Fit-For-Purpose Land Administration and the Framework for Effective Land Administration in Chad

Eva-Maria UNGER, Austria; Rohan BENNETT, Australia; Mahamat Abdoulay MALLOUM, Chad; Christelle VAN DEN BERG, the Netherlands; Claudia STÖCKER, Germany; Kaspar KUNDERT, Rwanda; Dina NAGUIB, Egypt; Markus KOPER, Germany; Divyani KOHLI, the Netherlands; Mila KOEVA, the Netherlands;

Key words: FELA; FFPLA; Chad; Cadastre

SUMMARY

The Republic of Chad's land administration system faces many challenges related to the implementation and management of its conventional surveying, mapping, and recording approaches. This situation results in land conflicts, non-productivity of agricultural land, uncontrolled urban development and hinders Chad's development more generally. As in other Francophone countries in Africa, Chad's land legislation dates back to 1967 and the body of law is poorly applied. This is reflected in the resurgence of land conflicts in both urban and rural areas and is also reflected in the low number of existing land titles. The paper outlines the findings and conclusions of the 'Improving Land Administration in Chad' project, that a team of the international arm of Netherlands' Cadastre, Land Registry and Mapping Agency, SmartLandMaps, Esri North Africa and Trimble together with the Ministry of Spatial Planning, Housing Development and Urban Planning (MATHU) conducted in N'Djamena, Chad. There the Fit-For-Purpose Land Administration approach was applied to demonstrate practical ways to increase tenure security in the country. To take this case study further the Framework for Effective Land Administration is used to identify key issues to be addressed in future implementations. The paper is divided into six parts. First a short introduction on the context of Chad is provided. Second a brief overview of the methodologies used is presented. Third, an outline of the activities that were conducted in the case study are described, which is followed by an overview of the different methodologies demonstrated in Chad. This overview then leads into an analysis that is using the Framework for Effective Land Administration to identify key issues that can guide further piloting in Chad. This is followed by a short conclusion summarising the main takeaways.

SUMMARY / Résumé

L'administration foncière de la République du Tchad est confrontée à de nombreux défis liés à la mise en œuvre et à la gestion de ses méthodes conventionnelles d'arpentage, de cartographie et d'enregistrement. Cette situation favorise les conflits fonciers, l'improductivité des terres agricoles, le développement urbain incontrôlé et entrave le développement du Tchad en général. Comme dans d'autres pays d'Afrique francophone, la législation foncière

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tchadienne date de 1967 et le corpus juridique est mal appliqué. Cela se traduit par la résurgence de conflits fonciers dans les zones urbaines et rurales et par le faible nombre de titres fonciers existants. Ce document présente les résultats et les conclusions du projet "Améliorer l'administration foncière au Tchad", mené à N'Djamena, au Tchad, par une équipe composée de la branche internationale de l'Agence néerlandaise du cadastre, du registre foncier et de la cartographie, de SmartLandMaps, d'esri et de Trimble, en collaboration avec le ministère de l'aménagement du territoire, du logement et de l'urbanisme (MATHU). L'approche de l'administration foncière adaptée y a été appliquée pour démontrer les moyens pratiques d'accroître la sécurité foncière dans le pays. Afin d'approfondir cette étude de cas, le Cadre pour une administration foncière efficace est utilisé pour identifier les questions clés à traiter dans les futures mises en œuvre. Le document est divisé en six parties. Tout d'abord, une brève introduction sur le contexte du Tchad est fournie. Ensuite, un bref aperçu des méthodologies utilisées est présenté. Troisièmement, un aperçu des activités qui ont été menées dans le cadre de l'étude de cas est décrit, suivi d'une vue d'ensemble des différentes méthodologies démontrées au Tchad. Cette vue d'ensemble conduit ensuite à une analyse qui utilise le Cadre pour une administration foncière efficace afin d'identifier les questions clés qui peuvent guider la poursuite du pilotage au Tchad. Le tout est suivi d'une brève conclusion résumant les principaux enseignements.

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1. INTRODUCTION

The Republic of Chad's land administration faces many challenges related to the implementation and management of its conventional land tenure surveying, mapping, and recording approaches. Cadastral mapping and land registration activities are considered slow and expensive, based on key stakeholder feedback, and also rely on only a few qualified professionals (surveyors) within the country. Without proper land information, land management becomes difficult. This situation means there are land conflicts, non-productive of agricultural land, uncontrolled urban development and hinders Chad's socio-economic development in general.

