ESPON

EUROPEAN UNION

Co-financed by the European Regional Development Fund

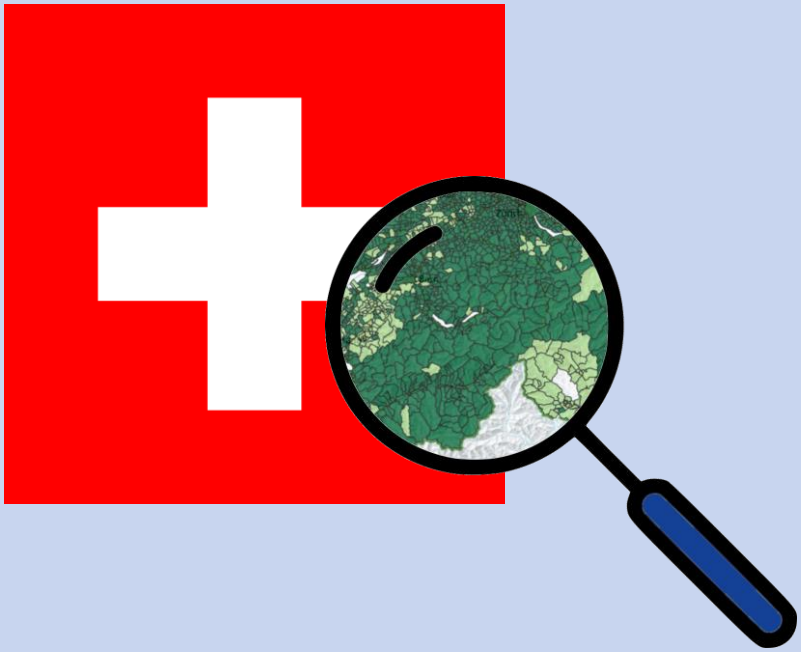
Inspire Policy Making with Territorial Evidence

TARGETED ANALYSIS //

DIGIPLAN – Digital plans and plan data in Switzerland

Annex 8 of final report

Final report // June 2021



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Abbreviations

FOSD	Federal Office for Spatial Development (Bundesamt für Raumentwicklung, ARE)
PLR Cadastre	Cadastre of Public Law Restrictions on Landownership (Kataster der öffentlich-rechtlichen Eigentumsbeschränkungen, ÖREB-Kataster)

Foreword by the research team and the Swiss stakeholder

In the DIGIPLAN project, we explored the development and state of digital plans and plan data in several European countries. It is the first of its kind; no similar research has been conducted before and the topic of inquiry was spanning wide from the beginning. An explorative approach was necessary to shed light on more or less advanced digital practices in different spatial planning contexts. However, we also present an early systematisation of general concepts, key terms and approaches, describing emerging digital plans, plan data and related practices. Although there is a huge diversity across the cases, they all have in common that there are high ambitions and continuous development in the field of digital plans and plan data. DIGIPLAN is a targeted analysis for stakeholders from Denmark, Norway and Switzerland, but its findings can inspire a wider professional audience.

This report is one out of six in-depth case studies, presenting findings from Switzerland. In Switzerland, the government has adopted a digitalisation strategy in 2016 and 2018, which supports the further digitalisation of plan data, especially in the framework of the Smart City/Regions initiatives. In addition, Switzerland published the new Swiss Federal strategy for geographical information in December 2020. Shortly after, the Federal government decided to provide most geodata for free and made them more accessible. In Switzerland, being a federal State, all Swiss cantons have set up their own cartographic portals dedicated to spatial development in addition to the actions taken at national level. DIGIPLAN will further inform the evaluation of building activities in and outside planning zones, monitoring of zoned and built-up land as well as development of related spatial policiesDIGIPLAN is a successful example of ESPON targeted analyses, a powerful means to transfer knowledge, share experience and facilitate the use of territorial evidence rooted in real place-based policy development processes.

Enjoy reading!

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Swiss Federal Office of Spatial Development

1 Introduction and data

ESPON DIGIPLAN provides an overview on digitalization of plan data in 15 ESPON countries (Task 1), insight information from case studies in 6 countries (Task 2) and several thematic papers, synthesizing the state of the art in topics related to digital plan data and digital plans (Task 3). The general conceptual and methodological framework is described in Annex 1 of the final delivery.

This Annex reports the case study on Switzerland, part of Task 2. The general conceptual and methodological framework for the case studies is described in Annex 1. The data collection in this case study is based on the exploration of the various data portals and on the main focus on expert interviews. The experts were identified according to contact details of central portals and also according to the snow ball principle. Additional experts were recommended by previous interview partners. In addition, several reports, websites and further literature on the case study are also included. Information from interviews in the text are indicated by (CH01) to (CH07), referring to an internal interview reference table. All interviews were conducted in German. Quotations are own translations based on transcription.

In the Swiss case, there are different emphases (see Table 1.1). First, the focus is on the public law restrictions cadastre (PLR-cadastre) introduced in Switzerland, whereby the national and regional (cantonal) perspectives were considered. Second, two interviews were conducted to gain a general insight into digitisation in spatial planning. Third, the cantonal structure plans are a central planning instrument, which is affected by digitisation. Therefore, this study also focuses on them.

In addition to our investigations, the following general points are to be mentioned in the context of digitalisation in spatial planning in Switzerland: i) the Confederation invests three million CHF to improve collaboration with geodata between the Cantons and the Confederation (Zweckgebundene NGDI-Mittel); ii) according to the Federal Council's Open Government Data (OGD) Strategy, the Swiss parliament agreed, in December 2020, to provide all digital geodata for free (Kostenlose Geobasisdaten); iii) the Confederation updated the Federal Strategy for Geographical Information in 2020 replacing the version of the year 2000.

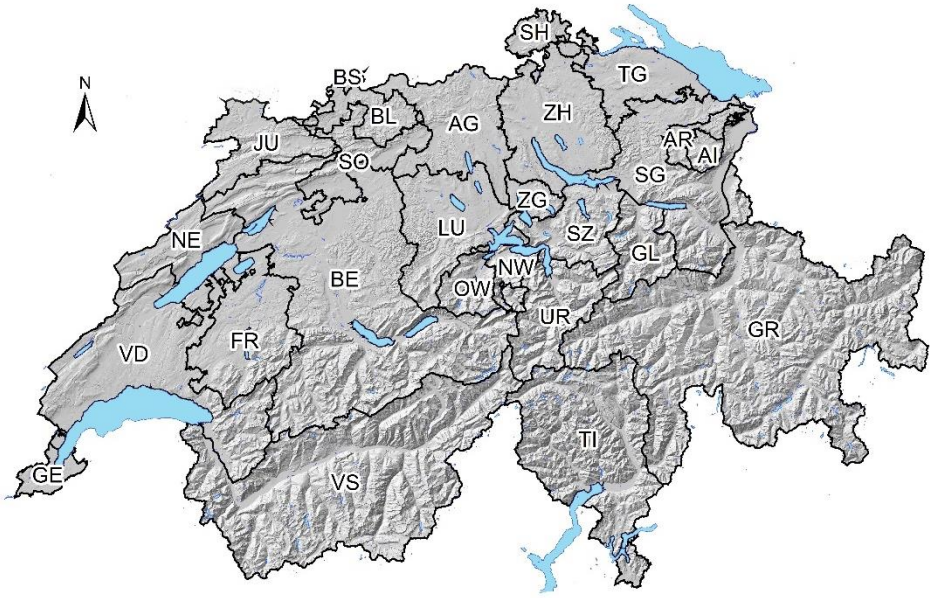
Table 1.1
Interviews held

Theme	Affiliation	Position
National	Office for Spatial Development	Spatial planner, Expert in Spatial Planning: EspaceSuisse, Association for Spatial Planning
	National government of Switzerland, Federal Office of Spatial Development	Expert in GIS Department
Cantonal structure planning	Basel-Stadt	Expert in Cantonal structure planning
	Regional government of Kanton Thurgau, Department of Spatial Development	Expert in Cantonal structure planning
Public-law restriction cadastre (PLR)	Regional government of Kanton Thurgau, Department of Geoinformation	Expert in PLR-Cadastre in Canton of Thurgau
	National government of Switzerland, swisstopo	Expert in PLR-Cadastre
	Neuchâtel	Expert in PLR-Cadastre

1.1 The Swiss planning system and the land use plan

Switzerland's administration is organised in federal, cantonal and municipal authorities (Map 1.1). In the field of spatial planning, the Federal Constitution gives the Swiss Federation the responsibility of establishing basic principles for spatial planning. This is implemented in the Spatial Planning Act, which acts as a framework law and was last revised in 2014.

