

# Cadastre 2014 – Review of Status in 2004

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**Key words:** Cadastre 2014, documentation of rights and restrictions, review, performance gaps

## SUMMARY

"Cadastre 2014" was a vision paper for future cadastral systems, which has been developed and published by FIG-Commission 7 in 1998. It has emphasized the future developments for cadastral systems with six statements including the documentation of public law restrictions and responsibilities, closer cooperation between cadastre and land registration, digital format and data modeling, closer cooperation of public and private sectors, and a higher cost awareness within the cadastral systems. Since its publication, "Cadastre 2014" has been translated into more than 20 languages and many developments have confirmed the visions and statements.

This paper assesses developments in the cadastral field since 1998, such as for example Internet/web, spatial data infrastructures (SDI), public-private-partnerships (PPP) and their implementation in practice. Within this context, the paper reviews the original six Cadastre 2014 statements from a 2004-point of view and also illustrates the shortcomings of the visions.

## ZUSAMMENFASSUNG

'Cadastre 2014' war eine Publikation über die Vision zukünftiger Katastersysteme, welche 1998 im Rahmen der FIG Kommission 7 entwickelt und veröffentlicht wurde. Die Entwicklung wurde mit sechs Kernaussagen charakterisiert, welche Aussagen über die Dokumentation der öffentlich-rechtlichen Eigentumsbeschränkungen, die engere Zusammenarbeit der Katastervermessung und des Grundbuchs, die vollständige digitale Form des Katasters und die Datenmodellierung, die engere Zusammenarbeit zwischen öffentlichem und privatem Sektor und die bessere Wahrnehmung der Kostenaspekte in Katastersystemen zum Inhalt hatten. Seit ihrer Veröffentlichung wurde die Broschüre in mehr als 20 andere Sprachen übersetzt und viele Entwicklungen haben die Vision und die Kernaussagen mittlerweile bestätigt.

Dieses Papier beurteilt die Entwicklungen im Bereich Kataster seit 1998, wie beispielsweise Internet/Web, Daten-Infrastrukturen, Partnerschaft zwischen privaten und öffentlichen Organisationen und ihre Einführung in der Praxis. In diesem Kontext will das Papier die Gültigkeit der ursprünglichen Kernaussagen aus der Sicht des Jahres 2004 überprüfen und auch auf allfällige Mängel der Vision eingehen.

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## 1. INTRODUCTION

The then Working Group 1 of FIG-Commission 7 was established in 1994 and was commissioned 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.*

In 1998, Working Group 7.1 submitted the booklet 'Cadastré 2014 – A Vision For A Future Cadastral System' [Kaufmann, Steudler et al. 1998] to the XXII FIG Congress in Brighton. The booklet identified the cadastral trends at that time, gave a picture in what fields cadastrés will develop and in what direction they will develop. It gave recommendations for professionals, national professional associations and for FIG as the international body.

Within this paper, a review of the 'project' Cadastré 2014 is undertaken from the 2004 perspective – ten years after the establishment of the Working Group and ten years before 2014:

- first, the TOR are investigated and how the delivered product complied with the requirements;
- the trend analysis is taken into account and it will be assessed to what degree the trends became reality so far;
- the six statements characterizing the visions are being reviewed and it will be evaluated if we are on track and how far we are from the goal. This assessment will give an indication of how far the change process has progressed.
- We will have a look how far the recommendations have been adopted by the different addressees.

Working Group 7.1 continued its work after 1998 and presented in 2002 at the XXIII FIG Congress in Washington another booklet with entitled 'Benchmarking Cadastral Systems' [Steudler, Kaufmann et al., 2002] describing benchmarking examples and its application in the evaluation of cadastral system.

In his foreword to 'Cadastré 2014', Ian Williamson stated: *I believe this report will become a benchmark against which cadastral systems worldwide will measure their development and reform.* This sentence is the guiding principle for this article, which will look at the performance gaps according to benchmarking principles.

## 2. ASSESSMENT OF COMPLIANCE WITH THE TOR

The TOR contained different tasks. Table 1 gives an overview of what has been done to ensure that the result will be consistent with the TOR.