As in other French-speaking (Francophone) African countries, Chad's land legislation dates from 1967 (Law No. 23/PR/1967 of 22/07/1967 on the Status of State Property, Law No. 24/PR/1967 of 22/07/1967 on the Land Property and Customary Rights Regime, Law No. 25/PR/1967 of 22/07/1967 on limitations on land rights and their implementing decrees), was largely inspired by colonial land legislation (the decrees of 1899, 1900, 1906, 1920, 1932, 1955 and 1956) and is not adapted to local realities. Also, the body of law is poorly applied and is reflected in the resurgence of land conflicts in both urban and rural areas and is also reflected in the low number of existing land titles that are stored and allocated.

To address these policy, legislative, and broader institutional problems, the Ministry of Spatial Planning, Housing Development and Urban Planning (MATHU), set up in December 2018 a commission composed of representatives of several ministries and civil society organisations (CSO) to revise the draft code developed, which was not adopted since 2014, and adapt it to current realities. This process was facilitated by the Food and Agriculture Organisation of the United Nations (FAO) and Oxfam Novib and was funded by the Embassy of the Kingdom of the Netherlands (EKN) in N'Djamena.

Since then, in 2019, the Dutch Ministry of Foreign Affairs launched the 'LAND-at-scale' programme with the aim of contributing to the achievement of the United Nations Sustainable Development Goals (SDGs) by improving the institutionalisation of land tenure and rights in developing countries.

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This paper reviews the results of the case study carried out by Kadaster International in Chad in October 2022. It is divided into six parts. First a short introduction on the context in Chad is presented. Second, the methodology used in this paper is described. Third, the case study with the selected case study areas and collected attributes are presented. The paper then presents an overview of the different FFP LA methodologies applied. Followed by a section that synthesises the case study findings by applying the FELA to formulate key recommendations. Finally, the paper concludes with an overarching summary.

2. METHODOLOGY

Whilst the results presented in this paper stem from experiences in practice, the underpinning work did use a simple case study approach (c.f. Yin, 2014) to guide the work. The case study method is a well-known and often used method conducting research within Land Administration discipline according to (Stubkjær & Cagdas, 2009). Here, the purpose of the case study was: i) understand the local land administration context with a view to supporting practitioner advocacy towards FFP LA amongst Chad land administration stakeholders; and ii) collect inputs and design requirements for future pilots (more in-depth case studies). (Yin, 2014) recommends four stages for a case study methodology: (a) Designing the case study, (b) Conducting the case study, (c) Analysing the case study evidence, and (d) Writing the case report and research implications. This research follows those stages in a rudimentary way. The entire process took place over 18 months, however, the in-field collection lasted only 1-week. It should further be noted that the case study was not aiming to train the local team, but merely demonstrate the approach and to show strengths/weaknesses of different approaches. For this case study, the project team worked with various stakeholders to demonstrate different ways of data collection. It should be noted that there are many other software and hardware providers and that the case study did not recommend any specific approach/software or hardware. Some demonstrations dealt only with spatial data collection, whereas some dealt with both spatial and social/administrative data collection. The second step of the methodology is using the Framework for Effective Land Administration to identify key issues to be addressed in future implementations in Chad. The UN-GGIM Framework for Effective Land Administration (FELA) (UNGGIM, 2020), was endorsed by Member States in August 2020. In this case, it provides a framework for understanding and presenting the challenges and opportunities observed in Chad. Overall, the paper contains lessons, experiences and documentation co-created between Kadaster International and project partners. Inputs are mainly derived from the case study but also from dialogue/interviews, webinars and workshops, report production conducted and developed during the project.

3. CASE STUDY
Following the recommendation by (Yin, 2014) the four stages for a case study (a) Designing the case study, (b) Conducting the case study, (c) Analysing the case study evidence, and (d) Writing the case report and research implications, were applied.

Figure 1: Case study overview

In the first step, ***Planning and Preparation (01)***, the availability of base materials, such as satellite imagery, cadastral maps and hardware, from our stakeholders is investigated. This took place from January to July 2022. A further step, as part of the planning and preparation, is to identify the case study areas. It is important to note that the first site chosen in the 9th district (Kalewa) of N'Djamena, was inaccessible during the month of October because of the exceptional rainy season in 2022. Thus, with the agreement of the Ministry in charge of land, some members of the local team were appointed to propose another site. After investigation, the sites of Lamadji and Sadjéri Koukaye were chosen. Site visits are organized to meet the communities and to investigate if the indented methodologies are feasible. After analysis and mutual agreement, it was agreed to work on both sites for the demonstration of different methodologies.

