**

- 1- What kind of challenges do women within the tribe face in accessing land for agriculture?
- 2- What kind of land restrictions that women face in cultivating land for the whole year?
- 3- Do women have separated tenure security over land? Please explain.
- 4- In case of divorce and marriage, can women still keep the land?
- 5- In inheritance, does the community ensure women with their inheritance land?
- 6- What kind of community restrictions do women need to apply for agricultural practices? Do women give a portion of their products to the community?

- 7- If the woman does not have access to the land, do tribal leaders and other community members allow women to use the land for basic needs?

**IDPs and the host community**

- 1- What kind of challenges did the IDP community face when they arrived in the hosting village? Or their old village?
- 2- Does an IDPs has any difficulties accessing his/her land? What kind of challenges have you faced so far regarding land tenure security?
- 3- What kind of difficulties has the IDP faced in accessing the land because of the lack of recognition and documentation from his community?
- 4- Why did you choose this village exactly?
- 5- How did the hosting community allocate the land for the IDP ? and what kind of land and restrictions, and community obligations apply to IDP?
- 6- What kind of jobs has the hosting community provided for the IDP to feed their families? In the case of agriculture, do IDPs pay or give a portion of their products to community leaders? If yes, explain in detail.

## Annex 2: Workplan

Year	2022																2023																											
Month	September				October				November				December				January				February				March				April				May				June							
Week	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4				
Pre-fieldwork																																												
Defining research																																												
Literature review																																												
Preparation of fieldwork																																												
Internship																																												
Fieldwork																																												
In-depth interview																																												
Focus groups interview																																												
Post-Fieldwork																																												
Data processing																																												
Data Analysis																																												
Report writing																																												

### Annex 3: The research matrix

Objectives	Research Questions	Methods	Respondent	Data Sources	Expected Outcome
1- To assess the Native Administration System's primary functions for providing returned IDPs access to land in South Darfur	<p>1-What practices and processes has the Native Administration implemented to provide returned IDPs security of tenure for their claimed lands?</p> <p>2-Who are the main actors of the Native Administration System involved in the processing of ensuring land rights for returned IDPs?</p> <p>3-What are the capacities of the Native Administration tribal leaders and other community members involved in addressing the IDPs' land tenure security?</p> <p>4-How does the Native Administration System mediate land conflict and internally displaced</p>	<p>Literature review.</p> <p>Journals</p> <p>Books</p> <p>-Semi-structured interview: -Focus group interview -In-depth interview</p>	<p>Tribal leaders (Sultan, Omda, and Sheikh)</p> <p>-National Land Registrar.</p> <p>-Land Professionals.</p> <p>-</p>	<p>-Focus group interview with IDPs</p> <p>-In-depth interviews with tribe leaders.</p> <p>- In-depth interview with the National Land Registrar and land professionals</p>	<p>-Overview of the Native Administration's main practices, processes, capacity, traditional law.</p> <p>-The associated relationship of the Native Administration entities</p> <p>-General workflow activity of the Native Administration</p> <p>-Use case diagrams of the Native Administration</p> <p>-Overview of the Native Administration's main actor</p> <p>-Identification of the conflict resolution mechanism regarding IDPs and their land disputes</p> <p>-</p>



