



Digital Planning, Building and Operation

A Project Survey

Technology
Report

Vienna,
March 2021

Dear reader,

Vienna is one of the most successful metropolises in the field of sustainable innovations. A total of around 9,200 companies in Vienna deal with urban and environmental technologies. More than 90,000 people generate an annual turnover of approx. 40 billion euros, i.e. 16 percent of the total turnover of Viennese companies

According to various studies, Vienna scores particularly high on innovative strength, comprehensive support for start-ups and a strong focus on sustainability. Vienna is also at the top of several "Smart City" rankings. The guiding goal of Smart City Wien is to provide the best quality of life while conserving resources as much as possible by 2050, and the Smart City Wien framework strategy makes this a reality through many innovative individual projects. The location is also convincing due to its research and technology-friendly climate, the geographical and cultural proximity to the growth markets to the east, the high quality of the infrastructure and the education system and, last but not least, the highest quality of life worldwide.

In order to optimally utilise the potential at this location, the Vienna Business Agency acts as an information and co-operation platform for Viennese technology developers. It networks companies with development partners from business, science and the city administration and supports Viennese companies with targeted monetary subsidies and a variety of advisory and support services. Target groups are companies from the fields of energy and the environment, mobility, and construction, as well as social innovations and assistive technologies.

This Technology Report provides an overview of the digitisation of the construction sector and shows a selection of digitisation projects in Vienna or with Viennese participation and companies that are active in this area in Vienna.

We hope you enjoy reading it!
Your Vienna Business Agency team



REACT-EU ALS TEIL DER
REAKTION DER UNION AUF DIE
COVID-19-PANDEMIE FINANZIERT.



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SMEs. With its unique network structure and its broad, strategic orientation, the Austrian platform holds a leading position in the D-A-CH region.

Different technologies, methods, use cases and life cycle phases can be distinguished. A categorisation of the most important digital technologies for the construction industry can be made in the areas of data acquisition, methods of data analysis and information acquisition and ultimately in the area of information utilisation (implementation).

1.1 Digitalisation in the Construction and Real Estate Industry

The digital transformation of the construction industry is in full progress. Digital processes and tools are changing the construction industry as a whole and offer great potential along the entire value chain.

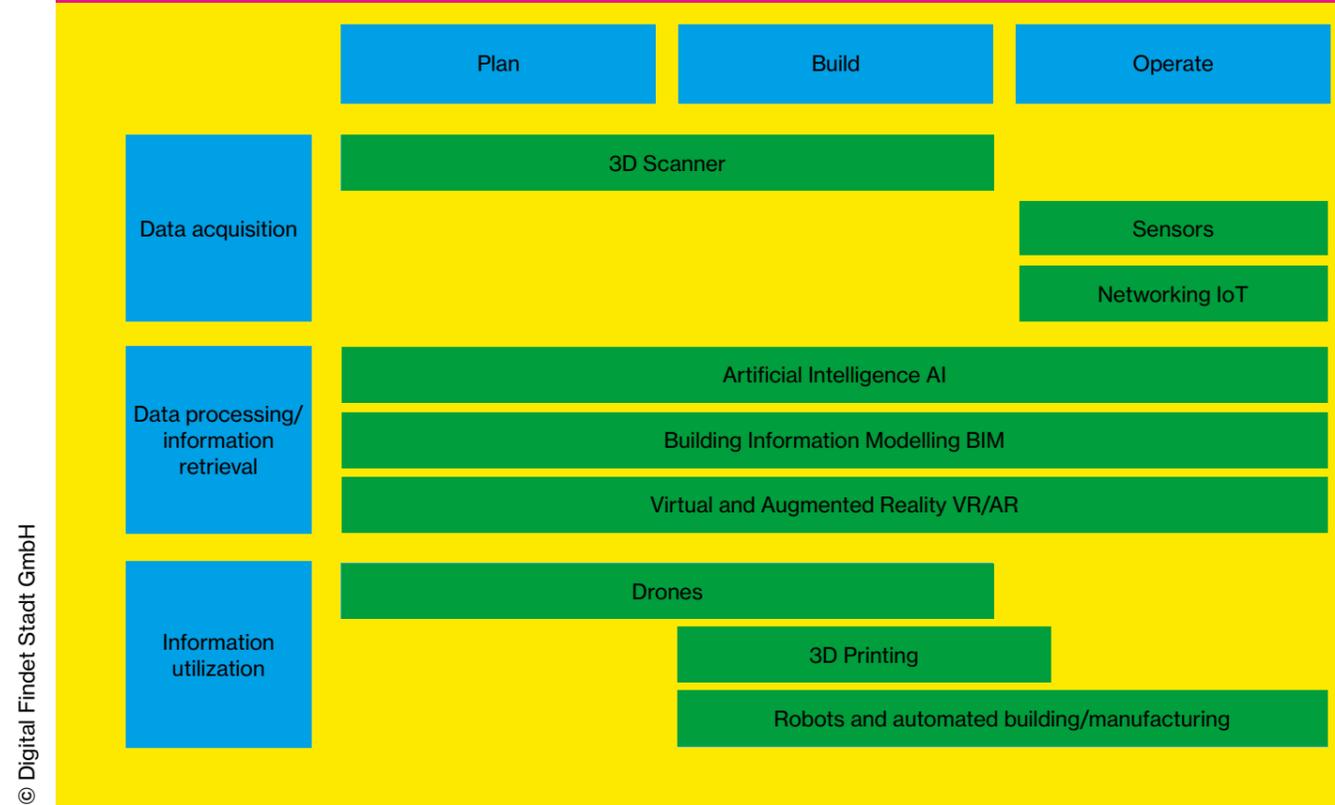
In many areas of life, digitalisation has already fully arrived. Computers, digital cameras, smartphones – technological developments are advancing rapidly and permeate all areas of our lives. The construction industry is still in the middle of this process of change. The switch from analogue to digital is changing project planning, construction and building operation. Buildings are planned three-dimensionally, visualised, and virtually inspected. Construction is increasingly off-site (prefabrication), automated and in future also 3D-printed. However, the potential is far from being fully exploited.

Countries where the government has provided stimuli show a higher degree of digitalisation. In Austria, there is still no strategy for digitalisation in the built environment. Although the standardisation and thus the market standards are in place. Austria's specific business landscape, which is mainly characterised by small and medium-sized enterprises (SMEs), must be taken into account.

“Digital Findet Stadt”¹ is Austria's largest platform for digital innovations in the construction and real estate industry and offers a diverse range of innovation support. With a network of over 300 companies and research institutes, the platform helps promising innovation projects to reach market maturity and strengthens the innovative power of Austrian

¹ www.digitalfindetstadt.at

The most important digital technologies in the construction sector



While sensor technology, IoT, 3D scanners, VR/AR applications and increasingly also drones have reached an advanced level of technical maturity, applications for artificial intelligence, 3D printing and automated manufacturing in the construction industry are still in the prototype stage. None of the technologies described has achieved real market penetration at the present time.

A key technology that connects the others and whose application enables continuous processes and value chains is Building Information Modelling (BIM). If BIM is widely introduced and applied, as demanded by the EU Commission, other digital technologies will also experience increasing demand. This report therefore focuses on Viennese projects using BIM and describes the related use cases and added values.

BIM is the method to create a digital building model with the help of appropriate software. The computer-aided 2D planning (Computer Aided Design CAD) is expanded into a spatial 3D model. The software allows different trades to work together on a common virtual model (or on superimposed partial models). The spatial planning of the 3D geometries is enriched with information and functions as the central information hub of a project. If the construction process management is also integrated and the schedules are linked to the required activities in the process flow and coupled to the building components, we speak of BIM 4D. With BIM 5D, mass extractions and component lists are created in order to calculate costs. Further information on production, assembly, ordering and logistics, as well as resource, life cycle, maintenance and servicing data are described with BIM 6D (sustainability) and BIM 7D (facility management FM).

The result is the so-called “as-built model” that provides all relevant data and documentation from the planning,

construction, and operation of the building. If this digital representation of the real building is additionally enriched with dynamic data from sensors, it is called a “digital twin”.

Working with BIM requires a new planning and project culture. Conventional communication between architects, consultants, specialist planners, trades and clients must be redefined in order to be able to exploit the potential of digitalisation. Then open collaboration in BIM projects will benefit from clear, uniform interfaces and, with shorter planning and construction times, lead to faster realisation with less waste of resources and energy – which results in higher quality and cost efficiency.

An increasingly important use case of BIM is the possibility to provide climate and resource-relevant information. With the information stored in BIM, key figures on energy consumption, microclimate, CO2 footprint and aspects of the circular economy are calculated, checked during building submissions, and certified when the building is handed over for operation. Some examples of this are also given in this report.

1.2 Impact of Digitalisation on Environmental Sustainability

1.2.1 The Most Important Use Cases of BIM

In this survey of innovative digitisation projects in the Vienna area, we asked which use cases BIM were applied. The 44 most typical use cases in the areas of planning, construction and operation were specified.

The results of the survey show that BIM is already universally established in larger projects in Austria, but the most frequent applications are clearly found in planning and construction (Figure 1).

With the help of the digital working method BIM, a continuous digitalisation of the planning, execution, and operation phases can be achieved. The cooperation requires a new understanding of roles and responsibilities, which requires organisational and structural changes in the companies. As the project surveys show, public clients in particular have currently taken up this challenge and are using the BIM methodology for educational and administrative buildings. BIM is also increasingly required in EU-wide tenders. 13 of the 15 projects presented in the report were commissioned by the public sector. In the area of digitalisation, this once again confirms the important role of public procurement in the innovation and transformation process. 40 percent of the projects examined are educational buildings, 33 percent administrative and office buildings, 20 percent infrastructure buildings and only seven percent residential buildings.

The possible uses of the BIM model are manifold. The following is an overview of the use cases requested, arranged according to project phases (planning, construction, operation).

In which phase of the life cycle was BIM applied?