Task	Comment
To study cadastral reform and procedures as applied in developed countries	The existing situation, the strengths and weaknesses as well as the reforms and trends have been investigated with two questionnaires. The majority of the responding countries were developed countries, but also developing and countries in transition contributed with information.
To consider the automation of the cadastre	All the answers showed a strong impact of automation on the development of the different cadastral systems
To consider the role of cadastre as part of a larger land information system	The questionnaires showed that cadastres served several purposes in most countries and that land information systems can only be successful when based on reliable cadastral information.
To evaluate trends in this field	The identified trends covered six areas, the extension of the content of the cadastre, the tightening of cadastral organisations, the replacement of drawings by data and the data modelling, the replacement of traditional tools (paper and pencils by computers), the cooperation of private and public sectors, and the awareness of economic aspects.
To produce a vision of where cadastral systems will be in the next twenty years	The vision was characterized by six statements corresponding to the trends.
To show the means with which these changes will be achieved	In the explanations of the statements the necessity of change was illustrate. The change in thinking and approaches (mental change) was identified as the most important mean to deal with the future, besides improved organisational arrangements and a consequent use of information technology.
To describe the technology to be used in implementing these changes	The vision was designed to be independent from technological change. The key technology – on which the visions are based on – is the overlay technique enabling to find out relations between objects by virtue of their location and the object-oriented data modelling. Developments in IT such as Internet, web and spatial database technologies did not have an impact on the vision but created better conditions for realization.

**Table 1:** Elements of the TOR and assessment of compliance with the results

### 3. RE-ASSESSMENT OF TREND DEVELOPMENT

The trend analysis undertaken for the Cadastre 2014 visions identified major trends in six areas. Figure 1 summarizes these trends.

#### Trend Analysis

- Trend to inability to meet the increasing needs of the land market because cadastre only shows private law matters; restrictions from public law are not shown and are not transparent to land market.
- Trend to inefficiency because the link between ‘map’ and ‘register’ is not efficient enough.
- Trend towards digital data format.
- Trend towards data automation and computerization.
- Trend towards privatization, especially in the level of operational control.
- Trend to New Public management (cost awareness).

**Figure 1:** Result of trend analysis

In all six areas the developments followed more or less the direction indicated by the trends. The speed of development, however, differed significantly. The driving forces, globalisation and trade liberalization, sped up the business processes. The movement of people from rural to urban areas increased the pressure on land resources in urban areas and led to land occupation and illegal settlements. Natural disasters triggered the implementation of new legislation. Land management became more challenging and land administration more demanding.

The application of IT happened very quickly, while the introduction of data modelling techniques took place rather slowly. Private-public-partnership was discussed very intensively but progress was not significant. Cost awareness improved but for important questions no universal answers were found.

Table 2 illustrates to what extent the trends became reality during the last ten years.

The identified trends became reality in general. No immediate reversal of the trends is expected.

<b>Trend</b>	<b>Re-Assessment of the Trends</b>
Trend towards inability to meet the increasing needs of the land market because cadastre only shows private law matters; restrictions from public law are not shown and are not transparent to land market	The last decade was characterized by globalisation, international trade liberalization, transition and growth of the population. These phenomena created on the one hand a growing need for traditional cadastral systems. On the other hand public legislation about land use planning, environment protection, natural resource management increased all over the world. Transparency about the legal situation of land decreased. Land markets suffer increasingly from this lack of transparency. In all countries the amount of agencies to be contacted to obtain a clear view about the legal status of land have increased. The number of political advances to correct this situation has increased significantly.
Trend towards inefficiency because the link between 'map' and 'register' is not efficient enough	As business processes have speeded up, the wish to have reliable information about land quickly and from a 'one-stop shop' became stronger during the last ten years. Many efforts have been undertaken to make the access to the information easier. Internet/web technology has contributed to better access but institutional obstacles and false competition between organisations are bothering efficient procedures.
Trend towards digital data format	Despite information technology progressing fast, the thinking of the stakeholders remained very much map-oriented. The process to produce structured data, to administer them in databases and to visualize these data only later as maps and pictures was not understood by all players in the cadastral domain. The development of geo-standards is heavily delayed. Nevertheless system providers are now aware of the importance of data modelling and terms such as data-centric, UML, XML/GML have become keywords in this domain.
Trend towards data automation and computerization	Information technology was introduced quickly in the cadastre domain. No cadastral project can be found which is not based on IT. Geographical database technology developed significantly in the last decade. The separation of graphical from attribute data is nearly overcome.
Trend towards privatisation, especially in the level of operational control	Public-private-partnership has become a key issue in the cadastral world. Solutions are investigated and the amount of private activity has increased. Assistance projects have normally a component dealing with the development of the private sector involvement. Especially in developed countries with a long tradition with public sector cadastres, progress is slow in this field.
Trend to New Public Management NPM (cost awareness)	Cost awareness improved during the last ten years. The value and the price for products and data of the cadastre were discussed all over the world. Tariffs were elaborated and put into force. Some questions have not finally been answered yet. The degree of cost recovery of the operation is much less disputed than the depreciation of the investment by fees.