Figure 2: Case study areas (blue Lamdji, green Sadjéri Koukaye)

Regarding the *Approach (02)*, two main activities should be mentioned here: agreement on the collected attributes and agreement on the demonstrated methodologies within the case study. Hence, first a discussion and agreement on what kind of data (spatial and administrative) data will be collected in the field was needed. Therefore, the team followed the ISO endorsed standard: 19152:2012 the Land Administration Domain Model (LADM) (Lemmen et al., 2015). Step by step, attribute by attribute, was discussed and after agreement amongst the team the attribute was included in the data model for the case study. It is important to note that the agreed attributes only serve demonstration purposes – this is not a proposal for a data model for Chad.

Party	Right	Spatial Unit
• Prenom [text] • Nom [text] • Numero d'identification [integer] • sexe [list: M/F] • Data of Birth [date: dd/mm/yyyy] • Nationality [text] • Representante [Y/N] • Type de personnage [list] • Etat civil [list]	• Type de droit foncier [list] • Source du droit foncier [list] • Pourcentage de propriete (%) • Statut [list] • ID d'unité spatiale	• ID d'unité spatiale • Coordonnees • Nom du collecteur [text] • Methodologie [list] • Utilisation des terres [list] • Confit [Y/N]

Figure 3: Overview of the attributes for the case study

Besides deciding on the attributes also the various values of the attributes were discussed. The case study focused on the demonstration of methodologies around data collection.

This is an overview of the different methodologies that were demonstrated:

 Figure 4: Overview of the different FFP-LA methodologies

Regarding *Awareness (03)* and sensitisation, once the sites were selected, the local team and the consultant organised a two-day awareness-raising activity among the communities. This activity began first with the administrative officials and then with the communities whose sites were chosen. Awareness-raising included multiple steps: inform the local administrations and then inform the community so that they understand the objective, the need for their mobilisation and their participation but also to manage expectations (no recordation solely demonstration

purposes). The communities were very receptive and understood the rationale for the demonstration of different methodologies. In step four special attention and a lot of effort is given into conducting a very basic **Training** to the local team to familiarise them with the tools and conduct some basic **Tool Customisation (04)**. Training includes participatory enumeration, basic understanding on coordinate systems, on handheld GNSS, and on the visible boundary approach. Further the local team are sensitised on different language issues and also on how to conduct interviews with and on behalf of women and vulnerable groups. Tools customisation entails that the tablets with the digital forms are customised, the GNSS Antennas are calibrated to receive the correction signals, etc. The fifth step is formed around **Data Acquisition (05)** and is explained in more detail in section four of this paper. After the data acquisition in the field is finished the **Data Processing** is done. Depending on the methodology different data processing steps had to be taken. Then, in step six, a comprehensive **Data Analysis and Validation (06)** is conducted. This involves the validation during the data acquisition with the interviewee and together with the community after the data analysis. The main purpose of the data analysis in step six is to identify the usability (pros and cons) of each methodology. It should be noted here that no holistic evaluation of each methodology was done during the case study. Step seven in the methodology is the **Presentation of Results (07)** to all relevant stakeholders (local team, leading land agencies, CSOs, NGOs, and donors).

