

Cadastre: Vision for the Future

The Impact of New Dimensions¹

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Abstract

The environment in which the professions of cadastre evolve has undergone profound changes. Technological innovation in the digital field has been considerable. Furthermore, social change has also been radically altered with, for instance, the emergence of social networks as a means of transforming our relations. Aside from the present crises, there have also been great changes in our economic evolution by the introduction of, on one hand, more flexibility and mobility and, on the other hand, the advent of globalization of production, work and consumption.

In addition to these exterior changes, internal changes have also taken place. These changes are specific to public administrations. Several trends can be mentioned: the evolution of the public discourse on transparency and accountability, the opening of public data, the emergence of the idea of a common good for our human societies. Other influences also have an impact, for instance, legislative change such as laws on administrative registers to foster interoperability or innovative professional software linked to the use of 3D.

These simultaneous changes apply considerable pressure on the profession. In this paper, we are going to identify the major trends that will most likely have an impact, apprehend the consequences expected and provide a structure for this development. We will try to give a general, coherent and prospective view of the evolution of cadastre.

Our paper will be divided into three sections:

1. Push and pull evolutions
2. Six strong foreseeable trends
3. Synthesis and conclusion

¹ This paper was presented at Commission 7 Meeting in Austria, September 2011. The authors state that in the professions of cadaster both external and internal changes apply considerable pressure. This paper identifies the major trends that will most likely have an impact, apprehend the consequences expected and provide a structure for this development.

SECTION 1: PUSH & PULL

Push

With the advent of the World Wide Web, the cadastre has entered globally in the digital era. This can be seen not only by how we input data, we look up for it, we store and exchange it, but also by the web applications nowadays offered to the public and their evolution. The general public has seen striking examples with Google Maps, Google Earth, Bing Maps, Street View, Sketch Up, etc. These applications can no longer be ignored by the professionals because they offer a new way of reading the territory and they inevitably structure what the public understands and wants. Similarly, several innovations regarding the use of these technologies are fundamentally modifying the profession. For example, let's mention the "mash up" technique which allows (almost) anyone to use maps to create new applications, the phenomenon of geolocalisation through smartphones, the flow of data generated by individuals, global services accessible through cloud computing offering platforms and applications or the huge potential offered by the billions and billions of new IP addresses accessible with the new Ipv6 protocol.

This technological evolution is the first wave we've identified under the « Push » section for upcoming change. A second one is linked to global economic change, it redefines the links between producer and consumer, which overlaps between what is called "hard" and "soft" laws and also we will see between private and public goods. As they evolve, these waves of change define new behaviors we will necessarily be confronted to : copyleft and creative commons which complement classic copyright laws, the common goods which present different attributes in the digital world than it does in the physical sense, so called "prosumers" who actively participate in the design of the product / service he or she will use, crowdsourcing which uses the ingenuity of the internet users to create what no other organization could come up with.

The economy is directly impacted by these profound changes. One only needs to observe sectors like the music industry, entertainment, the media, or telecom sector to see this. Doubtless, other economic sectors will also undergo such significant shifts.

These shifts require the rethinking not only of customer relationships, but also of the entire business model. It is of paramount importance to understand that, by entering in the value chain, the customer transforms all economic relations: we are no longer in a formal contractual relationship but in a participative transformational partnership.

The recent events of Fukushima and the Arab Spring clearly show that the conversations, the media coverage and the spreading of ideas are now global, almost instantaneous and socially unavoidable. A wind of change is blowing on the social organization of our society. Networks are proving to be the tools of this change.

By redefining a social layer based on volunteer work, the lack of binding constraints and the non-punishable, society is entering in the era of soft laws. It becomes legitimate, in a certain way, to act even though there might not be a legal framework to support the action. This fact will have significant consequences on our societies not only in public, social and political action but also in professional applications and services.

Legitimate action has found a legalizing base by bypassing classical processes. Fields where increased participation has created concrete examples are a perfect illustration of this change of paradigm: open source software, open data or linking internet users. Henceforth, acting with a willingly participating population will allow us to perform tasks which have so far been intractable for public or private organizations. We are living this in practical terms with Wikipedia, YouTube or e-bird, the content of which is created and shared by users.