**Table 2:** Trends and their re-assessment

## 4. REVIEW OF THE STATEMENTS OF CADASTRE 2014

The six statements characterizing the vision have been discussed intensively during the last years. It is worthwhile to investigate their present-day validity and the degree of fulfilment.

### 4.1 Review of Statement 1

**Statement 1 on Cadastre 2014**

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

restriction C

property 4

land

property 1

property 3

property 2

restriction A

restriction B

**Comment:** The population of the world is growing. The consumption of land is increasing. The absolute control of the individual or of legal entities of land is increasingly being restricted by public interest. To provide security of the land tenure, all facts about land must be made obvious by the cadastral system of the future.

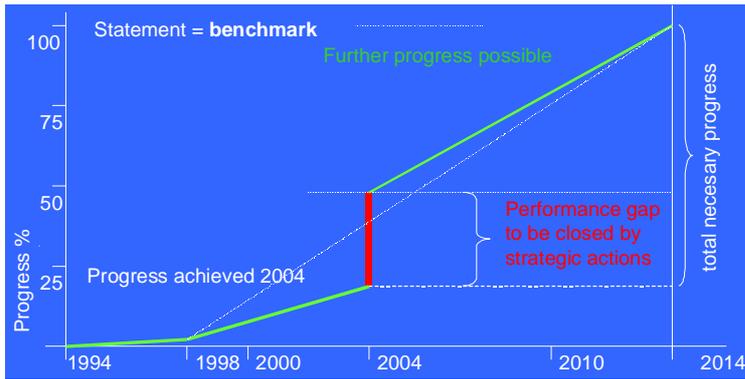
**Consequences:** A new thematic model is necessary. Surveyors must take into consideration public law.

Statement 1 has initiated a few discussions. The necessity of a complete documentation of the legal situation of land and working after the proven principles of the cadastre are not disputed in general, but the chance for realization is often assessed too pessimistically. A significant number of professionals have not yet understood the idea of the legal independence of information and the possibilities of the polygon overlaying technique to create easy-to-handle complete cadastral systems. The politicians, experts and even professionals

cannot imagine that the localization and description of land objects other than parcels and the verification and validation of the information about these objects might be a task for surveyors. It also seems to be difficult to imagine that the process of controlled insertion of information into a GIS could be an official registration. Traditionally maps were drafted and registration only took place in the book. Mental change is necessary.

Nevertheless some progress can be seen in this domain. An increasing number of cadastral organisations are doing work in the direction of statement 1. On the technical level system providers like ESRI and Intergraph undertake efforts to create respective data models and functionalities. Professional associations are assessing the effects of improved cadastral information on the development of the profession. In several countries the legislation has started to provide the basic legal regulations for cadastral systems containing reliable information on arrangements imposed by public laws.

