

Cadastre 2014: A Vision for Future Cadastral Systems

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SUMMARY

A quickly growing world population leads to increasing utilization of natural resources and impacts on environment. The absolute control over his parcel the land owner used to have, is increasingly restricted by public regulations enacted in the interest of the society. The localization and the implementation of these regulations are not always fulfilled with the necessary care. The documentation is often insufficient and not open to the public. This implies the danger of arbitrariness.

Modern cadastres, as outlined in the publication 'Cadastre 2014; A Vision for A Future Cadastral System' will be the future tools to handle the aspects of land appropriate. They create a model of the entire legal situation of land. Future cadastral systems will be public inventories of data concerning all legal land objects in a country and they provide legal security for the handling of regulations based on public law.

Modern cadastres play the role of bookkeeping systems of land matters. Like commercial account systems, they are obeying internationally acknowledged principles of keeping records and they can be adapted to the needs of the different societies and legislations.

It is self-evident, that such modern cadastral systems can only be managed with the help of information technology and a fruitful public-private partnership.

Reliable data provided by modern cadastral systems will strongly support political decision-making and sustainable development.

1. ABOUT FIG

FIG, the International Federation of Surveyors, was founded in 1878 in Paris. It is a federation of about 100 national associations and is the only international body that represents all surveying disciplines. It is an UN-recognized non governmental organization (NGO) and its aim is to ensure that the disciplines of surveying and all who practice them meet the needs of the markets and communities that they serve. It realizes its aim by promoting the practice of the profession and encouraging the development of professional standards.

FIG's activities are governed by a plan of work, which is regularly reviewed against a longer term strategic plan. The current plan of work focuses on the surveyor's response to social, economic, technological, and environmental change and the particular needs of countries in economic transition. FIG also recognizes that markets for surveyor's services are constantly changing. The plan accordingly lays emphasis on strengthening the professional institutions; promoting professional development; and encouraging surveyors to acquire new skills and techniques so they may be properly equipped to meet the needs of society and the environment.

1. ENVIRONMENT FOR THE DEVELOPMENT OF CADASTRE 2014

1.1 General Developments

The world, its different cultures, and its political and economic systems are in a permanent development process. This process is driven primarily by the activity and the creativity of humankind. New medical and technical possibilities have impacts on life, on the way of living, and on the way of doing business. One effect of this development is the growth of the world's population. More and more people are to be provided with food and water, housing, household and transport equipment, energy, etc. An increasing number of people are demanding leisure activities and facilities. The demand for waste removal, water cleaning, and recycling materials is increasing.

This development leads to an increase in the consumption of natural resources, particularly of land. It has been acknowledged that disorganized consumption of natural resources will lead to a degradation of nature, of the natural world, of the environment, and finally of humankind. Efforts are being made to encourage sustainable development. That means that development should be undertaken in such a way that a minimum of resources are consumed. It is the main goal of Agenda 21 to improve awareness of and introduce measures for a sustainable development of humankind in harmony with the environment.

As land is an important part of nature and the environment is the basis for nutrition, housing, energy production, resource exploitation, leisure activities, waste disposal, economic activities - in short for the

maintenance and survival of humankind - cadastres are a crucial aspect of sustainable development. Traditional cadastre systems, however, can no longer meet the high standards set by sustainable development. There is a need to adapt the currently successful operating cadastral systems to the new standards and to implement improved cadastral systems where no such infrastructure exists. This is one reason for the many ongoing cadastral reforms and efforts in the world. Unfortunately the changes are often not rigorous enough and a lot of human resources and financial means are invested with questionable results.

1.2 Role of Land Administration and Cadastral Systems

To be able to use land and natural resources in a sustainable manner comprehensive Land Management is necessary. Land management must base on Land Administration which is defined as 'the processes of determining, recording and disseminating information about the tenure, value and use of land when implementing land management policies'. For Land Administration access to a reliable bookkeeping system is indispensable. The cadastre plays the role of this bookkeeping system.

Level	General Business	Global Development Business
Strategic (goal setting)	Sound economic development	Sustainable development
Management (measures to meet strategy)	Company management	Land management (resource management)
Administrative (business processes)	Administrative unit	Land administration
Operation (tools for documenting and monitoring)	Accounting system <ul style="list-style-type: none"> • accepted principles of bookkeeping • reliable • complete • appropriate to needs • adaptable to development 	Cadastre <ul style="list-style-type: none"> • accepted principles of documentation of rights/restr. • reliable • systematic • appropriate to needs and laws • adaptable to development • public

Figure 1: Role of Land Administration and Cadastre in the business process

Like the successful operation and development of a business is based on a well developed financial administration system the sustainable development of humankind must be supported by a complete land administration system (Figure 1). Like in a financial administration system, the land bookkeeping must obey clearly defined rules that are valid worldwide in principle, and may be adapted in detail to accommodate national and cultural peculiarities.