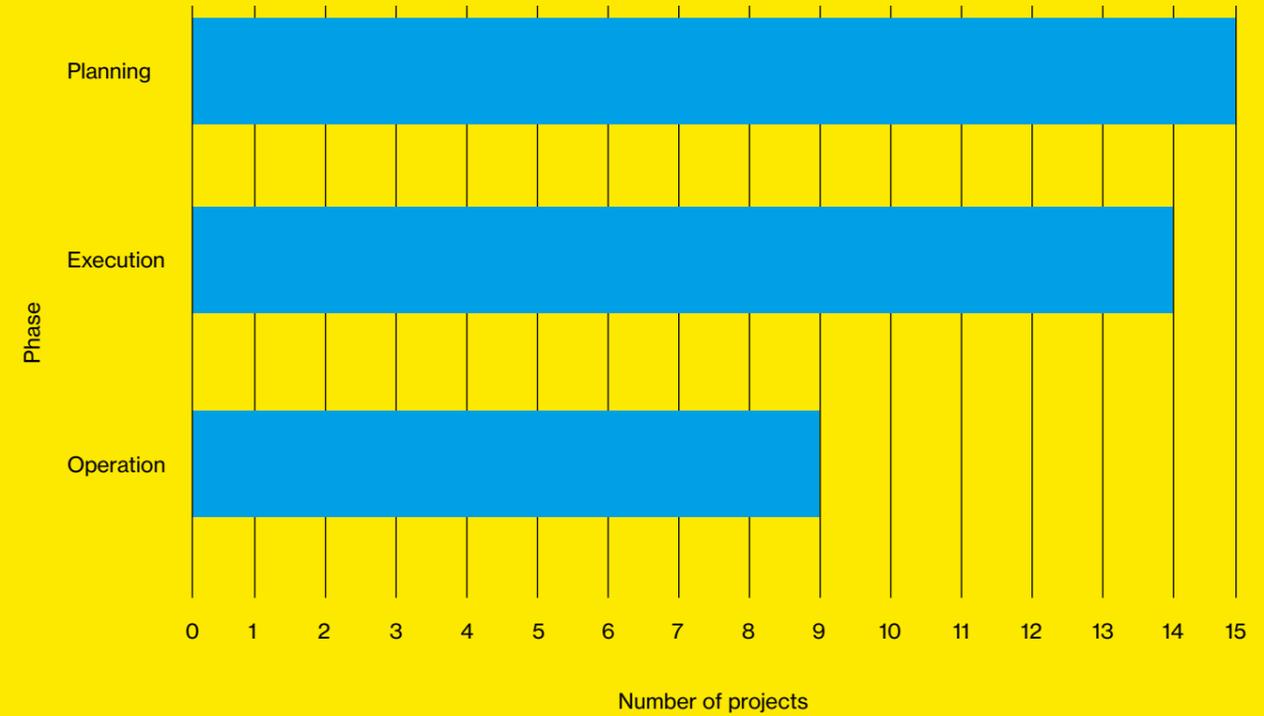


Figure 1: © Digital Findet Stadt GmbH

Project Types

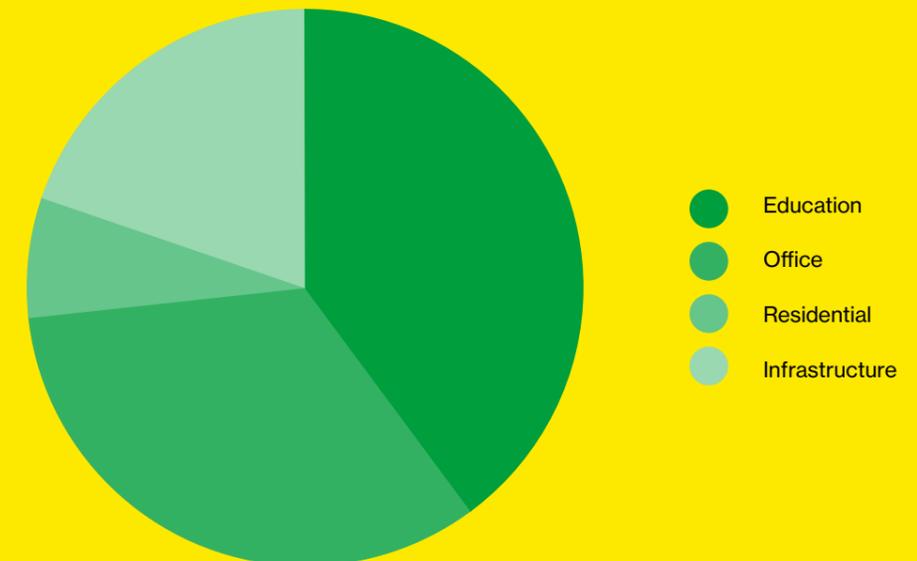


Figure 2: © Digital Findet Stadt GmbH

What are the most important BIM use cases?

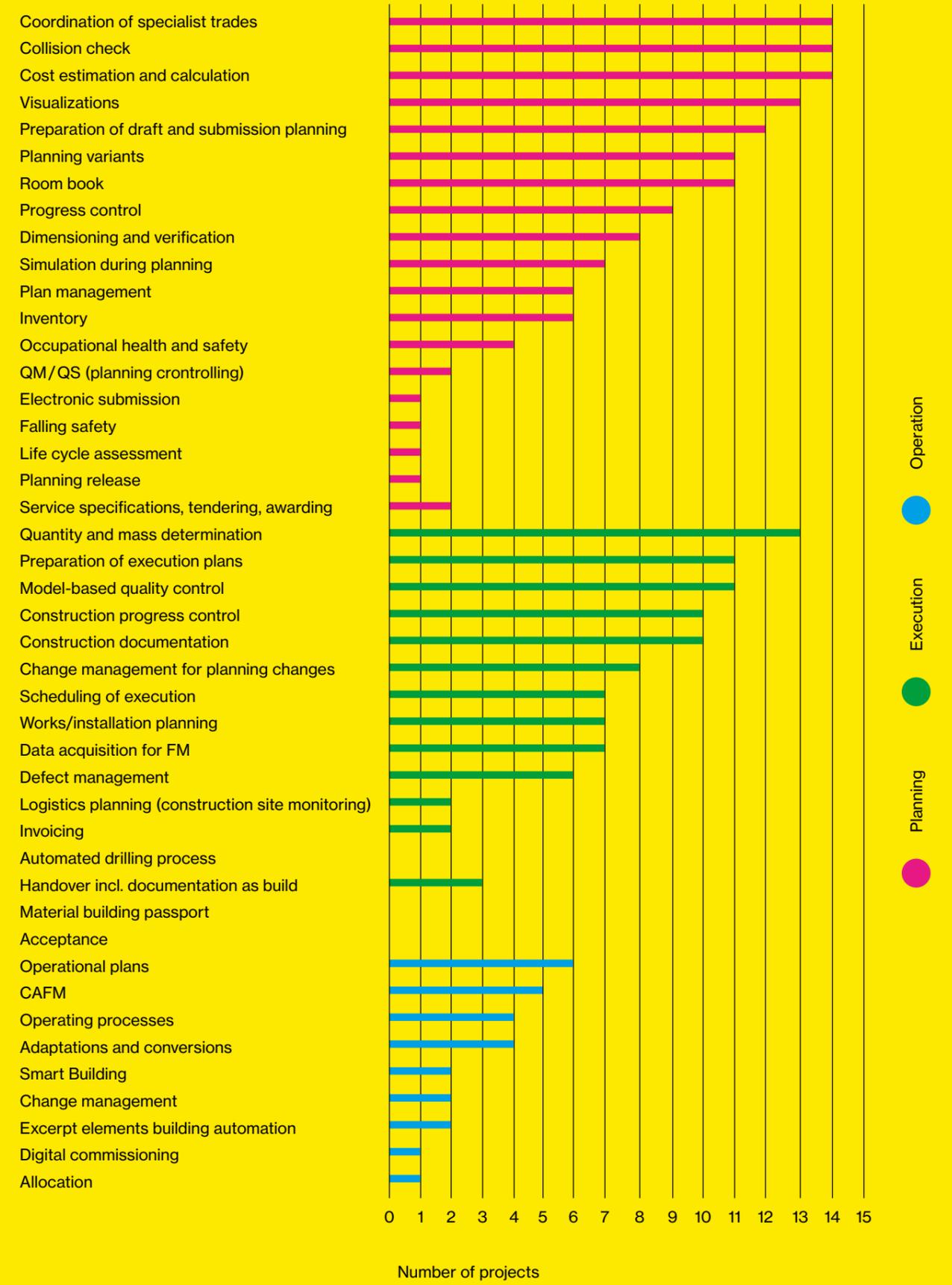


Figure 3: © vgl. Digital Findet Stadt GmbH

Figure 3 clearly shows that the advantages of integral planning with BIM are most frequently used in the planning phase. The reason for this is presumably that a great deal of communication is required in this phase of the project and the specifications regarding type and form as well as function are made so that the project can then receive its legal validity with the building permit. Electronic construction submissions have been possible at the City of Vienna since the beginning of 2021. The goal is to create a BIM city model that will serve as the basis for further urban planning decisions and can be used to create important simulations for the public space. Even in the project start-up phase, BIM can create added value. Different scenarios are documented and compared until the best solution is found. Most projects use this type of digital support, also because visualisations can be created directly on the basis of the model, which are indispensable in communication with the client or building owner. A virtual tour of the future building with VR glasses tops the already good possibilities of project representations that can be generated by renderings. For the coordination of different domains, the respective models are superimposed and checking algorithms indicate, if there are collisions between different components or if standards such as escape routes or fire protection are not complied with, for example.

The function of generation plans both in the design and in the execution phase and the possibility of deriving the cost-relevant model cubature masses are used very frequently. BIM programmes are already established in many architecture and planning offices. Quality control is usually carried out by means of a BIM model check. This involves checking whether predefined requirements for the model data are met. This includes checking for correct component connections as well as checking the completeness of the data. However, its use as a database and management tool is far from being exhausted. Some of the projects presented in the report can, however, indicate added value from the use of BIM throughout the entire project life cycle. Requirements such as the need for life cycle assessments, sustainability reports and energy management will further strengthen the position of BIM in operations. Life cycle assessments of buildings do not only apply to new buildings but also to (refurbished) existing buildings.

Which disciplines were involved in working with BIM?