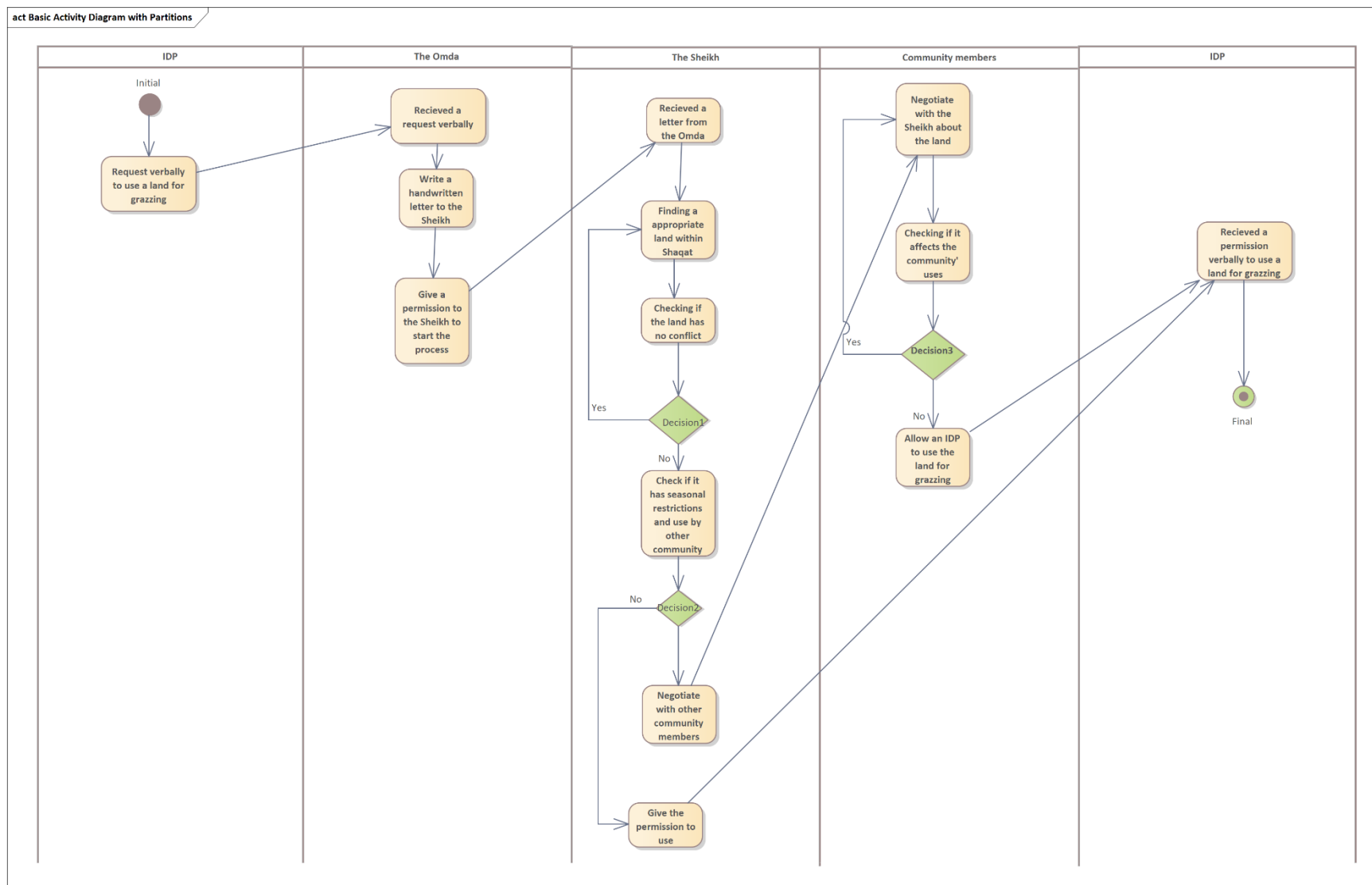
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	person's land tenure security?				
2- To identify the information system requirements for implementing functionalities to support the Native Administration System.	<p>1-What are the functional requirements needed to develop the ICT solution for the Native Administration System?</p> <p>2-What are the non-functional requirements and constraints needed to develop the ICT solution for the Native Administration System?</p> <p>3-What kind of information needs to be collected to address the claim of IDPs for their lands?</p> <p>4-How well does the information collected from different community stakeholders in the South Darfur community agree? stakeholders?</p>	<p>-Elicit and capture information.</p> <p>-Semi-structured interview</p> <p>-Validation requirement method</p>	<p>- Tribal leaders</p> <p>-IDPs</p> <p>-Land professionals</p>	<p>-Semi-structured interview</p> <p>- Collected information from:</p> <p>1- tribal leaders.</p> <p>2- IDPs</p> <p>3- land professionals</p>	<p>-Identification of the functional engineering requirements of the Native Administration System.</p> <p>- Characteristics and requirements of the proposed ICT solution.</p> <p>-Determination of the non-functional requirements of the Native Administration System</p>
3- To establish which land administration tool (s) have functionalities that meet the information	1-Which land administration tools has been experimented with in similar contexts that meet the system requirements?		<p>Tribal leaders</p> <p>-Community-IDPs</p>	<p>- Information collected from interviewees</p>	<p>-Table of the suitable land administration tools.</p> <p>- Recommendation of the appropriate land</p>

