



Co-financed by the European Regional Development Fund

Inspire Policy Making with Territorial Evidence

TARGETED ANALYSIS //

DIGIPLAN – Digital plans and plan data in Germany

Annex 6 of final report

Final report // June 2021



This Targeted analysis was conducted within the framework of the ESPON 2020 Cooperation Programme, partly financed by the European Regional Development Fund.

The ESPON EGTC is the Single Beneficiary of the ESPON 2020 Cooperation Programme. The Single Operation within the programme is implemented by the ESPON EGTC and co-financed by the European Regional Development Fund, the EU Member States, the United Kingdom and the Partner States, Iceland, Liechtenstein, Norway and Switzerland.

This deliverable does not necessarily reflect the opinions of members of the ESPON 2020 Monitoring Committee.

Coordination and Outreach

Christian Fertner, University of Copenhagen and Piera Petruzzi, ESPON EGTC

Authors

Swiss Federal Research Institute WSL (Switzerland): Anna Hersperger, Silvia Tobias, Corina Wittenwiler

Cite as

ESPON DIGIPLAN (2021) DIGIPLAN – Digital plans and plan data in Germany. Annex 6 of final delivery. <https://www.espon.eu/digiplan>

Advisory group

Stakeholders: Ole Pagh Schlegel and Bent Lindhardt Andersen, Danish Housing and Planning Authority, DK | Hilde Johansen Bakken, Ministry of Local Government and Modernisation, NO | Silvia Jost, Yves Maurer and Marc Pfister, Swiss Federal Office of Spatial Development, CH

ESPON EGTC: Piera Petruzzi (Senior Project Expert), György Alföldy (Financial expert)

Acknowledgements

We would like to thank the experts who participated in the interviews.

Information on ESPON and its projects can be found at www.espon.eu.

The website provides the possibility to download and examine the most recent documents produced by finalised and ongoing ESPON projects.

ISBN: 978-2-919795-63-5

© **ESPON, 2021**

Published in June 2021

Graphic design by BGRAPHIC, Denmark

Printing, reproduction or quotation is authorised provided the source is acknowledged and a copy is forwarded to the ESPON EGTC in Luxembourg.

Contact: info@espon.eu

TARGETED ANALYSIS //

**DIGIPLAN – Digital plans and
plan data in Germany**

Annex 6 of final report

Final report // June 2021

Disclaimer

This document is a final report.

The information contained herein is subject to change and does not commit the ESPON EGTC and the countries participating in the ESPON 2020 Cooperation Programme.

The final version of the report will be published as soon as approved.

Table of contents

Abbreviations	7
Foreword by the research team	8
1 Introduction and data	9
1.1 The German planning system and the land use plan.....	10
2 Scope of digital plan data.....	12
2.1 The current state of digital plan data.....	12
2.2 The historical background.....	16
2.3 Standards	18
3 Organisation of digital plan data	20
3.1 Organisation.....	20
3.2 Financing	22
3.3 The role of different actors for.....	23
3.4 Relation within different levels of government.....	24
3.5 Relation between governmental and not-governmental actors	24
4 Use of digital plan data.....	26
4.1 Use of digital plan data	26
4.2 Digital plan data on different levels	26
4.3 Accessibility	26
4.4 Process changes	27
4.5 Purpose / added value	29
4.6 Digital and analogue	30
4.7 Challenges.....	30
4.8 Future use scenarios	31
5 Synthesis and recommendations.....	33
References.....	35

List of maps, figures, charts and tables

List of maps

Map 2.1	Status of current regional plans in Germany, France and Switzerland in the Upper Rhine Conference area	16
---------	--	----

List of figures

Figure 1.1	Administration of Germany	10
Figure 1.2	Planning system in Germany.....	11
Figure 2.1	Interface of the geodata-infrastructure Germany	12
Figure 2.2	Website MetaVer with the metadata of the binding land use plans of Hamburg.....	13
Figure 2.3	Geoportal of Freiburg with the binding land use plans that are currently in force	14
Figure 2.4	Preparatory land use plan in the geoportal of Freiburg	15
Figure 2.5	History of XPlanung.....	17
Figure 3.1	Organisation of GeoRhena in the Upper Rhine Conference.....	22
Figure 4.1	Enabling of digital process chains based on the standards of XPlanung and XBau.....	28
Figure 4.2	Simplified flowchart for the preparation of a land-use plan in Stuttgart.....	29

List of tables

Table 1.1	Interviews held	9
Table 2.1	Standards in Germany regarding digital plan data	19

Abbreviations

GDI-DE	Geodateninfrastruktur Deutschland (Spatial Data Infrastructure Germany), project to make spatial data from different government levels available online.
INSPIRE	INfrastructure for SPatial InfoRmation in Europe, European directive
WFS	A standard protocol to share geographical features (e.g. polygons of plan areas) online
WMS	A standard protocol to share georeferenced map images (e.g. a scanned image of a plan) online.
XBau	A data standard and exchange format, supporting the communication of all actors in construction permit and inspection.
XLeitstelle	X Coordination center, central secretariat for XPlanung and XBau
XPlanung	A data standard and exchange format, supporting a lossless transfer of spatial plans between different IT systems.

Foreword by the research team

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 and 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. Although a targeted analysis for stakeholders from Denmark, Norway and Switzerland, DIGIPLAN findings can inspire a wider professional audience.

This report is one out of six in-depth case studies, presenting findings from Germany. No German stakeholder was connected to the DIGIPLAN project, but several interviews with practitioners from different levels of governance provided insights into various aspects of digital planning practices. As with the other case studies, we do not aim at giving a full picture of digitalisation of plans and plan data in Germany. This would go far beyond the scope of DIGIPLAN. Instead, we provide insights from different places in the planning system and in the country on current developments and challenges.

In Germany, as a federal country, the power of spatial planning is at state level which is a rather unfavourable precondition for nationwide digital standards in spatial planning. A commendable attempt is made with the exchange standard XPlanung which is presented in more detail in this report.

DIGIPLAN is a successful example of ESPON targeted analyses, a powerful mean to transfer knowledge, share experience and facilitate the use of territorial evidence rooted in real place-based policy development processes.

Enjoy reading!

Anna Hersperger, Silvia Tobias, Corina Wittenwiler

Swiss Federal Research Institute WSL

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 Germany, part of Task 2. The data collection in this case study is based on the exploration of the various data portals and on expert interviews. The experts were identified according to contact details on central portals and also according to the snowball principle where additional experts were recommended by previous interview partners. In addition, several reports, websites and further literature on the case study have also been included.

The focus of the German case study is on the one hand on the exchange standard XPlanung, considering the national perspective of the X Coordination center, but also the municipal context using the example of individual cities. On the other hand, a nationwide overview of the geodata infrastructure has been obtained. This case study also examines the international cooperation of GeoRhena between the three countries, Germany, Switzerland, and France. Information from interviews in the text is indicated by (DE01) to (DE05), referring to an internal interview reference table. All interviews were conducted in German. Citations are own translations based on transcription.

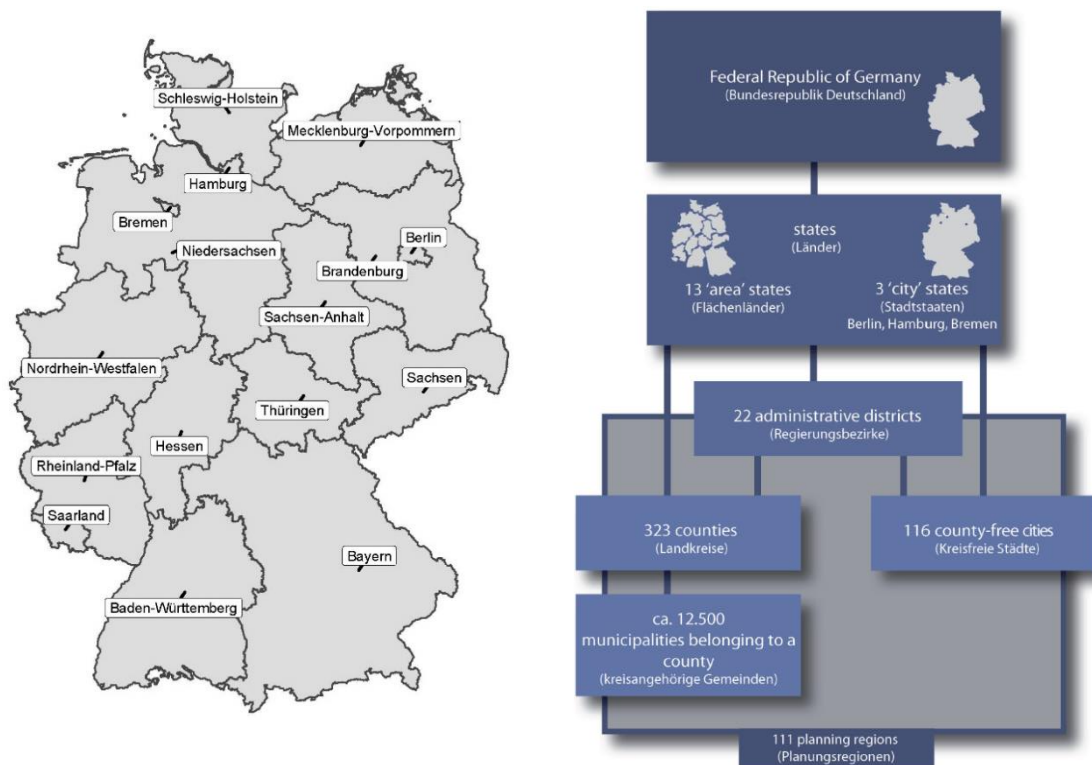
Table 1.1
Interviews held

Theme	Affiliation	Position
XPlanung	XPlanung Coordination Office and municipal land use plan Hamburg	Expert in Standard XPlanung and spatial planning
Infrastructure, standards plan data	GDI-DE	Expert in geodata infrastructure and national view
XPlanung, Municipal land use plan	XPlanung City of Stuttgart	Expert in Standard XPlanung and spatial planning in the City of Stuttgart
	City of Freiburg	Two experts in Standard XPlanung and spatial planning in the City of Freiburg
Planning across borders	GeoRhena	Expert in geodata and international collaboration

1.1 The German planning system and the land use plan

Germany has four levels of administration: the Federal Government, States, counties and municipalities (Figure 1.1). The principles of spatial planning are defined by the federal government in the Spatial Planning Act. In addition, the federal government can define guiding principles for spatial development, which are not binding.