Map 1.1
Switzerland and its cantons



TG Thurgau, BS Basel-Stadt, NE Neuchâtel; for a legend for full names of Cantons see: http://kantone-staedte.infos-schweiz.ch. Source: own compliation

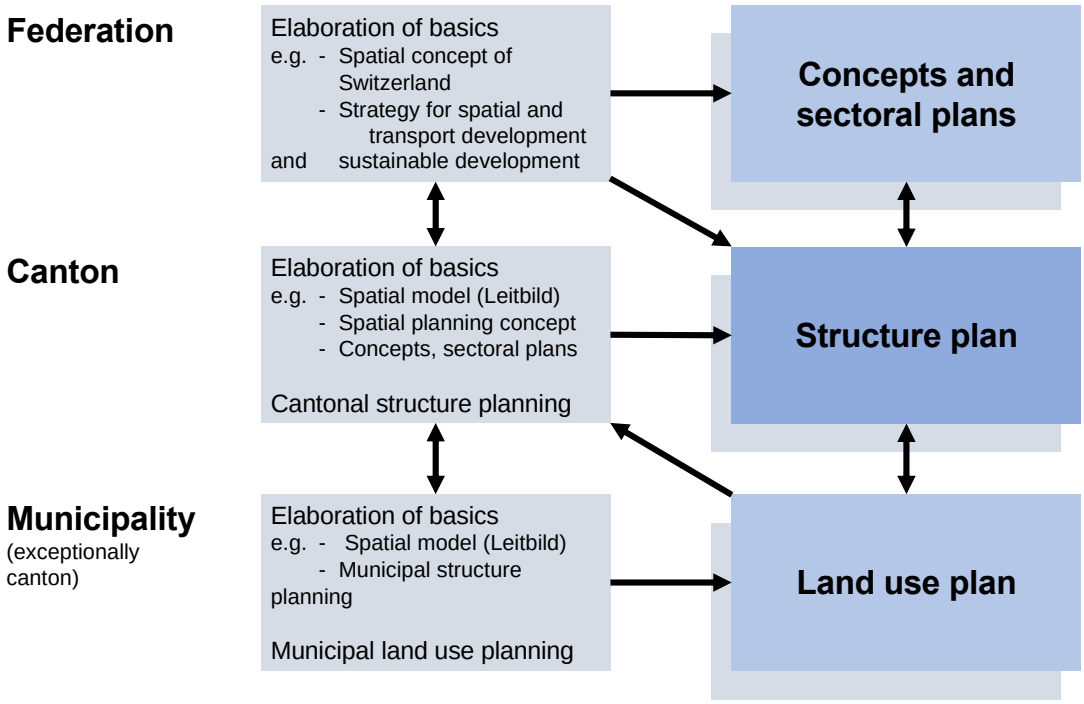
The cantons are responsible for spatial planning on their territory, but most delegate land use planning to the municipalities. The Spatial Planning Act requires that activities with a spatial impact must be coordinated. Activities with spatial impact are defined as the settlement of the land or the use of the land. The distinction between building and non-building areas is central in this context. The most important instruments in Swiss spatial planning are the structure plans and the land use plans (Figure 1.1).

The cantonal structure plans are prepared by the 26 cantons and approved by the federal government. They contain objectives and actions for appropriate spatial development, which must be considered by the communes. The cantonal structure plans consist of a map showing the relevant areas and a text section explaining the specifications. In subsequent land-use planning, the guidelines in the structure plan must be considered and respected.

The land use plan (also known as the zoning plan) is based on cantonal law and is the responsibility of the 2202 municipalities (number of municipalities for date 1.1.2020). In the plan, zones are defined for, for example, building, agricultural and protected areas. The land use plan is binding on landowners. As part of land use planning, there are special district plans (Gestaltungspläne) for local specification or to replace the general land use planning.

The federal government can deal with issues of national interest in sectoral plans and concepts. These include topics such as transport, military or geological repositories.

Figure 1.1
Spatial planning instruments under the Federal Law on Spatial Planning



Source: (Generalsekretariat GS-UVEK), original in German, own translation in English

2 Scope of digital plan data

The purpose of the PLR-cadastre is to provide the public with up-to-date and reliable information on public-law restrictions on ownership (Table 2.1). The implementation of the PLR-cadastre is anchored in the Geoinformation Act, which was passed in 2007 and has been in force since October 2009. The cantons are responsible for maintaining the cadastre, which is why the information is published on cantonal geoportals. An excerpt from the PLR for a particular property can therefore be obtained from the portal provided by the cantons. Framework models have been developed for the digitisation of various themes for the implementation of the PLR, which are intended to harmonise the themes across cantons. Of the 17 themes in the PLR-cadastre, one major theme is municipal land use planning. In the interviews, it was mentioned that neighbouring countries consider the PLR cadastre as a good example of the state of the art.

Table 2.1
Important portals associated with geodata and digital plan data in Switzerland

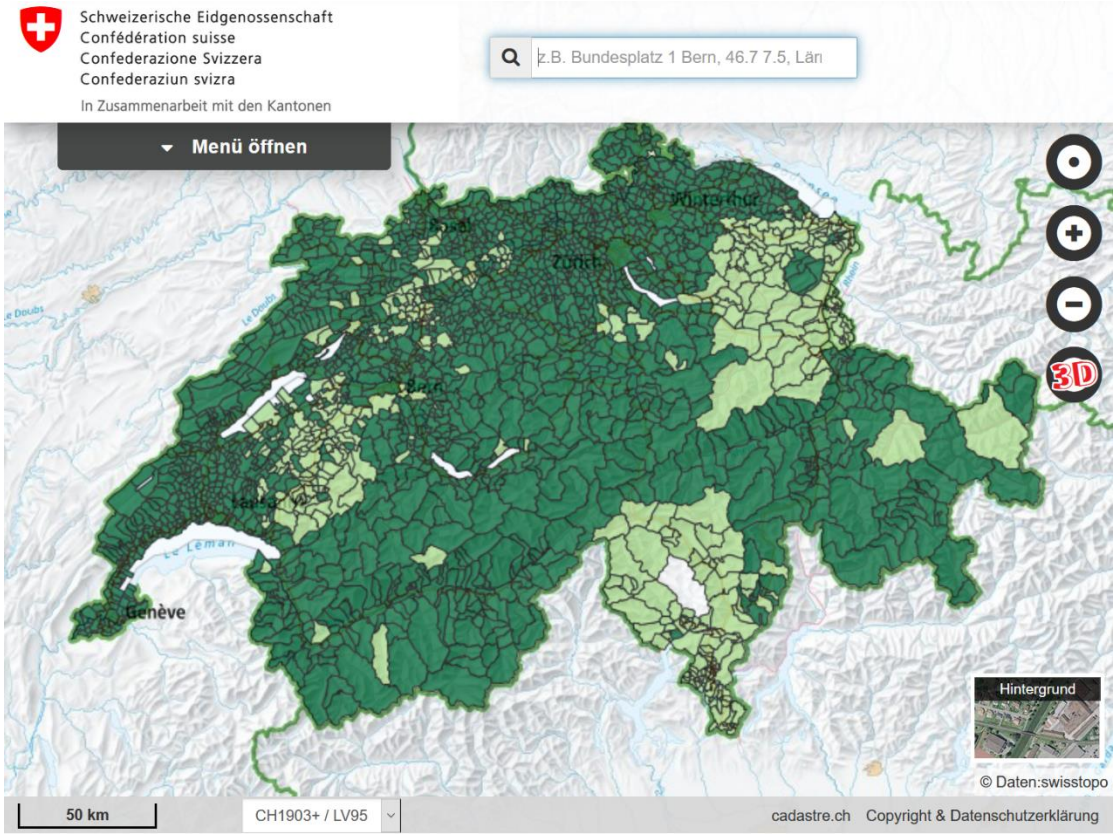
Name	Description	Link to portal
map.geo.admin.ch	Federal geoportal with data viewer	https://map.geo.admin.ch/
geocat.ch	Meta-Search-Engine for Geodata of Switzerland	https://www.geocat.ch/geonetwork/srv/ger/catalog.search#/home
geodienste.ch	Aggregation-portal for cantonal data	https://geodienste.ch/
open data swiss	Portal for open government data in Switzerland	https://opendata.swiss/de/
PLR Cadastre	Cadastre of Public Law Restrictions on Landownership	https://www.cadastre.ch/en/oereb.html, with links to cantonal portals

By the end of 2019, all cantons should have had put the PLR-cadastre into operation and made it available via a cantonal portal. There is some delay in some cantons but the PLR-cadastre will be available in the next few years (Figure 2.2.). In the canton of Thurgau, for example, all 80 municipalities have digitised their land use plans and made them available in the PLR-cadastre. However, the geodata shown is not legally binding and differ from the legally valid stamped analogue plan. In comparison, the geodata in the PLR-cadastre in the Canton of Basel-Stadt are legally binding.

