

Fit-for-Purpose Land Administration in Practical Application

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SUMMARY

World Bank and the International Federation of Surveyors (FIG) address the issue of building and sustaining land administration systems that are basically fit-for-purpose rather than blindly complying with top-end technological solutions and rigid regulations for accuracy in various publications over recent years. This concept calls for a flexible and pragmatic approach rather than requirements imposed through rigid regulations, demands for spatial accuracy and systems that may be unsustainable for less developed countries dependent on donor funding. Of course, such flexibility allows for land administration systems to be incrementally improved over time, should it be found necessary.

This paper presents a practical implementation of the key elements of a fit-for-purpose approach: flexible, inclusive, participatory, affordable, reliable, attainable and upgradable. The focus lays on merging the benefits of satellite imagery, automated processing and extracting parcel information, GNSS based ground data collection by professional surveyors and crowdsourcing local communities in an integrated field-to-finish land administration solution. At the end it highlights the need to design the upgradability of the initial implementation into the whole solution from the beginning.

Objective 1: Understand the key elements of a fit-for-purpose solution

Objective 2: Learn how to combine satellite imagery and ground based traditional surveying techniques

Objective 3: See the importance in designing upgradability and quality control of such a system from the start

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1. INTRODUCTION

Tenure security is an important issue for further development of human societies. It influences the economic use of natural resources, willingness to invest, sustainability of agriculture and environmental protection.

According to the report 02/2016 of GLTN and UN-Habitat (GLTN 02/2016) actually exists only in approx. 30 % of all countries an efficient and effective land administration system, able to guarantee tenure security. In these countries there is a need to continuously update the system in order to provide actual data and to comply with demands of the developing society. In countries without efficient land administration system big efforts have to be made to establish such a system. The last 2 - 3 decades proved that requirements for such a system may quite vary in different countries and regions.

This applies for

- contents of databases,
- functionality,
- institutional organization and
- subsequent use of data.

For this reason it is necessary to conceptualise and develop for every country an aligned system according to the circumstances. Such a system is termed since several years as “Fit-For-Purpose Land Administration”.

With the present paper the authors describe the requirements for a Fit-For-Purpose Land Administration and how to implement these in practice. It is referred to a KfW-financed project in Azerbaijan, where in the districts Ganja and Sheki all real estate objects were systematically and completely captured and transferred to the LA-system.

2. GENERAL CHARACTERISTICS OF FIT-FOR-PURPOSE LAND ADMINISTRATION

Land Administration (LA) is responsible for collection, administration and dissemination of data about:

- legal relationships on ownership and property of real estate objects,
- value of land and immovable property,
- land use, immovable property and associated resources.

The Fit-For-Purpose principle means a pragmatic approach for establishing (conceptualization/implementation) of LA. The application of formalities and regulations should not be too rigid. Different accuracies as needed should be possible for geometric data. The system should be designed in a sustainable way and widely independent from donors. The system should

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be designed with simple methods, which can be improved when necessary. It must serve the needs of the people and the society.

In detail we can define following characteristics of a Fit-For-Purpose Land Administration:

- Flexible... Flexibility is expected in many respects: mode of data capture, different ways of ownership, organization of workflows, etc.
- Inclusive... All parcels and real estate objects have to be captured completely. Therefore a systematic data capture (inventory) is required.
- Participatory... It is important to involve all persons concerned in the process (owners, users, neighbors, communal representatives etc.). That improves the legal security of data and acceptance by community members.
- Affordable... Through use of effective methods (CORS, GNSS, aerial photos) and local experts costs should be kept low.
- Reliable... Data capture and administration must be organised in manner to guarantee legal certainty, trustworthiness and actuality.
- Attainable... The design of the system must allow to realize it in a justifiable time period (max. 8 – 10 years) and with reasonable budget (max. 10 – 20 \$US) per parcel.
- Upgradable... After necessary implementation of the system to guarantee tenure security it can be extended any time. That applies the content of the data base, the accuracy of geometrical data, functionality of administrative software and the organization of maintenance.

If all above mentioned aspects are respected while realization of a Land Administration system, we can truly name it Fit-For-Purpose Land Administration.