Future cadastral systems will provide this bookkeeping function to support decision-making and sustainable development. The principles of a

cadastre are acknowledged world-wide. The details can be adapted to meet the needs and traditions of a particular country. Land management needs reliable information about the existing land and its resources and about the legal situation of these items. This information will be provided by future cadastral systems. Cadastres will be the basis for land administration systems that will support the world's hopes for sustainable development.

2. DEVELOPMENT OF CADASTRE 2014

2.1 Terms of Reference and Result

FIG, aware of the need for change in the cadastral domain and of the efforts in cadastral reform, initiated at the Melbourne 1994 FIG Congress by its Commission 7 the Working Group 7.1. The terms of reference for this Working Group were to:

Study cadastral reform and procedures as applied in developed countries, take in consideration automation of the cadastre and the role of cadastre as part of a larger land information system, evaluate trends in this field and produce a vision of where cadastral systems will be in the next twenty years, show the means with which these changes will be achieved and describe the technology to be used in implementing these changes.



A VISION FOR A FUTURE CADASTRAL SYSTEM

Jürg Kaufmann • Daniel Steudler
with the Working Group 1 of FIG Commission 7



July 1998

Figure 2: Cover of the publication on Cadastre 2014

The result of this work was published as a brochure with the title 'Cadastre 2014, A Vision for a Future Cadastral System' [Kaufmann, Steudler, 1998]. (Figure 2). It was presented 1998 at the FIG Congress in Brighton.

Since 1998, the brochure was translated into more than 20 different languages. In 2001 FIG had to provide a second edition because the first was sold out.

2.2 Information Collection

Working Group 7.1 studied the existing literature and the experience being gained in ongoing cadastral projects and had close contacts with the Office Internationale du Cadastre et du Registre Foncier, OICRF, an institute of FIG. These studies gave a clear view of the role and principles of cadastre and the importance of the security it provides for the coexistence and economic activities of humankind. Economic development on the basis of a functioning land market is only possible when land matters are settled in a legally correct way and within a secure legal environment. We also found that the traditional principles are proven and true and must be the basis for modern cadastres.

A wide-spread survey of existing cadastral systems and the reasons and aims of the ongoing cadastre reforms, and a second enquiry into the development of privatization and cost recovery in the different cadastre institutions, were carried out and the results documented in the brochure.

2.3 Development of the Vision for Future Cadastral Systems

Based on this input we were able identify the deficiencies of existing cadastres and the trends in development.

It became clear that the documentation and registration of private land rights does not provide enough information to assemble a complete picture of the legal situation of land. The legal environment has changed remarkably in the last few decades. Societies introduced new legislations under public law in the interest of a careful utilization of land and other resources. New laws concerning physical planning, protection of the environment, and the exploitation of limited natural resources emerged.

This process is going on and it can be considered as a fact that further legal regulations will and must be implemented.

All these regulations on one hand touch the absolute rule of the land owner, on the other hand create an unclear legal situation of land. This may in a medium term threaten the land market and hinder a sustainable development. Legal uncertainty can change the role of land being one of the most important instruments to provide economies with loans secured by mortgages. In Switzerland more than 60% of loans in a value of about 540 billion Swiss Francs are secured by land. This situation is similar in other countries and also in the EU.

Our investigations showed that services from cadastral systems are expected to be more efficient and comprehensive as they normally use to

be and assessing the technological development we saw the new promising possibilities of the information and sensor technology.

This resulted in the thesis that modern cadastral systems must be designed to be able to:

- give reliable and complete information on the legal situation of land by taking into consideration all legal impacts on land;
- adapt to the changing needs of societies by flexible organizations and well defined information structures and data models;
- work straight forward and efficiently by making use of appropriate technology;
- achieve best practice and flexibility by bundling the strengths of the public and private stakeholders;
- be run at minimum cost for citizens and communities.

To meet these requirements the principles for modern cadastral systems were developed.

3. PRINCIPLES OF CADASTRE 2014

3.1 New definitions

Cadastré 2014 applies the proven principles of the traditional cadastré but enlarges the objects to be processed by the cadastré and the content of cadastral systems.