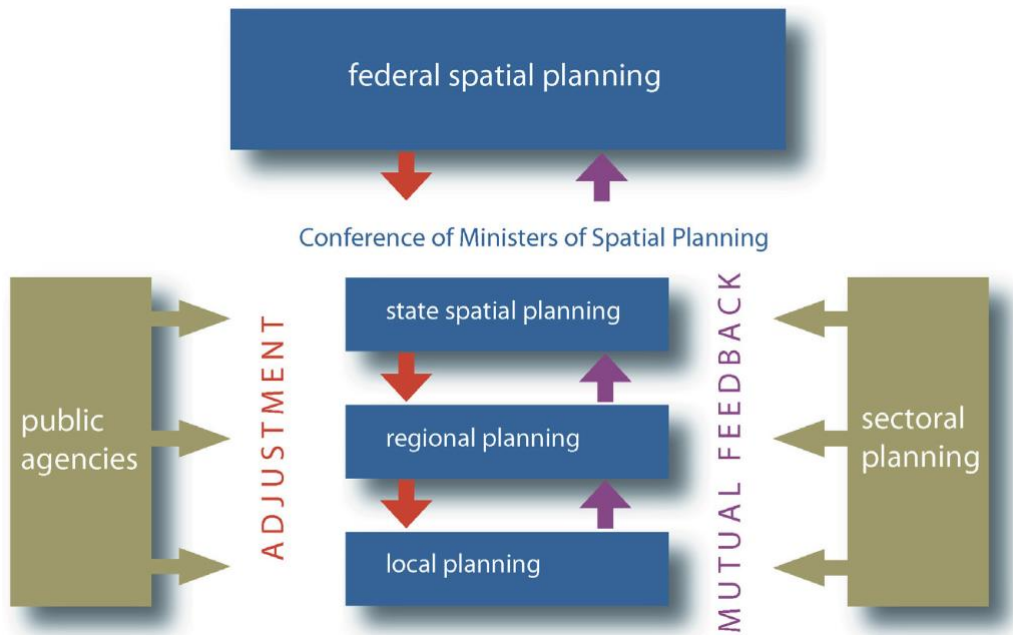
Figure 1.1
Administration of Germany



Source: Map: Own representation based on GeoBasis-DE / BKG 2020; figure: (Pahl-Weber & Henckel, 2008)

The fundamental aspects of spatial planning in Germany are defined by the Federal Government as principles of spatial planning (Figure 1.2). The federal government can also produce guiding principles for spatial development. The States and municipalities are responsible for implementing spatial planning, whereas the States often also implement planning regions for planning at regional, i.e. intermediate political, level. The States have a large freedom of action for spatial development plans (so-called state planning). However, a strategic environmental assessment is intended as an orientation to regulate actions that have an impact on spatial development. At a lower level, urban land-use planning for individual parcels takes place in the municipalities, based on the legal basis provided by the federal Building Code (Baugesetzbuch). The objectives of these plans are to be aligned and adapted to the objectives of higher-level spatial planning. In the context of urban land-use planning, the local authority draws up a preparatory land use plan, which acts as a basis for the subsequent binding land use plans. The binding land use plans are binding for the respective parcels.

Figure 1.2
Planning system in Germany



Source: Pahl-Weber & Henckel (2008)

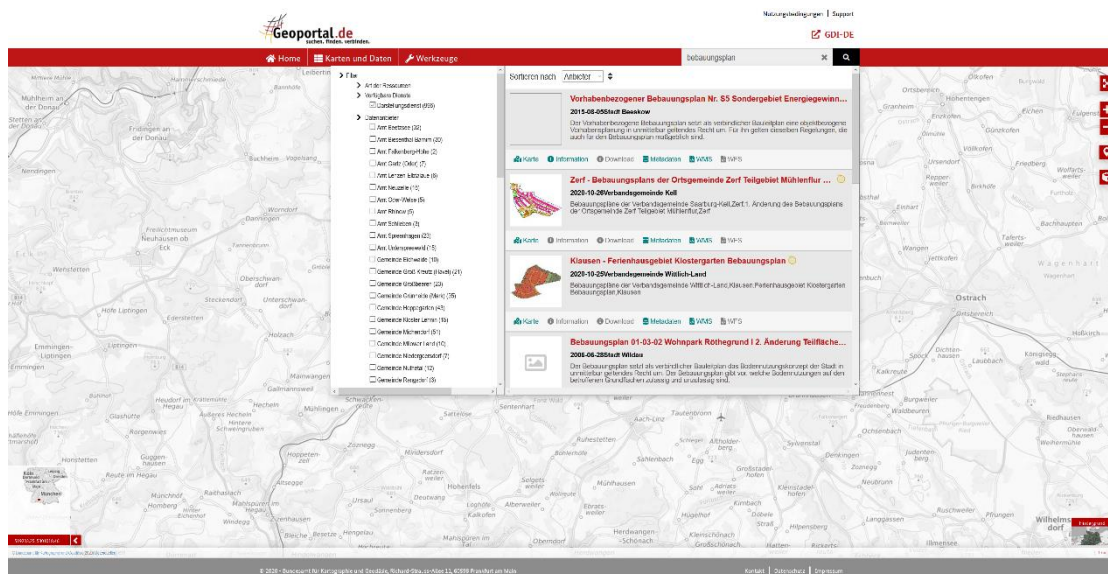
2 Scope of digital plan data

2.1 The current state of digital plan data

Geodata infrastructure Germany (GDI-DE)

In the geoportal of the geodata infrastructure Germany (GDI-DE), geodata from the Federal Government, the States and local authorities can be found and used (Figure 2.1). However, not all public geodata and plan data are currently accessible, as there are sometimes problems with the naming of the data sets or the metadata. There is still room for improvement. However, the aim of the GDI-DE is to make geodata more accessible with this infrastructure. Therefore, the GDI-DE is currently being revised and next year the new geoportal will be released (DE03).

Figure 2.1
Interface of the geodata-infrastructure Germany



Source: Binding land use plans (Bebauungspläne) and other digital plan data can be found with the search function (geoportal.de)

Portal for Metadata MetaVer

In Germany, there is a data portal for metadata, called MetaVer¹ (MetadatenVerbund) (Figure 2.2). The following States participate in this: Brandenburg, Free Hanseatic City of Bremen, Free and Hanseatic City of Hamburg, Mecklenburg-Western Pomerania, Saarland, Saxony and Saxony-Anhalt. This portal on metadata contains general descriptive information on the data set, links to services provided or to other geodata, information on spatial and temporal extent, information on availability and accessibility as well as additional information.

¹ <https://metaver.de/portal/>, access on 10.12.2020

Figure 2.2

Website MetaVer with the metadata of the binding land use plans of Hamburg

The screenshot shows the MetaVer website interface. At the top, there is a navigation bar with the logo 'METAVER MetadatenVerbund' and the text 'Ihr zentraler Zugangspunkt zu den Metadaten von Brandenburg, Bremen, Hamburg, Mecklenburg-Vorpommern, Saarland, Sachsen und Sachsen-Anhalt.' Below the navigation bar, there is a breadcrumb trail: 'Sie sind hier: Startseite > Suche > Metadaten'. The main content area displays the title 'Bebauungspläne Hamburg' and a 'Geodatenatz' icon. Below the title, there is a horizontal menu with tabs: 'Allgemeines', 'Verweise', 'Raum/Zeit', 'Fachbezug', 'Verfügbarkeit', 'Zusätzliche Info', and 'Zusatzfelder'. The 'Allgemeines' tab is currently selected.

Beschreibung

Bebauungspläne (Verbindliche Bauleitpläne) sind rechtsverbindliche Pläne, zu denen Baustufenpläne, Teilbebauungspläne, Durchführungspläne und seit 1962 die heutigen Bebauungspläne nach dem Bundesbaugesetz (BBauG) bzw. ab 1986 nach dem Baugesetzbuch (BauGB) zu zählen sind. Die Bebauungspläne bestehen aus der Planzeichnung, dem Gesetzes- bzw. Verordnungstext mit den textlichen Festsetzungen sowie einer Begründung. Bebauungspläne treffen für kleinere

Source: <https://metaver.de/trefferanzeige?plugid=/ingrid-group:ige-iplug-hmdk.metaver&docuuid=EBA4BF12-3ED2-4305-9B67-8E689FE8C445>, accessed on 10 Dec 2020

National status of plan data

There are various ways of digitising binding land use plans in Germany. On the one hand, data sets can be created directly in digital form, which is then available as a vector data set. These full vector data sets can be used to analyse individual elements. On the other hand, full vectorial digitisation of analogue plans is possible. In this case the individual elements of the analogue plans are captured as vectors. Thus, analyses are also possible. The last possibility is the partial vectorial digitisation of analogue plans, where only the perimeter of the plan is captured as vector and the scanned plan is linked to it. This guarantees the provision, but no analysis can be made of the content of the plans (DE03). This method is also called raster-ring scenario.

In Germany, the IT Planning Council 2017 decided that the responsible local authorities must be able to handle the exchange standard XPlanung before 2022. This does not mean that all plan data must already be available in this format, but that the local authorities are able to work with XPlanung. It is difficult to determine the current status in this regard, as the expert from the X Coordination center (XLeitstelle) explained, since the States and local authorities do not have to report on their activities. Indeed, the States pursue various strategies for implementing the exchange standard XPlanung, which the X Coordination centre does not have a complete overview of. The decision of the IT Planning Council from 2017 is binding, but cannot currently be sanctioned. The steering committee of XPlanung, in which the States and the Federal Government are represented, ensures mutual control. This setup allows the States to check what is going on in the X Coordination center. and the X Coordination center can get some insights on how far the individual States have progressed with the implementation of XPlanung. As one interviewee states:

“It is difficult to assess the status today, as nobody is required to give an account to the XPlanung control centre.” (DE01)

At the national level the legal basis for spatial plan data throughout Germany are established with the Building Code (BauGB) and the Online Access Act (OZG). The Online Access Act created a legal basis for a central portal for each State for spatial data. These portals must be implemented by 2023.