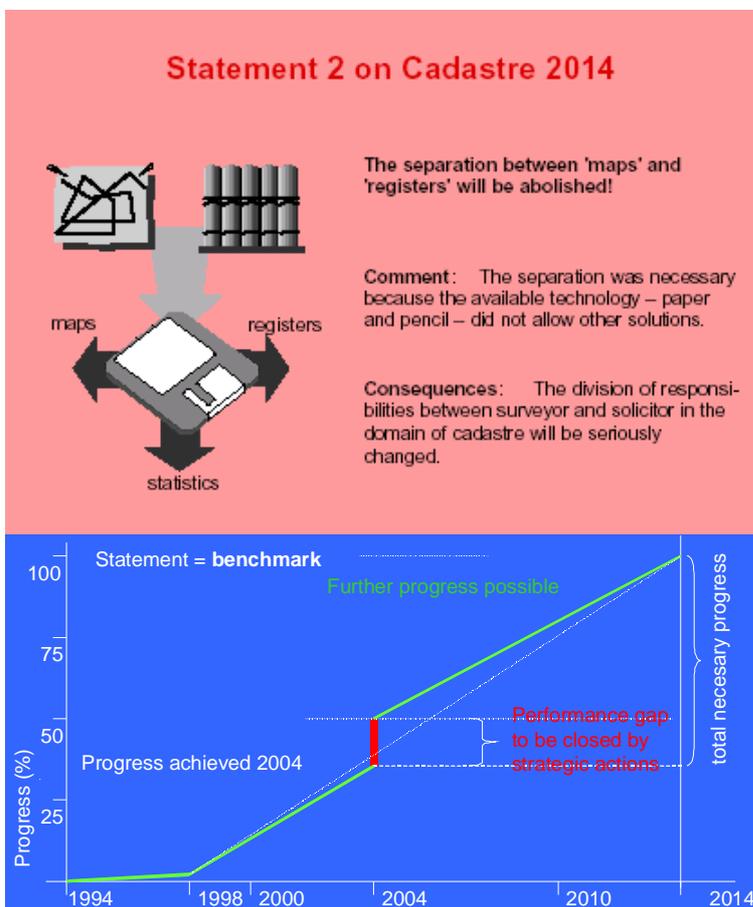
This statement has not lost anything of its importance. The lack of legal security in land matters has increasingly negative effects. The number of investors stopping their projects and looking for places where they face minimal risks grows. Politicians become aware that legal security is an important factor in the competition between locations.



**Figure 2:** Performance in the domain of statement 1

2014 substantial efforts are necessary to achieve the benchmark.

#### 4.2 Review of Statement 2



**Figure 3:** Performance in the domain of statement 2

Technology is ready to implement complete cadastral systems, but mental change is still slow. It seems that mental change is easier to achieve in countries with a short tradition in cadastral matters than in developed countries with a long and successful story of the traditional cadastre.

The performance gap shown in Figure 2 is considerable. Even when progress will be sped up in the second decade of cadastre

This statement was not much disputed. The cooperation between organisations dealing with the identification, description and documentation of land objects and those registering the corresponding rights, restrictions and the rightful claimants becomes easier with IT use and Internet/web technology.

In several countries separate organizations were merged and some projects for separation of the organisations were stopped and re-thought. The communication between the surveyors and the registrars was intensified in several jurisdictions.

Of course there are cases of competition, competence disputes and institutional obstacles, but communication technology will diminish the influence of people.

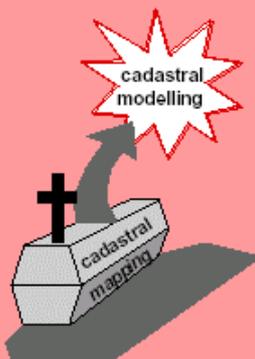
The statement proved to corre-

spond to the needs and does not have to be changed. It is not too important of how cooperation is achieved; it is much more important that cooperation takes place at all.

Progress in this domain is quite good. Mental change has taken place, because the advantage is obvious. The performance gap is rather small (compare Figure 3).

### 4.3 Review of Statement 3

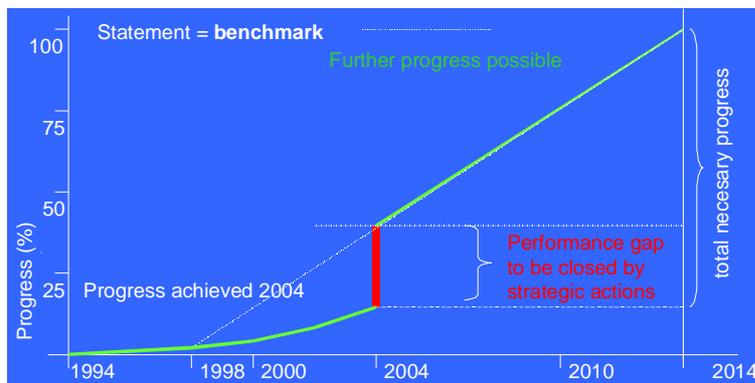
Statement 3 on Cadastre 2014



**The Cadastral mapping will be dead!  
Long live modelling!**

**Comment:** Maps have always been models, but the available technology did not allow for the use of these models in a flexible manner. So in mapping flexibility had to be brought in by different scales. Different scales had to be represented by different data models. Modern technology allows the creation of maps of different scales and registers in different forms from the the same data model.