Traditional Definition	Definition of Cadastre 2014
Land Parcel A land parcel is a piece of land with defined boundaries, on which a property right of an individual person or a legal entity applies.	Land Object A land object is a piece of land in which homogeneous conditions exist within its outlines. The legal land objects are described by the legal content of a right or restriction and the boundaries which demarcate where the right or restriction applies.

Figure 3: Definition Land Objects

The new objects to be processed are the land objects. Land parcels are one category of land objects (Figure 3).

Traditional Definition

Cadastre

Cadastre is a methodically arranged public inventory of data concerning **properties** within a certain country or district, based on a survey of their boundaries.

Definition of Cadastre 2014

Cadastre 2014

Cadastre 2014 is a methodically arranged public inventory of data concerning all **legal land objects** in a certain country or district, based on a survey of their boundaries

Figure 4: Definition Cadastre 2014

The new cadastre shall comprise not only the land parcels but all land objects in a defined area (Figure 4).

3.2 Statements on Cadastre 2014

These definitions are the bases for the first of the six statements on Cadastre 2014:

Cadastre 2014 will show the complete legal situation of land including public rights and restrictions!

Every piece of legislation concerning spatial matters defines legal land objects. All these land objects are to be carefully defined, verified, and kept in a public register.

Otherwise the legal security which is important for governments and administrations, economies, private persons, and land owners will not be guaranteed.

Lacking legal security leads to uncertainty, lack of confidence, disorder, and finally chaos. This means that citizens lose confidence in their country's institutions, the land market as an essential part of the economy ceases to function, business becomes weak, and the whole system can crash. We can see such effects in different regions of the world. The actual situation is characterized in figure 5.

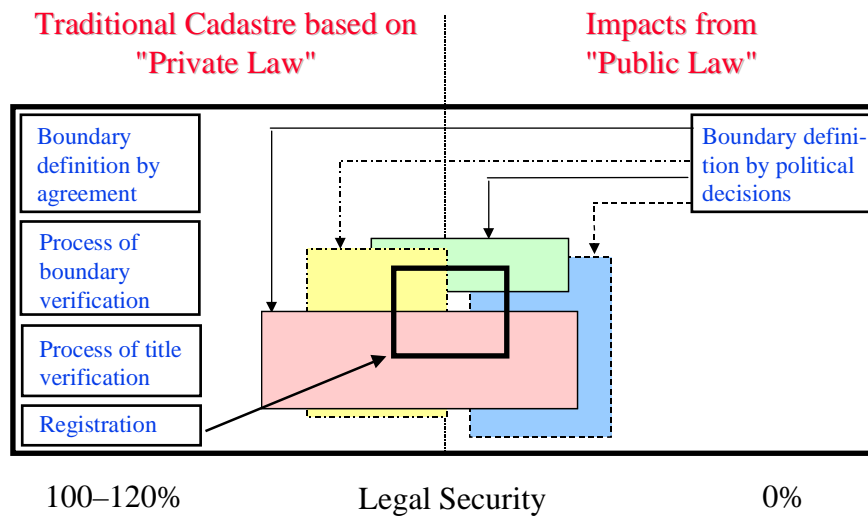


Figure 5: Lack of legal Security

Future cadastres shall correct this dangerous situation by applying the principles of cadastral systems on all legal land objects (Figure 6).

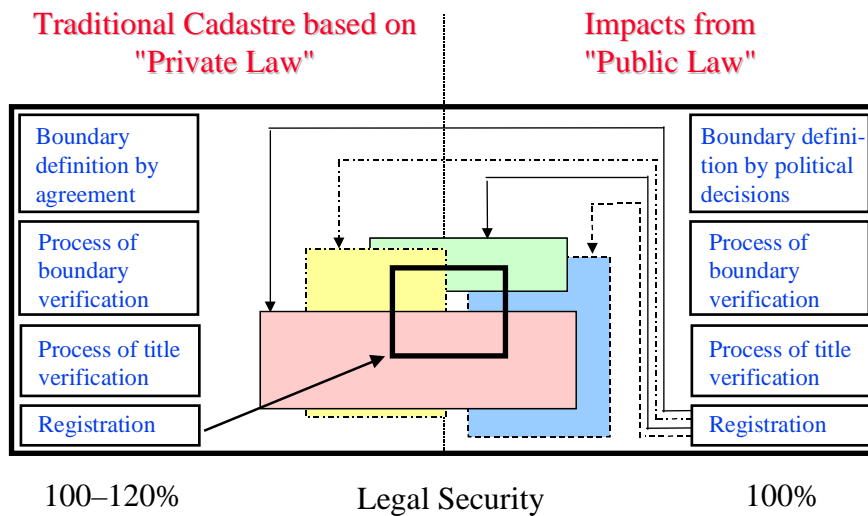


Figure 6: Cadastre 2014 documenting properly land objects defined by private and public law

All legal land objects must be carefully delimited, verified, and registered. This future complete documentation of the legal situation of land must respect a certain structure. It must respect the principle of legal independence, which is shown in figure 7.