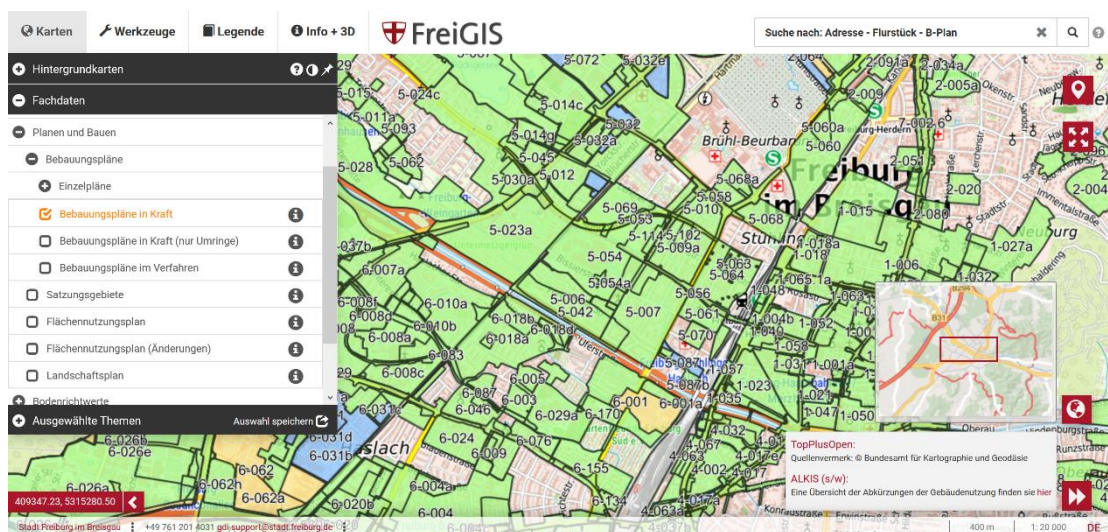
The INSPIRE Directive on the establishment of geodata infrastructures in Europe is also being implemented in Germany. For this purpose, there is a monitoring system which checks the implementation in the individual States and municipalities and shows the current status².

Baden-Württemberg: Stuttgart and Freiburg

The state portal in Baden-Württemberg is currently in progress. About one third of the municipalities have already agreed to make their binding land use plans available on the Internet via this portal. In Stuttgart, the binding land use plans have so far been digitally available within the city administration as scanned and georeferenced data. Publication via the Internet portal is planned. The legal texts concerning binding land use plans are also available in digital form, but these are not linked to the geodata. However, this is conceivable in the future. The expert from Stuttgart also noted the tendency for large cities to create their own data and to produce land-use plans in the full vectorial XPlanung format rather than smaller cities and municipalities, which tend more likely to the raster-ring method (DE02).

In the city of Freiburg im Breisgau in south-western Germany, binding land use plans are to be recorded in full vectorial form. Since about 2010, all binding land use plans have been available in scanned form with the perimeter as WMS and WFS service. The experts reported that of the approximately 750 existing binding land use plans, 100 have already been completed in full vectorial digitisation (Figure 2.3). A further 50 binding land use plans are well advanced in full vectorial digitisation and another 50 are at the beginning of full vectorial digitisation. While full vectorial digitisation is ongoing, there is currently an interruption in the process due to personnel changes. In addition, it is always necessary to convince people and demonstrate the added value in order to ensure continued funding. The binding land use plans will be ready by the time set by the INSPIRE-obligation. In addition, the geoportal in Freiburg is currently being revised and updated.

Figure 2.3
Geoportal of Freiburg with the binding land use plans that are currently in force



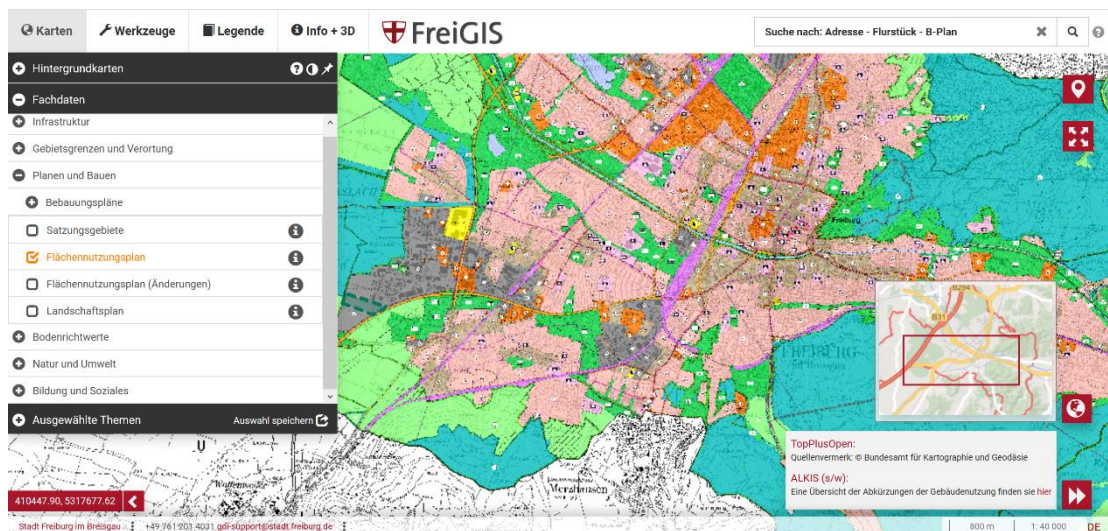
Source: <https://geoportal.freiburg.de/freigis/>, accessed 10 Dec 2020

In Freiburg, the preparatory land use plan has been available in digital form internally for some time now. However, this plan has only recently been published as a geo-referenced PDF file, and in a way that does not allow to zoom in on a plot (addressed also in Chapter 4.3 Accessibility) (Figure 2.4). The plan itself is

² <https://www.gdi-de.org/INSPIRE/aktueller%20Stand>, access on 10.12.2020

not yet INSPIRE-compliant, except for the metadata. However, it will be INSPIRE-compliant after the next revision (DE04).

Figure 2.4
Preparatory land use plan in the geoportal of Freiburg



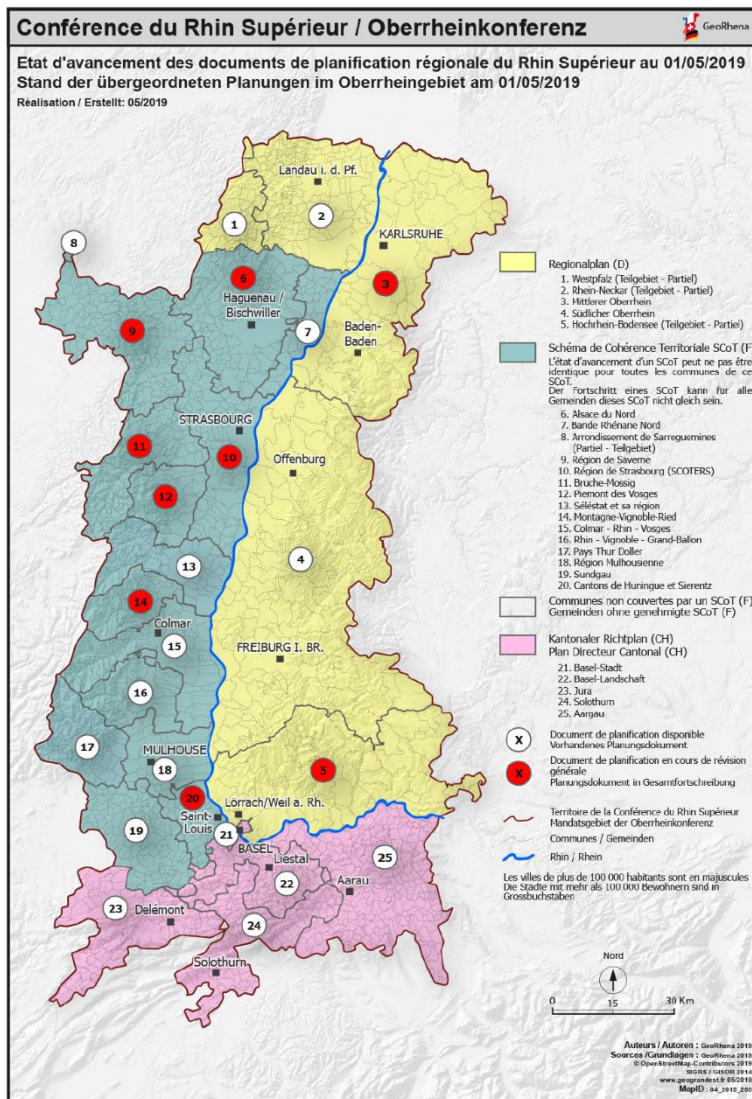
This plan is shown in a georeferenced PDF-format, which makes it impossible to view the plan in a parcel-specific manner. Source: <https://geoportal.freiburg.de/freigis/>, accessed 10 Dec 2020

GeoRhena international

GeoRhena was founded in 2004 with the aim of cross-border cooperation on various topics in the area covered by the Upper Rhine Conference Germany, France and Switzerland. A geoportal has been available since 2017, where cross-national geodata is published. The expert from GeoRhena mentioned that the INSPIRE directive created pressure for the publication of metadata. Although the national guidelines and the INSPIRE directive provide good guidelines for geodata, they are unfortunately not always implemented. For this reason, for example in the context of nature conservation, it is estimated that only about 10% of geodata from Germany, France and Switzerland are comparable. Also, in the spatial planning sector, the data sets differ between the countries. This makes international evaluations in the Upper Rhine area with digital spatial planning data difficult. However, GeoRhena has produced a plan on the current status of the regional plans of the three countries, which is publicly available (Map 2.1). In general, GeoRhena produces maps and plans on request. There are various work processes for this. For example, a working group from outside GeoRhena asks for a particular map or evaluation and brings the relevant data for it. Alternatively, GeoRhena asks the representatives of the respective countries whether the data is available. It should be noted, however, that GeoRhena does not standardise or harmonise data, but only works with compatible data sets. It can happen that requested maps and plans cannot be delivered by GeoRhena due to a lack of comparability of the data sets or because of incompatible definitions in the three countries (DE05).