Thus the participative empowerment fuelled by social networks redefines not only the social relation to public administration but also to ownership. Being able to add content to a parcel of official cadastre becomes a normal expectation for an increasing part of the general public. How should the owner position himself? And what about the cadastral systems, which must guarantee the information of real estate property?

These three « push » components, namely technology, economy and society, are the catalyze factors of an explosion that will profoundly change the actual definition of cadastre.

Pull

For the last decade or two, information systems have become more open and have integrated an increasing participation from people. There are 5 main stages to this evolution:

1. informational (look up)
2. transactional
3. personalization
4. augmented participation
5. transformational

As mentioned previously, these stages correspond to external changes, linked to technology, economy and society, but there is more. They also show a political, legislative and administrative evolution. Indeed, we argue that both public and private institutions have also evolved from within, through an inside strength, a « pull », an attempt to adapt to the evolution of society in order to offer increasingly better services.

The following table illustrates this evolution :

Stages	Societal policy	Laws and regulations	Administrative / Technical
Informational (look up)	Social responsibility	ISO 14001 & 26000 Reporting regulations	Accountability (transparency & reporting)
Transactional	Productivity	Laws about standards of information exchange	Interoperability (e-Gov)
Personalization	Digital identity	Laws on personal data protection	“MyFiles” (e-Id cards, citizen data vaults)
Augmented participation	Social networks	Laws on social networks	Social platforms (e-initiatives, petitions, forums, voting)

Transformational	Common goods	Laws on transparency and freedom of information	Cloud government (Mash-ups, Open data, API services)
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Three key “pull” stages determine the change and progress of the cadastre professions:

1. Social issues discussed at the political level,
2. Elaboration of laws and regulations to address the political objectives (International soft laws, European laws, National parliaments),
3. Regulations at a more local level that define the framework in which the public and private sector can act.

These three stages are interwoven in the political process and, together, form what we have called the pull process.

This pull process is, in a certain way, an institutional response to the push process and legalizes the existing (technological, cultural, economic and so on) behaviors created by society.

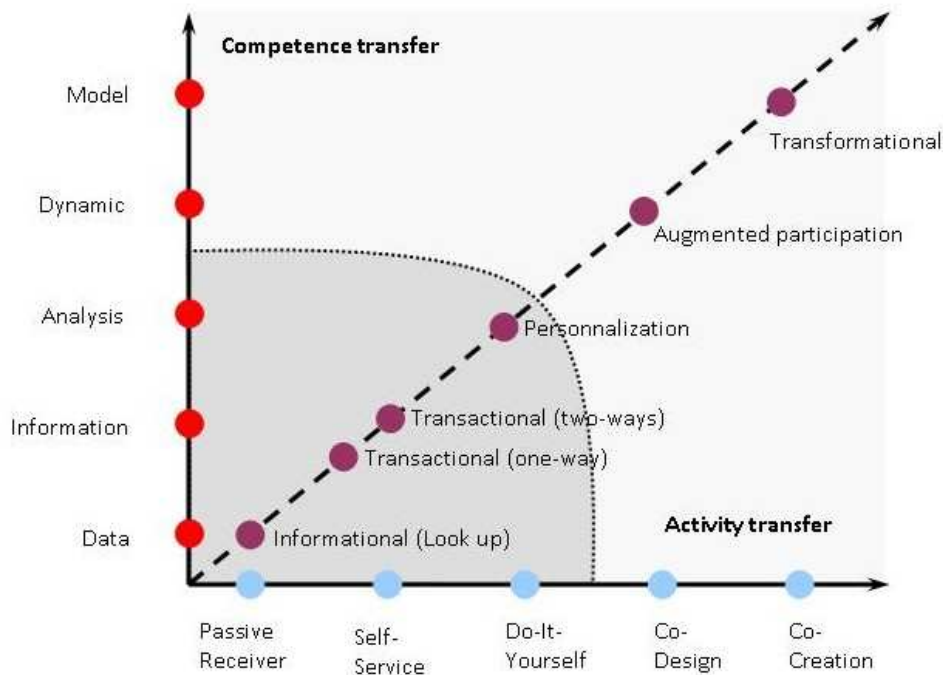
General model

Delivering online public services creates two essential transformations:

- An increasing transfer of the administrative *activity* to the final user.
- Simultaneously, a *competence* transfer to the final user.