It is up to the Cantons to define in their acts how and if digital plan data is legally binding. In the canton of Thurgau, the 17 main public-law restrictions on ownership under federal law are available in the cantonal WebGIS, among them the land-use plan. However, it is not the geodata that is legally binding, but in the case of land-use planning, the printed, signed and stamped plan. The digital plan data is so far, in a legal perspective, only a representation of the signed plan. Because there are differences between the modifiable digital data and the legally binding plan, the Geo2020 project was started in the canton of Thurgau in order to shift the legal status to the digital data. One of the main differences so far is that there is no authentication (Beglaubigung) in a PLR extract in the canton of Thurgau. However, it is anticipated that with the implementation of the project the discrepancies between digital geodata and analogue plans will be eliminated.

Similar to the canton of Thurgau, the land use plans signed in an analogue form are still legally binding in the canton of Neuchâtel. In Neuchâtel, there are also efforts to assign legal validity to digital data. The canton of Basel-Stadt has already achieved this step, with the geodata being legally binding. The cantonal experts mentioned the canton of Bern as another example. In this case, the Canton requires the municipalities to revise their land use plans before they can be included in the PLR cadastre. This provides an up-to-date basis to ensure that the plans are in conformity with the current situation. In general, the interviews revealed a general trend that more and more cantons are moving towards legally binding geodata in the PLR cadastre.

Figure 2.1
Status of the PLR Cadastre



Dark green means that the PLR register is active and available. Light green shows that the PLR register is planned. White colour indicates that the introduction of the PLR-cadastre has not yet been announced.
Source: https://www.cadastre.ch/de/oereb.html, accessed 12 Nov 2020

At the beginning of digitisation, the canton of Thurgau just got analogue land use plans from the municipalities and therefore digitised them for internal use. Currently, municipalities deliver land use plans analogously and digitally to the canton. For its own practice, the Canton of Thurgau uses only vector-based digital plan data, which are managed by the Cantonal Office for Spatial Development (ARE TG).

In the canton of Neuchâtel, there are two portals, the PLR cadastre portal and a geoportal with more comprehensive data sets. It is possible to take an excerpt from the PLR-cadastre on both portals. The maintenance of the digital data is also identical. In the canton of Neuchâtel, a revision of the land use plans is taking place, which is due to the age of the plans. As the expert reported, the cantonal spatial planning law stipulates that the digital plan data of the land use plans will become legally binding after the current revision (addressed also in chapter 4.4 Process change).

> *"In my opinion, digital plan data cover planning practice to a small extent, but with a growing tendency. [...] More efforts are made to use digital plan data in planning processes" (CH05).*

At present, digital plan data are not yet widely used in planning practice, as shown above in the quotation of an expert of national planning. There are great efforts to use digital plan data more in the planning process. There is also a growing desire for a comprehensive land use information system (CH05).

2.1 The historical background

Switzerland

An experienced spatial planner reported that digitisation has increasingly occurred in Swiss spatial planning, both in terms of land use planning and cantonal structure plans. In this context, the minimal geodata models of the federal government were a major milestone, which was also mentioned by the Federal Office of Spatial Development (FOSD) expert. These data models provide the basis for harmonised digital plan data. The Geoinformation Act as the basis for the PLR cadastre has also contributed to digitisation.

The expert from the FOSD mentioned that the awareness and the understanding of the added value of digital and structured data are important drivers for digitisation. In addition, developed data models of current projects were mentioned as a milestone. It should be noted that there are often no technical requirements (Formvorschrift) for data models. Thus, the method of conversion in a programme (software) or the formatting of a number is not specified. This could lead to a variety of implementations in software and therefore demands an agreement on unified implementation. The acceptance and appreciation of a formal regulation is therefore desirable as a further next milestone (CH05).

Looking broadly at Switzerland, the picture arises that the legal framework to digitise for PLR, combined with a time limit, have contributed significantly to the current state of digitisation, according to the spatial planning expert. However, digitisation began in larger cities and by innovative planning offices. Thanks to the existing people and resources of the cantons, the digitisation of plan data in the cantons but also in the municipalities has been pushed forward. In Switzerland, digitisation is thus a combination of top-down and bottom-up processes.

Thurgau, Basel-Stadt, Neuchâtel

The experts from the canton of Thurgau mentioned that in 1996 the first topics were digitised from the cantonal structure plans. Other themes from the cantonal structure plans were later also digitised and saved as vector data. Before 1996, however, only analogue data from the cantonal structure plans were used. The canton of Thurgau is now only working with geodata relating to the cantonal structure plans. The decisive factor was the initiative of the head of the office, whereby he expected an increase in efficiency through digitisation. The idea of increasing efficiency was a significant driver for the digitisation of cantonal structure plans. The digitisation of spatial planning in other cantons had little impact on digitisation in the canton of Thurgau. Similarly, the digitisation of the cantonal structure plans in Thurgau had little impact on the digitisation of municipal data in Thurgau, as the scale of the structure plans is not focused on parcels and is not directly included in the land use planning. In 2002, the GIS Association Thurgau (GIV) was founded and located at the Cantonal Office for Geoinformation. This association is responsible for geoinformation between municipalities, canton and private sector with several working groups. The land use planning working group made a major contribution to the development of a cantonal data model. This initiative prompted about 80% of the municipalities to digitise their land use plans. Acceptance was not a problem, as the municipalities had recognised the advantages of digitisation. The Geoinformation Act (2007) as the new legal basis initiated the digitisation of land use plans of the last remaining 20% of the municipalities. Thus, the land use plans in Canton Thurgau had already been digitised before the introduction of the PLR cadastre in 2012-2015. However, the PLR cadastre then formed the connection to the legal regulations. In terms of the PLR cadastre, the Canton of Thurgau made good progress, with the Office for Geoinformation playing a major part. As a result, the implementation of the PLR cadastre in the Canton of Thurgau is also an interesting example for other cantons. The cantons can use the digital data of the municipalities from the PLR cadastre to analyse the extent of building zones, a task it needs to perform for updating the cantonal structure plan. At present, there are still some inconsistencies in the digital data, which need to be corrected by the Office for Spatial Development in the canton of Thurgau. Before the PLR cadastre, however, the cantonal office for spatial development in the canton of Thurgau (ARE) digitised municipal plans at considerable effort to determine the settlement area. It was noted that the data of these digitised plans was of lower quality than it is today (CH02).

In the canton of Basel-Stadt, digitisation in the public authorities began in the 1990s. Digitisation of plans made it easier to handle the plans. This and also the easier accessibility through digitisation were mentioned in the interview as drivers of digitisation. In the years 2013 to 2015 the digitisation of the entire historical plan data was started. A start was made first with the historic photos of buildings, which would otherwise rapidly

lose quality. The historical plans are in the process of being scanned, labelled and then saved. A georeferencing of these plans does not occur. The historical plans are digitised over time, whereby data of entire neighbourhoods will gradually be digitised. In the process of digitisation, various experiences have been made, whereby the storage of different versions of digital plan data played a lower role at the beginning than it does now. Today, due to the possibilities of digitisation, the amount of data has increased. This has also been noticed in the pictures, which were taken in the context of planning projects. In the past, one or two pictures would have been sufficient, whereas today, due to the ease of use, multiple photos are taken.

In the canton of Neuchâtel, digitisation in cadastral surveying began in the 1990s. In the 2000s, the land use plans were first digitised by the spatial planning office for internal use, using the data of the official cadastral survey as a basis. In 2010/2011, this development led to the Canton of Neuchâtel participating as a pilot canton in the PLR Cadastre project. Most of the plan data had already been digitised. What was still missing was the link with the regulations for the PLR cadastre, which required considerable effort. Over the last one and a half years, the focus has been on revising the land use plan and adapting the legal basis to make the digital data legally binding.

2.2 Standards

Standardisation is particularly important for land-use planning and brings great added value in the analysis throughout Switzerland (CH01).