Map 2.1

Status of current regional plans in Germany, France and Switzerland in the Upper Rhine Conference area



Source: GeoRhena, <https://sdi.georhena.eu/geonetwork/sr/ger/catalog.search#/metadata/d8f7f7b4-4f52-4b01-9c6e-c25ea6574d7f>, accessed 10 Dec 2020

2.2 The historical background

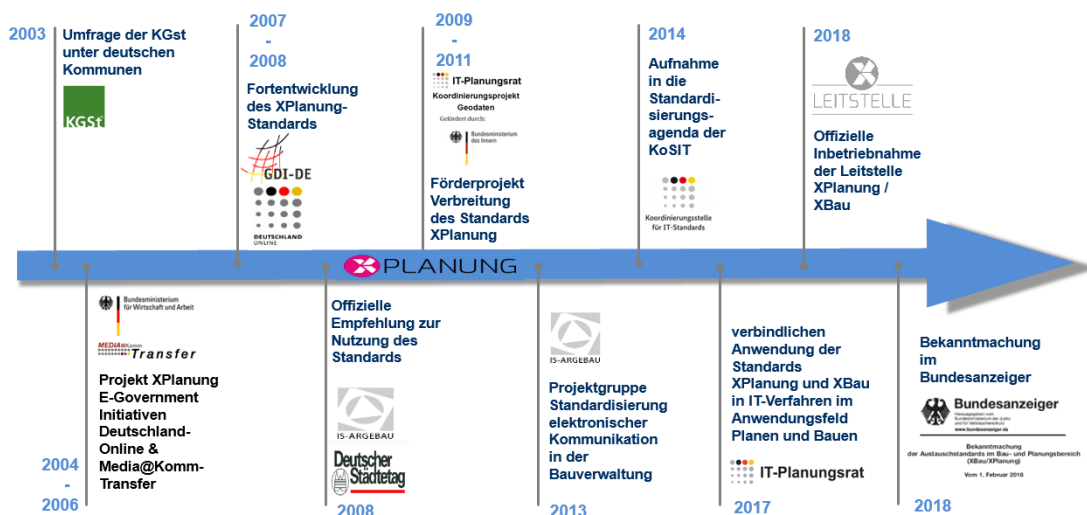
In 2005, the Geodata Infrastructure Germany (GDI-DE) was established as a collaborative project of the Federal Government, the States and the local authorities. The aim was to construct an infrastructure that would enable easier and better access to geodata on a broad range of topics. Working groups were set up to develop various topics and submit their proposals to the steering committee (Lenkungsgrremium). Furthermore, the INSPIRE Directive was introduced in 2007, which will provide a European infrastructure for researching, visualising and downloading data.

The very experienced expert from XPlanung's coordination centre reported that in the 1960s and 1970s digitisation was considered a great opportunity by the planners. At that time financial resources were invested in urban development concepts. In the 1980s and 1990s money became scarce with the oil crisis. The authorities were also subject to criticism. Together with data protection concerns, this led to stopping

previous developments. The era of perspective incrementalism began, where work was very project-oriented. There were a few long-term monitoring issues and strategies during this period. Nowadays, however, strategies and processes are again more in focus. The expert pointed out that the processing of digital plans had been an important topic in teaching for a very long time. In practice, however, knowledge on digital plan data was not demanded for a long time. These days, digitisation is slowly moving into practice and digital data is increasingly used (DE01).

In the early 2000s, there were several e-government projects on standardisation in Germany (Figure 2.5). At the federal level there was the Bund-Online project. Among others, the Deutschland-Online (D-Online) project was launched, which intended to establish cooperative eGovernment between the Federal Government, the States and local authorities. As part of this project, a survey was conducted in the municipalities in the State of North Rhine-Westphalia on the subject of geodata (Figure 2.5). The expert from the X Coordination Centre reported that the survey showed a great need for standardisation for the exchange of land-use plans. The D-Online project consisted of several pillars, of which one was geodata and another construction. The Federal Government, States and local authorities were then able to cooperate voluntarily on specific topics in order to elaborate solutions. The City of Hamburg was also involved in this process. The city and metropolitan region of Hamburg was thus quickly found as a partner for the standardisation project within the project D-Online. This standardisation project was voluntary and did not include a budget. The idea behind the voluntary cooperation was that participation would be worthwhile because of the added value standardisation would create. The projects ran until about 2007 / 2008, when D-Online ended (Figure 2.5). As a result, the German Constitution was amended in 2010 (Art. 91c), enabling the Federal Government and the States to develop IT standards. On this basis, the IT Planning Council was founded, which then drafted a standardisation agenda. In 2012 / 2013, the IT Planning Council also defined the needs for standardisation (Standardisierungsbedarf). From 2008 to 2014, the standards were only promoted on a voluntary basis and as part of support programmes (Figure 2.5). In 2017, the IT Planning Council then passed the decision for the standards XPlanung and XBau (Figure 2.5). As a result of this binding decision, the local authorities in Germany must be able to work with these standards at the latest in 2022.

Figure 2.5
History of XPlanung



Source: <https://www.xleitstelle.de/leitstelle/historie>, accessed 10 Dec 2020

In the city of Stuttgart, the entire plan archive was digitised for internal use in 2003 to simplify work processes and archiving. The INSPIRE Directive then initiated the publication of the digital plan data in Stuttgart. However, Stuttgart has some legal problems with old land-use plans, as the focus in the post-war period was on the reconstruction of the city and many land-use plans were created within a short time. Due to the fast process many procedural errors occurred, which made these plans legally void. However, these plans have a certain significance. Therefore, Stuttgart is now checking which of these land-use plans are still relevant

and current. These and the newer land-use plans will then be published in future via a state-wide portal. Digitisation in Stuttgart was generally fostered by the environmental law (LUBW (Landesanstalt für Umwelt Baden-Württemberg)). Since digital data was needed in response to this law at an early stage, other data was digitised within the authority over time. In addition, the city of Stuttgart initiated the Digital Move project. This project aims at digitisation in the administration in order to standardise, automatise and efficiently design internal administration processes and to aim for process high quality.

In the city of Freiburg, the digitisation of plan data began in the late 1990s and early 2000s. The first CAD data to visualise plan content was available at the City Planning Office. The first data had not yet been georeferenced, but this was gradually incorporated. In 2005, the establishment of a Geodata infrastructure in Freiburg began, which made it possible to make digital data available both internally within administration and externally. Thus, digital data became accessible with the infrastructure and the added value of digitisation could be captured. However, the digitisation of the land-use plans did take place later, starting in 2007. The analogue plans were scanned, georeferenced and made available as a WMS service. It also became clear that there is a need for a standardised presentation in compliance with planning law. Therefore, there were thoughts about how the digitisation of the land-use plans could be carried out in a standardised manner. In 2014 there was a further upswing in digitisation in Freiburg. The city won funding for an employee for the full-vector digitisation of development plans. In addition, since 2015 new land-use plans have been produced digitally and in full vectorial form. Although these plans are not yet fully compliant with XPlanung, the data can be exported to XPlanung.

GeoRhena

The Upper Rhine Conference was founded after the Second World War for cross-border cooperation. At the beginning, the participation of local authorities in this cooperation was very open and loose. The working group on regional planning has existed almost since the beginning of the Upper Rhine Conference. The working group led to the formation of GeoRhena in 2004.

2.3 Standards

In Germany, the need for standards came up in some instances before digitisation, but increased with the digitisation of plan data. When planning offices and local authorities started to digitise plans in the 1990s, digital plans were provided in a wide variety of data formats, which made it difficult to compare them. As a result, the first ideas for a geodata infrastructure to store the data came up. Another entry point for the development of standards has been the participation processes. Data for participation processes has been digitised in the context of some funded projects. Thus, it was necessary to prepare the data for participative interaction on the Internet, in a manner that follow-up work requires little effort. This in turn showed the need for standardised digital plan data, as the X Coordination center expert described (DE01).

From the year 2004, interested parties could voluntarily participate in the exchange standard XPlanung as part of the Germany Online (Deutschland-Online) project. Several large cities such as Hamburg, Berlin and Stuttgart took part. In addition, medium-sized cities such as Oldenburg and various administrative counties such as Elbe-Elster also participated. Furthermore, the Conference of Ministers for Spatial Planning (MKRO) and the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR) as well as the Association of German Cities, the German Association of Rural Counties and the German Association of Towns and Municipalities participated. As one interviewee states:

“At the beginning, the implementation of the XPlanung standard was difficult in the municipalities. [...] Although the programme was from the federal government, it was not binding. The idea was to work together at eye-level, at federal, state and local level. What was developed there would have such great added value that there was no need for any regulations on implementation.” (DE01)

The INSPIRE Directive requires that digital data must be searchable, visualisable and downloadable. However, the implementation of INSPIRE in the States may vary slightly (addressed also in chapter 4.7 Challenges). There are similarities between the data models of INSPIRE and XPlanung. For this reason, the X

Coordination center recommends that plan data be prepared in the XPlanung format. Using pre-configured transformation rules in software, so-called presets, the plan data can then be transformed from XPlanung format to INSPIRE. However, there are still obstacles, such as INSPIRE using an older version of GML than XPlanung.

Table 2.1
Standards in Germany regarding digital plan data

Standards	Standard for what?	Portal
XPlanung	Exchange of digital plan data	Independent from portals
XML	Metadata	Geodata catalogue
WMS	Visualisation of Geodata	possible in many portals
WFS	Possibility of downloading Geodata	possible in many portals
Transformation regulation from XPlanung to INSPIRE		

GeoRhena

GeoRhena itself does not harmonise data sets, but works with the lowest common denominator. For this reason, the resolution of the data is often very rough, despite much effort. INSPIRE is mandatory for Germany and France, but not for Switzerland. Nevertheless, Switzerland has taken INSPIRE's requirements into account, with digital plan data being compatible. Yet, there are heterogeneous data with different definitions in the three countries. For example, the population density is calculated differently, with water surface being subtracted in some cases. As a result, the data is not comparable. The expert noted that resources, i.e., time and money, are often scarce in authorities GeoRhena works with. In addition, working processes are defined by the countries, making additional data collection difficult. However, this could possibly change in the future if more efforts were made to make plan data comparable. There is still a great need for action (DE05).