3. JOINT APPROACH OF GCI & TRIMBLE

GCI and Trimble proved in the past 15 years in various projects, that they dispose of necessary methodologies, technologies and experiences for establishing a Fit-For-Purpose Land Administration system. This is guided by following principles:

- The applied methods and technologies have to be as simple as possible.
- The accuracy of data capture is reduced to a reasonable rate according to the circumstances.
- If different procedures are causing same costs, the more accurate will be used.
- The work is executed as far as possible by local experts. International experts support where no local know-how is available.
- The projects support as well the state and communal institutions as the private sector.
- The legal framework (laws, by-laws) is further developed as far as necessary.

GCI and Trimble follow the principles of Fit-For-Purpose Land Administration in the projects they support.

3.1 Flexibility

Depending on the required accuracy, financial frame conditions, vegetation and available infrastructure different technologies for data capture are in use.

Generally boundaries of parcels are determined and surveyed in the field. If the country runs already a CORS, the boundaries are surveyed with GNSS-receivers in RTK-mode. The results are directly transferred to a field computer, displaying in the background orthophotos or satellite images. The evaluation of the boundary and building survey is done immediately in the field with Penmap[®] software.



Fig. 1: Survey of boundary with GNSS

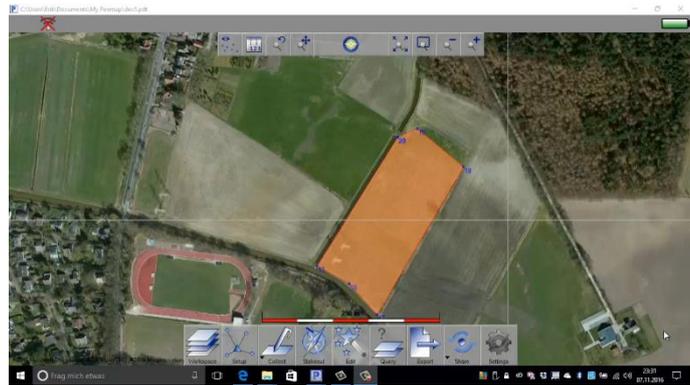


Fig. 2: Data capture software Penmap[®] on field - computer

If no CORS is available, Trimble receiver with RTX-technology can be used. These receivers allow establishing temporary fix points, using Trimble RTX-service and after sufficient initialization time to survey points in RTK-mode. The absolute accuracy is a few centimeters. Alternatively the detailed surveys can be made using temporary fix points with the known base-rover methodology. Boundaries and topographic surveys demanding less accuracy can be digitized from the digital background orthophotos and controlled through survey of selected points. This applies for example for boundaries of forest and pasture land, for boundaries of water bodies and for boundaries between different land use. If no aerial photos are available, they can be taken fast using UAVs.

It shall be stressed, that ownership boundaries with demand for higher accuracy (in urban areas, boundaries of small scale agricultural plots) must be identified and surveyed in the field under presence of owners and their neighbors. In most cases these ownership boundaries can't be identified on the aerial photos without a doubt. The following pictures illustrate this fact clearly.



Fig. 3: Orthophoto with agricultural plots

Bild 3: Orthophoto mit Feldern



Fig. 4: Orthophoto with plots and boundaries

Bild 4: Orthophoto mit Feldern und Grenzen



Fig. 5: Orthophoto with village



Fig. 6: Orthophoto with village and Boundaries

The used surveying systems have an integrated laser distance meter. This allows surveying also such points that can't be surveyed directly with the GNSS-rover, using indirect methods like intersection or extension. Alternatively electronic tachymeter can be used in areas of dense construction or vegetation.

3.2 Inclusive

While establishing a modern Land Administration it is convenient to proceed systematically and comprehensively. Even if legal questions like ownership, possession or use rights cannot be solved immediately on the ground, a systematic and area-wide inventory of all real estate objects makes sense. The method is low priced related to costs per object. A comprehensive data base is established, serving not only for tenure security but also for other tasks of Land Management.

The extent and grade of details of semantic data to be captured has to be chosen carefully. On the one hand comprehensive and detailed data allow manifold usage of the data. On the other hand the

time and effort for first establishing the Land Administration is increased significantly, that has to be avoided.