Since the PLR cadastre is a cadastre of legal restrictions, international standards did not play a role in the implementation of the cadastre. The expert on the PLR-cadastre said that this degree of linking geodata and legal information is unique so far. However, a European working group once held an exchange on the implementation of different PLRs in the various countries (Steudler, 2016). As with the PLR cadastre, international standards, i.e. INSPIRE in particular, did not have much influence on the federal framework models, as the expert from the FOSD stated. Nevertheless, data management and the concept of the life cycle of geodata were included, for which INSPIRE was the inspiration. The expert from the Office for Geoinformation in the Canton of Thurgau also mentioned that he had not yet had any contact with INSPIRE.

The canton of Thurgau has a cantonal data model for land use planning, which was implemented 10 years ago. This was adapted with the introduction of the federal minimal geodata models and the framework models of the PLR cadastre. The municipalities are responsible for classifying their zones into the cantonal model. This cantonal model is also shown in the PLR cadastre. The canton then handles the assignment of the cantonal data model to the minimal geodata model of the federal government. The expert from the Office for Spatial Development of the Canton of Thurgau estimated that the national minimal geodata models are certainly more efficient and more meaningful than 26 individual solutions with different interpretations. However, it must be considered that such a national data model was a great effort in Switzerland, involving many working groups and intensive discussions. The expert from the Office for Geoinformation also mentioned the importance of standardisation and harmonisation for the comparability of data. Currently, many digital plan data are already available in geoportals, but are not yet comparable. Harmonisation at cantonal level for the cantonal structure plans is therefore also in progress. However, there is always the question of how much influence a higher level (federal government) can and should have on the lower level (canton). However, a cantonal planner (CH07) expects that standardisation and harmonisation for comparability will continue to increase in Switzerland. Due to the different interests, an attempt is being made to find the lowest common denominator, which can be agreed on (cf. quotation below).

> *"In the future, there will certainly be a move towards harmonisation and standardisation. In the end we will have to agree on the lowest denominator" (CH07).*

Like the canton of Thurgau, the canton of Neuchâtel also has a cantonal data structure. This is based on the national minimal geodata model. In the current revision of the land use plan, new land-use plans based on the existing data are being produced with the new standards of the canton of Neuchâtel. The PLR cadastre also shows the cantonal data structure of the land use plans (CH06).

In the canton of Basel-Stadt, plan data is exchanged between Germany and Switzerland for international projects such as IBA Basel or Landschaftspark Wiese. Since the Swiss data comply with the federal minimal geodata models and the German data also meet certain requirements, this does not present a problem.

However, the different data resolution in the three countries Switzerland, Germany and France is a challenge for the international presentation of regional plans (CH04).

3 Organisation of digital plan data

3.1 Organisation

Federal minimal geodata models

The Geoinformation Act has been in force in Switzerland since 2008. This law requires federal minimal geodata models and geodata illustration models in order to allow a broad use of geoinformation (Bundesamt für Raumentwicklung ARE, 2020a). A federal minimal geodata model was also established for land-use planning. The cantons are required to provide the federal government with the relevant data so that the federal harmonised data set can be published on the national geoportal[1]. Currently a model is being developed for a nationwide dataset of the cantonal structure plans. For this reason, the federal government and the cantons are currently discussing how to ensure that the cantons can commit to them on a voluntary basis as far as possible (CH05).

Federal sectoral plans

Sectoral plans show national strategies in specific sectoral or thematic areas. The Federal Government can thus show objectives and requirements or targets in the sectoral plans (Bundesamt für Raumentwicklung ARE, 2020b). The sectoral plans are digitally available as vector data with the corresponding object sheet on the national geoportal (CH05).

Cantonal structure plans

The cantons are responsible for developing the cantonal structure plans, which is why they are also responsible for digitisation. The expert from the canton of Thurgau commented that the digitisation and digital preparation of the cantonal structure plans was carried out independently of the other cantons (CH07).

Municipal land use planning

The municipalities are responsible for land use planning. Thus, the municipalities maintain the freedom to name and define their use zones themselves (within cantonal limits). However, these must be transferable into the optional cantonal model and into the minimal federal geodata models (CH02). In some of the cantons studied, the land use planning data in the PLR cadastre are shown in the cantonal data model (Thurgau, Neuchâtel).

Cadastre of Public Law Restrictions on Landownership (PLR Cadastre)

The Geoinformation Act legitimises the PLR cadastre. Framework models were created for the presentation of the data in this cadastre. A degree of harmonisation was intended to ensure a minimum level of comparability of the data throughout Switzerland. The PLR cadastre represents the public-law restrictions on ownership, which can be found in the land use planning, for instance. However, the planning processes for land use planning are not controlled by the PLR cadastre, but take place in the usual planning processes. Nevertheless, the PLR-cadastre represents a change, as the information is presented separately in the PLR-cadastre in accordance with the legal basis (cf. quotation of a PLR expert below; CH03). The management and organisation of the legal texts in the context of the PLR-cadastre is the responsibility of the cantons.

> *"The implementation of the PLR cadastre requires a rethinking. [...] With digitisation, we are moving away from this presentation because the information can be overlaid separately and viewed individually. In order to make the different legal bases visible, the topics for the PLR cadastre are separated. In this way the legal processes can be assigned more easily." (CH03)*

[1] https://map.geo.admin.ch

The PLR cadastre is based on the Geoinformation Act (data act) and various other laws, for example the Forestry Act (act for specific topic in PLR). There are discrepancies between these specialised and data laws. A major point of discussion is the legally binding nature of the data. The PLR cadastre can be used by cantons as an official publication organ. However, this is not prescribed in the federal legislation; the cantons have the freedom to implement this within the framework of their own legislation. In the example of spatial planning, land-use planning is regulated by cantonal legislation. The question therefore arises as to what extent a national data law can intervene here. Is it permissible to prescribe a details of implementation on the basis of the harmonisation mandate in the context of the Geoinformation Act? For example, the water protection law restricts the construction near water bodies. The regulation does not yet clarify how the distance to the water body is to be represented geometrically. On the one hand, the distance could be a line or on the other hand, an area. This detail and others are currently the subject of discussion (CH03). The various laws concerning the public law restrictions on a parcel are displayed as a whole in the PLR cadastre and must fit together. However, it is not yet possible to display all specific texts for a parcel. The question arises of how this can be implemented, since the legal texts unfold their effect as a whole (CH05).

The canton of Thurgau was a pilot canton in the development of the PLR cadastre. The development of an administrative management tool, ÖREBlex, has played a major role in this process, with the three categories of “legal regulations”, “notices and legal bases” and “notices” being represented (CH03). The Canton of Thurgau, as well as many municipalities, now use this tool to manage information on legal bases in the context of PLR content (building regulations, laws, federal and cantonal ordinances). In this administration tool, there is a link to cantonal and federal legal texts, whereby adjustments are automatically transferred. It also contains historical information and regulations. Only the municipal legal foundations are managed manually and reported by the municipalities, which is a possible source of errors (CH02). However, this tool has proven to be helpful, which is why it is now used by more than half of the Swiss cantons (CH03).

In the Canton of Thurgau, conflicts between the Data Act (Geoinformation Act) and the specialised law (Spatial Planning Act) were also identified, with the main point relating to the legal validity of digital data. The canton is now in the process of adapting the specialised legislation in order to eliminate the difficulties of the two legal bases. Furthermore, the expert noted that the distribution of tasks among the authorities has changed to a certain extent as a result of digitisation. However, this is not regulated by law. The Canton of Thurgau, for example, is taking over the task of updating the building zone reserves for the municipalities for the municipalities by consulting the PLR data (CH07, more on this in section 3.3).

In the canton of Neuchâtel, the coordination of specialised legislation with data legislation works well because the offices in the canton work well together. The legal bases in the PLR cadastre for the land use plans, i.e., the municipal building regulations, were captured manually at considerable expense. These documents are now good working documents. The canton uses a web solution to link these documents with the geometry. This is then checked by the spatial planning office. With the current revision, the latest documents and currently valid plans are identified. Even though it is possible to certify the PLR cadastral excerpt in the canton of Neuchâtel, this has never been requested. Due to the exact quality, the data are used as if they were legally binding (CH06).

3.2 Financing

Digital data production is usually financed by the data owners themselves, as the expert from the FOSD said. The municipalities are responsible for land use planning, the canton for cantonal structure plans and the federal government for sectoral plans or national topics.[2] However, the regulation of data management differs from the regulations of data production in Switzerland and depends on the canton. The FOSD expert also noted that end users pay less for the provision of digital plan data compared to the past. If the data sets require payment, then the price of the data does not cover the data itself, but instead covers the preparation of the data for the individual delivery, as stated below by a planning expert at national level[3].

[2] An exception is the digitisation and production of a digital data set on sustainable energy. The Swiss Federal Office of Energy is interested in these data and therefore co-financed the digitisation of these plans.