3 Organisation of digital plan data

3.1 Organisation

Geodata infrastructure and XPlanung

The German geodata infrastructure (GDI-DE) includes a steering committee where the Federal Government is represented by the Ministry of Economics and the Ministry of the Interior, the States themselves and the local authorities by the three central associations (Spitzenverbände), the German Association of Cities, the German Association of Counties and the German Association of Towns and Municipalities. This steering committee makes collaborative decisions for the GDI-DE. The decisions lead to work assignments that are then passed on to the coordination office (Koordinierungsstelle). This coordination office is not responsible for the technical regulation of the data, but for the development of the geodata infrastructure and for the coordination of the various authorities. The aim of the GDI is to ensure that the infrastructure can be used everywhere and is also integrated into the European geodata infrastructure. In the current geoportal a wide range of topics can be researched and displayed via a visualisation service. However, the data itself remains with the data providers. A second version of the geoportal is currently being developed and will be introduced in 2021. It should enable an improved search function. The search for geodata in the geoportal depends essentially on the metadata and the labelling of the data sets. However, the metadata are not specified by the GDI, but depend on technical specifications. In the case of spatial plan data, INSPIRE and XPlanung (X Coordination center) are responsible for the technical specifications. The relevant regional authorities are responsible for the implementation of technical specifications and standards. In the case of urban land use planning, the municipalities are responsible for the implementation of XPlanung and INSPIRE standards. This can be a challenge because the significance of such standards can vary considerably from municipality to municipality. Neither the GDI-DE nor the X Coordination center is a supervisory organ that monitors the implementation of XPlanung. The coordination office of the GDI-DE merely points out general problems in the digitisation or provision of geodata. In addition, the coordination office shows the differences among States in implementing the INSPIRE Directive. As the INSPIRE Directive has to be integrated into the legislation of the individual States, there may be small differences among the States. For example, in some States local authorities are only affected by INSPIRE if they are obliged under their own legislation to manage their urban land use planning electronically. Since this is currently not the case, municipalities are not affected by the INSPIRE Directive according to this interpretation. As one interviewee states:

“That is what a GDI is for: to have a data basis for weighing up these interests. And the EU Directive INSPIRE is also intended to encourage the better consideration of environmental aspects in decisions at all levels.” (DE03)

The GDI-DE itself does not develop software for the data processing of digital plan data, but rather supports it with the specifications of the standards. However, good contact with software producers is very important. For land-use plans, the coordination centre is responsible for this (DE03). The X Coordination center does not develop software either, but is responsible for standard maintenance in the context of plan data (DE01).

Under the Online Access Act (OZG, 2003), there is to be a portal, at least state-wide, by the end of 2023, where all information on spatial planning is integrated. This includes land-use plans, regional plans, preparatory land use plans, regional planning procedures and declaratory procedures. This is the minimum goal in Germany. However, no monitoring of the implementation of this law has been foreseen, as no contracting authority has been appointed for this.

The X Coordination Centre was established in 2018 on the basis of a decision by the IT Planning Council. This coordination centre for the standards XPlanung and XBau is responsible for the maintenance and further development of these standards. There is no monitoring for the implementation of XPlanung, as is the case with the OZG. The binding decision of the IT Planning Council itself is not a part of the German Building Code. Therefore, there is no mandate for monitoring. Within the framework of the OZG there are various digitisation laboratories, with Hamburg being highly involved. One digitisation laboratory is concerned with the provision of spatial planning plans, another with participation procedures. In the latter case, a prototype platform is planned, through which all spatially related participation processes can be carried out. A solution

will be developed which can then be supplied to the States and local authorities on an open-sourced basis (DE01).

The INSPIRE Directive has been transposed by the States into their own legislation. The States are thus responsible for the subsequent implementation. There is an INSPIRE Monitoring³ for the implementation of the INSPIRE Directive⁴. With monitoring, attention can be drawn to general problems and appropriate actions can be initiated (DE03).

In the full vectorial implementation of binding land use plans in XPlanung, the textual specifications are assigned to the binding land use plan as a whole. In addition, the individual paragraphs are assigned to the corresponding elements. Thus, specific analyses can be made. This basis can also be used in the future for developing digital building permitting. The complete as well as specific representation of the textual definitions in the system is redundant and thus the system could be improved (DE01).

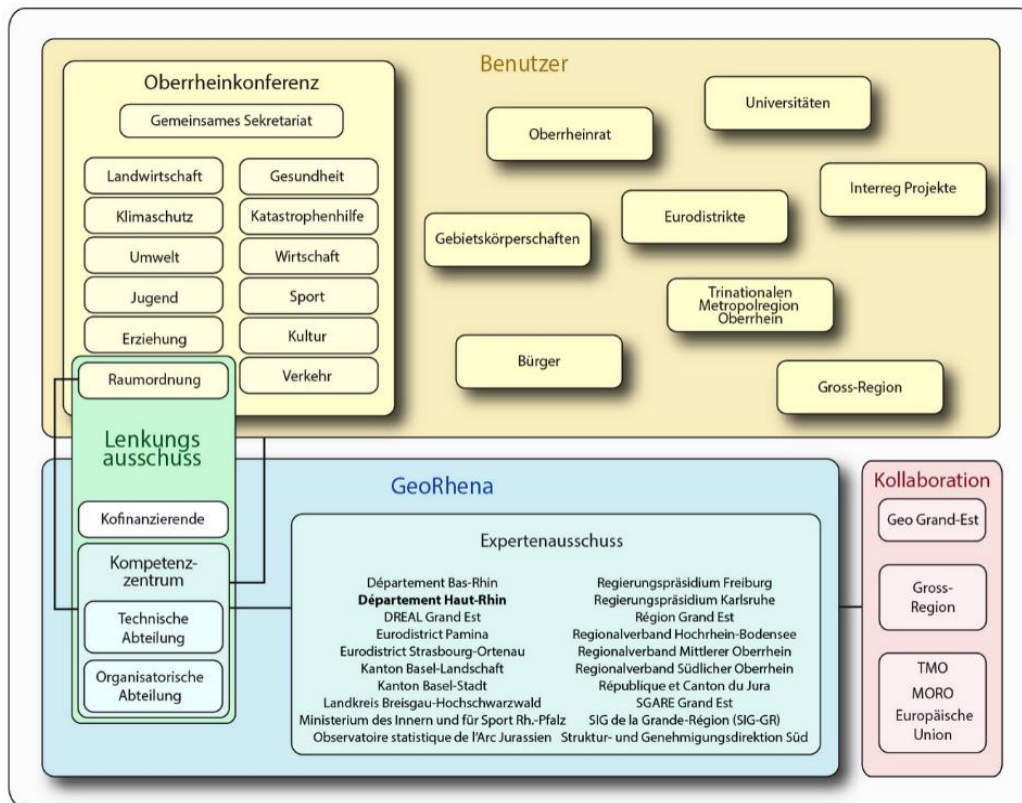
GeoRhena

In the Upper Rhine Conference there are various working groups to support international cooperation in Germany, France and Switzerland, among others on spatial planning (Figure 3.1, top left). GeoRhena is a cross-border cooperation with representatives from Germany, France and Switzerland and part of the Upper Rhine Conference's working group on regional planning, although GeoRhena also deals with issues other than regional planning (Figure 3.1, in blue). GeoRhena works on request, which means that maps, analyses and plans are produced on certain topics when they are requested. For example, a map on the current status of regional planning in the three countries was produced. If the current status is requested, this map is quickly updated but the map is not updated at regular intervals, but only on request. A unified map of all regional plans is not possible because of various incompatibilities (DE05, addressed also in chapter 4.7 Challenges).

³ <https://www.gdi-de.org/INSPIRE/aktueller%20Stand>, access on 10.12.2020

⁴ https://inspire-geoportal.ec.europa.eu/mr2019_details.html?country=de, access on 10.12.2020

Figure 3.1
Organisation of GeoRhena in the Upper Rhine Conference



Source: https://www.georhena.eu/de/Georhena_DE, accessed 10 Dec 2020

In principle, all data from GeoRhena is handled as open data and is made available as WMS or WFS, unless it concerns sensitive subjects and information. The data is documented in German and French. GeoRhena has also developed a declaration of intention to facilitate the mutual exchange of information on spatial planning topics⁵.

3.2 Financing

The GDI-DE expert explained that the steering committee will be supported by the coordination office and is jointly financed by the Federal Government and the States. The States contribute to the financing according to a key that is based on the number of inhabitants and the area of the State. The XCoordination center is also financed by the Federal Government and the States with 500,000 euros per year.

The X Coordination center expert noted that the States are responsible for the implementation of XPlanung in the municipalities. They have different strategies on how to accomplish that. Often funding programmes are used which support the digitisation of plan data or the municipalities receive support from the GDI of the State. In Schleswig-Holstein, for example, infrastructure to make digital plans available is provided. However, the digitisation and financing of the municipal plan data themselves is handled by the municipalities. In another State, Lower Saxony, a programme called Plan Digital was initiated, where four million euros were

⁵ https://www.georhena.eu/sites/default/files/Cartes/08_2015_220.pdf, accessed 10 Dec 2020

invested in the digitisation of the regional land use plans. As a further example, the expert referred to Hamburg, where within three years the 3000 zoning plans were digitised fully vectorially at a cost of 850,000 euros. During the transition phase in Germany, increased effort was expected in the correct application of the software, e.g., to avoid overlaps in plans. For this implementation phase of XPlanung, the planning offices were supported by the investor (mostly by the city) with 0 - 5% of the digitisation costs. The X Coordination center also cooperates with municipalities in part to enhance and provide open-source projects (WMS, WFS) (DE01). As one interviewee states:

“Who finances the digitisation of plans currently being drawn up? There is always the question of how much effort is required. [...] We assume that by now all plans are somehow digitised/created with digital information systems, be it with CAD or GIS programmes. If the software is used correctly, the effort is very low.” (DE01)

State development plans and regional planning in Germany are renewed approximately every 15 years and are regularly financed by the States. Since technologies are expected to change anyway during this period, the additional expenditure specifically caused by digitisation is estimated to be low (DE01).