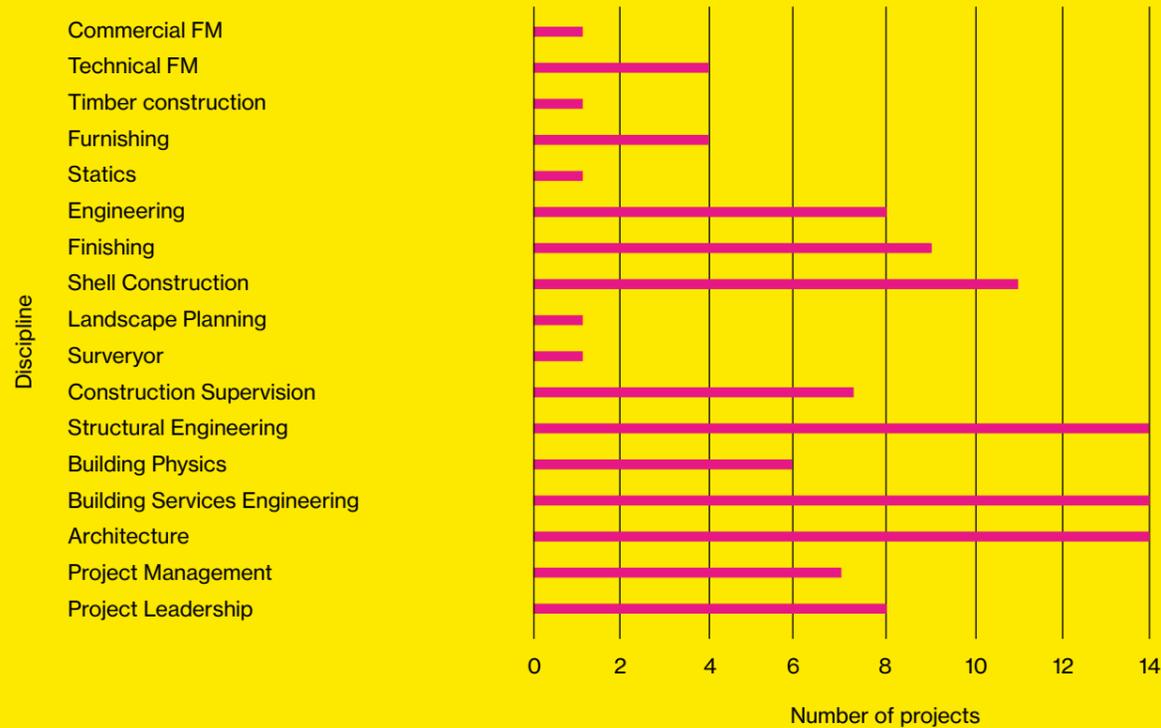


Figure 4: © vgl. Digital Findet Stadt GmbH

Life cycle costs and efficiency potential related to digital technologies

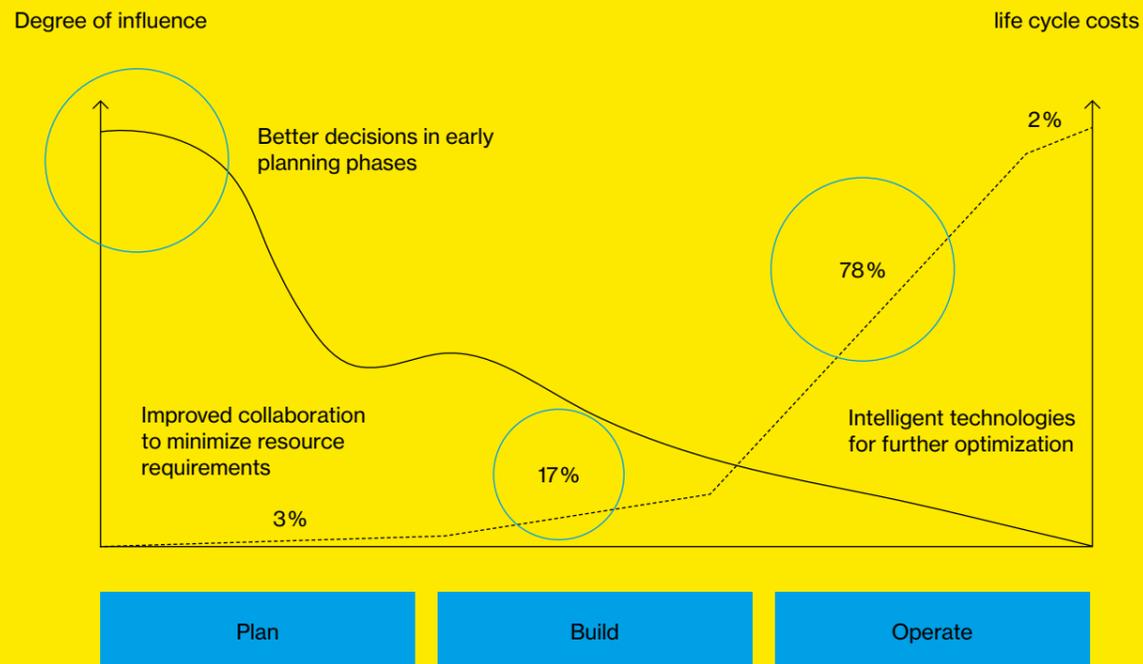


Figure 5: © Leitfaden Hochbau, IG Lebenszyklus und Digital Findet Stadt GmbH

1.3 Resource Efficiency

Throughout the course of the project, resource efficiency is an important issue in terms of economic viability and impact on the environment. Working with BIM reduces the risk of errors. Conflicts are displayed with the help of clash detection. Different disciplines are overlaid and visualised. Impacts, interrelationships, and correlations become visible at an early stage, thus avoiding time-consuming and expensive changes. Planning during construction is a thing of the past, as the construction process has already been simulated using the model. By identifying and correcting errors in advance, BIM contributes to faster or on-time project completion and reduces the waste of time and resources. However, the potential opportunities will only be realised when as many disciplines as possible participate in the model and an "as-built model" is handed over to the client, which can then also be used to its full extent. For this project survey, we asked which disciplines were involved in BIM.

The evaluation in Figure 4 shows that there is already a good information flow from planning to construction. Especially the planners who generate building shapes (architecture, structural design and building services engineering), who work in the three-dimensional space, use the virtual building to reflect on and localise their work. Those who work in a more data-based way, such as building physics and surveyors, seem to use BIM less. The same can be observed in the execution phase; the model is used as a working tool for shell construction, finishing and engineering, especially in projects with a high degree of prefabrication, such as timber construction, which is represented with a project in the report. In building operations, BIM is used by the technical FM. The possibility of data documentation for later use is included here.

operation, while these costs are most significantly influenced during the design planning period (see Figure XX). The timely use of simulation tools based on BIM models can help provide more information for informed decisions and to provide a renewable energy supply. During the construction process, construction sequence simulations help to reduce the complexity and to save resources. Once the building operates, intelligent building technology adapts services and supplies to the actual needs of the users. The necessary data is provided by networked sensors and BIM-based positioning.

For the renovation of existing buildings, a BIM model can be generated using 3D laser scanning and detailed point cloud images. In this way, important information is made available to install renewable energy systems. In some of the selected projects digital point cloud images are used to obtain a comparison of the target status and the actual status.

Therefore, BIM is an enabler of climate-smart buildings! Including the technical aspects at an early stage is important to achieve energy-efficient operation. In the best case, future operators are included in the planning phase. Although this makes the coordination and the planning process more complex, it can be managed with the help of BIM without neglecting the architectural design. This is impressively demonstrated by the innovative projects in this report.

1.4 Energy Efficiency and the Use of Renewable Energy Sources

Simulationen von Umwelteinwirkungen anhand des Modells gehören noch nicht zum planerischen Alltag der Projekte. Dort wo sich die Auftraggebenden aber dafür entscheiden, diese Vorhersagen auszuwerten, entsteht schon in der Planung ein höherer Wissenstand für den Betrieb und die Nutzung von Gebäuden. Klima- und Energiesimulationen helfen dabei, Risiken zu minimieren und Kosten zu sparen, da haustechnische Anlagen auf Basis von Jahressimulationen sehr genau dimensioniert werden können oder auch planerisch und baulich auf Anforderungen reagiert werden kann, falls Windsimulationen oder Verschattungsstudien nicht die gewünschten Ergebnisse liefern. Über einen Simulationsprozess wird das bestmögliche Ergebnis im Spannungsfeld zwischen Ökonomie, Ökologie und Gestaltung ermittelt.

IG Lebenszyklus Bau has calculated that on average 80 percent of the total costs of a property are generated during

1.5 Circular Economy and Natural Building Materials

When the project is handed over to facility management (FM), all the information is collected in the BIM database (digital commissioning). The required data and plans relevant to operations are available to CAFM (Computer Aided Facility Management). Use cases and goals defined in the planning phase as well as quality requirements now become decisive. If the building model has been well maintained throughout the project process and filled with the relevant information, the digital twin is valuable for building use and documentation.

Circular economy is the future topic of the construction industry. The deconstruction of buildings and the ability to recycle materials used must be considered during construction. This is not only required by the Recycling Building Materials Ordinance², but also by the demand for a sustainable building. A holistic life cycle assessment that also includes deconstruction, demolition and disposal costs is necessary. In this context, the recyclability of the building materials is crucial. Composite building materials and chemically treated materials are problematic. The information on used building components should be documented in a material passport, for example, so that the subsequent release of materials when the building is demolished can be part of the value chain (urban mining). The material building passport is a database with all building materials and components. Via a connection to SAP/ERP, an economic assessment can be made, and the material residual value of a building can be determined after its useful life. The added value is therefore not yet completed after the building has been depreciated but is re-determined depending on the materials used and global commodity prices.

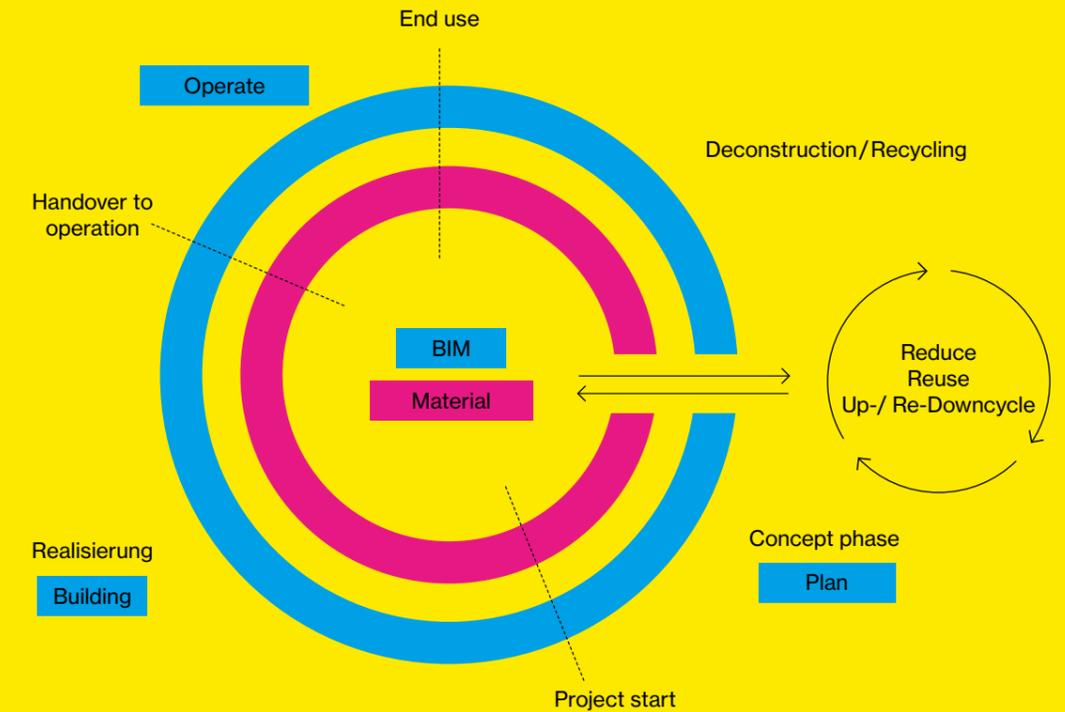
The choice of material is therefore important not only for the service life but also for deconstruction; natural materials and pure raw materials retain their value or can even increase it depending on market developments. Wood is a recyclable raw material. Modular prefabrication is widespread, especially in wooden construction, because it brings advantages in logistics and production. Automated production so as 3D printing require digital models as input. This is why BIM is needed here. Ecological construction paired with BIM technology is therefore a future-proof duo.

²

The Recycling Building Materials Ordinance (BGBl. II No. 181/2015) entered into force on 1.1.16.

Elements of the circular economy at the material level and the planning level with BIM

© Digital Findet Stadt GmbH



1.6 Importance of Standardisation

Uniform standards and open data exchange formats are necessary so that small and medium-sized enterprises (SMEs) can also participate in BIM projects.

In practice and in the literature, this is referred to as open-BIM. The definition is not always clear. According to building-Smart international, "[...] at its core, openBIM is a vendor-neutral collaboration process. openBIM processes can be defined as shareable project information that supports seamless collaboration for all project participants. openBIM facilitates interoperability to help projects and assets throughout their lifecycle."³

The basis for working with openBIM is the open data model and the exchange format IFC (Industry Foundation Classes), which is standardised worldwide in the ISO 16739⁴ standard and is being developed internationally by building-SMART. At the national level, the necessary roles, project phases and other basics for a comprehensive, uniform, product-neutral, systematised exchange of graphic and alphanumeric data are described in ÖN A 6241-2. Furthermore, in Austria, tendering, awarding and invoicing (AVA) is regulated in the standard ÖN A 2063-2:2021; this standard was supplemented in March 2021 with definitions for AVA-relevant BIM properties.

These rules of cooperation clearly define the process and enable resource-saving work. These standards are essential for the Austrian construction industry, which is dominated by SMEs, as they enable efficient work based on sound principles.

³

Why OpenBIM® – www.buildingsmart.co.at/bim/warum-openbim

⁴

ISO – ISO 16739:2013 – Industry Foundation Classes (IFC) for data sharing in the construction and facility management industries – www.iso.org/standard/51622.html

2.1 BOKU Vienna Library and Seminar Centre (Ilse-Wallentin-Haus)

Submitted by
ARGE DELTA SWAP Architekten,
SIDE – Studio for Information Design GmbH

Location
Peter Jordan-Straße 82
1190 Vienna

Project start
January 2018

Completion
July 2020

open BIM

The new library and seminar centre for BOKU Vienna is a pioneering project in the field of sustainability. It was built in wooden construction and extends the existing BOKU campus with a usable area of around 3000 m². It was planned by the consortium DELTA SWAP Architekten. The planning by ARGE DELTA SWAP Architekten was carried out using an integral BIM model, on which work was carried out across all trades. In addition to the central 3D model, a number of tools were used before and in parallel with the BIM planning – digital is more than just BIM. The EVA software (rapidlayouing.com) was already used in the competition. The site configurator was used to find the building structure that conformed to the zoning regulations for the narrow building site; interactive work on the 3D model displayed current parameters such as density and heights. The spatial programme manager and floor plan configurator were used to develop the first-floor plan variants, with the programme taking spatial relationships and exposures into account. Since the BIM model was already available in the preliminary design, coordination with the university and the client was discussed using the 3D model, so the client was interactively involved in the planning process. Variants could be developed and coordinated in conceptual models and elaborated and coordinated with BIM. The planning took place in the model and all the resulting information from the planning was entered into the model. Parallel documents (plans, lists, overviews, etc.) were linked to the model in an appropriate way (e.g., data sheets with elements or calculations with HVAC systems). In order to compare the planning and the actual built condition, a point cloud survey was carried out at least twice during the course of the project. This survey was overlaid with the models and tracked. Based on higher planning quality, transparent communication and organisation of information, the consistent use of BIM resulted in higher adherence to schedules and cost security. 3D data

was uploaded from the CAD software to a platform (BIMcollab) and could be viewed and walked through directly via web virtual reality (VR) or VR glasses (hub.ivanize.com/boku.html).