[3] As mentioned in section 1, the Swiss parliament approved the OGD strategy in December 2020.

"The whole Open Government Data (OGD) movement, which the administration has captured, requires less effort, there is no longer the need to draw up contracts, but rather the information is placed on the internet where users can obtain it. [...] Therefore, the costs for the end users are decreasing. There is data that has to be paid for [...], but you pay less and less for the data as such but for the preparation of it." (CH05)

The financing of the PLR cadastre was regulated in a way that the infrastructure and the digitisation of the plan data were considered separately. Since the federal government had expected the cantons to digitise their planning data before the PLR cadastre was established, as the expert noted (CH03), financial support was only granted for the additional costs arising from the Geoinformation Act, i.e. the infrastructure of the PLR cadastre. The swisstopo expert explained that the federal government and the cantons each contributed half of the financial support to the PLR cadastre.

The experts from the canton of Thurgau reported that the municipalities themselves financed the digitisation of the land use plans. As the municipalities also see added value in the digital data, digitisation at the expense of the municipalities did not present a problem. Often the municipalities work together with private planning firms and pay them to produce the plans. The municipal data are delivered to the canton to be incorporated into the cantonal data model. Since there are still some errors in the assignment to the cantonal model, the canton has to correct these errors, which takes time and human resources. However, these costs should decrease in the future. The digitisation and production of cantonal data is financed by the canton. The costs in the canton for these cantonal issues consist mainly of the time spent by the cantonal employees on producing data sets for the cantonal structure plans. The updating of the data is also carried out within the canton. Depending on the topic, this is done by the individual departments or by the Cantonal Office for Spatial Development.

The expert from Basel mentioned that the Land Register Survey Office (Grundbuchvermessungsamt) is responsible for organising the financing of land use plans. Within the canton, the data is accessible at no cost.

The first digitisation of land use planning in the canton of Neuchâtel was financially supported by the canton and the pilot project of the PLR cadastre. The canton assumed the financing on the basis of compliance with certain data formats and guidelines issued by the Cantonal Spatial Planning Office. The municipalities did not need to spend anything on this apart from resources for checking the data. However, the current revision of the land use planning is at the expense of the municipalities. The storage and maintenance of geodata is, however, the responsibility of the canton, which also covers the costs. The two geoportals in Canton Neuchâtel are accessible for free. However, the purchase of data for third parties comes with a small administrative fee in Canton Neuchâtel.

3.3 The role of different actors

Digitisation

The expert from the canton of Thurgau reported that the cantons submit cantonal data sets to the federal government so that the federal government can compile a national data set. Here, the recently discussed question arises of how a communal data set can reach the federal government if a commune does not agree to supply the data. Can the federal government contact the municipality directly, or how does the canton deal with this? Digitisation has shown that the allocation of responsibilities in digital spatial planning in Switzerland is complex (CH07). The spatial planning law defines the thematic competence. As a result of digitisation, it can happen that municipal data is collected by the canton and delivered to the federal government, although the municipalities would actually be responsible for it. Such roles are currently still being clarified. In the canton of Thurgau, however, this has so far not caused any conflicts, as the issues have been considered jointly by the canton and the municipalities and solutions have been found (CH07).

In the canton of Neuchâtel, the canton played a leading role in the first digitisation of the municipal land use plans. The canton now also initiated the revision of the land use plan. Nevertheless, the municipalities are responsible for the implementation of the current revision of the land use planning. The canton then controls and validates the land use planning and also manages the digital data. The expert concluded that municipal autonomy in this French-speaking canton in land use planning is smaller compared to municipalities in German-speaking Switzerland (CH06).

Standardisation

Standardisation is needed to ensure comparability. For the corresponding data models, a consensus of the authorities is crucial (CH05). The public authorities, in particular the Federal Office for Spatial Development, played an essential role in the standardisation of spatial plan data. For national comparability of plan data there are the federal minimal geodata models, whereby the federal government plays a leading and central role (CH01). The interviews showed that cantons use a cantonal data structure, in which for example the data of the land use planning in the PLR cadastre are shown (CH02, CH06). A planning expert at national level expressed it as follows:

> *"Where there is no formal requirement, which has been found in a consensus, then this (consensus) must be found first. This is crucial. Cantons, regions, agglomerations, municipalities - these are of course stakeholder number 1. They have to agree with the draft/data model. Their role is very important, and it is essential that they are consulted." (CH05)*

In the standardisation and harmonisation of cantonal and municipal data, the respective responsibilities of the authorities must be defined. It is currently being clarified how much influence the federal government can have on cantons and cantons on municipalities to demand standardised data, although the technical responsibility lies with the lower level of authorities (CH07).

It was mentioned in the interviews that the different data collection methods must be considered when interpreting cantonal data sets. In the example of the crop rotation areas (Fruchtfolgeflächen), the data were collected slightly differently in the individual cantons, which makes comparability impossible. This must be taken into account when interpreting the data. This is particularly noticeable when the data is published and accessible to everyone. There is thus a risk that this easy availability could lead to incorrect data interpretations. Authorities have little control over this (CH07).

PLR cadastre (Public law restriction)

The PLR cadastre is based on the Federal Geoinformation Act. However, the implementation thereof, e.g. in land-use planning, is regulated by cantonal legislation. The federal government can only give recommendations. The cantonal regulations and recommendations apply to the handling of the PLR cadastre in the cantons (CH03).

3.4 Relation within different levels of government

In the context of his work, an expert in spatial planning has noticed that the dialogue between the cantons is very important during the digitisation process. This dialogue is supported, for example, by the cantonal planners' conference where all cantonal planning directors regularly meet. The expert also sees the opportunity that cooperation within the authorities could be facilitated by simplified digital processes. Furthermore, cooperation between the authorities is on a good path and a lot is already in progress. However, cooperation could be a challenge for the municipalities, as they are often faced with resource scarcity. This is due to the militia system in the Swiss municipalities, since most municipal politicians work for the municipality only on a volunteer or part-time basis (Schweizerischer Gemeindeverband, 2016). In particular, small to medium-sized municipalities need support and networks for regional exchange. The association of towns or municipalities could play a stronger role in this. According to a spatial planning expert, exchanges between the cantons take place through cantonal events or directly on a bilateral basis (CH01):

> *"The exchange of experience between the cantons is very valuable. Regular exchanges take place in the relevant working group of the Cantonal Planners' Conference, where problems and open questions are discussed. This exchange already existed before digitisation, but was also helpful for questions concerning digitisation. Good examples could be shared. Especially for land use planning, the exchange was very useful" (CH01)*

The swisstopo expert noted that the digitisation of plan data has not significantly changed the structure of relations between the authorities, as the information in the PLR cadastre is public and accessible to all. However, digitisation had consequences on all administrative levels in cleaning up their data stocks to deliver

the current data (CH03). The FOSD provided support in its cooperation with the cantons in establishing the PLR cadastre. The Specialist Information Communities (Fachinformationsgemeinschaften (FIG)) are mainly responsible for technical specificities in the interaction of the federal government with the cantons (CH05).

On a more conceptual level, the exchange between the federal government and the cantons takes place either through the federal offices themselves or through the federal Coordination, Geo-Information and Services (KOGIS). The expert also mentioned that the cooperation between the Federal Government and the cantons has changed due to the federal minimal geodata models. As the Federal Government demands more information from the cantons in connection with these data models, its influence on the cantons increases accordingly. In the same way, the influence of the canton on the municipalities has also increased, as the canton demands information from the municipalities, which is then passed on to the federal government.

The GIS Association Thurgau (GIV) was cited by an expert as a successful model for cooperation between municipalities, cantons and the private sector. The network contributes significantly to raising awareness and clarifying issues and can also be seen as a driver for cooperation, as the expert pointed out:

> *"The GIS Association Thurgau (GIV) has been in existence for 15 years and during this time has coordinated the cooperation in the context of digitisation with the municipalities and the canton. It has also sensitised stakeholders and clarified questions. In my opinion, the GIS association is a successful example. The association is a driver for cooperation with the municipalities" (CH02)*

In the canton of Neuchâtel, cooperation within the authorities was already well established before digitisation. Digitisation resulted in a greater practice of communication, which increased transparency within the cantonal administration. In addition, the communes and the canton cooperate well, which was intensified by the data collection (CH06).

The expert from the canton of Basel-Stadt reported on international cooperation with GeoRhena and the neighbouring countries Germany and France. The expert noted that data quality differs, with France having much less detailed plan data than Germany and Switzerland. Thus, despite good cooperation, a joint presentation is difficult. Nevertheless, the German land use plans have an indirect influence on planning in the canton of Basel-Stadt. For example, the canton was able to plan an urban railway because of its knowledge of the development plans in Germany (CH04).