The Stuttgart expert reported that the financing of municipal digitised plan data in the State of Baden-Württemberg is handled by the municipalities themselves, as they are also responsible for planning at the municipal level. In Baden-Württemberg, a state-wide portal for the provision of land-use plans is currently being developed. There is support (e.g., through validators) for the municipalities which publish their plan data via this portal. In general, the expert estimates that there are only a few municipalities which make the binding land use plans available at a charge (DE02).

The former digitisation (scanning and georeferencing) of binding land use plans in the city of Freiburg was supported by a funding programme. The funding was invested in personal costs. Although the digital production of plan data is more costly than the analogue production, it produces high-quality data which allows sophisticated analyses. At present, half of the binding land use plans are produced by the city of Freiburg itself and about half by planning firms. The current financial expenses cover mainly the digitisation of the old analogue land use plans. The provision of the urban land-use plans, road panorama data and the 3D data is offered free of costs (DE04).

3.3 The role of different actors for

Digitisation

The establishment of a national portal for the provision of digital plan data is stipulated by the Online Access Act. The application of the exchange standard XPlanung is defined by the decision of the IT Planning Council. However, the X Coordination center has little influence on the implementation of this standard. The digitisation of binding land use plans at the municipal level can, for example, be supported by funding programmes of the States (DE01).

Standardisation

The exchange standard XPlanung is implemented autonomously by the competent authorities. The X Coordination center is responsible for maintaining the standard and can also support States or municipalities with knowledge. However, to date there is no supervisory body that monitors the implementation of XPlanung (DE01).

The INSPIRE Directive has been transposed by the States into their own laws, whereby differences may arise, for example in the way local authorities are affected. The coordination office of the geodata infrastructure Germany (GDI-DE) has the task of showing the differences and coordinating the INSPIRE monitoring. INSPIRE monitoring can also be used to take measures to improve comprehensive provision of digital plan data, but also to improve cooperation between authorities. In addition, the coordinating office also identifies general problems of data provision on the GDI-DE in an impact matrix (DE03).

Geodata infrastructure (GDI)

The geodata infrastructure Germany offers the possibility of providing digital plan data. The accessibility of the data and whether access protection is provided for sensitive data depends on the service provider. There is no nationwide procedure for this (DE03).

In the city of Freiburg, the urban planning office (Stadtplanungsamt) is responsible for the land-use plans (preparatory land use plan and binding land use plans). In many cases, geodata infrastructures are only created at the federal state and national level. However, in 2005 Freiburg voluntarily decided to create its own GDI in order to subsequently save costs and make the current status of the data easily accessible. Since Freiburg's urban county takes over the tasks of a municipality and a county, there are many stakeholders involved who can benefit from the GDI (DE04).

3.4 Relation within different levels of government

The X Coordination center cooperates with the partners of the geodata infrastructure Germany (GDI-DE), especially in terms of standards, data models and code lists. In this context, the X Coordination center defines the content requirements and specifications for digital plan data, whereby the infrastructure is designed to provide a wide range of data (DE03).

The expert from Hamburg said that the interaction within the authorities has been reduced as there is now direct access to the binding land use plans via the Hamburg geoportal. The various users of the plan data do not depend on the data providers or their contacts. When disturbances on the geoportal were still common, the authorities and users contacted the data providers in Hamburg. This indicated interest in the data (DE01). As one interviewee states:

“We provide a lot of information on land use in the framework of INSPIRE. This is all digital information. Due to the diversity of data provision, we are less frequently asked questions. So whether you want to see this in a positive or negative perspective” (DE01).

The expert from Stuttgart did not observe any change in the relationship between the individual actors. Although the activities of the authorities became more transparent due to the easier access to data, this change had no direct influence on the individual actors (DE02).

GeoRhena

GeoRhena acts as a facilitator for international cooperation between Germany, France and Switzerland. GeoRhena supports this process, for example, with a declaration of intent to promote the exchange of information between these countries and also with plans showing the current status of regional planning. International exchange can thus benefit. The GeoRhena expert also emphasised that the human aspect is important in cross-border cooperation. Thanks to the GeoRhena network, the experts from the three countries know each other, which is why the barrier to cooperation is lower (DE04).

3.5 Relation between governmental and not-governmental actors

The Hamburg expert said that the criticism of intransparent preparation of plan data decreased due to digitisation and provision of plan data. In addition, the DIPAS (digital participation) project is currently being implemented in Hamburg, where the population can be involved in the conception of land use plans. However, effects of digitisation on participation processes and on planning are difficult to determine. As one interviewee states:

“There is little criticism that behind closed doors, some kind of planning concept is being developed which nobody would know about and which would not be transparently presented to anyone. That is why no news is good news; if there are few complaints about a lack of participation, it can be seen as positive that participation opportunities are available.” (DE01)

The expert from Stuttgart has also noted increased transparency through the digital publication of plan data. Digital public hearings also make it easier to participate. However, participation in Stuttgart is not directly dependent on digital means, but rather on the relevance of the project itself (DE02).

The GDI-DE works with municipalities indirectly via companies. Initially, cooperation was modest, as there was not much demand for the XPlanung standard, but rather for the provision of data. In the meantime, however, this has changed and companies advertise that they support standards (e.g., XPlanung) (DE03).

4 Use of digital plan data

4.1 Use of digital plan data

The expert from Hamburg said that the city offers digital plan data. However, little is known about the demand for the plan data and the users of this data. Only when there are reports of malfunctions of the portal or errors with data sets, does it become clear who is interested in these digital data. The way the data is used is up to the users. However, there are possibilities to develop towards digital cities, where sensors could be used as data sources for short-term and flexible development strategies. In Hamburg, for example, there is a discussion about e-scooters, where short-term concepts could be developed to integrate them into public transportation (DE01). As one interviewee states:

“Hamburg offers a service and we notice that now gradually ideas are arising to use this data. [...] It is a little bit the problem, also from GDI, we do not really know the customers. We only know them if the web service doesn't work, then the customers contact us.” (DE01)

GeoRhena

The interview with GeoRhena revealed that the plan on the current status of regional planning by Germany, France and Switzerland is mainly used for cooperation. When they draw up their own new plans or revise an existing plan, the authorities are able to see which of their neighbours' plans are current. Thus, they may consider them and contact the authorities involved and include them in their own planning. The expert said that this plan is often downloaded and used. However, they rarely receive more detailed feedback (DE05).

4.2 Digital plan data on different levels

In Germany there is a national geodata infrastructure (GDI) as well as geodata infrastructures in the individual States. In addition, there are sometimes also geodata infrastructures at the county or municipal level. However, this depends on the objectives of the individual stakeholders. In 2005, the city of Freiburg decided on a central office for geodata management. Freiburg has thus established its own geodata infrastructure. Due to the organisation of Freiburg as a city and city county, there is a wide range of tasks, as Freiburg takes on the tasks of both a municipality and a county. This has contributed to the introduction of the GDI. In this authority there are many users who benefit from the central provision through the GDI. As one interviewee states:

“The broad range of tasks (from a city and county combined) clearly enabled us to do the GDI. [...] There are users in all kinds of areas who can benefit from it. And yet we are still active in the city to show them the benefits of the GDI.” (DE04)

4.3 Accessibility

As far as possible, all geodata should be available via the German geodata infrastructure (GDI-DE). The GDI serves as a collection portal for the metadata, with the data providers being responsible for providing the data sets. This means that data providers are also responsible for access protection for any sensitive data. In this regard, there is no national concept or strategy in Germany that coordinates access protection.

In Stuttgart there are currently still some legal discrepancies in the binding land use plans. This has inhibited publication via the internet. However, Stuttgart is aiming to determine the current binding land use plans and make them available via the central internet portal in Baden-Wurtemberg as soon as possible. The expert said that legal difficulties with binding land use plans are also imaginable for other municipalities (DE02).

In the city of Freiburg, the preparatory land use plan (Flächennutzungsplan) has been available in digital form within the administration for several years. However, the plan was initially published digitally only by making the PDF available. This is due to the fact that the preparatory land use plan is designed at a scale of 1:25,000. Publication of the geodata on a parcel scale is therefore undesirable, as this could lead to misleading conclusions on the basis of the scale. By providing the PDF, a parcel-by-parcel interpretation was avoided. The preparatory land use plan was published this year on the new geoportal of Freiburg. It

was ensured that the zoom level for the external users is regulated in such a way that it is not possible to view the data set parcel by parcel.

4.4 Process changes

The expert from the X Coordination center raises the question of how the use of digital data will change in future. It is possible that the participation processes of the population will take place digitally using digital data. Digital plan data could also be analysed and incorporated into strategic planning and concepts. For this purpose, the two standards XPlanung and XBau are a step in this direction, as the digital plan data can now be used on a standardised basis. As further described by the expert, the technologies were already available long before they arrived in practice (CAD, etc.). This could be due to the fact that priorities were set differently with the economic crisis in the 1980s and 1990s. It is possible that the 1970s investments in urban development monitoring were not continuously developed. Over time, the image of planning has also changed. What used to be more project-oriented is now more oriented towards processes and strategies. The expert had observed this among planners and also found that this is even more welcome in teaching (DE01).