The figure presented hereafter introduces a "transfer matrix", which not only allows the monitoring of the progress made in the availability of public services — and therefore benchmarking it — but also becomes a strategic management tool. By improving the understanding of the present and future role of users (citizens, businesses, others administrations, and civil society organizations) this transfer matrix illustrates the paradigm shift for the public services.

We are now dealing with a citizen empowerment process that has to be engaged beyond the simple translation of administrative services into their online counterpart.



The figure presented above radically transforms the classic approach by clearly defining the type of activities now transferred to the users and the competence transfer that accompanies it. Here, we introduce new sophistication levels: namely the "Augmented participation" and the "Transformation" levels.

Therefore, the horizontal axis now represents the activity transfer with the following levels:

1. **Passive Receiver:** The user only has access to structured information that he or she can discover through search engines or tree structures.
2. **Self-Service (One-Way):** The user can choose specific documents and download them.
3. **Self-Service (Two-Way):** He or she can exchange documents or emails with the administration.
4. **Do-It-Yourself:** The user can perform complete transactions, including payments.
5. **Co-Design:** Both the user and the administration can personalize services (e.g. tax forms, etc.)
6. **Co-Creation:** The user can participate in the political and democratic life of his/her region or country (e.g. the Swiss model initiative and referendum, forum, etc.)

The vertical axis represents the competence transferred to the user of the online service. The levels of sophistication vary from raw "data" to the "model" level, as follows:

1. **Data:** At this level, we deal with raw data or measurements, such as those produced by statistical services.
2. **Information:** A context is added to the data so that a meaning is created.

3. **Analysis:** We now can infer a theory from information. This allows analysis and better understanding of phenomena.
4. **Dynamic:** Time is introduced. The time series add a new dimension to the previous theory.
5. **Model:** Forecasts can be made from the dynamic theories inferred by using the information available. Scenarios can be tested and simulated to forecast the effects of changes and to discuss future changes.
- 6.

The 5 levels used in this model are defined as follows:

Informational / Look up:

The user looks up information on the Internet. This phase is traditionally the first one to be implemented as an online service. This remains a strong demand from users. With the development of search engines, the way we look up information has drastically changed. The menu presentation is superseded by a fast access to information through these search engines, Google being the leading one.

Transactional One-Way:

The user can download documents. Even though this phase now seems very basic, it is still essential to the users who manage their documents electronically. A content and document management system is central to such activity.

Transactional Two-Ways:

The user can upload documents and send e-mails. It still is nowadays a major contribution but hasn't reached all levels of the administration, especially for non structured demands. The user can perform complete transactions, including payments. This stage is a milestone for productivity gains and profitability of eGovernment initiatives. It is underway in most administrations around the world. This stage will be crucial for a sustainable system since it saves time and money both for the users and the administration.

Personalization:

The user can use personalized information and transactions. The documents are pre-filled for his/her personal use. The transaction is completely secure and customized. This phase will use a key element that closely resembles a folder called "My Files". It will allow grouping all of the activities and administrative documents in a single virtual place that will be accessible at all times. The traceability of the transactions and activities will become essential to guarantee a sound accountability.

Augmented participation:

This level corresponds to what may be called a wiki-democracy where citizens and businesses can initiate change. This is exemplified by projects such as Open Government initiatives where users are asked to participate in the development of better administrative services. Another example is the Swiss initiative where citizens can propose new laws. In this context too, the U.S. primary campaign lead by Barack Obama is essentially based on participation. The field is of course very broad and much is left to explore in order to create new services in a connected world. Forums, blogs, social networks are only a few recent examples that have emerged, but most of the field still remains to be invented.

Transformational:

Co-creation is the key word here, leveraging mash-ups and crowdsourcing. This level profoundly modifies the concept of "common good" by redistributing the roles between the administration and the citizens. The latter are involved in the creation of a new digital administration. By opening up government data, citizens can transform the way the new public services are created and delivered. This transformation implies a redefinition of the "common good" and "public good".

The transformation matrix defined by the transformation along two axes gives a more complete approach to the evolution and strategy of eGovernment online services than the classical model. By going beyond a benchmarking goal, it helps to drive a strategy. The progress of services can still be analyzed, but the tool now also helps to better define priorities and explain the evolution of the services. The users become active stakeholders of the project and not merely final users. By being turned into a participative partner and not having to adapt to a forced evolution, the relationship between the administration and its users changes to better serve the citizen-actor, as well as the entrepreneur-actor or the consumer-actor.