3.5 Relation between governmental and not-governmental actors

A spatial planning expert said authorities will become more transparent due to the easier accessibility of digital plan data. Increased participation can also be assumed due to the easy accessibility. According to his experience, however, the interest of people in the plan data is not directly linked to digitisation, but rather to the affected area. However, the digital possibilities make participation easier. The canton of Obwalden was cited as an example, which had already carried out the public participation process for the last cantonal structure plan revision digitally. However, when publishing digital plan data, the expert mentioned that third parties sometimes do not know which data can be found where. But once this is better known, the expert expects improved cooperation (CH01). The expert from the FOSD also reported on a more intensive exchange with the population due to the publication of digital plan data. This, in turn, increases transparency through better visibility of the authorised pans (CH05).

Due to the public and easy access of the data in the PLR cadastre, the interest of the real estate market, notaries and banks in the information in the PLR cadastre is high. The real estate market benefits from this, as it facilitates access for their risk assessment and valuation of properties. Banks and insurance companies are also very interested in this information (CH03).

In the canton of Thurgau, it was observed that private companies (planning firms etc.) are more progressive than the municipalities, as they have to position themselves on the market and therefore take advantage of consulting opportunities. The expert therefore assumed that the influence of these private companies has increased. It should also be mentioned that the general population has easier access to digital plan data. It was therefore noted that the public is becoming more aware of the issue of digital plan data. The participation processes for citizens in the canton of Thurgau still take place in analogue form. In future, the aim is to manage participative processes digitally. In terms of cooperation, the GIS Association Thurgau (GIV) should

be mentioned, as it has so far proved to be advantageous for all parties involved. This association includes not only the authorities but also private planning companies. Cooperation between public and private sector is illustrated below in the comments of a PLR and a planning expert.

> *"The private sector is technically more advanced than the municipal administration (canton of Thurgau). In the canton of TG there are many small municipalities which are generalists and not specialists. The private sector supports the municipalities because they are specialists and they know what is state-of-the-art. And they have taken the opportunity to advise the municipalities. The municipalities listen to them too. Since the private sector is more advanced than the public authorities, it has gained influence" (CH02)*

> *"Planning becomes more transparent thanks to the digital data and easy accessibility. This makes it easier for private individuals, landowners and also consultants to access information. Since this digital information is public, the position of all actors has been strengthened." (CH01)*

The expert from the canton of Basel-Stadt mentioned that events for participation in urban district plans are highly appreciated and valuable. At these events, anyone can take a position and a discussion is initiated. The expert found the discussion in digital chats more challenging. It was also noticed that the preference in which medium the discussion takes place could differ from generation to generation (CH04).

In the canton of Neuchâtel, cooperation with private individuals is managed by the spatial planning office. However, this has not changed significantly as a result of digitisation (CH06).

4 Use of digital plan data

4.1 Use of digital plan data in different planning processes

Digital plan data can be used in many different ways. They can be used in formal planning as well as in informal processes or analyses.

Formal planning process

The FOSD expert said that digital plan data is used in the formal planning process for information and communication via the internet. However, this is the responsibility of the responsible local authorities, and therefore this can be implemented in different ways (CH05). In the canton of Neuchâtel, the digital data of the land use planning are used as if they were legally binding. This is possible because of the adequate data accuracy, although the digital data is not yet legally binding. (CH06).

Informal planning process

There is potential to use digital plan data in informal planning so that, for example, evaluations of it can flow directly into the planning process. Today, data exchange in plan data design processes is not yet anchored in the process itself. In the future, however, data could be used in such a way that it can directly change the drafting process (CH05).

Evaluation of planning

The digitisation of plan data offers the possibility to use this digital data for the evaluation of planning (more on this in Annex 3, Thematic Practice Paper "Future technical developments and possibilities"). Digital plan data is used for monitoring at federal level in Switzerland. For example, digital plan data is needed to examine the building zone dimensioning of the municipalities and thus incorporate it into the subsequent planning (CH05). In the canton of Basel-Stadt on the other hand, digital plan data is also used for urban development and prognoses of development (CH04).

Further use

The municipal plan data is important for the Canton of Thurgau for establishing monitoring the current level of accessibility (road, public transport) and planning future extensions. Private actors are also interested in the digital plan data. For example, the Swiss Federal Railways (SBB) or a mobile network provider Swisscom can benefit from the data and use it for their own purposes (CH02). By publishing the plan data on the internet in the canton of Basel-Stadt, the data can be used in a variety of ways. Thus, research, nature conservation and associations can also acquire the data via the Geoshop and use it for their purposes (CH04). The expert from the canton of Neuchâtel also noted that the digitisation of plan data creates new needs and requirements. This also opens up many new possibilities for use (CH06).

In the canton of Thurgau, the data on building zone reserves is used as a parameter for the cantonal structure plans. Raum+ is a method for creating overviews of settlement reserves[4]. Therefore, the canton of Thurgau joined the Raum+ project to survey their building zone reserves, with the first basic survey taking place in 2014. The ARE expert (CH07) explained that the results were criticised because the building zone reserves could not be digitised in parcel detail at that time. In fact, the zones were drawn on an analogue paper plan in a survey meeting and subsequently digitised. During the first update in 2018, however, a more accurate data quality was achieved, as the data basis was based on digital data. This also resulted in greater acceptance by the municipalities, as the expert reported. Since a revision is planned every four years, the third revision is planned for 2022.

[4] https://www.raumplus.ethz.ch/de/home/, access on 18.12.2020

4.2 Digital plan data on different levels

The swisstopo expert stated that the implementation of the digital PLR cadastre had no impact on the digitisation or digital provision of the cantonal structure plans. This is due to the fact that the land use planning and the cantonal structure plans relate on different administrative levels. The cantonal structure plans are binding on the authorities and are not sharply focused on specific parcels. In contrast, the topics in the PLR cadastre are defined on a parcel-by-parcel basis. How the cantonal structure plans are digitised and made available to the public depends on the information policy of the respective cantons and is related to their approach to transparency, as stated by a PLR expert (CH03).

"This is a question of the canton's information policy. PLR and cantonal structure plans are independent and have no influence on each other" (CH03)

The federal government is interested in digital plan data in order to carry out nationwide analyses (e.g. building zones). Cantonal authorities are more interested in specific zones of land use planning or cantonal structure plans. Municipalities, on the other hand, tend to concentrate on their own territory (CH02). In the planning of dimensioning of building zones (Bauzonendimensionierung), a canton can obtain feedback from certain criteria (still hypothetical). However, this interaction is currently still supported manually, but could be automated in the future (CH05).

4.3 Accessibility

"Due to the easy accessibility of the information, transparency in the process has been achieved. It is easier to refer to the same basic information" (CH03).

After the statement above, the PLR expert explained that the information in the PLR register is publicly available and free of cost. However, accessibility to digital data besides the PLR cadastre depends on the data owners or the cantonal regulation.

In the canton of Thurgau for example, municipal plan data is not available before it comes into force or are laid out for public participation in the municipalities. The public participation for revised land use plans is conducted analogously. The canton only receives the plan data of the municipal land use planning for review. However, some municipalities also submit the data to the canton for preliminary examination. The preliminary examination becomes easier with digital plan data. Therefore, the canton of Thurgau intends to make the preliminary examination compulsory. This should make any discrepancies between cantonal and municipal goals clearer. In addition, the canton will be able to comment earlier on municipal intentions, which will speed up the review process (CH02). The cantonal structure plan will be digitally published for the consultation process. So far, digitisation has not resulted in the earlier publication of digital cantonal structure plans. In the consultation procedure, a thematic layer has been published digitally in the WebGIS for the cantonal structure plans in the canton of Thurgau. The expert presumed that this could be applied more often in the future (CH07).

The geodata from the cantonal structure plans in the canton of Thurgau have been available since the year 2013 for CHF 50 via the ThurGIS Shop. Since 2018 these data have been available free of charge via the shop and since 2019 all geodata from the cantonal structure plans can be obtained directly from opendata.swiss as a WFS service. To obtain data via the ThurGIS Shop, interested parties must create a free account. This can be regarded as a small barrier to the acquisition of data. On request, the data has also been shared with planning companies as shapefiles before 2013.

At the federal level, the sectoral plans are published digitally after approval by the Federal Council.

4.4 Process changes

The expert from the FOSD said that the planning processes have not changed much due to digitisation. The plans are the result of planning. But there is great potential that digital data fosters analyses during the planning process that will impact the plans (CH05).