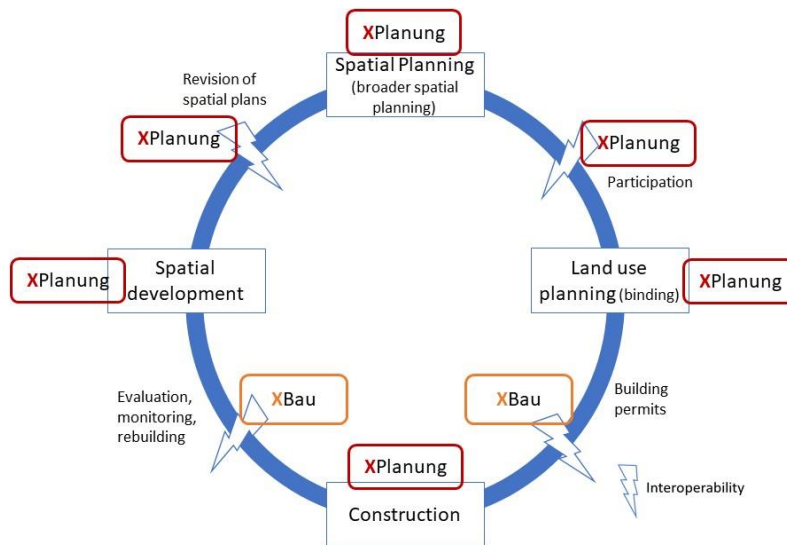
Digital process chains

Digital data forms the basis for digital process chains from strategic planning to land-use planning and zoning, to architectural design, construction and monitoring of the built environment (Figure 4.1, see also Annex 3, Thematic Practice Paper “Future technical development and possibilities”). Thus, digital process chains enable re-use of digital data, enabling digital building applications or analyses for changes in planning law. Since planners are at the beginning of process chains, the added value of digital plan data is small for them. Experience has shown that planners tend to be critical and cautious towards XPlanung and the central provision of plan data (DE01, DE04). However, the reason for this caution is an unanswered question. It is desirable, however, to use the opportunity for digitisation and also for digital participation procedures proactively. Digitisation can also make the administration an attractive workspace (DE01). The multiple use of digital data should be given more weight in the future, which will contribute to the transition (DE04). As an interviewee states:

“In order to establish digital process chains in construction and planning, digital data, interest in such topics and the integration of XPlanung data, XBau data in process chains of construction and planning are needed.” (DE01)

“The chance of planning would be to monitor their own actions more quickly and also to facilitate a performance review of whether planning has led to success. Or also to merge population data with infrastructure/traffic data. You can do all that, but you have to be willing to implement it.” (DE01)

Figure 4.1
Enabling of digital process chains based on the standards of XPlanung and XBau



Source: (Zaspel-Heisters, Regnery, & Vogel, 2020).

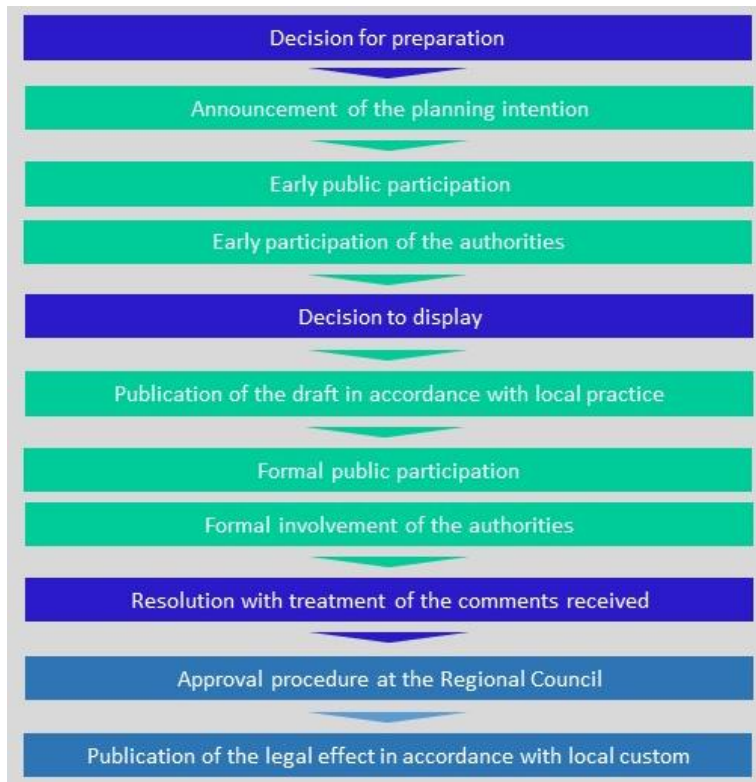
Digital processes also play a significant role in the city of Freiburg. For example, the electronic file (E-Akte) was introduced as part of the digital process in the administration of building law (Baurechtsverwaltung). In future, the building permit process should be partially automated using digital data as a basis. However, this is a complex matter, as it involves many different stakeholders. Therefore, in order to achieve not only facade digitisation with many changes from analogue to digital, some more time is needed to implement the digital processes. This will require more time than the implementation of the Online Access Act in 2022. A legal basis is also very important for completely digital processes. At present, however, there is still a requirement to sign binding land use plans in analogue form. The adaptation of the laws is still a matter of the future (DE04).

Hamburg, Stuttgart and Freiburg

In Hamburg, a transparency portal was established on the basis of the Transparency Act. In addition, Hamburg provides digital plan data and strives to provide the planning regulations in digital form. The expert believes that it is not yet clear whether planning practice is and has been actively or passively changed by digitisation. At least an increased transparency has been achieved by publishing the digital plan data (DE01).

In Stuttgart, the planning processes have not yet changed due to digitisation, as these refer to the legal regulations, which have not changed so far and include many steps (Figure 4.2). The only change so far has been that some steps are now performed digitally or are available digitally (binding land use plans, digital participation portal on the internet). Nevertheless, the analogue and signed land use plans are legally binding, which is why legal certainty in planning is unlikely to change at this point (DE02).

Figure 4.2
Simplified flowchart for the preparation of a land-use plan in Stuttgart



Source: (LH Stuttgart, 2017).

In Freiburg, the administrative processes are defined in the same way as in Stuttgart. Therefore, the digitisation of individual process steps or elements has only a small influence on the process. However, it is anticipated that the digitisation of plan data and process steps will increase efficiency. However, the publication of digital plan data has a significant influence, as the accessibility of the land-use plans is improved by a digital portal. In addition, the barrier to viewing land-use plans is lowered, since they no longer have to be inspected at the administration office. This can improve participation. So far, the experts in the city of Freiburg have noted that the opportunities for informal participation in spatial planning processes have increased. This participation is still at an early stage in the planning process, which is why implementation is even freer and more flexible than in formal participation. In the case of formal participation, the barrier providing digital participation is greater, since there is an obligation to respond to each person submitting comments and planning is already at an advanced stage. This could mean that the implementation of digital participation is even less advanced than in the case of informal participation, where there is more flexibility (DE04).

4.5 Purpose / added value

The expert of the GDI-DE coordination office concluded that the best incentive to digitise and digitally produce plan data is to recognise the benefits. Thus, the GDI and also INSPIRE should be considered for their own benefit to the economy and not as an obligation. Standardised geodata is very important for comparability and its benefits. However, this requires uniform provision. There can also be added value for the municipalities in the fact that digital and partially automated work processes can be made possible on the basis of digital development plans and that a unified participation process can also be created. Awareness of this is the best incentive (DE03). However, there is the challenge that acceptance at the beginning of the process chain is more difficult to achieve among the planners, because the added value only occurs later in the analysis and the planners themselves benefit little from the analysis (DE01, addressed also in Chapter 4.7 Challenges).

For the further full vectorial digitisation in Freiburg, convincing is needed for the financing. However, digitisation will create added value in the use of data if the content is accessible to all and people can directly work with it. For example, since 2005, the advantages of easy access via the geodata infrastructure in Freiburg have been better realised. Standards are needed to add further value to digital plan data, so that every specialist application can read this data and thus work with it several times (DE04).

As part of the D-Planung project (digital land-use planning), Hamburg has developed a cockpit, which provides the person responsible for drawing up binding land use plans with an overview of the current status of the land-use plan procedure. It also contains a knowledge database in which the 3000 existing binding land use plans are integrated. Now the digital provision of plan data has the advantage that AI-supported methods can be used to evaluate the binding land use plans (DE01).

4.6 Digital and analogue

The expert from Hamburg explained that analogue planning processes are becoming less and less common. Within the planning processes, there are various possibilities for participation in the early planning up to realisation. However, since entire planning processes take a long time, especially participation information can be missed due to personnel changes or changing responsibilities. This raises the question of how the information from informal planning procedures is incorporated into formal planning. Digitisation therefore offers a great advantage, so that an overview of planning processes is guaranteed over a long period of time. In this way, an attempt is made to digitise all participation processes and prepare them so that they can also be used for subsequent formal procedures in Hamburg (DE01).

4.7 Challenges

The expert from the coordination office of the geodata infrastructure Germany (GDI-DE) said that there is some room for interpretation when implementing the standards. Among other things, the complexity of data models and spatial planning itself could be the greatest challenge. A high level of expertise is needed to deal with them. This expertise must be learned by many local authorities. In order to achieve the goal of finding as many geodata as possible in the interdisciplinary geodata infrastructure, the metadata has to be qualitatively adequate. But often there is still room for improvement. In some data sets the bounding box is not set correctly, i.e., the section of the room in which the data set is located. Such uncertainties in the metadata make it more difficult to find specific data sets (DE03).

The implementation of XPlanung at the beginning of Deutschland-Online was difficult. A major challenge was the lack of commitment to the standard and the added value that was seen as the incentive to participate. In addition, a strong effort had to be made to convince the software developers to implement the XPlanung standard technically. A further challenge concerns the acceptance of the standard XPlanung. Planners who are responsible for the creation of binding land use plans are experiencing a bigger effort. However, the benefits of the standard only appear in the later analysis of the planning, which is normally carried out by other people (DE01).

The expert from the X Coordination center and the City of Hamburg said that specific analyses using plan data are only possible with full vectorial data capture, such as the calculation of construction potential. Therefore, this approach is also recommended by the X Coordination center. However, if local authorities decide on a partial vectorial recording of plan data (raster ring) and at some point want to switch to a full vector recording, this will result in a significant additional workload. Moreover, partial vectorial capture is sufficient to comply with the INSPIRE directive. The challenge here is that the local authorities can decide to use partial vector data capture despite the great advantages of full-vector capture of plan data. Furthermore, it was mentioned that Hamburg as a city-state is not confronted with the same challenges as smaller municipalities or States with large areas (Baden-Württemberg, Rhineland-Palatinate). This in turn makes a general approach to full vectorial implementation difficult, as the circumstances can be very different (DE01).