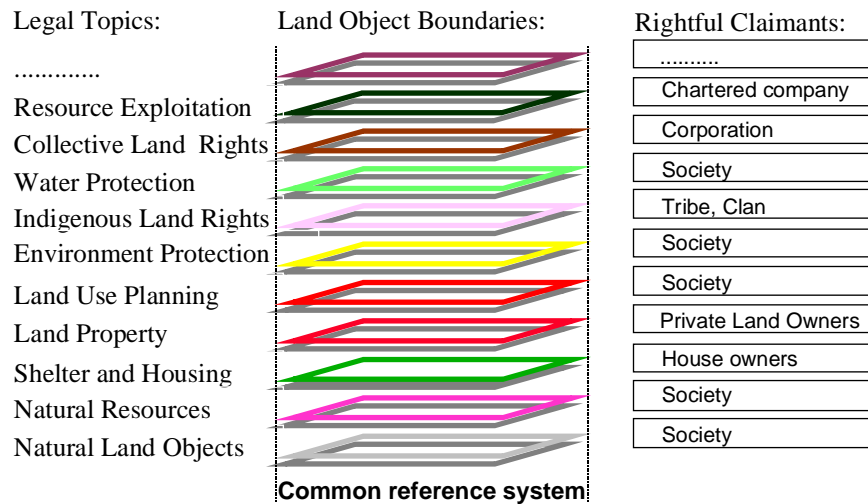


Figure 7: The principle of legal independence

The different legal land objects are to be arranged according to the laws by which they are defined. This structure allows the immediate adaptation of the cadastre to the development of the legislation. It is not necessary to rearrange the information. New legal topics can simply be added by including a further information layer.

The effects of polygon overlaying

Building 24 is a land object in the information layer 'Constructions'

Parcel 125 is a land object of information layer 'Private Property'

The relation between parcel 125 and building 24 is found by 'cutting' the layers 'Private Property' with 'Constructions'

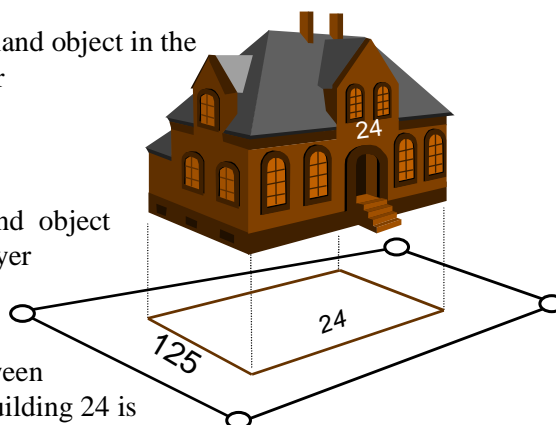


Figure 8: Finding relations between Land Objects by the 'Overlay Technique'

The future cadastral systems are therefore no longer parcel-based. They take into consideration the different land objects, defined by the laws of a given jurisdiction. All these land objects are defined as geographical

objects in a common reference system. To investigate impacts of restrictions on a certain property parcel the land objects are compared geographically by the overlay technique when this is needed (Figure 8).

The second statement on Cadastre 2014 says:

The separation between 'maps' and 'registers' will be abolished!

The establishment of separate organisations for map production and land registration was often necessary in the past because the two operations used to require different skills, and the available technology did not allow for other solutions. With information technology (IT) it is possible to link land objects directly with the information needed for registration. Land objects can be described in future by the geometric and the alphanumeric parameters, with the latter containing the legally relevant records. The still often practised separation of the physical and organisational structure will become unnecessary.

Statement three takes into consideration that modern information technology based cadastres will have a forceful impact on the way of working:

'Cadastral mapping' will be dead! Long live modelling!

Information technology works with digital data and provides the ability to model objects of the real and legal world. Maps as analogue representations will lose their function as information storehouses; their only purpose will be to represent information in such a way that it can be communicated easier and in a more comprehensive form. In future we will have increasingly different graphic representations as extracts of the cadastral model tailored to the needs of the individual customer. To store maps as a picture on a computer is therefore an archaic operation.