Process for approval of land use planning in the canton of Thurgau:

The municipalities submit an analogue dossier to the canton for the purpose of examining the land use plan. In the canton, the analogue dossiers are scanned when they arrive and then only circulate in digital form. In addition to the analogue dossier, the municipality also submits a digital geodata set with all the elements (including those to be approved). These digital geodata (Format Interlis) should correspond to the plans in the analogue dossier submitted, which unfortunately is not always the case (CH02).

In the canton of Thurgau, there are still various changes from digital to analogue and vice versa in the planning process of the land use plan. As a result, the digitisation of plan data has only led to a slight increase in efficiency for the authorities. The expert also said that analogue processes need to be rethought and adapted to digitisation. It should be noted that new needs are added by digitisation. The current project in the canton of Thurgau, Geo2020, aims to move the binding character for land use plans from paper plans onto the geodata. This is expected to result in a massive increase in efficiency, which is currently not yet visible due to the dual strategy with digital and analogue plan data. The project will not only improve planning processes, but also clarify open questions between digital and analogue data. Due to the easier accessibility of digital plan data, spatial planning is already a little more transparent. Within the PLR cadastre, a pre-publication status is available for amendments in process. For this purpose, the perimeter is marked and it is indicated that at this location planning is currently revised. However, the implementation of the project is intended to increase transparency even further. In Canton Thurgau, the legal certainty of digital plan data has not yet changed. However, the data basis has improved, which is expected to benefit project planning. The Thurgau expert assumed that this will probably be further strengthened by the digitisation of the planning processes. The planning processes also include participation procedures. In future, these processes will be conducted completely digitally during the cantonal structure plan revision in the canton of Thurgau, which is expected to increase the efficiency. In addition, according to a PLR expert, the effort could be reduced, while maintaining discussions on the digital platform (CH02). However, a planning expert also mentioned potential drawbacks:

> *"The digitisation of plan data creates completely new opportunities for participation. The data is more accessible, details can be handled, data can be visualised and tools can be applied, which means that participation can take place digitally. This can also support and facilitate the evaluation of participation. There is, however, a risk that the nuances (interpersonal aspects) in the participation process could be lost." (CH01)*

In the canton of Basel-Stadt, internal consultation on land-use planning and cooperation with the public are mainly digital. However, there are still public events for the population in the case of urban district plans, where paper plans are also used. However, the expert found that the planning processes have not changed so far, apart from the more easily accessible data. The expert from Basel-Stadt also mentioned increased transparency through the easily accessible digital plan data. With the PLR cadastre, for example, zoning changes are automatically published in the Cantonal Bulletin. The digital processing of building submissions will certainly become more efficient, as it will no longer be necessary to transport paper files from one office to the other. The expert noted that since digitisation, fewer meetings are held within the cantons where plans are discussed. Nowadays, everyone can comment on plans at their own workplace, which is why fewer meetings are held. In contrast, physical meetings with the population will continue to take place. However, it is still unclear how this might look like in the future (CH04).

In the canton of Neuchâtel, both analogue and digital plan data will become legally binding with the ongoing revision of the land use plans. The public consultation documents in various stages of the planning process have been available on the internet for some time, but they can still be in analogue form. The building permits are now submitted digitally in a software SATAC. The quality of the digital data depends on whether they have been digitally recorded or digitised. For example, digitally recorded data is of higher quality than digitised plans based on analogue plans. However, the new land use plans will be of even higher quality because the plans to be published will be exceptionally carefully checked for their quality. With the revision of the land use plans, certain data will be defined more precisely, such as the protection of Jura mountains. Thus, the

existing restrictions for protection have been further specified with the revision. In addition, the expert generally concluded that there is more data due to digitisation, which means that planning processes can be both more complex and more efficient (CH06).

4.5 Purpose / added value

The spatial planning expert sees added value in more rational discussions based on digital plan data. All people involved can all obtain information from public digital data, which is why the discussion is expected to focus more on this data rather than on individual opinions. Nevertheless, the expert expects that planning will remain challenging in the future, although digitisation can bring great added value and benefits (CH01).

The expert from the FOSD sees the added value in digital data if it is accessible and usable. In this case, the authorities also have the opportunity to show their view and interpretation. An expert from the canton of Thurgau sees advantages of digital data in the more sophisticated analyses that can be made during the planning process. Data from a wide variety of topics can be combined and analysed in an integral manner. However, the goal of digital planning should always focus on fulfilling the expectations placed on spatial planning (CH05).

The added value of digital plan data in the canton of Basel-Stadt lies in the possibility of overlaying information and the easy accessibility of digital data. Moreover, it is easier to look for a plan digitally than to look for it in the physical archive. These improvements in the administration in the canton of Basel-Stadt acted as a driver for the digitisation of plan data. But the digital data not only offers added value for the administration, but also for the population. Thanks to easy access to the data, citizens can obtain information quickly and easily, as stated below by a cantonal planner (CH04).

> *"Digitised/digital plans can be more easily layered on top of each other, making the information easier to see. Moreover, this is handier than the, sometimes, huge plans we have. It is quicker to grasp/access. Otherwise you always had to go to the cellar and look for the plan in a folder, which photo is the right one. So, you have an overview and have faster access. That was the initiator for the digitalization." (CH04)*

In the canton of Neuchâtel, digitisation has resulted in an increase in efficiency thanks to quick access to digital data within the canton and a faster building permit process (CH06).

4.6 Digital and analogue

A spatial planning expert expects that the digitisation of plan data and planning processes will progress even further. However, the expert noted that analogue plans can still be valuable for discussion. It is not yet clear whether the paper plans will still be used for discussions or whether they will be replaced by digital plans in the future. This might change with time. Thus, the preference for the medium for plan discussions could also be a question of generations (CH01). The expert from the FOSD used an example to explain what analogue plan data could still be used for. In one case it was not clear whether an area belonged to prime cropland areas or not. By looking at the historical, analogue documents, clarification and legal certainty was gained (CH05).

The Office for Geoinformation of the Canton of Thurgau now receives all data redundantly from the municipalities. On the one hand, an analogous dossier is submitted for the land use planning, which is then approved. On the other hand, digital geodata of the entire municipality is supplied for publication in the PLR cadastre. The technical and content-related reviews of the changes are currently only conducted on the basis of the analogue dossiers. The digital geodata are checked exclusively for model conformity (CH02). In the cantonal structure plans in the canton of Thurgau, data management with geodata is digital. An exception are meetings with other departments or experts, where paper plans are used for discussion because of practicality. The results of the discussions are subsequently digitised again and then digitally managed. The expert of the cantonal structure plans mentioned that during a discussion, a WebGIS had been used interactively once before (CH07).

As in the canton of Thurgau, spatial plan data in the canton of Basel-Stadt is now only produced digitally. Both cantons still have old analogue plans. In the canton of Thurgau, cantonal structure plans older than 1996 are not digitised. In the canton of Basel-Stadt, however, historical plans are gradually being digitised.

Paper plans are also being used for discussions in meetings. But paper plans are also still shown on public display in the participation process of land use planning, although these can also be found digitally on the internet. The building permit application is currently submitted in an analogous form (CH04). In the canton of Neuchâtel, on the other hand, building permits are already processed digitally. The general data on requested building permits can be found on the geoportal. Details, however, can only be viewed in analogue form at the municipality due to data protection issues (CH06).

In future, digital signatures might become an important element in spatial planning. Nowadays, the digital signature is not in use and all plans are physically signed in the canton of Neuchâtel (CH06).

4.7 Challenges

Increasing expectations

A spatial planning expert said that spatial planning is always challenging because different interests collide. Due to digitalisation and new technical possibilities, the demands on spatial planning are also increasing. This does not directly speed up processes, as more information or analyses can be included within the processes. In addition, interpersonal relationships could be lost with the shift to digital portals of participation or discussions (CH01). The expert from the canton of Basel-Stadt also mentioned that social contacts could be lost due to digital working practices. However, this is not intended (CH04).

Standardisation and harmonisation

The expert from the FOSD sees a challenge in the lack of specialists who have a deep understanding of data and can work with the data. In addition, the interaction of standardisation with data models and the need for flexibility is a challenge. For a project for bundling of data on infrastructure, models should be available, which all participants agree on. However, these models should also be flexible and adaptable in order to react to changes in data. So, the question arises, how many standards and models are needed so that planning and development remains attractive and is not too restricted? The expert emphasised that standards are important because without a common basis the data cannot be compared. It is precisely the federal minimal geodata models that are central to the comparability of geodata throughout Switzerland. Everybody needs to accept that these are rather fixed and can only be adapted with great effort. It is possible that artificial intelligence could be advantageous in order to structure data. However, with the 26 cantons in Switzerland, the data set is somewhat small to be able to apply artificial intelligence (CH05).