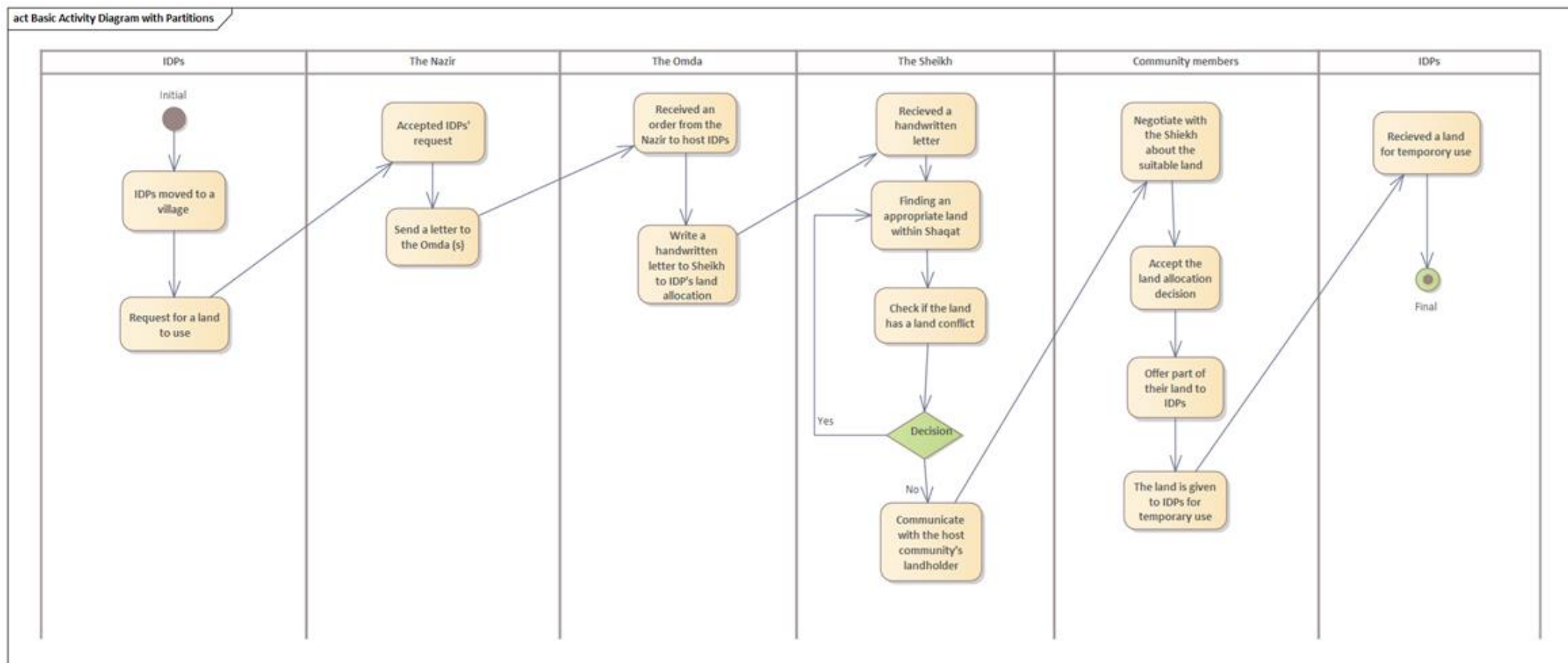
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<p>system requirements for implementing an ICT solution for the Native Administration System.</p>	<p>2-Which land administration tool can meet the capacity of the community in South Darfur?</p> <p>3-Which tool or suite of tools is recommended and can help the community to support land conflict resolution and minimise IDPs' land conflict issues?