The fact that in future information technology will be used to operate cadastral systems is expressed by statement four:

'The paper and pencil cadastre' will be gone!

According to the terms of reference of our working group, the work concentrated on developed countries because one thought then that in developing and transitional countries the traditional methods would be carried on. Today, eight years later, you cannot find any cadastre project in the world where information technology is not involved. IT makes work easier.

The trend to privatize the operational work to be executed in the field of cadastre is reflected in statement five:

Cadastre 2014 will be highly privatized! Public and private sectors are working closely together!

The privatization and new public management topic will affect the cadastre as it affects any other domain of human activity. This is a fundamental trend. The public domain will nevertheless have to provide for secure land

titles but it will outsource most operational work and concentrate on supervision.

Finally, in statement six the aspect of cost recovery which is also a potent trend, is expressed:

The cost of Cadastre 2014 will be recoverable!

The awareness that even operations executed by the public sector have their price, and that the public and the private sectors have at least to cover their cost, leads to efforts to implement cost covering fees also in cadastre. In several cadastral systems it was proved that cost recovery is possible. Because cadastre is a long-term investment the depreciation period for the initial investment costs can be longer than for normal goods.

4. EFFECTS OF CADASTRE 2014

Cadastre 2014 is the bookkeeping system for the scarce resource land. This bookkeeping is complete, accurate, and reliable. It documents facts and therefore avoids disputes. Political processes and sustainable development is often hindered by fruitless discussions. Future cadastral systems document all facts in an indisputable manner.

Decisions can be taken on the basis of complete and reliable information. This accelerates the implementation of the decisions.

Because Cadastre 2014 provides a reliable and clearly defined model of the existing situation, the effects of planned measures can be tested in the model. Erroneous decisions can be avoided.

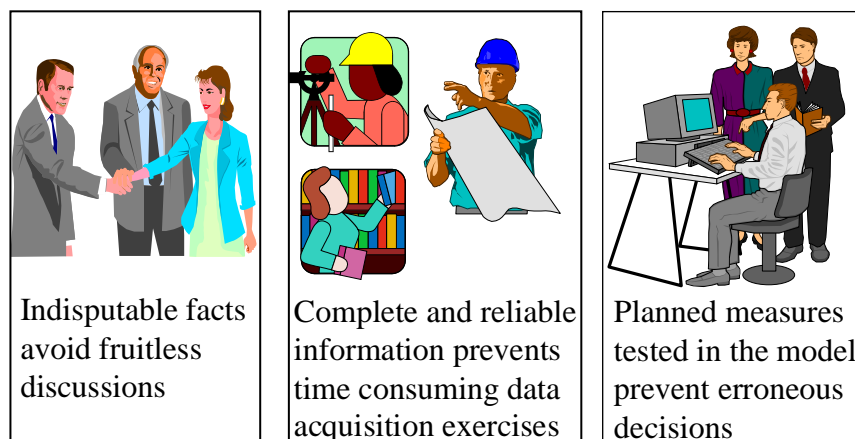


Figure 9: Effects of Cadastre 2014

The danger of too much and/or inconsistent regulations hampering development, can be banned. Over-regulation and inconsistency may be

identified with the help of complete and reliable cadastral information in an early stage of action.

The time consuming acquisition of base data, which today often amounts up to 75 to 80% of the total project duration, will not be necessary when the cadastre provides complete and reliable information. Projects can be implemented in shorter periods. Money and human resources can be saved (Figure 9).

5. CONCLUSION

Cadastre 2014, basing on the successful principles of the traditional cadastre but applying them on a wider range of legal land objects, supports sustainable decision-making, which is only successful when based on reliable and complete information about the situation of land. With its help political discussions are focused on the really existing problems and the possible solutions. The relevant facts, created by legal assignments are carefully and securely documented.

With the consequent application information technology and data modeling and of the principle of legal independence efficient and flexible operation of the cadastre system is guaranteed.

The cooperation of public and private sectors and the cost recovery make cadastre 2014 a smooth efficient tool in the hands of societies.

Cadastre 2014 providing a complete and up-to-date accountancy about land and enabling efficient and effective use of it, meets humankind's future needs. It is a mighty tool to manage the further development of the world.

REFERENCES

Kaufmann J., Steudler D. with Working Group 7.1 FIG Commission 7 (1998) Cadastre 2014, A Vision for A Future Cadastral System