3.3 Participatory

For acceptance of Land Administration by the community members it is important to keep the process of establishing and maintenance of the system transparent. Before starting the systematic data capture the local authorities and the population has to be informed comprehensively. Therefore public events, reports in the television and local print media, information in the internet, placards and flyers are convenient. The benefit of Land Administration for owners and users has to be emphasized. So the confidence and support of the population can be gained.



The support of the owners is indispensable during determination of boundaries and capture of semantic data.

Fig. 7: Determination of a boundary

3.4 Affordability

During conceptualisation of projects to establish Land Administration it has to be considered to keep the costs within an acceptable frame. Due to this following measures are taken:

- Surveying and data capture is done systematically and area-wide in regions or the whole country.
- The creation of necessary framework conditions (CORS, digital orthophotos, development of modern software) requires an appropriate initial investment. If the projects are big enough the costs per real estate object can nevertheless be kept low.
- The predominant part of the work is executed by local experts. If there is not enough qualified personnel available, people are trained with adequate trainings for 1 – 2 month. International experts support public awareness campaigns, development of required software, quality assurance and the further development of the legal framework. They support only those tasks where the necessary local know-how is not sufficient.

- For data capture, data processing and data administration software solutions based on Open-Source products or adaptable commercial solutions for the respective application are chosen. That reduces the costs for software systems considerably.

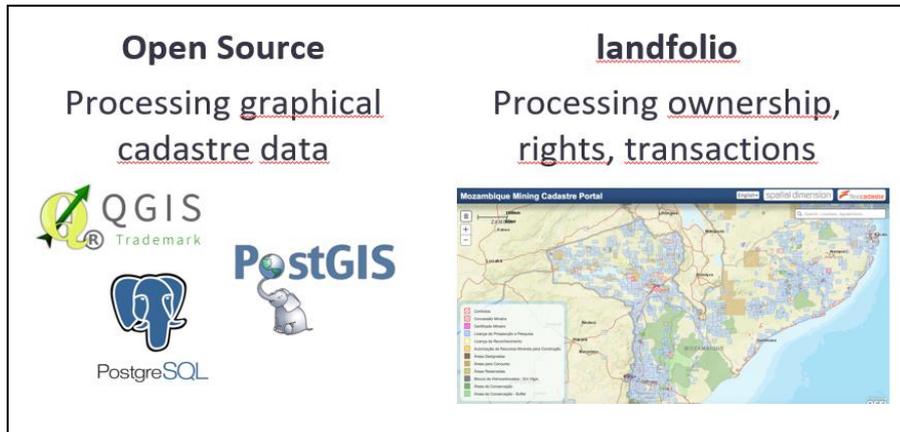


Fig. 8: Technologies for data handling

- Whenever possible, available data and documents are evaluated and considered for data capture. As a matter of course the actuality and correctness of those data has to be checked and confirmed without a doubt.

3.5 Reliability

The reliability of data is guaranteed through different measures:

- The owners and neighbors are invited to the boundary determination, before the boundary marks are surveyed.
- Existing documents, e.g. from land reforms are compared to the actual situation in order to preclude eventual illegal occupation specifically of communal or state land.
- The owners have to legitimize themselves in the frame of the local boundary determination in order to be able to prove their legitimate participation in the process. For legitimization photos of all participants are taken, from their IDs photos can be taken and digitally assigned to the persons, fingerprints can be scanned or eyes (iris) can be scanned biometrically.



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Fig. 9: Fingerprint scanner

- The results of the cadastral survey are publicly exposed to enable the affected people to check the results. Aerial photographs are displayed in the background to facilitate them the understanding and interpretation of the maps.
- The owners and beneficiaries have the opportunity to object against the results. After decision on the objection the way to start legal proceedings is free.
- As metadata the methods of point determination, the instant of time and executors of all boundary points and real estate objects surveys are captured and recorded. When using modern data capture devices that means no extra effort. The benefit for increasing legal security in cases of boundary conflicts is obvious.

3.6 Attainability

The most important aspect for conceptualization and implementation of Land Administration is the realization within an appropriate budget and an appropriate time-frame. In practice experiences show that the costs per parcel/ real estate object are between 5 to 20 \$US. This depends very much of the wage level in respective countries. The availability of cost intensive prerequisites like CORS and digital orthophotos is also relevant. It is important to illustrate always the benefit for the individuals as for the whole society compared to the costs.