</p>				<p>administration tool for the community to ensure tenure security for IDPs</p> <p>-Identification of the land administration tool that can minimise land disputes within the community.</p>
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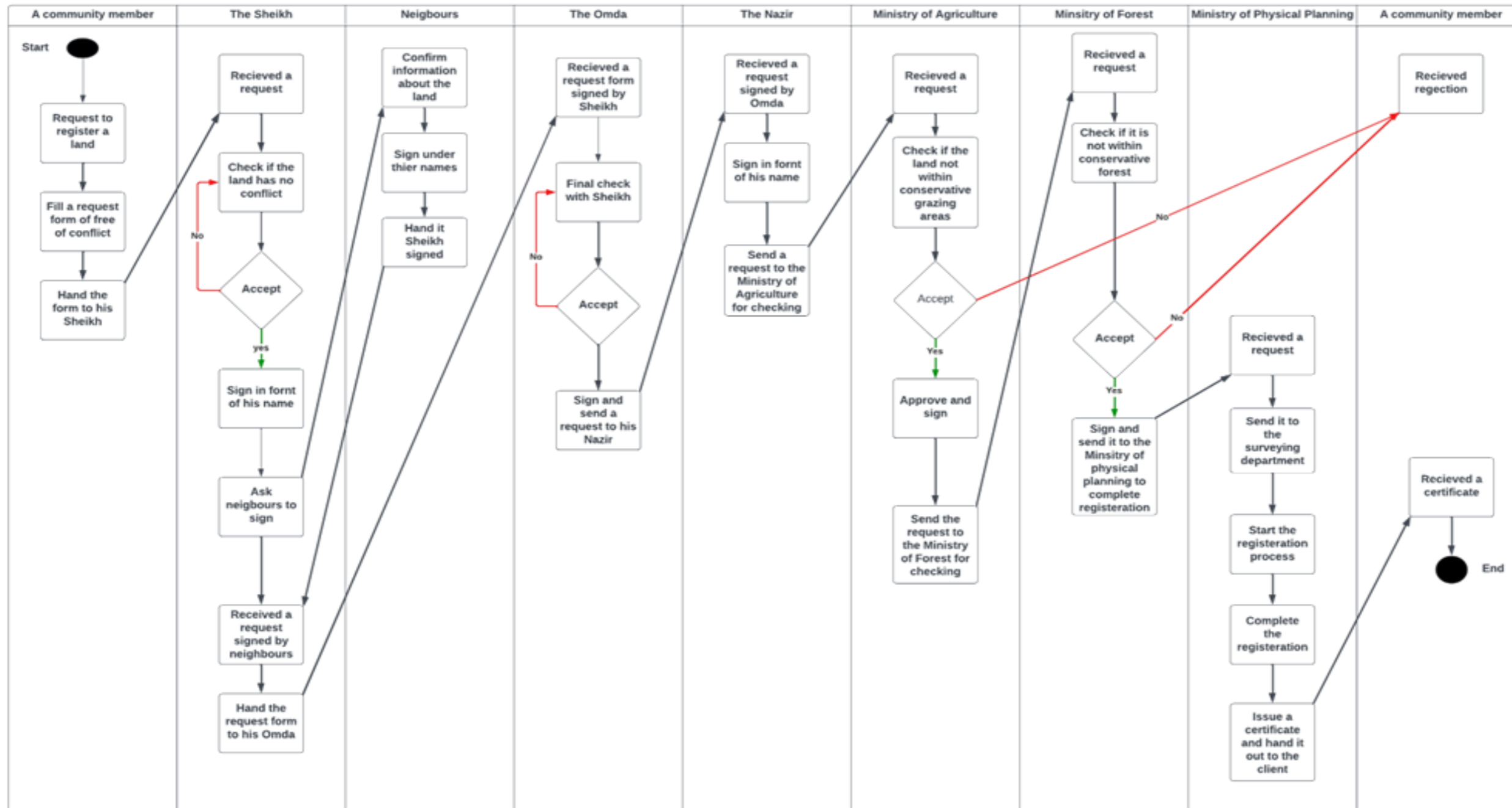
## Annex 4: The activity diagram for allocating land for grazing purposes for an IDP