4. FFP-LA Demonstration in Chad

The case study on the different methodologies for collecting spatial and administrative data took place in October 2022 in N'Djamena, Chad. Besides the methodologies, the focus of this case study was on partnership and collaboration amongst different institutions, who are active in the land sector in Chad. Hence the following stakeholders were involved:
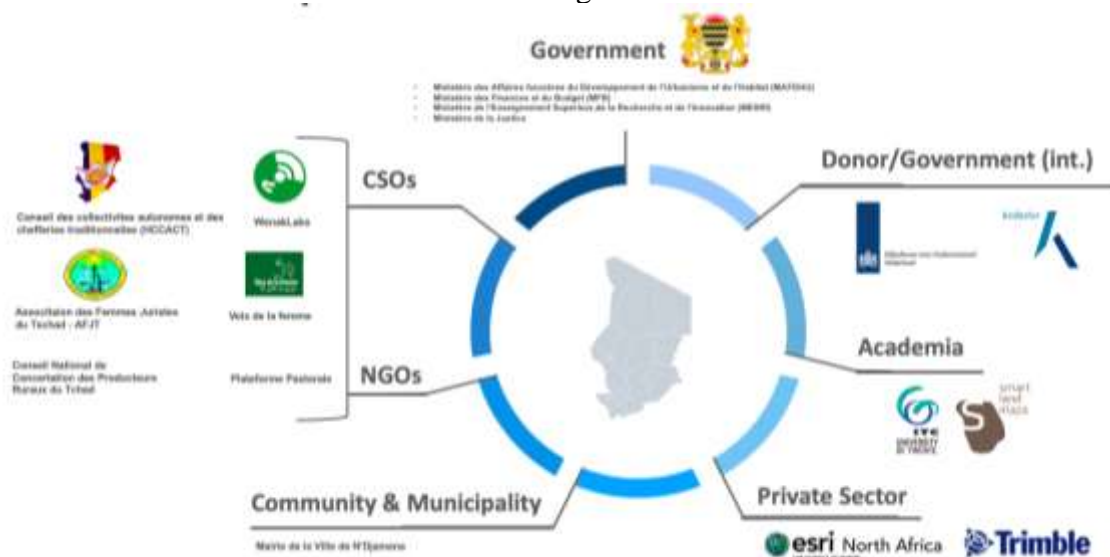

Figure 5: Overview of stakeholders for the case study

Therefore, for the case study, the team organised through Kadaster International was set up, in the following setting:

Facilitation was provided by Mahamat Abdoulaye Malloum (local consultant). Hardware and Software for the data collection was provided by SmartLandMaps (SLM), Trimble and Esri North Africa. ITC (University of Twente) provided an online demonstration. The case study took place in several stages. It is necessary to emphasise that the identification of the field site, sensitisation and demonstration 1 were carried out exclusively by the local team under guidance from the distance through Kadaster International. The other parts of the case study were launched after the arrival of the international team. They took place from 10 to 14 October 2022 in the office and in the field. In terms of process, participants were briefed on the use of the technologies, then headed to the field for data collection demonstrations, before returning to the office for any post-processing work needed, and final wrap-ups.

Demonstration 1: Conventional survey with a total station
A conventional survey with a total station was performed by the local team. This survey served as a baseline for comparison with other demonstration methods. The objective was to demonstrate the advanced skills and knowledge required to complete such a survey. It was carried out by local surveyors. The community leaders as well as people from the communities voluntarily participated.

Demonstration 2 and 3: Participatory mapping
This demonstration involved participatory mapping based on high resolution satellite imagery (HRSI) printed on A0 map sheets. Other background imagery such as classical aerial orthophotos or high resolution UAV-based orthophotos can be used for participatory mapping as well. However, in the case of Chad, it was not possible to conduct UAV flights for this demonstration and no UAV-based imagery could be derived. Nevertheless, the workflow of UAV-based data acquisition was demonstrated and discussed in theory. A comparison of the advantages and disadvantages of the UAV-based approach compared to the classical aerial and satellite approach were discussed. Further it was shown how UAVs can be used to acquire actual high resolution imagery over an area of interest, but also to explain the background, benefits and drawbacks of the different sources of imagery. The main participatory mapping activity consisted of taking the printed satellite images to the field, aiding in map orientation and annotating the boundaries together with community members using the required tools (e.g. standarized pens, labels with object IDs). The attributes were collected separately by the team using an online questionnaire on a tablet (for the SLM approach) and paper (for the paper-based approach). The aim was to show the advantages and disadvantages of using basic imagery and the two different approaches to collect the administrative data. The digitisation was done after the field work through hands on digitising (for the paper-based approach) and automatic digitisation of the annotated maps using the SLM digitization workflow: taking photos of the paper maps, photogrammetric processing, georeferencing and automatic extraction and vectorization of sketched lines through SLM (Stöcker et al. 2022).

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Figure 6: Participatory Mapping with SLM

Demonstration 4: Field Apps with GNSS

This demonstration involved capturing multiple plots using preloaded images in a mobile field app. First, the team setup field apps on the tablets and then went into the field to capture the polygons related to the parcels. For the field apps, different options exist. In this demonstration, we used the following GNSS solutions in combination with applications on mobile Android OS or iOS devices

- Trimble Catalyst DA1 + FieldMap (esri)
- Trimble Catalyst DA2 + PenMap (Trimble)
- Mobile Phone + QField

The Trimble Catalyst GNSS is a real-time-kinematik (RTK) solution. The correction service is provided by Trimble, no need for a base station or Continuously Operating Reference Station (CORS) network. Here are various options available in the market by different manufacturers and providers. While the mobile phone is a simple GNSS solution without correction to improve the accuracy.