○ Disciplines involved in BIM:
Project management, architecture, engineering, building physics, structural engineering, shell construction

○ Companies involved in the project:
Bundesimmobiliengesellschaft m.b.H (BIG) (client), ARGE DELTA SWAP Architekten, Braun GmbH, Bollinger Grohmann ZT GmbH, IBO – Österreichisches Institut für Bauen und Ökologie GmbH, SIDE – Studio for Information Design GmbH, Teamgmi Ingenieurbüro GmbH

⁵ The list of projects and the list of innovative companies does not claim to be complete or accurate. The texts and photos were provided by the project participants.

BOKU Vienna Library and Seminar Centre; © Florian Voggeneder



Use-Case Overview BIM⁶

PLAN	BUILD	OPERATE
<ul style="list-style-type: none"> ● Visualisation ● Coordination of specialist trades ● Progress control (of planning) ● Preparation of draft and submission planning ● Cost estimate and cost calculation ● Room book ● Electronic submission ● Collision check 	<ul style="list-style-type: none"> ● Factory/assembly planning ● Preparation of implementation plans ● Quantity and mass determination ● Model-based quality control ● As-build documentation 	

⁶ Source: ARGE DELTA SWAP Architekten und SIDE-Studio for Information Design GmbH

2.2 Reconstruction Golmerbahn Grüneck

Submitted by
SIDE – Studio for Information Design GmbH

Location
Grüneck
Rodund, 6780 Schruns

Project start
June 2020

Completion
2022

open BIM

After an initial pilot project, future construction projects will be handled using the BIM method. Some of the properties of Illwerke VKW and its subsidiaries will also be recorded as BIM models for future conversion projects.

One such project is the reconstruction of the Golmerbahn stations. For its digital recording by means of 3D laser scanning, detailed point cloud recordings are created by the internal surveying department and subsequently used as a basis for the as-built modelling.

The resulting building data models (“single source of truth”) are used throughout the entire life cycle of the building. The planners were already provided with template files (Revit file or Allplan and Archicad) during the architectural competition, which already contain the existing model as well as various requirement specifications and the relevant BIM standards of the client.

In the course of the conversion work, the construction progress will be documented, and the as-built model updated on the basis of regular point cloud surveys. In addition, the building data model is used for quality assurance, cost control, construction site management and building operation.

The BIM Collaboration Format (BCF) is used for efficient and comprehensible model-based communication. This was primarily used for the transparent coordination of planning processes across different trades. The corresponding platform (BIMcollab) is used for management.

○ Disciplines involved in BIM:
architecture, building services engineering, construction supervision (ÖBA), contractors, structural engineering

○ ACompanies involved in the project:
illwerke vkw AG (client), SIDE – Studio for Information Design GmbH



Golmerbahn Grüneck; © SIDE GmbH

Use-Case Overview BIM⁷

PLAN

- Inventory
- Planning variants
- Visualisations
- Coordination of professional trades
- Progress control (of planning)
- Preparation of draft and submission planning
- Cost estimate and cost calculation
- Room book
- Simulation during planning
- Plan management (plan number assignment, plan designation)
- Life cycle assessment
- Collision check

BUILD

- Scheduling of the execution
- Factory/assembly planning
- Preparation of execution plans
- Construction progress control
- Change management for planning changes
- Defect management
- Model-based quality control
- Quantity and mass determination
- Building documentation
- Data acquisition for FM

OPERATE

- CAFM
- Operational plans
- Operating processes
- Adaptations and conversions
- Change management

2.3 Motorway Maintenance Department Bruck an der Leitha

Submitted by
Autobahn- und Schnellstraßen-Finanzierungs-
Aktiengesellschaft (ASFINAG)

Location
2460 Bruck an der Leitha

Project start
03/2016

Completion
09/2019

open BIM

The pilot project for the construction of the new Bruck an der Leitha motorway maintenance depot has now become a showcase project for cooperation with BIM between the client and contractor. During the planning phase, the future user was able to walk through the new to be built motorway maintenance depot using VR glasses and get an idea of the future conditions. When the bid was submitted, the client requested the development of a BIM concept. In addition to the conventional planning, the digital (partial) models and the client information requirements (AIA) for the construction phase were also prepared and published with the tender.

Using the data gathered from the model, 40 percent of

the masses are billed directly via the model. Many learnings and advantages could be made through invoicing in the model. Due to the transparency and the same database, billing issues are a thing of the past and the project participants can devote more time to other tasks. Furthermore, the risk of errors is minimised when the data originates from a common model and the components do not have to be calculated manually each time. In addition to BIM, other tools for digitalisation were also tested. Among others, tools for documenting the defects remedy were used by the construction contractor and the local construction supervision. DAQRI's smartglasses were used to scan some interior spaces during the execution phase, and it was possible to follow the recording directly on the laptop. After the highly successful premiere of new digitalisation tools and BIM in Asfinag's building construction, everyone agreed: "It's a pity we didn't have this experience earlier!"

Further information: www.digitalfindetstadt.at/news/asfinag (Source: Autobahn- und Schnellstraßen-Finanzierungs-Aktiengesellschaft (ASFINAG))

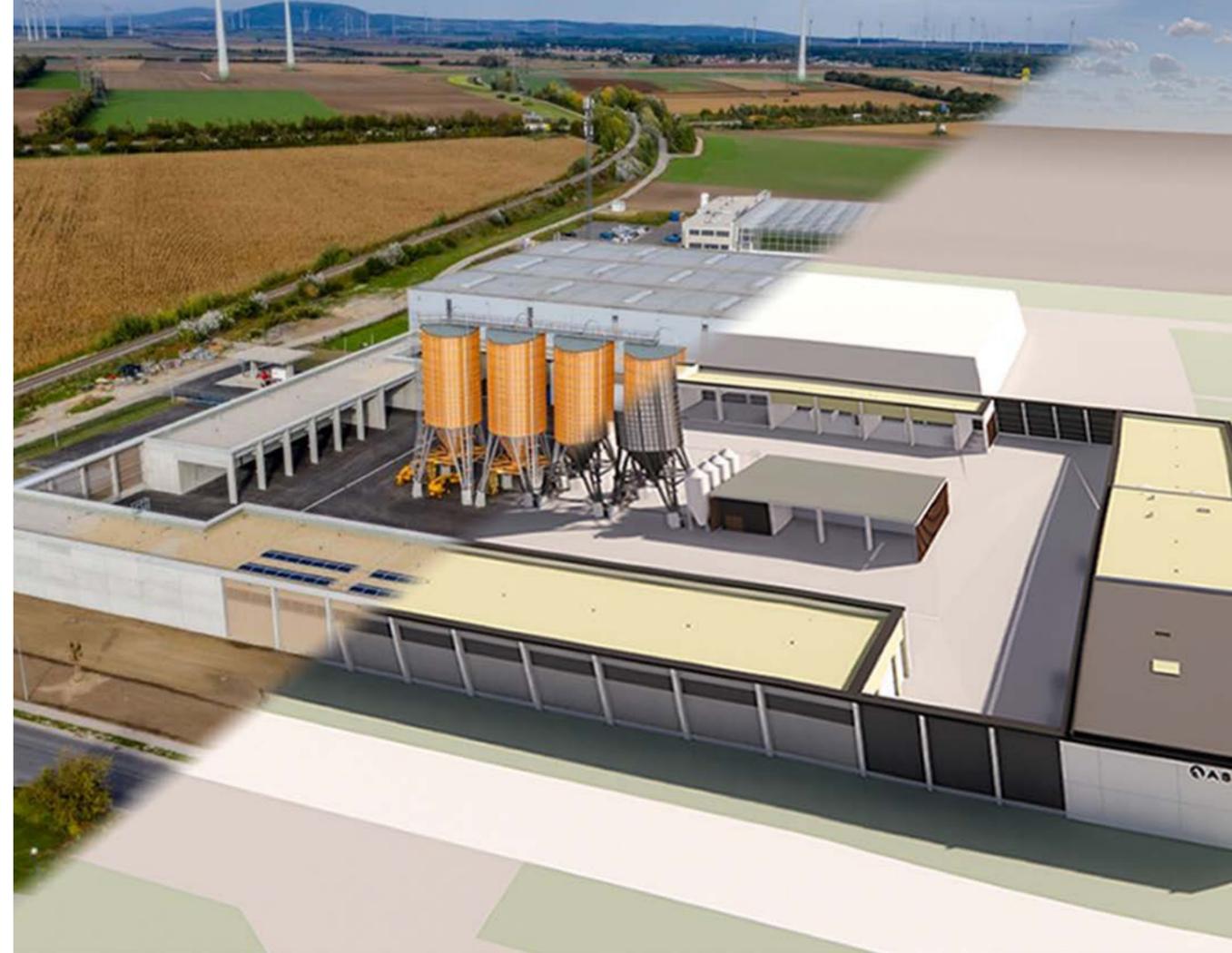
○ Disciplines involved in BIM:
users, project leadership, project management, construction supervision, architecture, building services engineering, structural planning, shell construction, finishing, furnishing, engineering, technical services

○ Companies involved in the project:
Autobahn- und Schnellstraßen-Finanzierungs-Aktiengesellschaft (ASFINAG) (client), Acht Engineering ZT GmbH, Christian Andexer Architekt, Elektro Planung Walter e.U, FCP Fritsch, Chiari & Partner ZT GmbH, Leyrer + Graf Baugesellschaft m.b.H., TK 11 Gebäudetechnik GmbH

BIM – Scope of services⁸

“DUTY” (TO BE PRICED OUT)	“FREESTYLE” (AWARD CRITERIA)
CONSTRUCTION PROCESS MODEL (4D) <ul style="list-style-type: none"> ● At least assembly date ● Monthly actual state 	PROJECT STRUCTURE AND PROCESS ORGANISATION <ul style="list-style-type: none"> ● BIM concept for optimisation
CONSTRUCTION COST MODEL (5D) <ul style="list-style-type: none"> ● 40% of the construction costs (per trade) ● monthly adjustment 	VEREINFACHUNG DER ABRECHNUNG (5D) <ul style="list-style-type: none"> ● Additional measures
INVENTORY MODEL (“AS-BUILT”) <ul style="list-style-type: none"> ● LOD 300 ● IFC model and native file 	VERBESSERUNG DER EIGENÜBERWACHUNG <ul style="list-style-type: none"> ● Proposals for model-based quality assurance

Motorway maintenance depot Bruck an der Leitha; © FCP Fritsch, Chiari & Partner ZT GmbH and Leyrer + Graf Baugesellschaft m.b.H.