**Consequences:** In 2014 there will be no draftmen and cartographers in the domain of cadastre.



**Figure 4:** Performance in the domain of statement 3

The traditional thinking of many of the surveying and mapping stakeholders hampered the understanding of this statement. The idea of a conceptual data and representation modelling technique only progressed slowly, as well as in the area of standardisation. The competition took place on format level and traditional regulations of graphical representation were dominant for a long time.

As suggested in the re-assessment of the trends these obstacles were overcome only in the recent years. It can be expected that progress will accelerate in the second decade. Efforts to derive representations from data models with the help of object oriented representation models have become more significant.

This statement can remain unchanged as well. Strategic efforts to close the remaining performance gap must be undertaken in conceptual data modelling standardization and in the elaboration of software tool

able to create feasible graphical representation of contents of object-oriented databases.

#### 4.4 Review of Statement 4

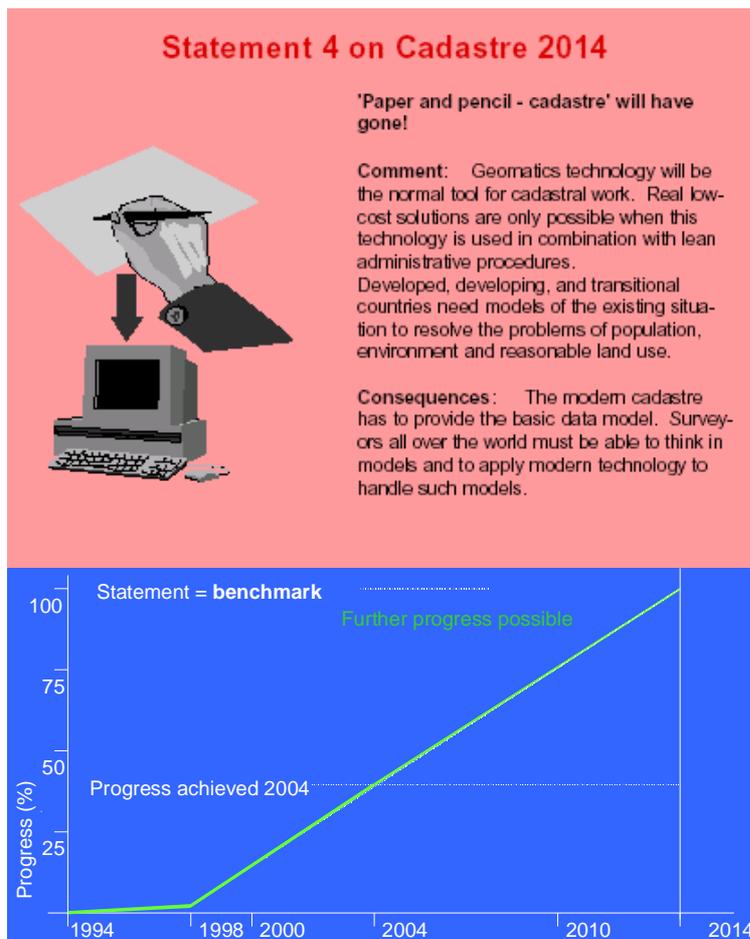
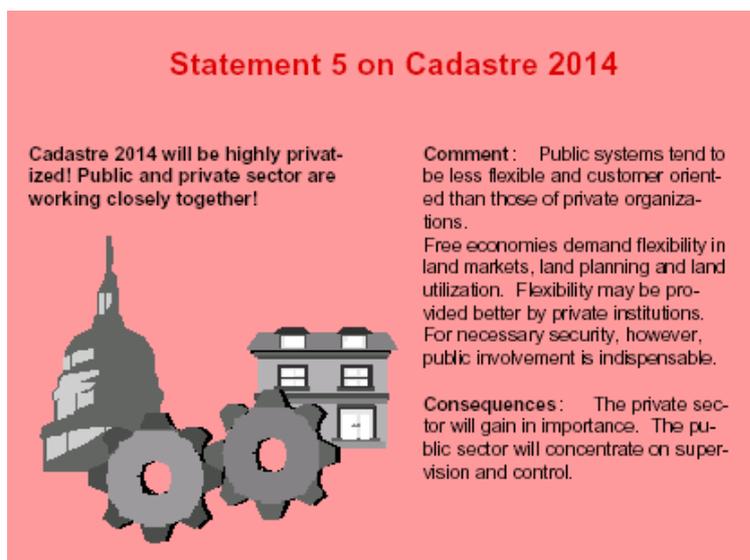


Figure 5: Performance in the domain of statement 4



What was a vision in the year 1998 became a reality in 2004. IT is the tool of modern cadastral systems. The problem, however, is that the systems are often too heavy and too complex. To replace IT-infrastructures requires considerable finances, mainly for education, instruction and training. Good experience to reduce cost has been made by the use of data modelling. The systems are to be designed as simple and straightforward as possible to assist system replacement and to allow the application of low-cost IT-components. The principles stated in Cadastre 2014 require only simple structures of low complexity.