The expert from the canton of Thurgau also named harmonisation as the greatest challenge in digitisation in spatial planning. Harmonisation of cantonal data sets is necessary for the national comparability of digital plan data. The example of building zones in the canton of Thurgau showed that the assignment of communal zones to cantonal zones does not work properly. Also, the allocation of transportation surfaces to building zones or non-building zones is handled differently among municipalities. However, this parameter is important for the determination of the settlement area. In addition, there are still discrepancies in the allocation from the cantonal to the national model, as was noted at the Cantonal Planners' Conference. This is shown by the following example: three cantons converge on Mount Titlis. Even though the three cantons have assigned the zones correctly according to federal guidelines, they assign the mount Titlis to different zones (remaining settlement area or landscape protection zone). Comparability should therefore be treated with caution, despite the federal minimal geodata models. The difficulty here is that the federal government cannot prescribe the assignment of zones to the cantons at the necessary technical level because of the separation of responsibilities prescribed by law. Accordingly, a common and meaningful process with the cantons must be determined, which can be very time-consuming (CH07).

In the canton of Basel-Stadt, experience has shown that plan data can be exchanged easily within Switzerland due to the federal minimal geodata models. Internationally, however, the canton faces challenges because the digital plan data is not comparable with some data from the surrounding countries (CH04).

Publication of digital data

The expert of the cantonal structure plans Thurgau also mentioned another challenge in publishing the digital cantonal structure plans. The scale of these plan data is 1:50,000, which means that the boundaries of the objects are blurred to highly the strategic nature of the plan. In the case of the geodata, it is now possible to

view the cantonal structure plans theoretically with a sharp focus on individual parcels. The canton of Thurgau has solved this difficulty by limiting the zoom level of this data set for the public in the geoportal. This means that it isn't possible to view the plan in a parcel-by-parcel perspective. This is intended to prevent misunderstandings. In addition, the expert mentioned that a greater effort for data quality has to be made if this data set is published. For example, the attributes must be checked and supplemented so that misunderstandings can be avoided. However, if data sets have the potential to be misunderstood, they should not be published. In the canton of Thurgau, however, this has not yet caused any problems (CH07).

Data management

The expert from the canton of Basel-Stadt has noted that the data management effort is increasing. Although the plans no longer have to be retrieved from the archive, the filing and storage of the different digital plan data is a challenge. During the digitisation process it was not clear how often and which versions of plan data to store (CH04). Data management is also a challenge in the canton of Neuchâtel. For example, it is still an open question how to update redundant digital and analogue data so that the municipalities do not have conflicting data (CH06).

4.8 Future use scenarios

The process of digitisation is not yet complete. In the future, participation is possible in various digital and analogue forms. It may also be possible to increase the participation of the population by combining different forms (CH01).

In the canton of Thurgau, more use should be made of 3D data in future. This would make it possible, for example, to display geothermal probes in three dimensions, which in turn could be helpful for planning purposes. Another example are variable groundwater levels. Particularly in summer, when the drought is increasing, the availability of up-to-date digital 3D data could help to regulate when certain farmers are allowed to draw water from the river fed by the groundwater. Although these ideas are still under discussion, they are conceivable in the future. As the expert also mentioned, the government's openness to digitisation plays a major role. Because the government in Canton Thurgau is open to digital processes, virtual reality (VR) and augmented reality (AR), as well as various applications of BIM, could also be an issue in the future. The expert on cantonal structure plans said that the use and application of digital data and geodata will increase in the future due to existing and upcoming added value. It will presumably become normal to view the cantonal structure plans digitally in a WebGIS and no longer as a map.

The expert from the canton of Basel-Stadt noted that digital approaches to planning will increase in the future. This includes video conferencing, where, for example, people can meet for an international meeting with GeoRhena. It is also possible that in future there will be joint international portals for exchanging plan data. In the canton of Basel-Stadt, the three-dimensional visualisation of plan data and projects is also increasingly being targeted. The opportunity here is a presentation of capacities for new construction or expansion in the land use planning and also the possibility of bringing a project closer to the population and politicians. There are, however, risks that a project will not be well accepted once they are shown in 3D, such as in the case of a test planning on the Klybeck Islands with high-rise buildings. The project was not received well because the height of the buildings became visible through the three-dimensional visualisation and bothered the population (CH04).

In Neuchâtel three-dimensional representation will also increase in future, as two-dimensional plans cannot cover the complete picture. The expert also mentioned that the basic 2D data is good due to digitisation, which can now be used further. Thus, there are also aerial photographs which date back several decades, so that the development can be understood. The time component should therefore be taken into account in spatial planning (CH06).

5 Synthesis and recommendations

How does the availability of digital plan data empower different actors?

Overall, the statements made in the interviews in Switzerland showed that in most cases everyone has access to the digital plan data, which strengthens all actors in this regard. In the context of the PLR cadastre, the transparency of plan data with public law restrictions on ownership is an objective that has been achieved in practice. There are advantages of public data for the authorities, investors, but also for private parties, as planning is simplified due to the easy accessibility. Thanks to the transparent plan data, the authorities and their work is more visible to private parties. However, this will not make the authorities more significant, but the Canton might take over some tasks from the municipalities as seen in the Canton Thurgau regarding the building zone reserves.

How does the availability of digital plan data change collaboration within the administration and between administration and stakeholders?

Cooperation within the authorities has changed in various ways. On the one hand, the overlapping work on geodata has led to closer cooperation between the offices of an administration, as is the case in Canton Thurgau. On the other hand, cooperation within the offices may decrease because the digital data can be easily sent and commented digitally, which requires fewer meetings as in the canton of Basel-Stadt. Thus, cooperation can be increased or decreased by digitisation within the offices and depends on the approach of the authorities.

The PLR cadastre was cited as a good example of the joint task between the cantons and the federal government. For the creation of this cadastre with digital data, intensive cooperation was required in working groups.

How does the driver (e.g. efficiency, need for transparency, need for control) and funding source of digital plan data affect planning practice?

According to the interviews, digitisation in the field of spatial planning has so far had an impact on the accessibility of digital plan data. For example, authorities can access digital plan data much easier and faster than analogue plan data. Thus, there is more transparency in regard of the existing planning documents. However, the planning processes themselves and their transparency have not changed much so far, and current projects and developments will change this in the future (e.g. Geo2020 in the canton of Thurgau).

The division of tasks in accordance with the Federal Spatial Planning Act has not changed in Switzerland due to digitisation. However, new tasks have arisen in the area of digitisation, such as the assignment of building zones to the national minimal geodata model. Such new tasks were distributed with intensive cooperation and a common consensus. There should be a consensus between the federal government and the cantons to define and implement federal minimal geodata models.

Patterns

From several interviews it emerged that digitisation started in the cantons for internal use. Clearly, the added value of digital plan data was recognised by the canton, which is why great effort was put into this (e.g. digitisation of analogue land-use plans by the canton before the municipalities digitised them in the canton of Thurgau). Furthermore, it was shown that the recognition of the added value of digitisation in spatial planning and of digital plan data is a major motivation for the implementation of digitisation. Nevertheless, a national cadastre of public ownership restrictions or federal minimal geodata models require national approaches to ensure national implementation. Thus, the legal basis for the PLR cadastre was the crucial factor for its implementation. The federal minimal geodata models serve as a basis for nationwide compara-

bility of digital plan data. The situation in the municipalities varies greatly, depending on the Cantonal requirements and supports, as well as on their own resources, with larger municipalities tending to be more advanced.

Policy recommendations

Enhance communication and participation of stakeholders with digital plan data

Easy access to digital plan data increases their user community, on the one hand. On the other hand, their versatile usability enables communication with various stakeholder groups and supports their involvement in planning processes. The recent open data decisions of the Federal government underpin this recommendation.

Promote the PLR cadastre to a wider public

The information on land use planning and other public law restrictions contained in the PLR-cadastre is of considerable interest not only to the administration, but also to a wide range of interested parties, such as private investors, notaries and NGOs. Therefore, the PLR-cadastre should be made more widely known.

Clarify the legal role of digital plan data

Digital plan data is increasingly replacing printed plans as a source of information. However, their legal status remains diverse and partly unclear. Some cantons use digital plan data as if they were legally binding, while others insist on the printouts. It is recommended that in the near future digital plan data should be the legally accepted basis for spatial planning.

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