Use-Case Overview BIM⁹

PLAN	BUILD	OPERATE
<ul style="list-style-type: none"> ● Inventory ● Visualisation ● Dimensioning and verification ● Coordination of professional trades ● Progress control (of planning) ● Collision check 	<ul style="list-style-type: none"> ● Scheduling of the execution ● Factory/assembly planning ● Preparation of execution plans ● Construction progress control ● Change management for planning changes ● Quantity and mass determination ● Settlement ● Building documentation ● Data acquisition for FM 	<ul style="list-style-type: none"> ● Operational plans

⁸ Source: Autobahn- und Schnellstraßen-Finanzierungs-Aktiengesellschaft (ASFINAG)

⁹ Source: Autobahn- und Schnellstraßen-Finanzierungs-Aktiengesellschaft (ASFINAG)

2.4 New Building of the Bio-Institut of the HBLFA Raumberg-Gumpenstein

Submitted by
BME Baumanagement ZT GmbH, buildingSMART Austria, Heid und Partner Rechtsanwälte GmbH

Location
Leitnerweg 1
8951 Stainach-Pürgg

Project start
2020

Completion
2021

open BIM methodology

From the public client's point of view, the Bio-Institut should be a "lighthouse project" for sustainability and digital transformation for the entire life cycle. The entire planning and construction process as well as the ongoing operation will be carried out according to the open BIM (Building Information Modelling) methodology or supported with open data formats (IFC). By capturing the project as a digital model, interface problems between the trades were avoided and improved communication and coordination from the tendering stage through the planning, execution and utilisation phases resulted in increased transparency and cost security as well as efficient operation (transparent maintenance). Within the project, the potential for increasing control and efficiency was analysed on the basis of international benchmarks. In the course of the project, three project variants were compared in LOI 100 by means of building simulation. From the design stage onwards, the technical building equipment and structural design were continuously subjected to overall BIM coordination with the architectural model. The technical models were continued and the building authority approval was based on the building models. For the submission of the "Klimaaktiv Gold" certification, a building simulation was carried out and the data delta of the BIM model was disclosed. The planning models were continuously updated during the construction phase. An as planned – as built comparison was made using laser scanning and point clouds. The law firm Heid und Partner Rechtsanwälte GmbH was responsible for the procurement and contract law aspects of this open BIM project. The

legal advisor conducted a 2-stage EU-wide negotiation procedure to find a GC+. In particular, special BIM contract components based on ISO and GEN standards were incorporated for all planners and contractors ("BIM-BVBs") and the anchoring of the horizontal sustainability principle in the specifications (in particular intelligent energy concept, ecological building materials) was ensured.

○ **Disciplines involved in BIM:**
architecture, building services engineering, structural engineering, building physics, shell construction, finishing, furnishing, engineering, surveyors, wooden construction, facility management

○ **Companies involved in the project:**
Landwirtschaftliche Bundesversuchswirtschaften Gesellschaft mit beschränkter Haftung (BVW) (client), BME Baumanagement ZT GmbH, buildingSMART Austria, Heid und Partner Rechtsanwälte GmbH, Pilz & Partner ZT GmbH, tgaplan gebäudetechnik gmbh

New building of the Bio-Institute of the HBLFA Raumberg-Gumpenstein;
© BME Baumanagement ZT GmbH



Use-Case Overview BIM¹⁰

PLAN

- Inventory
- Planning variants (BAP)
- Visualisations
- Dimensioning and verification
- Coordination of specialist trades
- Progress control (of planning)
- Preparation of draft and submission planning
- Cost estimate and cost calculation
- Room book
- Simulation during planning
- QM/QS (planning controlling)
- Collision check

BUILD

- Creation of IFC models and execution plans
- Construction progress control incl. laser scanning as built
- Model-based quality control (TGA)
- Quantity and mass determination
- Data acquisition for FM

OPERATE

- Computer Aided Facility Management (CAFM)
- Operationally relevant models, documents, scheme

2.5 Education Campus Landgutgasse, Landgutgasse 30, 1100 Vienna

Submitted by
iC consulenten Ziviltechniker GesmbH

Location
Landgutgasse 30
1100 Vienna

Project start
2018

Completion
2023

open BIM

The Landgutgasse education campus is planned as an innovative building with a renewable energy supply. The energy for heating and cooling is largely sourced locally via energy piles and deep probes under the building. The electricity supply is supported by the large-scale photovoltaic (PV) system on the flat roof. The remaining electricity demand is covered by the public grid.

Planning, execution and operation are carried out using BIM methods. The entire building, the static model and the technical building equipment are modelled and filled with relevant information. The coordination in this open BIM project is partly automated via the Solibri software. The project quality is thus efficiently kept high, as collisions can be found and the need for coordination can be easily coordinated. The model also serves as the basis for precise cost calculations.

○ Disciplines involved in BIM:
users, project leadership, project management, architecture, other consultants, building services engineering, structural engineering, building physics, statics, landscape planning, interior fittings

○ Companies involved in the project:
Magistratsabteilung 34 – Bau- und Gebäudemanagement (client), Ernst&Young Real Estate GmbH, iC consulenten Ziviltechniker GesmbH, schluder architektur ZT GmbH

Educational Campus Landgutgasse 30; © expressivat + schluderarchitektur



Use-Case Overview BIM¹¹

PLAN

- Planning variants
- Visualisations
- Dimensioning and verification
- Coordination of specialist trades
- Progress control (of planning)
- Preparation of draft and submission planning
- Occupational health and safety (planning and testing)
- Cost estimate and cost calculation
- Room book
- Simulation during planning
- Plan management
- QM/QS (planning controlling)
- Collision check
- Planning release

BUILD

- Not included in the GP's scope of services
- Planning options: Time saving through integral overview of different options, better recognition of dependencies
- Visualisation: 3D representation leads to better communication; by-product of model-based planning, no additional effort
- Dimensioning: data link between static calculation and structural model
- Coordination of disciplines: simpler model-based coordination with collision check
- Progress control: analysis of LOI (Level of Information) data with better overview of planning progress

OPERATE

- Smart building: autonomous demand-based room-by-room CO2 control of ventilation; demand-based control of heating, cooling and sun protection (with manual override option). Detailed recording and analysis of energy consumption with visualisation for users to raise awareness. Highly efficient PV system.

2.6 Reservoir Gelbe Haide

Submitted by
Mensch und Maschine Austria GmbH

Location
Triester Strasse und Draschepark
1230 Vienna

Project start
01 April 2019

Completion
December 2020

open BIM

The project comprised the construction of a storage basin, an overflow basin and a supply channel to the storage basin. The basin serves as flood protection for the neighbouring residential areas of the Liesing, a river that flows through the middle of the city Vienna. Since its completion at the end of 2020, the basin has been able to absorb 10 million litres of rainwater and thus protects the Liesingbach and adjoining paths from pollution.

3D models in IFC format were created by HABAU Hoch und Tiefbaugesellschaft m. b. H. and supplemented by formwork planning by Doka GmbH. By using a common digital project platform (CDE), which considerably simplified the communication and coordination of the construction site and project participants ("construction progress control"), and pre-coordinated cycle planning ("scheduling of execution") with the BIM methodology, hardly any additional material was needed on site, thus saving resources. Thus, the formwork units were configured in such a way that they had to be dismantled as little as possible on the construction site in order to use them for the next concreting section. All essential parameters, such as the lifting capacity and reach of the crane, were also taken into account in the design. Each of the five transfer units was exactly long enough and heavy enough to be moved with the crane in one lift. Due to the pre-coordinated cycle planning, a cycle could be formed approximately every three days with four workers. Normally, this would have taken five days and six workers. For a total of 13 cycles, about two months of construction time were needed ("factory/assembly planning").

Mensch und Maschine Austria trained the Doka GmbH project team in the areas of construction, coordination and management. Afterwards, support was given in the area of exchange in open BIM projects in individual, project-related coaching and consulting. In the native area, intensive work was done on the project templates and (Revit) family templates, and assignment tables were prepared for the Industry Foundation Classes (IFC) export.

Further information: www.doka.com/at/news/press/gelbe-haide (Source: Doka Österreich GmbH)uordnungstabellen für den Industry Foundation Classes (IFC) Export aufbereitet.

○ Disciplines involved in BIM:
project management, shell construction, finishing, technical FM, other disciplines

○ Companies involved in the project:
City of Vienna (client), Doka Österreich GmbH, HABAU Hoch und Tiefbaugesellschaft m.b.H, Mensch und Maschine Austria GmbH

Gelbe Haide storage basin; © Doka Österreich GmbH



Use-Case Overview BIM¹²

PLAN

- Planning variants
- Visualisations
- Dimensioning and verification
- Progress control (of planning)
- Cost estimate and cost calculation

BUILD

- Scheduling of the execution
- Logistics planning (site supervision)
- Route/ assembly planning
- Construction progress control
- Quantity and mass determination
- Settlement
- Building documentation

OPERATE

2.7 Future Art Lab mdw University of Music & Performing Arts

Submitted by
FCP Fritsch, Chiari & Partner ZT GmbH

Location
Anton-von-Webern-Platz 1
1030 Vienna

Project start
2016

Completion
2020

open BIM

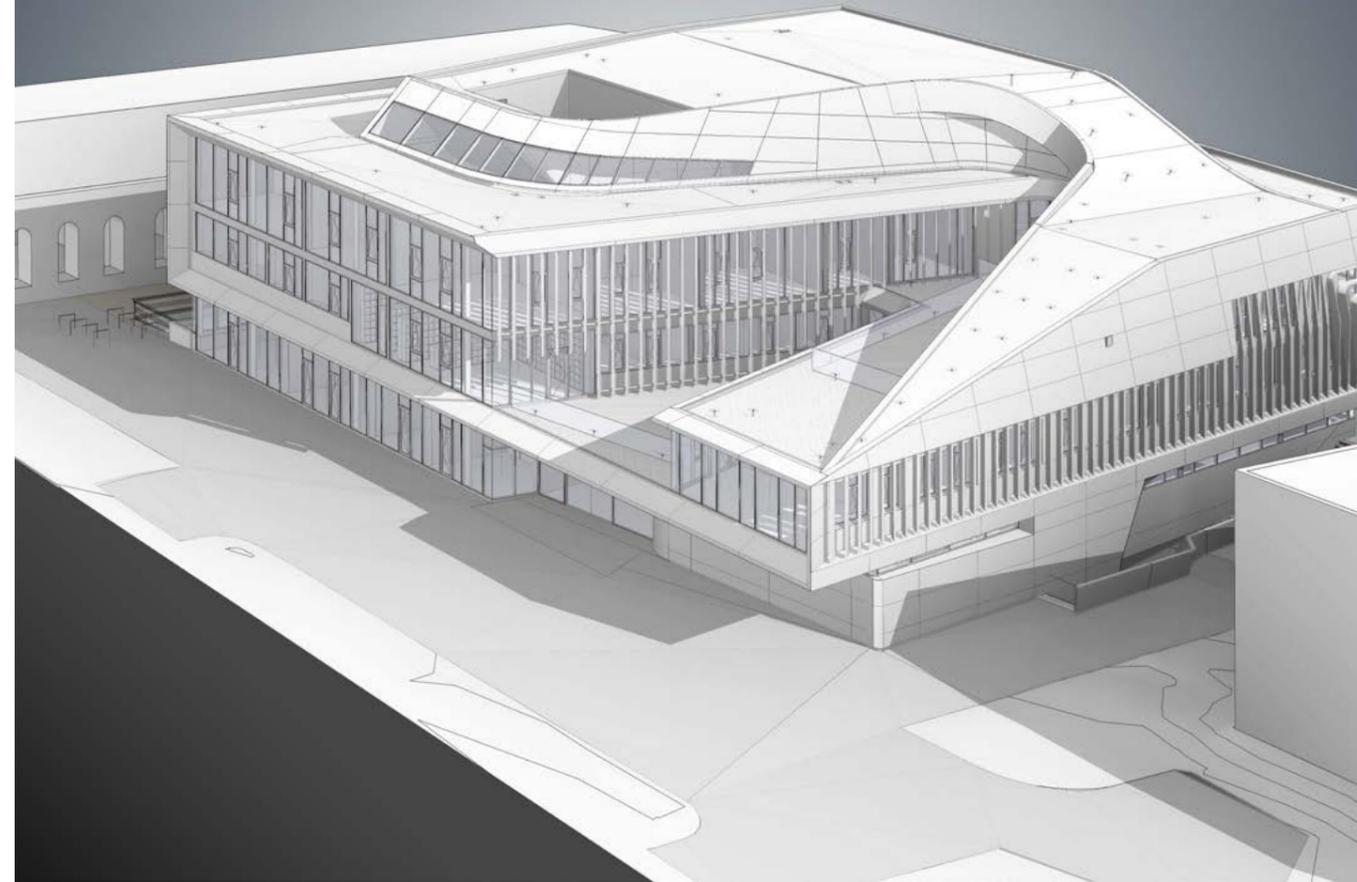
The new institute building is being constructed on the campus of the University of Music and Performing Arts in Vienna's 3rd district. The building will contain three institutes of the university on its two underground and three above-ground floors: the Institute for Electroacoustics, the Institute for Keyboard Instruments and the Film Academy with cinema.