This statement should be reformulated in the sense of: "Paper and pencil in the cadastre will be replaced by lean IT-infrastructures applying simple data structures of low complexity". The efforts undertaken so far open the opportunity to achieve the goal now. No performance gap is identified in this field.

## 4.5 Review of Statement 5

Public-private-partnership is discussed very intensively and the creation of a private sector for operational work is a main topic in most of the on-going cadastral projects. Of course no project intends to privatise the strategic alignment of the cadastral system and the supervision and verification of the results produced by the private sector.

In countries with a long tradition with centralized public cadastres, the progress in the involvement of the private sector is in general slower than in developing countries and countries in transition. Re-engineering of these systems seems to be difficult. The statement is still valid. A performance gap exists, but the intensity of discussion gives hope that progress will accelerate.

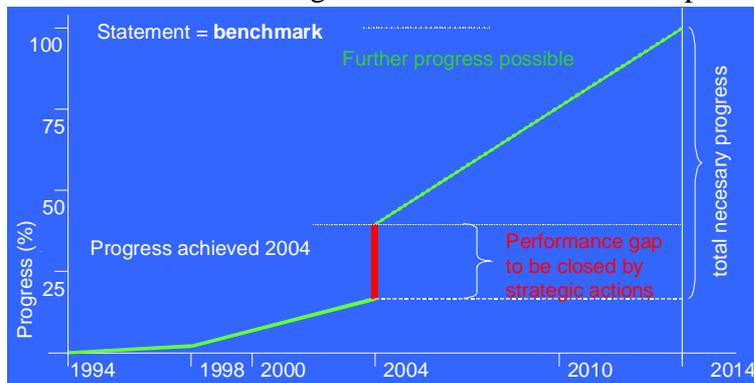


Figure 6: Performance in the domain of statement 5

## 4.6 Reviw of Statement 6

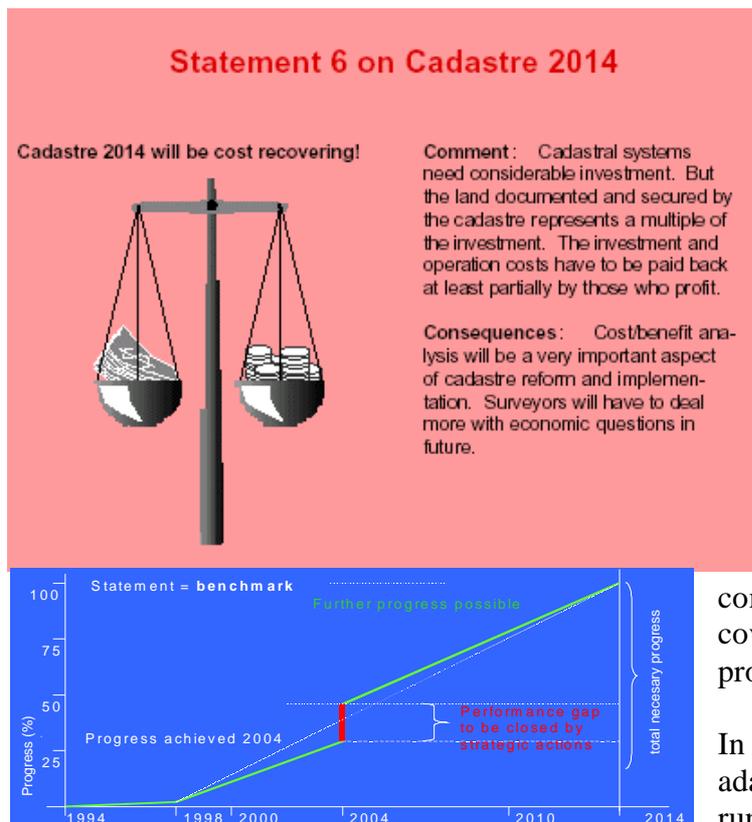


Figure 7: Performance in the domain of statement 6

The discussion of the economic questions of cadastre has intensified and the opinions differ considerable. Consensus exists in the question of the running costs, which are anyway to be covered by registration and transaction fees.