## Annex 5: The activity diagram for allocating land for an IDP



### Annex 6: The activity diagram for registering land through the Native Administration System



## Annex 7: Comparison of some existing land administration tools

LA Tools	Functions and capabilities	Target Users	Examples of previous implementations	Accuracy of data	Spatial information	Non-spatial information	Ease of Use	Availability	Reference/ Document ID
1.STDM	<ul style="list-style-type: none"> <li>-Support continuum of land rights</li> <li>-Filling the gap</li> <li>-Generates images</li> <li>-Records land claims</li> <li>-Records and manages lands</li> <li>-Linkage of spatial and administrative data</li> <li>-Supports different type of data</li> <li>- ?</li> </ul>	<ul style="list-style-type: none"> <li>-People in developing countries</li> <li>- Countries with a lack of cadastral coverage</li> <li>-Post-conflict areas</li> <li>-People living in customary areas and slums</li> </ul>	<ul style="list-style-type: none"> <li>-Kenya</li> <li>-Uganda</li> <li>-Malawi</li> <li>-</li> </ul>	<ul style="list-style-type: none"> <li>-Different recordation of data is possible.</li> <li>-Different accuracy of coordinates.</li> </ul>	<ul style="list-style-type: none"> <li>Different spatial units:                             <ul style="list-style-type: none"> <li>-Sketch-based</li> <li>-Polygon based.</li> <li>-Line-based.</li> <li>-Point-based (handheld GPS)</li> <li>-Text-based</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>It supports different parties:                             <ul style="list-style-type: none"> <li>-Tribes</li> <li>-Clans</li> <li>-Village</li> <li>-</li> </ul> </li> <li>-Social tenure relations.</li> <li>-Boundaries (Can be described in words)</li> </ul>	<ul style="list-style-type: none"> <li>-Needs community involvement.</li> <li>-User interface (using a pencil)</li> <li>- Requires high-accurate satellite images(1:2000 scale).</li> <li>-Handheld GPS instruments for spatial units' locations</li> <li>-Computers</li> </ul>	<ul style="list-style-type: none"> <li>Available and open source</li> </ul>	<ul style="list-style-type: none"> <li>1.<a href="#">Home   Social Tenure Domain Model (STDM) (glt.net)</a></li> <li>2. <a href="http://www.fig.net">www.fig.net</a></li> <li>3. <a href="#">Count-Me-In English 2010.pdf (glt.net)</a></li> <li>4. Customary Land Tenure Security: Tools and Approaches in Sub-Saharan Africa (a synthesis report) (UN-HABITAT, 2019)</li> <li>4. The Social Tenure Domain Model (Lemmen, 2010)</li> </ul>

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							-STDM free installation software Needs training for users		
2. Unmanned Aerial Vehicle (UAV) technology	-Moving sensor for capturing overlap images. -Faster land coverage -High image resolution -Speed measurements -Recognise Different land uses. -Cheaper land data acquisition -Boundary delineation -Adapting different	Adapts stakeholders' needs Communities in customary areas. Small farmers' lands Surveyors Vulnerable group Governmental sector	-Kenya -Ethiopia -Rwanda -Ghana -Indonesia	Up-to-date maps. High and temporal resolution High accuracy up to 10 cm	Mapping of general and fixed boundaries. Collects spatial information through participatory mapping.	Its aerial image supports gathering personal information through a participatory approach.	Automated pilot aerial platform Supports participatory mapping Needs training for users. Computers for data processing. Software for image processing Printers <b>Requires:</b>	Available Affordable	Exploring UAV in Indonesian cadastral boundary data acquisition (Ramadhani et al., 2018)  EVALUATION OF UAV-BASED TECHNOLOGY TO CAPTURE LAND RIGHTS IN KENYA (Stöcker, Koeva, et al., 2019)  Unmanned Aerial System Imagery, Land Data and User Needs: A Socio-Technical Assessment in Rwanda (Stöcker, Ho, et al., 2019)  Remote Sensing for