The project includes both open-BIM and closed-BIM components. The architects (P&T) and the structural engineers (FCP) worked in a common Revit model. The HVAC and electrical engineering worked in separate sub-models, the electrical sub-model was also hosted on the Revit server and lively linked to the architectural and structural model. The HVAC model was coordinated with the Revit models in regular cycles as an IFC file. In addition to the use cases listed in the table, the following were also addressed: Creation of the 3D technical models, change management, plan derivation from the model and use for operation and maintenance.

○ **Disciplines involved in BIM:**
project management, architecture, building services engineering, structural planning, building physics, shell construction

○ **Companies involved in the project:**
Bundesimmobiliengesellschaft m.b.H. (BIG) (client), FCP Fritsch Chiari & Partner ZT GmbH, Gawaplan Haustechnische Anlagen Gesellschaft m.b.H., Kubik Project GmbH, Pichler & Traupmann Architekten ZT GmbH

Future Art Lab mdw Uni für Musik & angewandte Kunst – Entire BIM Model:
© FCP Fritsch, Chiari & Partner ZT GmbH / Pichler & Traupmann Architekten ZT GmbH



Use-Case Overview BIM¹³

PLAN

- Inventory
- Planning variants
- Visualisations
- Dimensioning and verification
- Coordination of specialist trades
- Progress control (of planning)
- Preparation of draft and submission planning
- Occupational health and safety (planning and testing)
- Cost estimate and cost calculation
- Room book
- Simulation during planning
- Plan management (plan number assignment and plan designation)
- Collision check

BUILD

- Scheduling of the execution
- Factory/assembly planning
- Preparation of execution plans
- Model-based quality control
- Quantity and mass determination

OPERATE

2.8 Salzburg District Administration

Submitted by
ALLPLAN Gesellschaft m.b.H

Location
Ernst-Lodron-Strasse
5201 Seekirchen am Wallersee

Start of planning
07/2020

Completion
06/2023

mixed BIM

The new building of the district administration Salzburg in Seekirchen has the goal, in addition to an increased geometric definition in the model, to also include the information content of essential components in the model and to update / adapt it continuously until operation.

The DELTA SWAP consortium is responsible for the general planning and overall BIM coordination. Allplan is responsible for the building services engineering, building physics and klima:aktiv certification. The entire planning process is accompanied by a BIM project execution plan (BAP). In addition to continuous maintenance of the component information (LOI maintenance) through to operation, both the costs (model-based quantity takeoff) and the planning quality are at the forefront of BIM planning.

Advantages and added values that the use case design planning brings with it include a faster exchange of current plan statuses, the coordination of different trades, the rapid implementation of changes, the detection of collisions and the possibility of faster creation of layouts (additional options such as details in 3D possible).

○ Trades involved in BIM:
architecture, building services engineering, structural engineering

○ Companies involved in the project:
Land Salzburg (client), ARGE DELTA SWAP,
ALLPLAN Gesellschaft m.b.H, Bollinger und Grohmann ZT GmbH

Salzburg Umgebung District Administration; © ARGE DELTA SWAP



Use-Case Overview BIM¹⁴

PLAN

- Coordination of specialist trades
- Preparation of draft and submission planning
- Cost estimate and cost calculation
- Room book
- Plan management (plan number assignment, plan designation)
- Collision check
- Bill of quantities, invitation to tender, award of contract

BUILD

- Quantity and mass determination

OPERATE

2.9 Hauptstraße 139, 2391 Kaltenleutgeben

Submitted by
Dipl. Ing. Wilhelm Sedlak Gesellschaft m.b.H

Location
Hauptstraße 139
2391 Kaltenleutgeben

Project start
June 2021

Completion
December 2022

mixed BIM

The planning and construction of a residential building in Kaltenleutgeben was carried out using digital working methods. The privately financed residential complex in Kaltenleutgeben consists of two components that offer space for 40 flats. A special feature of this project is that it has been built into a slope, which has a gradient of up to 55 percent. This is a challenge in terms of construction site logistics, as it results in several plateaus that must be secured in different ways. Another complication is the limited storage space on the road, which is why the storage and transport of materials at the construction site must be well thought through. This is one of the reasons why it was decided to use BIM from planning to construction. The following services were provided with BIM: integral planning methodology, model-based communication, planning derivation, LV derivation, BIM as an information source, shell measurement, defect management and as-built documentation. The aim was to create a better understanding of the project for all participants to identify obstacles and difficulties at an early stage and solve them in time.

○ **Disciplines involved in BIM:**
project management, project leadership, architecture, building services engineering, structural engineering, shell construction, finishing

○ **Companies involved in the project:**
Sedlak Immobilien GmbH (client), Architekturatelier Steinwider ZT GmbH, bimspot GmbH, Dipl. Ing. Wilhelm Sedlak GmbH, ZENTRAPLAN Planungsges.m.b.H.

Wohnbau – Hauptstraße 139; © AS Architektur Augustin Steinwider ZT GmbH



Use-Case Overview BIM¹⁵

PLAN

- Planning variants
- Visualisations
- Coordination of specialist trades
- Preparation of draft and submission planning
- Cost estimate and cost calculation
- Room book
- Collision check

BUILD

- Scheduling of the execution
- Logistics planning (site supervision)
- Change management for planning changes
- Defect management
- Model-based quality control
- Quantity and mass determination
- Building documentation

OPERATE

2.10 Technology Centre Seestadt, tz2, 1220 Wien

Submitted by
ATP architekten ingenieure, Siemens AG Österreich

Location
Christine-Touaillon-Straße 11
1220 Vienna

Project start
Start of construction – 04/2018

Completion
05/2019

closed BIM

The 2nd section of the Seestadt Technology Centre, integrally planned by ATP Vienna using BIM, offers ideal conditions for Industry 4.0 companies. The fundamental requirement for the planning was a modular building structure with a high degree of flexibility. With systematically designing the rental spaces in a special “H” structure, it was possible to realise sophisticated architecture, economic efficiency of the building and the required flexibility. The experience gained from the facility management of the first building section – also planned by ATP – could be used specifically for the planning of the extension. As with all projects, ATP made use of integral planning with BIM. The joint digital model was used for decision-making throughout the planning process and contributed to quality and on-time implementation during the construction phase.

The second component of the Vienna Business Agency's technology centre tz2 expands ASCR's state-of-the-art research environment. In Siemens' first BIM project in Austria (see Use Case 15 “Digital Twin”), ASCR is conducting research on, among other things, a complete and uniform building data repository that will not only serve efficient planning in the future, but also enable high value creation during the operating phase. Furthermore, 3D laser scans of the building were taken during construction. The shell of the building, the building services and the final finishing were recorded without any gaps and serve as the overall documentation and quality control of the BIM model. The scans were used to bring the specialist trades models into an as-built state and to enrich them with further relevant data for operation. The model was then transferred to operation and integrated into the BIM-capable building management platform Desigo CC. Afterwards, existing data points were linked to the corresponding objects in the BIM model to ensure optimal operation.

Further information: www.youtube.com/watch?v=GW-WsSyQ4fal (Source: Siemens AG Österreich)

○ **Disciplines involved in BIM:**
architecture, other consultants, building services engineering, structural planning, technical FM, technical services, tendering, and billing

○ **Companies involved in the project:**
Vienna Business Agency (via WA Business & Service Center GmbH) (client), ATP architekten ingenieure, Vienna, Siemens AG Austria (Smart Infrastructure), Siemens Gebäudemanagement & -Services GmbH

Seestadt Technology Centre (tz2), © ATP architekten ingenieure, Wien – Fotografier: Kurt Kuball



Use-Case Overview BIM¹⁶

PLAN

- Planning variants
- Visualisations
- Coordination of specialist trades
- Preparation of draft and submission planning
- Estimation and calculation of costs
- Room book
- Plan management (plan number assignment, plan designation)
- Collision check (by Solibri)

BUILD

- Preparation of execution plans
- Construction progress control
- Model-based quality control (from LPH 3 Level 1, by Solibri)
- Quantity and mass determination
- Building structure documentation

OPERATE

- Operational plans
- Operating processes
- Adaptations and conversions: Recording of the tenant: interior fittings using BIM and tracking of the changes
- BIM as-built: Capture of the natural mass of the shell as a digital point cloud, comparison with the as-planned model and tracking of deviations. Transmission to PAG as as-built model
- Building Automation

2.11 Technology Centre Seestadt, tz3, 1220 Wien

Submitted by
Heid und Partner Rechtsanwälte GmbH

Location
Christine-Touaillon-Straße 9
1220 Vienna

Project start
March 2021 (start of implementation planning)

Completion
(expected) autumn 2023 Construction completion

open BIM

The construction of the third part of the building is scheduled to start in 2022 and is to be realised using the BIM planning method. The general planning (GP) has already been commissioned. The client intends to implement a total of three use cases as part of the general contractor award and contract execution. The creation of the BIM model and the entire BIM implementation planning will be carried out by the general contractor. The general contractor (GC) will adopt and continue the BIM model created by the GP. The works and installation planning will be carried out by the GC.

BIM in the public procurement of construction services (Use Case 1)

By applying the BIM methodology in the award of contracts (e.g., model-based generation of quantity-related items in accordance with the BVerG 2018), it is expected that comprehensive control of the execution will be ensured by means of a complete BIM model. Furthermore, a reduced effort for the preparation of tender documents is expected, increased auditability and transparency of items in the documents and increased cost security of the overall project.

BIM in the context of the planning and execution process (Use Case 2)

It is expected that there will be less effort for updates and changes, less susceptibility to errors due to the derivation of the planning documents from the BIM model, increased quality of the planning documents due to the continuous use of the model as a central source of information, a reduction of collisions in the execution, and an avoidance of supplements and changes in the execution.

Pre-commissioning and simulation of the building services systems (Use Case 3)

All work steps required for the "real" commissioning of the building services systems are to be carried out in advance, parallel to construction, in order to identify any planning errors at an early stage, increase energy efficiency, minimise information losses between engineering and commissioning, achieve faster commissioning (avoidance of long adjustment times), develop contributions to interface standardisation / handover between planning and commissioning.

○ **Disciplines involved in BIM:**
Project management, project leadership, architecture, other consultants, building services engineering, structural engineering, building physics, shell construction, finishing, furnishing, technical FM, other disciplines

○ **Companies involved in the project:**
Vienna Business Agency (via WA Business & Service Center GmbH) (client), ATP Wien Planungs GmbH, Heid und Partner Rechtsanwälte GmbH, plandata GmbH

Technology Centre Seestadt, preliminary rendering: © ATP/Telegram71



Use-Case Overview BIM¹⁷

PLAN

- Coordination of specialist trades
- Progress control (of planning)
- Preparation of draft and submission planning
- Occupational health and safety (planning and testing)
- Cost estimate and cost calculation
- Collision check

BUILD

- Scheduling of the execution
- Factory/assembly planning
- Preparation of execution plans
- Construction progress control
- Change management for planning changes
- Defect management
- Model-based quality control
- Quantity and mass determination
- Settlement
- Building documentation
- Data acquisition for FM

OPERATE

- Digital commissioning
- CAFM
- Smart Building
- Operating processes
- Adaptations and conversions
- Extract elements
- Building automation

2.12 AHS Ettenreichgasse – Renovation and Expansion

Submitted by
SOLID architecture ZT GmbH

Location
Ettenreichgasse 41-43
1100 Vienna

Project start
August 2018

Completion
2022

open BIM

This project expands the infrastructure for all-day classes, a multifunctional event room, a dining hall and additional rooms for day care are provided. A cluster system will be implemented in the existing and new buildings.