Return of investment through data fees is disputed. Too expensive fees hinder an intensive use of the data. If the fees are too low, the time for depreciation of the investment is much too long. The theory, that higher tax income from value-added products will cover the investment cost is not proven.

In fact, the statement should be adapted. Cadastre 2014 will cover its running cost and contribute to a return of investment. As cost awareness is

much higher than at the beginning of the discussions, there is not a big performance gap. Additional studies looking into the economic aspects of the cadastre would support more economical cadastral systems.

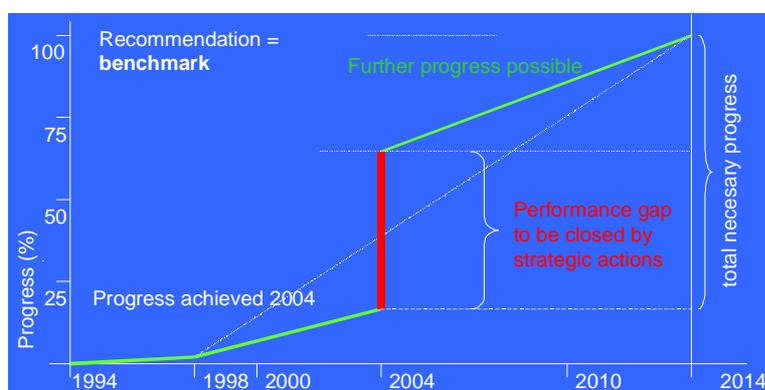
## 5. EVALUATION OF RECOMMENDATIONS

Another result of the Cadastre 2014 working group has been recommendations for the surveyors, for FIG, and for the different national member associations.

The overview in Table 3 shows the recommendations and comments the reaction of the addressees.

Adressee	Recommendations	Comments
Surveyors can contribute to Cadastre 2014	<ul style="list-style-type: none"> <li>- by complementing the traditional skill of producing maps and plans with data modelling techniques;</li> <li>- by understanding the phenomenon of public law land objects;</li> <li>- by playing the role of a land administration specialist.</li> </ul>	<p>Surveyors all over the world are confronted with the progress of IT and gradually learn to change attitudes and procedures.</p> <p>The thinking in data models is not sufficiently developed and public law land objects still play a secondary role in the thinking.</p> <p>Land administration functions concentrate still mainly on land parcels.</p>
FIG can contribute to Cadastre 2014	<ul style="list-style-type: none"> <li>- by establishing a competence centre for modern cadastral systems;</li> <li>- by developing recommendations for a future national licensing policy for land surveyors;</li> <li>- by re-enforcing its contacts with governments and NGOs.</li> </ul>	<p>FIG did not establish a competence centre as was proposed. Commission 7 did not follow-up the topic.</p> <p>No efforts have been made to redefine licensing policies. Licenses remain focused on land parcels.</p> <p>The president of FIG promotes Cadastre 2014 very strongly.</p>

**Table 3:** Reaction on Recommendations



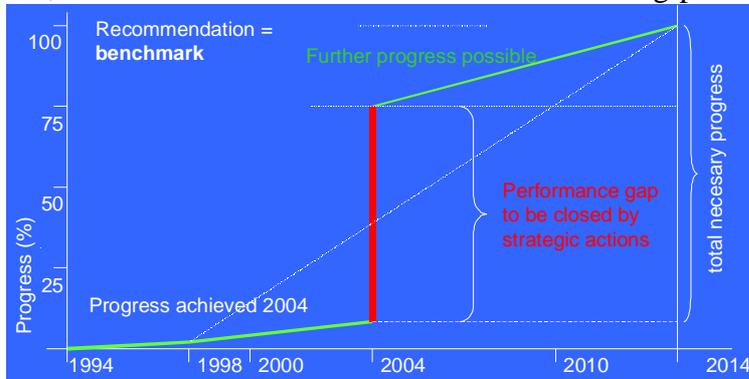
**Figure 8:** Surveyors performance gap

In view of the remaining 10 years, the performance gaps are considerable. Mental changes obviously need a considerable amount of time. The long successful tradition and the occupation by the daily business do not make it easier to concentrate on new aspects.