Demonstration 5: Automated feature extraction

This demonstration was facilitated from a distance through University Twente ITC. The presentations and applications covered automated feature extraction (AFE) based on different methodological developments and software solutions. The demonstration illustrated open source and commercial tools that can be used to generate an automatically boundaries that after can be further edited and approved or disguarded by the experts only being in office conditions. AFE has been under development for multiple domains. Most notable are infrastructure management in urban areas (e.g. transport, buildings), and agriculture (land use). Since cadastral boundary delineation based on image sources is a challenging problem, the development of new automatic algorithms and experimental projects from variety of software

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has been done in the last years. It was argued that some cadastral boundaries are visible and coincide with natural or human-made physical objects boundaries. Approaches which are imagery based have proved the usability for land titling and recordation of all people-to-land relationships in e.g. Ethiopia and Rwanda. Some studies assert that visible boundaries, such as hedges, fences, roadways, and buildings etc., which might indicate cadastral boundaries, could be automatically extracted using methods based on machine learning. The percentage of visible boundaries can sit anywhere from 70%+ down to 0% in other areas – always depending on the regional context. Within the demonstration of different methodologies, and also in regard to fostering collaboration amongst different institutions, two methods have been tested based on Chad images: 1) open source tool developed under the its4land project (www.its4land.com) and 2) eCongitoion commercial software application (Figure7).
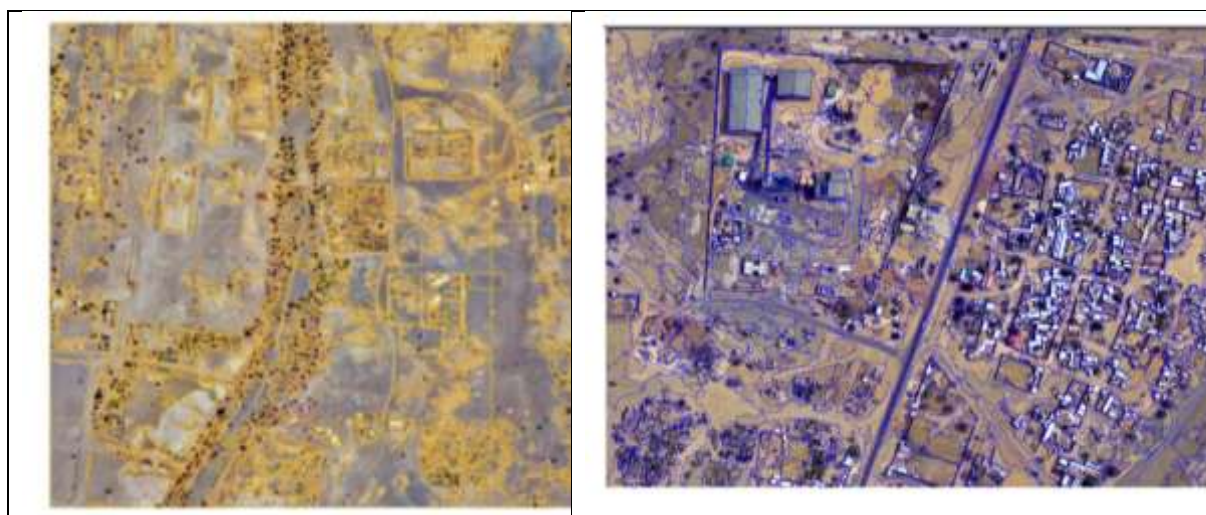

Figure 7: (left) ad Hoc Simulation of Automated Feature Extraction with Its4Land (source: Mila Koeva); Ad Hoc Simulation of Automated Feature Extraction in Chad – with e-cognition (source: Divyani Kohli)

By showcasing all different methodologies, the basic FFPLA methodology diagram as presented in (Lemmen et al., 2020) (then called 'snake' diagram') was updated as follows:

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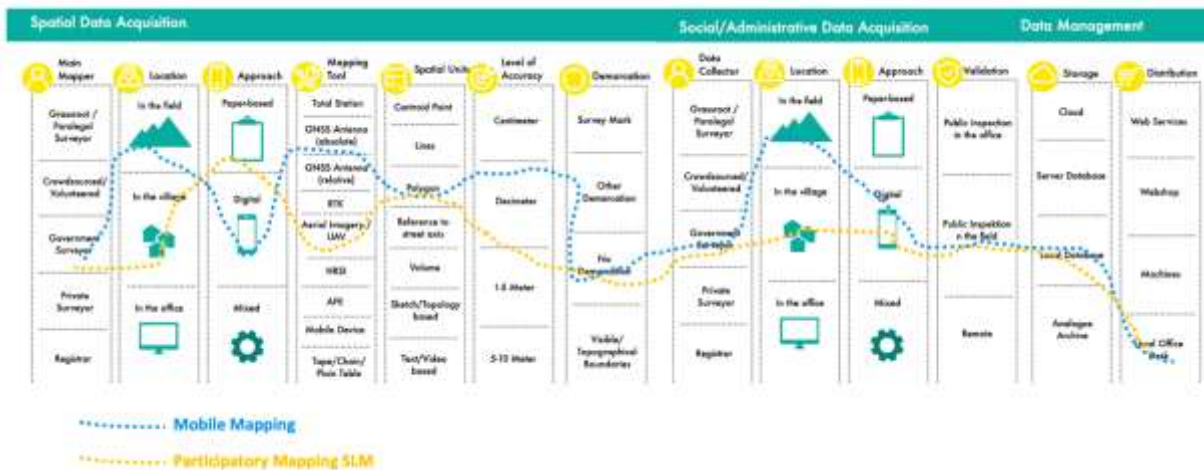Orlando, Florida, USA, 28 May–1 June 2023

Figure 8: Basic FFPLA methodology diagram (adapted from Lemmen et al., 2020)

The updated version shows the differentiation in three categories: Spatial Data Acquisition, social/administrative data acquisition and data management. Like the original 'snake' diagram this diagram is seen as a simple advocacy/awareness tool to explain different options and possible combinations of methodologies. In this figure the indicated paths show the participatory mapping approach by Smart Land Maps and the field apps with GNSS approach. This basic FFPLA methodology diagram was then used to lead the discussion on what kind of approach could work for future pilots in Chad.

5. FRAMEWORK FOR EFFECTIVE LAND ADMINISTRATION

The UN-GGIM Framework for Effective Land Administration (FELA) (UNGGIM, 2020), endorsed by UN Member States in August 2020, provides a framework to promote the documentation, recordation, and recognition of people-to-land relationships in all forms. The FELA references globally accepted concepts and approaches to support the global effort of securing land and property rights for all. In this case FELA is used to assist the understanding of the challenges and opportunities for future piloting in Chad and presenting it in an efficient way. The table as shown in table 1 does not claim to cover all challenges and opportunities but to indicate the ones who seemed most prompting to the authors. FELA was presented and discussed with various stakeholders located in Chad in September 2021. Further, FELA was afterwards used to conduct interviews with those stakeholders. The summary of the interviews included a graphical representation and a textual part. This graphic and the interviews are now enhanced with the lessons learnt from the case study and converted into a table to formulate key challenges and opportunities for future pilots in Chad. At a more specific level, table 1 summarises the key opportunities and challenges relating to each FELA strategic pathway.

Table 1: Opportunities and Challenges for future piloting in Chad

Pathway	Opportunities and Challenges
Governance, Institutions and Accountability	**Political stability** is needed for a holistic transformation towards a sustainable land administration; **Unclear mandates** and **changing leadership** in ministerial posts; **Political will** is existing and can be leveraged **Networks** amongst different ministries established;
Law and Policy	**Absence of Land Policy** (especially for women and nomadic) also causing lengthy processes; **Legal framework** to be in place for piloting/a complete role out in Chad; **International examples** on successful land policies can support developments; Development of policy can consider **lessons learnt** from case study and future piloting;
Finance	**Sustainable business model** for land administration is not existing; **Donor support** in the future is likely; Governmental interest to explore **Public Private Partnerships** is given;
Data	**Available data is segmented and paltry;** **Lack of vision** for data governance and geospatial data strategy across ministries; Developing and implementing **data quality and open data standards;** Establishment of a robust **IT infrastructure;**
Innovation	**Combination of different methodologies** to address the various land realities on the ground envisioned; **Innovation limitations** based on hardware, electricity, connectivity, capacity etc.;
Standards	Lack of **data standardisation** program; **Capacity** around standards;
Partnerships	**Donor-working groups** coordination; **Extension of the network** of partners (NGOs, CSOs, private sector etc.);
Capacity and Education	**Capacity and level of literacy** in specific areas; **Capacity development** programs will be needed for piloting; **Enthusiasm** of the local team; eagerness to learn; Agreement on the need to involve the **local team** in the implementation of future initiatives;
Communications and Awareness	Communication and awareness programs which aim to be nationwide for future piloting can be challenged due to **considerable differences** in terms of perception of land tenure and other social norms; **Monitoring and evaluation indicators** may vary for the pilots **Gender responsive approach** and particular attention to **vulnerable groups** (landless, nomads...);