Community land registers for Internally Displaced Persons in South Darfur, Sudan: ICT solution

	<p>environmental conditions</p> <p>-Photogrammetric principles</p> <p>Extract dense cloud from its image.</p> <p>Generates orthophoto image.</p>						<p>Prior flights planning</p> <p>Ground Sampling Distance (GSD)</p> <p>Ground Control Points (GCPs).</p> <p>Flying permission</p> <p>Pilot certification</p>		<p>Land Administration (Koeva et al., 2022)</p> <p>Scaling up UAVs for land administration: Towards the plateau of productivity (Stöcker, Bennett, et al., 2022)</p>
3.SmartLandMaps	<p>-Captures any land tenure forms.</p> <p>-Based on the SmartSkeMa tool</p> <p>- Accessible land-based mapping processes</p> <p>-Documents unclear customary tenure rights</p> <p>-Digital sketches of maps drawn by</p>	<p>-Local organisations</p> <p>-Indigenous people</p> <p>-Record customary tenure</p>	<p>-Rwanda</p> <p>- Southern Kenya</p> <p>-Benin</p> <p>-Ethiopia</p>	<p>-Depends on the community 's needs</p> <p>Easy updated</p>	<p>Spatial components:</p> <p>-Parcels' boundaries</p> <p>-Plots</p> <p>Digital maps from hand-drawn community sketches.</p> <p>-Uses satellite, aerial, and topographic</p>	<p><b>Thematic components and attributes:</b></p> <p>-owner</p> <p>-ID</p> <p>-Different land uses</p> <p>-Rights</p> <p>-Restrictions</p> <p>-Supports collecting spots of land claims</p>	<p>-Uses satellite images, aerial images, and topographic maps</p> <p>Community engagement</p> <p>-Inclusiveness</p> <p>-Participatory mapping</p> <p>-Helps to mitigate conflict over</p>	<p>Available</p> <p>-Computers are needed</p> <p>-GIS software is needed</p> <p>-Ground truthing is needed.</p>	<p>SmartLandMaps - From Customary Tenure to Land Information Systems (Degbelo et al., 2021)</p> <p><a href="#">Home   SmartLandMaps</a></p> <p><a href="#">SmartLandMaps:</a></p>