A further challenge for the digitisation of plan data is the legal basis. Although the Online Access Act stipulates that 575 administrative services must be provided digitally by 2023, the same ministry is also responsible for the Building Act and does not demand a comprehensive digital provision of plan data. If digitisation were to be included not only at the digital law level but also in the specialised legislation, i.e., the Building Code, this would be more beneficial for digitisation, as non-compliance would also have consequences (DE01).

Hamburg, Stuttgart, Freiburg

Hamburg has digitally made preparatory land use plans for itself and neighbouring municipalities in the entire metropolitan region. The municipalities are now planning to update their plans. However, there are still a number of organisational challenges to be overcome, whereby it must be clarified how to work cooperatively on an infrastructure spanning several federal states and how each is responsible for its own plan data (DE01).

Experts from Stuttgart and Freiburg mentioned that the transition from analogue to digital with the required standards can be challenging. In particular, standardisation is sometimes viewed critically, as this is seen as a restriction on individual planning performance. However, the re-use aspect of plan data in other areas is expected to become more important in the future. Thus, standardisation will also find its way into planning, even though this may take some time.

In Freiburg there are still many problems with interoperability in planning processes, because the processes are not yet completely digital. However, digital data only adds value when they are actually used. That is why entire digital processes with digital components up to the building permit process are important. The challenge here is to create these digital processes in the complex environment of planning and building permits. Freiburg is confronted with the challenge that the planning firms are often not yet prepared to create the plans according to XPlanung and INSPIRE. Freiburg makes a preparatory land use plan in combination with a landscape plan. So far, there is no model for the landscape plan in XPlanung, which is a crucial issue for the preparation of the plan. However, in future, standards such as XPlanung and INSPIRE should be a knockout criterion for the selection of planning offices.

The experts from Freiburg see a further challenge in the different speeds of digital development and the long-term nature of planning. In digital engineering, it is likely that a new interface will already be used after one or two years or that the software will change. In contrast, the production processes in planning sometimes take longer and, until the plans are revised again, a few more years. This balancing act is challenging for the digitalisation of planning processes and has to be managed (DE04).

GeoRhena

GeoRhena does not harmonise data and works with the lowest existing denominator of cross-border data. As a result, plan data often has components with different definitions or different recording intervals, which makes it difficult to present them in a common plan. As a result, there are often only rough cross-border data, even though a great deal of effort was put into them (DE05).

4.8 Future use scenarios

The GDI-DE expert said that the goal of digitisation in spatial planning is constantly changing and adapting, it is a moving target. For example, the INSPIRE Directive was adopted in 2007, while the first smartphones appeared only a year later. Thus, there are difficulties rotating maps by hand with a WMS service on the smartphone, because the map is always facing north. The demands for standards, therefore, change over time and a continuous improvement is strived for, also through new standards. It is important to note that there are always motivated people who are very progressive, but also rather unmotivated people who develop more slowly. This must be dealt with, but the aim is that the basic level of standards, for example, should be higher in the future than it is today (DE03).

In Hamburg it is planned to present the XPlanung data in three dimensions. The corresponding building potential will be displayed three-dimensionally, which does not correspond to the buildings, but to the possible area of land that can be overbuilt. This in turn can be used to check the objectives of planning or to monitor the utilisation of the planning law. The expert from Hamburg also said that there is currently a discussion about whether digital plan data could be used as a basis for the taxation of land. For this purpose, digital data in full vectorial format in XPlanung are necessary. So far, however, there has been no joint action by the Federal Government and the States.

In Stuttgart, a full vectorial recording of binding land use plans is planned for the future, which can also be checked with the help of validators in Baden-Württemberg or the X Coordination center (DE02).

The experts from Freiburg expect much more to be digitised in the next 10 years. Formal participation in land use planning is to be transferred to a digital platform in the future. The building permitting processes,

as well as visualisation, should also develop in the digital direction in the next few years. For example, it is necessary to consider how digital plans can be taken to a building site (tablets etc.). Thus, there are still many aspects to be dealt with.

GeoRhena

The GeoRhena expert said that there is still a great deal of work to do on international geodata, especially regarding standardisation. Comparability and compatibility are the most important priorities. However, the expert estimated that future developments would move in the direction of standards, so that at some point in the future GeoRhena's mediation work would no longer be necessary. However, it will certainly take several years until then.

5 Synthesis and recommendations

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

The expert from the X Coordination center estimated that planning will be strengthened due to digitisation. There are new possibilities for monitoring processes in planning. For example, digital process chains can be used to track how the plans were accepted and implemented, right up to the digital building permit. Thus, the implementation of the plans can be checked and the plans can be adjusted accordingly. Furthermore, in Hamburg there is an effort to present the XPlanung data in three dimensions. Thus, so-called planning envelopes can be shown with the corresponding building permits which allow planners to assess compliance with planning objectives and the utilised potential of the planning law can be checked.

The X Coordination center expert further mentioned that the public is empowered through participatory processes where digital data is used and information is combined and displayed. This can be implemented, for example, with large data tables that act like a giant tablet. At the so-called "digital campfire", various pieces of information can be placed directly on top of each other to support analysis, discussion and negotiation.

With digital plan data, evaluations and analyses are possible. These can be presented to politicians and can provide a solid foundation for projects or plan-making. This can also strengthen politics (DE01).

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

According to the interviews, collaboration within the authorities is doing well and has also improved, for example in Stuttgart, due to the digital exchange of data. For instance, in Freiburg, the added value of good cooperation in the use of digital data was also recognised, so that closer cooperation is taking place within the city administration. Digitisation has led to the introduction of the XPlanung exchange standard, which is maintained by the X Coordination center. This coordination centre works closely with the coordination centre of the geodata infrastructure in Germany in order to implement infrastructure requirements.

International cooperation between Germany, France and Switzerland is already good and its intensity depends on the ongoing projects. GeoRhena has made a significant contribution to building a network and facilitating cooperation. To what extent digitisation supported these efforts is not clear from the results obtained. However, it became clear that the network and the involved humans are essential points for collaboration (DE05).

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

There have been many projects and initiatives in Germany to create geodata infrastructures or to introduce the exchange standard XPlanung. For example, digitisation has already had an impact on individual process steps in spatial planning, for example by making digital participation possible in land use plans drawn up in the city of Hamburg. However, the digitisation of entire planning processes has not yet taken place. For example, the analogue plan data with the original signature are still legally binding throughout Germany.

The XPlanung project, which was initially handled as a voluntary and recommended exchange standard, is now to be implemented on a mandatory basis. An expert also said that this project is doing many things well - from the theoretical approach to practical implementation. There are still many challenges and some problems in the implementation, though. Nevertheless, the implementation in Hamburg, for example, is very impressive (DE04).

Patterns

There are two approaches within the implementation of XPlanung. As some experts argued, the full vector approach to digitisation of plan data will be implemented mainly in large cities. In areas where the INSPIRE

directive is more important, it is also possible that the raster-ring scenario will be used in the context of XPlanung. However, as reported by an expert from Geooffice (AT07), there is a tendency to use the full vector method for current and future plan data collection and to use the raster-ring scenario for digitising older plans. In future, the full-vectorial plan data should be the preferred method, as also recommended by the X Coordination center in Hamburg.

Germany shows the importance of the mandatory implementation of the exchange standard. Before the obligatory, XPlanung was only implemented by individual authorities who were motivated to do so. The exchange standard was not implemented nationwide until it became binding through a decision by the IT Planning Council. The same was also observed in the establishment of geodata infrastructures. In some States, counties or cities, a geodata infrastructure for the publication of plan data had already been provided for quite some time. However, it was with the Online Access Act that the implementation and publication of plan data on a statewide portal became binding nationwide.

Policy recommendations

Introduce a nationwide digital exchange standard

XPlanung is a feasible approach for creating digitalisation standards in spatial planning, particularly in a federal country. Similar standards should be adopted in other countries.

Develop digital process chains

Digital plan data has the potential to increase efficiency and coherence of various administrative processes. The combined standards of XPlanung and XBau enable the link between strategic planning, land-use planning, architectural design, construction, and monitoring of the built environment. If they can be pursued together, they foster unprecedented synergies in the planning and construction context.

Go for fully digital plan data

The Raster-Ring approach was a feasible solution for the transition from printed to digital plan data. However, it has serious limitations for practical use. Fully digital plan data offer better opportunities to satisfy future needs of spatial planning.

References

- LH Stuttgart. (2017). *Vereinfachtes Ablaufschema Aufstellung eines Bauleitplans nach Bestimmungen des Baugesetzbuches (BauGB, Stand: 29.7.2017)*. Stuttgart: Amt für Stadtplanung und Stadterneuerung, Retrieved from <https://www.stuttgart.de/medien/ibs/Ablaufschema-Bebauungsplan-Stand-2017.pdf>
- Pahl-Weber, E., & Henckel, D. (2008). *The planning system and planning terms in Germany: A glossary*. Retrieved from Hannover: <http://nbn-resolving.de/urn:nbn:de:0168-ssoar-285601>
- Zaspel-Heisters, B., Regnery, D., & Vogel, F. (2020). Geoinformationen in der Raumplanung. *IzR Informationen zur Raumentwicklung*, 3/2020, 113.



Co-financed by the European Regional Development Fund

Inspire Policy Making with Territorial Evidence

espon.eu



ESPON 2020

ESPON EGTC

4 rue Erasme, L-1468 Luxembourg

Grand Duchy of Luxembourg

Phone: +352 20 600 280

Email: info@espon.eu

www.espon.eu

The ESPON EGTC is the Single Beneficiary of the ESPON 2020 Cooperation Programme. The Single Operation within the programme is implemented by the ESPON EGTC and co-financed by the European Regional Development Fund, the EU Member States, the United Kingdom and the Partner States, Iceland, Liechtenstein, Norway and Switzerland.

Disclaimer

This delivery does not necessarily reflect the opinion of the members of the ESPON 2020 Monitoring Committee.

ISBN: 978-2-919795-63-5