SECTION 2: SIX THESES

Trends

We have identified six major trends that will most likely have an influence on the vision of cadastre. These trends are linked to technological, economic and social evolution, and come from the push process described above. They are also part of the emergent pull process that has begun to appear in several countries. The six theses presented hereafter influence the entire evolution of the field in which the cadastre operates. They tell us a story by adding dimensions not only in geometry but also in meaning.

Thesis 1: The cadastre will include the third dimension of the landscape and of the objects beyond the current legal framework.

Comment: The technology allows a thorough three dimensional vision of the land. This is now integrated in several products largely distributed by companies such Google and ESRI but also Nokia, Microsoft and several others. This paradigm change raises the issue of height, ownership and that of co-ownership (e.g. several owners of the different levels in buildings) and the rights attached to the third dimension such as for example the right to a view.

Consequence: A new 3D model of the land and of the buildings is necessary and land surveyors have to take 3D into account.

Thesis 2: The cadastre will blend the strategic map and the dynamic map of the land to show its historical evolution. Both views will evolve independently.

Comment: The push of technology makes it possible to store the information with different time stamps instead of erasing or superseding it. An animation of the evolution of an object or a region becomes possible by adding the dimension of time.

Consequence: The current separation between the static object and the dynamic object will be deeply transformed. A static object becomes a snapshot at a given moment of its dynamic version.

Thesis 3: The cadastre will be multifunctional and multijurisdictional.

Comment: The political as well as the technological influence foster the emergence of functions of a territory. Different regions can be viewed not only as jurisdictions, but also through the lens of different functions such as the environmental function, the transportation function, etc. It therefore will be possible to assess the impact of policies on different functions and to create many functional approaches to the territory. Moreover, the interoperability between various local cadastres will render a change of function possible upon request.

Consequence: The local cadastres will be blended into larger ones and include not only jurisdictional views but also functional views.

Thesis 4: Social networks will transform the cadastre.

Comment: The phenomenon of georeference by the public becomes a more and more normal and accepted tool to extend the cadastre. Almost all new moving devices include GPS chips (smartphones, cameras, cars, even cattle!) that can report flows of data. This allows to georeference the objects and their surroundings in a completely new way.

Consequence: The cadastre will deal more with flows of data and less with stocks of data.

Thesis 5: New commons will emerge as a referenced object of the cadastre.

Comment: Data will be more and more made available to the general public by the administration and, through mash-up techniques, will be transformed into a new virtual object the « Common Good ». This new object is a composition of several layers of data and services. It will create value and be used as a global public good.

Consequence: Both the private and the public sectors will gain added value by leveraging these new commons. As it is mainly composed of information, the resource is essentially non-rival (consumption by one person doesn't prevent simultaneous consumption by another) and non-excludable (it is difficult if not impossible to prevent someone to have access).

Thesis 6: The cadastre will become an essential element of knowledge society.

Comment: The cadastre follows the same path as society as it evolves from an information society to a knowledge society. This is seen through the addition of georeference to many human activities, the emergence of co-creation by entire crowds, and the body of knowledge that the cadastre carries enters more and more into models and decisions. The objects of the cadastre will be part of a feedback loop that makes its way into knowledge society.

Consequence: Land surveyors will be dealing more with soft fields of knowledge rather than hard science in the future.



<http://etat.geneve.ch/geoportail/geo3D>

SECTION 3: SYNTHESIS AND CONCLUSION

This document presents the different thesis that will most probably change the cadastre professions. We tried to describe how activities and competencies are shifting from the provider to the end user. Six main theses are then described by integrating the main trends that can be seen today as transformational for the cadastre. These trends come from a push from exogenous shifts (technological, economic, societal) or from pull shifts (as the public services adapt and operate change).

This is still a work in progress and should be seen above all as a tool for thought rather than a firm conclusion. It can be used, for instance, as the basis of a conversation process specifically for professional software applications. We can anticipate a (r)evolution towards new dimensions for the cadastre. While leaving behind the map (2 dimensions), the cadastre is going towards far unexplored dimensions. It is this evolution towards new dimensions that we should work on to design together with the stakeholders a future cadastre to better serve society.

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