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	<p>the community</p> <ul style="list-style-type: none"> <li>-SmartLand Map's cloud environment</li> <li>-Automated feature extraction</li> <li>- GIS software</li> <li>- Computer vision techniques for sketches digitisations</li> </ul>				<p>maps to gather spatial information.</p> <ul style="list-style-type: none"> <li>-Geographical features from sketches</li> </ul>	<p>Captures local spatial Knowledge</p> <ul style="list-style-type: none"> <li>-Collects information on rights, restrictions and responsibilities from the community.</li> <li>-Transparency of collected data.</li> </ul>	<p>lands.</p> <ul style="list-style-type: none"> <li>-Based on Community's discussion.</li> <li>-Mapping knowledge is required.</li> <li>-Information could be sketched and drawn in a white cloths or paper sheets if there is no printer</li> </ul>		<p><a href="#">From customary tenure to land information systems – University of Twente Research Information (utwente.nl)</a></p> <p>(Stöcker et al., 2022)</p>
4.SmartSkeMa	<ul style="list-style-type: none"> <li>- sketching and tracing through a cross-platform tool.</li> <li>- Applies through computer vision and artificial intelligence</li> <li>-Automatic digitisation of the</li> </ul>	-Communities and indigenous people	<ul style="list-style-type: none"> <li>- Rwanda</li> <li>-Ethiopia</li> </ul>	<ul style="list-style-type: none"> <li>-Requires A1 or A0 Size sheet</li> <li>-Flexible data accuracy based on the community</li> <li>-Scalable</li> </ul>	<ul style="list-style-type: none"> <li>-Digitisation of hand-drawn maps</li> <li>-Detection of different feature types based on the visual language of symbols</li> <li>-Supporting</li> </ul>	<p>Capturing local language terms</p> <ul style="list-style-type: none"> <li>-Supporting different terms for the same notion.</li> </ul> <p>Building a traditional ontology</p>	<p>Hand-drawn sketches</p> <p>Community involvement</p> <p>Includes SVG editor to edit, draw, delete a drawn object.</p>	<p>Available</p> <ul style="list-style-type: none"> <li>-A computer is needed</li> <li>- Knowledge of ontology is needed</li> <li>-A packaging</li> </ul>	<p><a href="#">SmartSkeMa: Scalable documentation for community and customary land tenure – University of Twente Research Information (utwente.nl)</a></p> <p>SmartLandMaps - From Customary</p>

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	<p>sketch map</p> <p>-A base map is used to project data into the Cartesian coordinate reference system.</p> <p>-Relative positioning is used for a blank paper sketch.</p> <p>Inputs from scanned or photographs images.</p> <p>Transform non-spatial information attributes to geo-referenced data.</p> <p>-Transforms the polygons of the sketch map into a coordinate system.</p> <p>Capture the qualitative spatial</p>			<p>accuracy</p> <p>Digitalized images in SVG format.</p>	<p>the association of land tenure relations with mapping features</p>	<p>Capturing statements made by community members</p>		<p>tool is needed (Docker tool)</p> <p>-Scanner</p> <p>-GCPs are required</p>	<p>Tenure to Land Information Systems (Degbelo et al., 2021)</p> <p>Local Domain Models for Land Tenure Documentation and their Interpretation into the LADM (M. Chipofya et al., 2020).</p> <p>(Karamesouti et al., 2018)</p>
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	<p>description</p> <p>Recognises symbols drawn by the sketchers.</p> <p>Adaptor model to capture social and cultural knowledge.</p> <p>Using query to align drawn sketches with specific scenario</p>								
5.Cadasta	<ul style="list-style-type: none"> <li>- Mobile and web-based tools</li> <li>-Supports users to document, map, manage, store, and analyse land rights data</li> <li>-Supports creating land use plans for countries</li> <li>-Create 3D data for assessment</li> <li>-Helps the establishment of</li> </ul>	<ul style="list-style-type: none"> <li>-Vulnerable and marginalised communities</li> <li>-Indigenous group</li> <li>-Pastoralists</li> <li>-Customary groups</li> </ul>	<ul style="list-style-type: none"> <li>-Kenya</li> <li>-Bangladesh</li> <li>-Uganda</li> <li>-Brazil</li> <li>-Peru</li> <li>-India</li> <li>-Colombia</li> <li>-Haiti</li> <li>-Nigeria</li> <li>-Zambia</li> </ul>	<ul style="list-style-type: none"> <li>-High-resolution image</li> <li>-Multiple base maps</li> <li>-</li> </ul>	<ul style="list-style-type: none"> <li>-Collects spatial information about households data</li> <li>-Mapping and documenting forests</li> <li>-Documents women's land rights</li> <li>-Using tools for geolocating communities'</li> </ul>	<ul style="list-style-type: none"> <li>Managing forest information</li> <li>Managing community land tenure information.</li> <li>Building a system for reporting a natural disaster</li> <li>-Collects property rights data.</li> </ul>	<ul style="list-style-type: none"> <li>-Participatory approach</li> <li>-Uses custom reports</li> <li>-Supports survey data reporting</li> <li>-Web app builder</li> <li>-Needs capacity building</li> <li>-Supported by ESRI GIS</li> <li>-Community</li> </ul>	<ul style="list-style-type: none"> <li>-Available</li> <li>-Not open source (needs Arc GIS)</li> </ul>	<p><a href="https://cadasta.org/">https://cadasta.org/</a></p>