The project is managed with open BIM. The as-built survey of the buildings was carried out by a surveyor using point cloud scanning + 360 degree photos. The as-built model and the environment model were created in Archicad. The dynamic BIM planning and the 2D plans derived from it are continuously coordinated by the architects (ARCH) / TGA / structural engineering (TWP). Using the model-based visualisation, it is possible to navigate through the model during construction meetings. The model-based communication works with BIM Collaboration Format (BCF). Furthermore, the bills of quantities (BOQ) are derived from the model and the BOQ items with corresponding costs are linked to model elements. By means of model-based plan management, the currently released plan statuses are coordinated, put out, and connected to the plan management platform.

Further information: www.solidarchitecture.at/projects/143/project.html (Source: SOLID architecture ZT GmbH)

○ **Disciplines involved in BIM:**
project management, project leadership, architecture, other consultants, building services engineering, structural engineering, construction supervision, shell construction, finishing, engineering, building physics, other disciplines

○ **Companies involved in the project:**
Bundesimmobiliengesellschaft m.b.H (client), BIMCOS e.U., HTB-Plan Haustechnik Planungs GmbH, ode office for digital engineering, SOLID architecture ZT GmbH, Woschitz group GmbH

AHS Ettenreichgasse; © SOLID architecture ZT GmbH



Use-Case Overview BIM¹⁸

PLAN

- Inventory
- Planning variants
- Visualisations
- Dimensioning and verification
- Coordination of specialist trades
- Progress control (of planning)
- Preparation of draft and submission planning
- Occupational health and safety (planning and testing)
- Cost estimate and cost calculation
- Room book
- Plan management (plan number assignment and plan designation)
- Collision check

BUILD

- Preparation of execution plans
- Construction progress control
- Change management for planning changes
- Model-based quality control
- Quantity and mass determination
- Building documentation
- Data acquisition for FM

OPERATE

- Operational plans
- Award

2.13 V2B7 “Weitblick im Viertel Zwei”

Submitted by
Drees & Sommer GmbH & Zechner & Zechner ZT GmbH

Location
Meiereistraße 12
1020 Vienna

Project start
2018 / Construction start: 2021

Completion
2024
as specified by the developer Value One

closed BIM

In the 120-metre-high commercial tower “Weitblick”, a lifestyle hotel with a rooftop bar and 246 exclusive rooms as well as approximately 28,000 square metres of office space are being built on approximately 48,000 square metres of gross floor area in the “Viertel Zwei” district. It will be equipped with sustainable, flexible, and smart technologies as well as maximum broadband capacity. As part of the planning process, Drees & Sommer carried out a Digital Ready Check, in which the requirements for a digital building were examined. The criteria of the Check are, on the one hand, the connectivity of the building (provider, mobile radio, etc.) and, on the other hand, the degree of digitalisation of the building infrastructure (building automation, access control, etc.). Zechner und Zechner ZT GmbH was responsible for the overall BIM coordination in this project.

The AF planning variants served as a basis for decision-making based on model-based mass determination and cost estimation. The model was used as a basis for renderings, animations, and 3D VR representation, thus facilitating and accelerating the decision-making process. Furthermore, the load-bearing structures were transferred from the model into the static calculation software and the calculation results flowed back into the model. The use of closed BIM (REVIT-SERVER) enabled a cloud-based real-time coordination model. Periodically rule-based checks are performed. The communication on the model was carried out using the bcf cloud solution BIMCOLLAB. The continuous coordination on the model significantly increases the planning quality and reduces risks. The model served as the basis for various simulations (e.g., shading of the surroundings, daylight quotient calculation, thermal simulations, wind comfort studies). Use cases for construction and operation have not yet been carried out (start of construction 2021).

Further information: www.value-one.com/de/Projekte/Weitblick_project_308 (Source: value one holding AG)

○ **Trades involved in BIM:**
General contractor, civil engineering, user project management, project leadership, architecture, building services engineering, structural engineering, building services, shell construction, finishing, technical services

○ **Companies involved in the project:**
value one holding AG (client), Mario Cucinella Architects / Zechner & Zechner ZT GmbH, Drees & Sommer GmbH, KS Ingenieure ZT GmbH, SIDE – Studio for Information Design GmbH, ZFG-Projekt GmbH

V2B7 “Weitblick im Viertel Zwei”; © Mario Cucinella Architects



Use-Case Overview BIM¹⁹

PLAN

- Inventory
- Planning variants
- Visualisations
- Dimensioning and verification
- Coordination of specialist trades
- Progress control (of planning)
- Preparation of draft and submission planning
- Cost estimate and cost calculation
- Room book
- Simulation during planning
- Collision check

BUILD

- Scheduling of the execution
- Factory/assembly planning
- Preparation of execution plans
- Construction progress control
- Change management for planning changes
- Defect management
- Model-based quality control
- Quantity and mass determination
- Building documentation
- Data acquisition for FM
- Special request management
- Handover incl. documentation as-built

OPERATE

- CAFM

2.14 Biozentrum University of Vienna Campus-Vienna-Bio- center 4, 1030 Vienna

Submitted by
Vasko+Partner GesmbH

Location
Schlachthausgasse 43
1030 Vienna

Project start
2017

Completion
2021

open BIM

At the Schlachthausgasse 43 located in Vienna's 3rd district in the largest life sciences cluster in Austria the new Biology Centre of the University of Vienna was built by the Federal Real Estate Company.

More than 5,000 students and almost 500 employees will learn, research and work in the building, which was realised according to the plans of the Berlin architects Karsten Liebner and Marcel Backhaus in a joint venture with Vasko+Partner. The Biozentrum was planned and built entirely with BIM. Advantages are: automated area evaluation, simple creation of a material concept, automated room book, where it was possible at any time to generate current area lists bundled according to the most diverse categories and room books with over 200 attributes per room using a LIVE synchronisation via PowerQuery and Pivot. The automated mass evaluation, simple administration of door and window lists, real-time cost calculation, automatic section generation, collision control with other planners, simple creation of overview plans and concepts (fire protection, building physics, etc.) and automated data evaluation for life cycle analysis also proved to be advantageous. The use of virtual reality for modelling made it possible to virtually enter and visually inspect the building at any time before construction began, including data from all trades. The filament printing process provided us with "tangible model construction" up to a scale of 1:200 at the push of a button.

○ Trades involved in BIM:
architecture, other consultants, building services engineering, building physics, structural engineering, shell construction, finishing, furnishing, technical services

○ Companies involved in the project:
Bundesimmobiliengesellschaft m.b.H. (client), University of Vienna, Vasko+Partner GmbH, Marcel Backhaus and Karsten Liebner

Biozentrum University of Vienna; © Liebner Backhaus



Use-Case Overview BIM²⁰

PLAN

- Planning variants
- Visualisations
- Dimensioning and verification
- Coordination of specialist trades
- Progress control (of planning)
- Preparation of draft and calibration planning
- Occupational health and safety (planning and testing)
- Cost estimate and cost calculation
- Room book
- Plan management (plan number assignment and plan designation)
- Fall protection
- Collision check
- Planning release
- Bill of quantities, invitation to tender, award of contract

BUILD

- Preparation of execution plans
- Construction progress control
- Change management for planning changes
- Defect management
- Model-based quality control
- Quantity and mass determination
- Handover incl. documentation as-built

OPERATE

2.15 Landesdienstleistungs- zentrum Salzburg (Public Service Center), 5020 Salzburg

Submitted by
M.O.O.CON GmbH

Location
Fanny-von-Lehnert-Straße 1
5020 Salzburg

Project start
2019

Completion
2026

open BIM

With the Landesdienstleistungszentrum (Public Service Centre) Salzburg 1150 employees from 18 locations of the state of Salzburg scattered throughout the city will be brought together in a new building of approx. 40,000 m². After defining the requirements and a Europe-wide competition, the general planning team with Burtscher – Durig ZT GmbH has been selected. The planning and construction of the building is be BIM-based. The medium-term goal here is to transfer valid data (as built) into the building operation. The long-term goal is to use digital documentation based on the BIM model throughout the entire life cycle of the building. The planning is done in open BIM, so that a cross-software working method is possible. Any kind of communication concerning the planning is handled via the model. During planning, content and quality of the planning models are examined by the BIM project management team on the client side. Semi-automated processes are set up for this purpose, which check the geometric conformity (collision check) on the one hand and the completeness of the metadata content on the other. The building data model should serve both as a basis for photo-realistic visualisations, the ongoing assessment of project progress as well as decision-making, and must therefore map work statuses in the appropriate quality. Later building users can participate in the planning process via a coordinated model. During construction, it is planned that in addition to the visual comparison between the model and the construction site (target vs. actual status comparison), point cloud surveys will be carried out by the construction supervision. Defect and change management will be organised directly with the model. Important processes and information required for building operation are known from the start; a corresponding documentation strategy was developed in advance and specified in the client information requirements (AIA). The handover of the BIM model is planned in 2026 hand in hand with the handover of the actual building and will be taken into

account accordingly in the testing phase. Operating and movement data will be recorded in a structured manner during operation and linked to the inventory data from the model. In doing so, the central database will provide an optimal basis for operators and users.

○ Disciplines involved in BIM
architecture, building services engineering, construction supervision, contractors, structural analysis

○ Participating companies*
Province of Salzburg (client), M.O.O.CON GmbH (overall project management), DSC Doralt Seist Csoklich Rechtsanwälte GmbH (legal responsibility)

*Project is currently in award phase



Public Service Center Salzburg; © Burtscher-Durig ZT GmbH

Use-Case Overview BIM²¹

PLAN

- Planning variants
- Visualisations
- Coordination of specialist trades
- Progress control (of planning)
- Preparation of draft and submission planning
- Cost estimate and cost calculation
- Simulation during planning
- Collision check

BUILD

- Preparation of execution plans
- Construction progress control
- Change management for planning changes
- Defect management
- Model-based quality control
- Building documentation
- Data acquisition for FM

OPERATE

- CAFM
- Operational plans
- Operating processes
- Adaptations and conversions
- Change management

The objective of the Vienna Business Agency is the continuous development of international competitiveness by supporting both Vienna-based companies and their innovative strengths, and the sustainable modernization of the city as a business location. To achieve this, the Agency provides free consultations to all entrepreneurs in Vienna on the topics of business creation, business location or expansion, business support and financing. Furthermore, networking contacts in the Viennese economy are also made available.