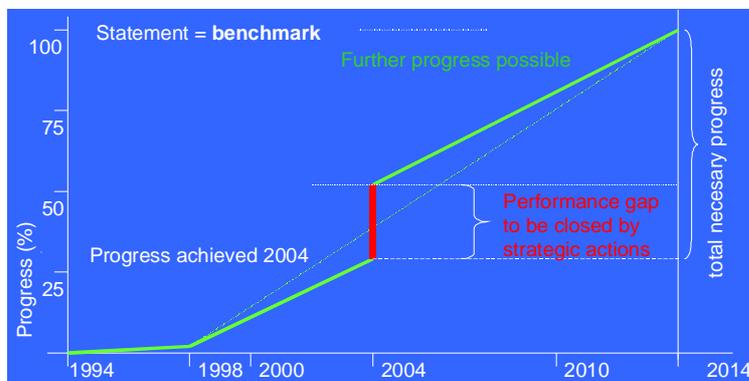
The individual surveyor needs the support of FIG and the na-

tional member associations in order to deal better with the changing professional environment. Land parcel mapping and the private property cadastre have dominated the way of thinking of surveyors for decades.

FIG, in view of the recommendations has left a big performance gap. The president's efforts



**Figure 9:** Performance of FIG



**Figure 10:** Performance of national associations

to promote the ideas of Cadastre 2014 were not underpinned by the establishment of a competence centre or deeper reflections on the future role of licenses.

Some national associations did considerable work in the field of Cadastre 2014. In addition to presentations, seminars and discussions, they also established interest groups and commissions dealing with the future of their cadastral system. However, there are not many countries that looked into these issues and the lack of practical examples seems to obstruct quicker development.

## 6. CONCLUSIONS

Over the last decade Cadastre 2014 had considerable impact on the development of cadastral systems and on the way of thinking of the stakeholders in the cadastre. The need for better legal security in land matters has been confirmed and became even more urgent the last few years. In most of the areas where Cadastre 2014 will have an impact, there are performance gaps that need to be closed. In order to close these gaps, efforts are needed mainly in the mental area. Of course not every country and every cadastral system needs to be as suggested by Cadastre 2014. Countries can choose different speeds and they decide themselves on the use of resources and finances for the cadastre.

This review however makes clear, that the trends and the concept are still valid and that cadastrals are developing in the direction proposed by the original booklet in 1998.

## BIOGRAPHICAL NOTES

**Jürg Kaufmann:** was born in Switzerland in 1942 and graduated from the Department for Rural Engineering and Surveying of the Swiss Federal Institute of Technology with additional studies in economics and commerce. After many years of surveying practice in Switzerland, he founded his own company KAUFMANN CONSULTING, working for public and private institutions in the field of cadastre and geomatics on a national and international level. Among many other involvements in public and private consulting projects, Jürg Kaufmann was a main consultant to the management board of the reform project of the Swiss cadastral surveying system from 1982-1994. Since 1995, he also got involved in international projects in Liechtenstein, Belarus, Ukraine, Georgia and Kosovo. From 1994-1997, he was main consultant for the implementation of a modern cadastral system in Belarus, commissioned by the Swiss Federal Office for Foreign Affairs (FOFEA). Since 1998, he is commissioned by UN-DESA as Chief Technical Advisor for the cadastral project in Georgia.

From 1990-2003, Jürg Kaufmann represented Switzerland in the FIG-Commission 7, where – between 1994-2002 – he twice chaired working groups resulting in the publications 'Cadastre 2014' and 'Benchmarking Cadastral Systems'. In 2003, he was elected as president of 'geosuisse', the Swiss professional association of surveyors.

**Daniel Steudler:** graduated from the Swiss Federal Institute of Technology (ETH) in Zurich in 1983, earned the Swiss license for licensed land surveyor in 1985, and did his M.Sc.Eng. degree at the University of New Brunswick, Canada from 1989-91. Since 1991, he is working with the Swiss Federal Directorate of Cadastral Surveying with the responsibilities of supervising and consulting Swiss Cantons in organizational, financial, technical, and operational matters in cadastral surveying. Since 1994, he is involved in the activities of FIG-Commission 7 as a working group secretary until 2002. He became the official Swiss delegate to Commission 7 in 2003. Between April 2000 and February 2004, Daniel did a PhD at the University of Melbourne, Australia, under the supervision of Prof. Ian P. Williamson. The main research topic was to develop a framework and methodology for evaluating cadastral systems in the larger context of land administration.

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