	Awareness at all ministerial/governmental level that community involvement is imperative; **Awareness for the local community** for ensuring and promoting a participatory approach **Mutual trust** between the local community and the officials/ministries/local team

6. CONCLUSIONS AND RECOMMENDATIONS

This paper stems from the case study that was conducted within the 'Improving Land Administration in Chad' project and leads to key issues to be addressed in future piloting/implementation programs in Chad. The paper presented the different stages of the case study and presented the challenges and opportunities, by using FELA, for future piloting in Chad. Overall, the paper reveals the specific shortcomings in the present land administration system. The impact of the case study and the project in general can be summarised as that government officials and communities in the case study areas are aware of the possibilities of the FFPLA approach and tools to further develop the land administration system in an urban and rural setting in Chad. Chad is making significant progress in terms of awareness and commitment. Whilst there are significant challenges in terms of logistics and political stability, the case study and analysis using the FELA reveal the importance of future piloting as a step towards a holistic approach for Chad.

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BIOGRAPHICAL NOTES

Dr. Eva-Maria Unger works with the international arm of the Netherlands national mapping, land registration and cadastral agency as a Senior Land Administration Advisor. She holds a MSc. in Geodesy and Geoinformation, and a PhD in Land Administration. Eva-Maria was chair of the FIG Young Surveyors Network and initiated the Volunteer Community Surveyors Program (VCSP) supporting the UN-Habitat GLTN's county-level implementation plans and programmes. Dr. Unger completed a secondment with UN-GGIM and is the director of OICRF.

CONTACTS
Dr. Eva-Maria Unger
Kadaster International
Apeldoorn
NETHERLANDS
Email: eva.unger@kadaster.nl
Web site: https://www.kadaster.com/

Dr. Rohan Bennett
Kadaster International
Apeldoorn
NETHERLANDS
Email: rohan.bennett@kadaster.nl
Web site: https://www.kadaster.com/

Mahamat Abdoulaye Malloum
Private Consultant/Socio-historien, Expert en gouvernance foncière.
N'Djamena
CHAD
Email: https://www.kadaster.com/
Web site: https://www.kadaster.com/

Christelle van den Berg
Kadaster International
Apeldoorn
NETHERLANDS
Email: rohan.bennett@kadaster.nl
Web site: https://www.kadaster.com/

Claudia Stöcker
SmartLandMaps
Münster

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GERMANY
Email: claudia.stoecker@mail.de
Web site: www.smartlandmaps.org

Kaspar Kundert
SmartLandMaps
Kigali
RWANDA
Email: kasparjkundert@gmail.com
Web site: www.smartlandmaps.org

Dina Naguib
Esri North Africa
Cairo
EGYPT
Email: dina.naguib@esrinorthafrica.com
Website: www.esri.com

Markus Koper
Trimble Land Administration
Bochum
GERMANY
Email: markus_koper@trimble.com
Website: https://ffp.trimble.com/

Dr. Divyani Kohli,
Faculty ITC, University of Twente
Enschede
The Netherlands
Email: d.kohli@utwente.nl
Website: https://www.itc.nl/

Dr. Mila Koeva,
Faculty ITC, University of Twente
Enschede
The Netherlands
Email: m.n.koeva   @utwente.nl
Website: https://www.itc.nl/

Fit-For-Purpose Land Administration and the Framework for Effective Land Administration in Chad (12242)
Eva-Maria Unger, Rohan Bennett (Netherlands), Mahamat Abdoulaye Malloum (Chad), Christelle van den Berg
(Netherlands), Claudia Stöcker (Germany), Kaspar Kundert (Rwanda), Dina Naguib (Egypt), Markus Koper
(Germany), Divyani Kohli and Mila Koeva (Netherlands)

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