With regard to the time factor it can be stated that the time frame for establishing a Land Administration in a greater region, e.g. economically strong provinces, is minimum 3-5 years. The creation of the infrastructure (CORS, digital aerial photos, building of local resources in the state and private surveying sector, further development of the necessary legal framework) takes appropriate time. Through clever organization some processes can be realized in parallel and the overall duration of the project can be shortened.

To establish Land Administration in a whole country, we can figure with a time frame of 6-10 years. It will be difficult to realize it faster, but it shouldn't take longer.

3.7 Upgradeability

If expecting to implement a LA-system within an appropriate time-frame with adequate costs not all possible contents and functionalities can be realized. One has to concentrate and reduce to the necessary and feasible features. Only this way the system can be made serviceable. The most important functions with highest priority are the data for tenure security, land use planning, development of infrastructure and taxation. Those contents should be dealt with in the first phase.

Concurrently this has as a consequence that the system should be further developed in a later stage to serve the needs of a developing society in a better way.

Such further developments can be:

- higher accuracy of geometric data,
- detailed semantic data e.g. for real estate objects,
- additional information,

- better means of access for users.

Additionally the administrative procedures must be organized in a manner that new ownership or use rights are promptly and inevitably registered in the data sets of LA. For example new parcels, originated through division, should be registered with new legal relationships only after surveying and taking over into the real estate cadastre. That assures the permanent actuality of all data.

4. SUSTAINABILITY OF LAND ADMINISTRATION

All aspects mentioned in chapter 3.1 to 3.7 have to be considered for establishing a Fit-For-Purpose Land Administration in order to achieve the desired sustainability. Additionally following principles apply:

- Local capacities have to be build up after realization of the implementation phase in order to enable national authorities for later maintenance with local resources.
- Data models and software solutions must be further developed and be adapted to developing needs of users.
- After the initial phase the costs for further development of the LA-system should be covered by own revenues for provision of data at least for the most part.
- The reputation and importance of the respective authorities and service providers increase only if data of the LA-system can be provided to a large extent to state and private users. This implies an increasing demand for data of the LA-system and the social appreciation of Land Administration increases. That is the best prerequisite for sustainable Land Administration in the respective countries.

REFERENCES

GLTN 02/2016: GLTN and United Nations Human Settlements Program UN-Habitat; Report Fit-For-Purpose Land Administration - Guiding Guidelines for Country Implementation; HS Number: HS/099/16 E2/2016; Nairobi Kenya.

BIOGRAPHICAL NOTES

Dr. Gernod Schindler started his career after his studies of Geodesy in Moscow in a research center for modern surveying technologies in Leipzig / Germany in 1982. In 1993 he became a publicly chartered surveyor in Saxony (Germany) and founded his own surveying office to provide his services in the fields of cadastral surveying and land regulation. Based on his deep knowledge in land administration and land management Dr. Schindler founded the company GCI - Geo Consult International in 1995 to participate in various land management and land administration projects. Since 1994 he worked as a short term expert with different responsibilities in project management (concept of projects, implementation, monitoring, reporting, backstopping) in the fields of cadastre, registration of real estate property and GIS / LIS in many development projects. Additionally he gained high competence in business administration, staff management, staff training, quality management and finance controlling.

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Personally he provided technical services to a wide range of bilateral and multilateral donor-funded projects as in Georgia, Azerbaijan, Mongolia, Namibia, China, Romania, Bosnia and Herzegovina, Ukraine, Russia, Slovakia, Montenegro, Kosovo and Turkmenistan.

Erik Schütz is managing director of HHK Datentechnik GmbH in Braunschweig, Germany. He holds a master degree in geodesy of Technical university in Dresden, Germany. For over 20 years Erik is motivated by a vision to bring high-end surveying technology to the hands of everyone by bridging the gap between expert surveying hard- and software and traditional drawing techniques. Erik started his career as a GPS product manager and later marketing director with Carl Zeiss, Germany before moving to Colorado working for Trimble in various roles. In 2008 he founded Penmap to implement his idea of such a technology for a wide-range audience.

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