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	<p>use data for natural resources management.</p> <ul style="list-style-type: none"> <li>-Dashboard</li> <li>-Creating an accessible and transparent land tenure system.</li> <li>-Multiple data layers</li> <li>-Multiple data types</li> <li>-Data storage</li> <li>-Supported by Esri's GIS mapping Software.</li> </ul>				boundaries	<ul style="list-style-type: none"> <li>-Creates community reports.</li> <li>Surveys for advocate</li> </ul>	<p>controls the data</p> <p>Documentation of forest rights.</p> <ul style="list-style-type: none"> <li>-Handheld GPS units are needed for collecting data</li> <li>-Tablets</li> <li>-Drone imagery</li> <li>-Flexible data types</li> </ul>		
6.Smartphone app (Esri's collector for ArcGIS)	<ul style="list-style-type: none"> <li>-Based on polygons rather than boundaries.</li> <li>-Processes the data in the cloud-based geographic information system</li> <li>-Satellite images</li> </ul>	Communities in customary areas	Northern Ghana	<p>Satellite image scale 1:4000</p> <p>-Accuracy obtained from the app itself</p>	Polygons of parcels	<p>Information association:</p> <ul style="list-style-type: none"> <li>-Names of landholders.</li> <li>-Family holder.</li> <li>-Customary freeholder.</li> <li>-Occupier.</li> <li>-Crops</li> <li>-Seasonal use</li> <li>-</li> </ul>	<ul style="list-style-type: none"> <li>-Visualises the data in a cloud-based geographic information system.</li> <li>-Community participation</li> <li>-Can be attainable.</li> <li><b>Reliable:</b></li> <li>- Coverage of</li> </ul>	<ul style="list-style-type: none"> <li>-Available</li> <li>-Affordable</li> <li>-Commercial software</li> <li>-Supports the use of GNSS receiver and</li> </ul>	Participatory Land Administration on Customary Lands: A Practical VGI Experiment in Nanton, Ghana (Asiama et al., 2017)

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							different land tenure types -The ability to collect as many as land parcels in the area of interest.	Bluetooth connection	
7.Field Survey App	<p>A mobile application connected with handheld GPS.</p> <p>-Captures all types of land relations</p> <p>-Creates nationwide cadastre coverage</p> <p>-Displays the orthophoto of the study area.</p> <p>-Support additional base data for supporting the data collection methods</p> <p>-Collects coordinates</p>	<p>Communities</p> <p>Neighbours</p> <p>Family members</p> <p>Local authority</p>	Colombia	<p>Flexible accuracy based on the stakeholder needs</p>	<p>Surveys boundaries using the app</p> <p>-links parties and people tenure relations (spatial units)</p> <p>-Associates completed boundaries with people to land relations.</p>	<p>Collect all data elements and associated constraints.</p> <p><b>-Stores different types of rights:</b></p> <p>-ownership</p> <p>-possession</p> <p>-occupation</p> <p>-informal</p> <p>-disputes</p> <p>-Captures and stores personal id and personal documents</p> <p>-Uploads official documents</p>	<p>A mobile application connected with handheld GPS.</p> <p>-Visualises the calculated area size on the screen</p> <p>-Data collection could be online or offline</p>	<p>-Available</p> <p>- Commercial</p> <p>-ArcGIS software is required</p>	<p><a href="#">Field Data Collection App for Mobile Workers   ArcGIS Field Maps (esri.com)</a></p> <p>Designing all-inclusive land administration systems: A case study from Colombia (Morales et al., 2021)</p>

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						such as deeds or titles			
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