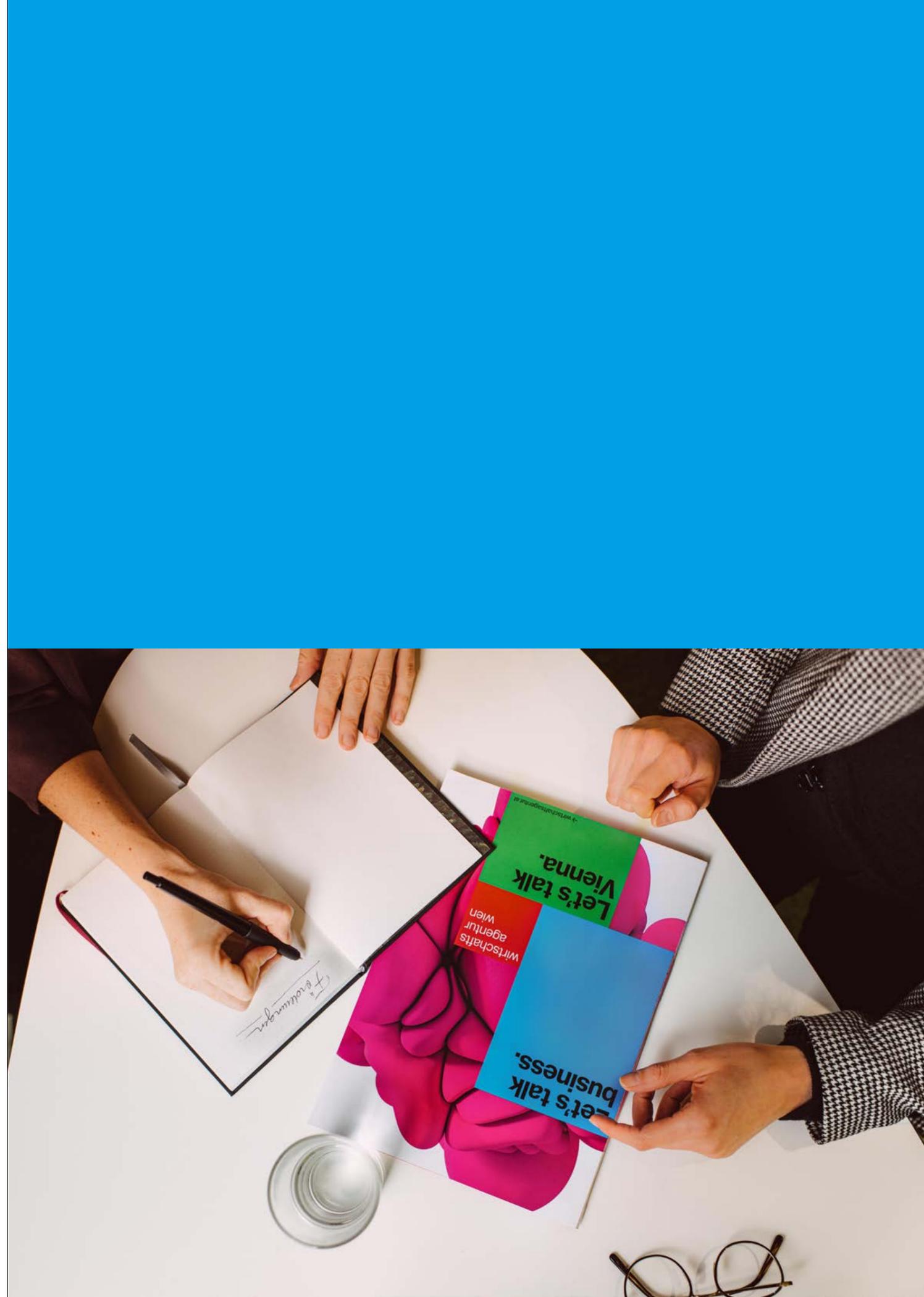
The Vienna Business Agency supports and helps businesses complete their research and development projects with both individual consulting and monetary funding. Depending on requirements, they will receive information about sponsorships, financing opportunities, possible development partners, research service providers, or research infrastructure, according to their needs.

The Vienna Business Agency sees itself as a network of the Viennese Green Tech & Social Tech industry and supports businesses with consultations, as well with distribution and networking among themselves. Events and workshops on topics from the sustainability sector are held regularly.

Additionally, the Vienna Business Agency helps with company relocations or internationalization services. Assistance is provided to business founders and young entrepreneurs in the start-up area. Free workshops and training sessions on topics of everyday business are offered as well as small, affordable office spaces.

Founders Labs²² support aspiring entrepreneurs and founders with a two-month, part-time program to help them get started.

All funding programs of the Vienna Business Agency can be found here: viennabusinessagency.at/funding/programs





In the alphabetical list²³ on the following pages, we offer you an overview of selected companies from Vienna that offer services in the digital construction sector.

Companies in the field of digital construction

COMPANY	DESCRIPTION	CONTACT/WEBSITE
6B47 REAL ESTATE INVESTORS AG	Property developer with locations in Vienna, Germany and Poland. Project development of privately financed residential projects (owner-occupied and rental) as well as commercial and mixed-use properties.	www.6B47.com
ACHT ENGINEERING ZT GMBH	Building on many years of structural engineering expertise, Acht Engineering has made a name for itself as a competent partner for services in the field of organizational and project-related BIM consulting and BIM coordination. "Less is more" is the motto in strategic BIM consulting, added value is to be developed through the targeted use of BIM methodology. Acht is also the right contact when it comes to bridging gaps in data exchange or automating work steps in common BIM software (including Revit, Civil 3D, ArchiCAD, Desite) through appropriate scripts.	www.acht.at
ALLPLAN GMBH	Allplan GmbH is an engineering company in the field of building services, building physics and energy planning based in Vienna and St. Pölten. For several years, Allplan has been a competent and collaborative planning partner using the BIM process. Furthermore, Allplan accompanies several research projects on this topic as a project partner. The consistent further development of BIM methods, both in projects and in research, benefits both the collaboration with customers and partners.	www.allplan.at
ASPERN SMART CITY RESEARCH GMBH & CO KG (ASCR)	Aspern Smart City Research GmbH & Co KG is Europe's largest and most innovative energy research project. Launched in 2013 by Siemens, Wien Energie, Wiener Netze, Wien 3420 and the Vienna Business Agency, ASCR uses real data from the aspern Seestadt city development area to research solutions for the future of energy in urban areas.	www.ascr.at

²³

This list does not claim to be complete.

COMPANY	DESCRIPTION	CONTACT/WEBSITE
ATP ARCHITEKTEN INGENIEURE	With more than 900 employees, ATP is the leading office for integral planning in Europe and has been planning with BIM since 2012. Thanks to its long-standing culture of integral planning, ATP can fully exploit the advantages of BIM for the benefit of quality and sustainability. ATP's own BIM standard, developed over several years, is available on the market via BIMpedia.	www.atp.ag
AUTOBAHNEN- UND SCHNELL- STRASSEN-FINANZI- ERUNGS-AKTIENGE- SELLSCHAFT (ASFINAG)	The construction industry is rebuilding – digitization processes and new ways of working have become part of everyday life and demand change. ASFINAG therefore focuses on the topic of digitization. In addition to general digitization topics, the topic of BIM – Building Information Management – is particularly prevalent. BIM modeling is only one of the numerous aspects. The most important part is the path of the data – from data creation to the IT systems in the company. ASFINAG's goal is to pass on the required data (e.g., for the inspection of structures, planning, or construction measures, and for official notification requirements) to the stakeholders quickly, without media discontinuity and without loss of information. To this end, more and more services are being made available – also for mobile devices – to enable this digital route for data.	www.asfinag.at
BIMSPOT GMBH	bimspot is an intuitive, web-based BIM platform that makes model-based building information centrally available to all project participants. The requirements for this information are defined digitally, and the information quality is validated and controlled. The transparency gained, the improved information basis and automated processes can save time and reduce costs due to errors.	www.bimspot.io
BME BAUMANAGE- MENT ZT GMBH	BME Baumanagement ZT GmbH offers holistic planning solutions for projects of all sizes. On the occasion of the project Bioinstitut Raumberg-Gumpenstein, the office was converted to 3D planning and BIM. Despite the complicated building structure, very good synergies could be achieved with all planners involved. The further training of the 15-member team through appropriate training courses has a high priority in the company.	www.bme.at

COMPANY	DESCRIPTION	CONTACT/WEBSITE
BOGENSBERGER VERMESSUNG	With state-of-the-art technologies and many years of experience, Bogensberger Vermessung accompanies projects in the fields of surveying and geomonitring. The company provides planning bases for construction projects, renovations and conversions, as-built plans of buildings, roads, freight routes and industrial plants, are experts in the documentation of cultural assets and in the solution of risk and damage cases. BIM services include 3D laser scanning, BIM modeling, as-built inspection and much more.	www.bogensberger.com
BOLLINGER+ GROHMANN	Bollinger+Grohmann has adapted its office structure with the start of BIM implementation as a central planning process. The complexity and interdependencies of contemporary planning processes become visible by overlaying models of different disciplines involved in a project. Working in 3D with a coordinated BIM process enables enhanced coordination of all trades, improved efficiency, and a collaborative workflow.	www.bollinger-grohmann.com
BUILDINGSMART AUSTRIA	buildingSMART Austria is part of the worldwide buildingSMART network, which sees itself as the "home of BIM". buildingSMART is the initiator of the open data format IFC and develops this internationally valid standard for all built assets like buildings, tunnels, bridges, roads, etc. The contracts between buildingSMART International on the one hand and ISO and CEN on the other hand enable a more than 60-year validity of the standards. In Austria, specialized working groups cooperate closely with public and private clients on the overall implementation of these standards in various projects.	www.buildingsmart.co.at
BUNDESIMMOBIL- IENGESELLSCHAFT M.B.H.	The Bundesimmobiliengesellschaft (BIG), as one of the largest real estate owners in Austria, is intensively involved with BIM and its application in projects. It is essential that the specifications are kept uniform throughout Austria to give the service providers entrusted with planning security for uniform standards. From BIG's point of view, the BIM planning method can only be implemented successfully if there are no "restrictions" in the course of planning, i.e., we must think and live-in terms of "open BIM".	www.big.at
DELTA	For the comprehensive construction service provider DELTA, BIM is not just a digital tool, but an inner attitude of interdisciplinary, partnership-based cooperation at eye level. With 5D, DELTA uses a BIM variant that has been expanded to include cost and schedule planning, which offers security and transparency in decision-making. DELTA is currently working on the integration of the sixth dimension: the ecological component.	www.delta.at

COMPANY	DESCRIPTION	CONTACT/WEBSITE
DIPLO. ING. WILHELM SEDLAK GES.M.B.H.	The company is mainly active in new construction, refurbishment, and special construction as a total contractor, general contractor or master builder. To drive innovation in the construction sector, the company runs and supports research projects and implements BIM working methods.	www.sedlak.co.at
DREES & SOMMER PROJEKTMANAGEMENT UND BAUTECHNISCHE BERATUNG GMBH	Drees & Sommer focuses on consulting for the implementation of tailored digitization modules. The spectrum ranges from Digital Ready Checks through the implementation of digital processes and methods such as BIM to Smart Buildings. Clients are supported in the digital assessment of the current situation and the development of proposals for action and are accompanied through all project phases during implementation.	www.dreso.at
EY ÖSTERREICH	The digitalization of the construction industry is advancing and is also the focus of EY's real estate team. BIM plays an essential role in the planning, construction, and operating process of real estate. Among other things, the company is currently implementing a BIM pilot project, in the field of educational construction, as a BIM manager.	www.ey.com/at
FCP FRITSCH, CHIARI & PARTNER ZT GMBH	FCP's engineering activities cover a wide range with contracts in the field of building construction and civil engineering. These engineering services are provided not only for projects in Austria, but also abroad. In all areas of planning, great emphasis is placed on modernization and digitalization to be able to adapt to the changing conditions of the times. FCP has been dealing with the topic of BIM for 8 years and is thus one of the industry leaders in this field.	www.fcp.at
GAWAPLAN HAUSTECHNISCHE ANLAGEN GES.M.B.H	Gawaplan GmbH is a building services engineering office. The company plans, tenders and manages the construction of energy-efficient plants, alternative heating, and cooling systems of all sizes. The plants are also designed in 3D and BIM if required.	www.gawaplan.at
HABAU HOCH- UND TIEFBAUGESELLSCHAFT M.B.H	From planning to the finished building and beyond: The HABAU GROUP unites experts from all disciplines under one roof. The team, which has been working together for many years, sees itself as the central interface for all those involved in the overall process. Our practical know-how in combination with Building Information Modeling (BIM) forms the basis for modern, transparent, and efficient project management.	www.habaugroup.com

COMPANY	DESCRIPTION	CONTACT/WEBSITE
HEID UND PARTNER RECHTSANWÄLTE GMBH	Heid & Partner is one of the leading Austrian law firms in public commercial law. The firm specializes in public procurement law, construction and construction contract law, IT law and data protection. In the area of digitalization and BIM, the firm's services include comprehensive legal support for (new) processes and products such as BIM models, alliance agreements or BIM-BVB.	www.heid-partner.at
IBO – ÖSTERREICHISCHES INSTITUT FÜR BAUBIOLOGIE UND -ÖKOLOGIE (VEREIN) UND IBO – ÖSTERREICHISCHES INSTITUT FÜR BAUEN UND ÖKOLOGIE GMBH	As an independent association, the IBO researches the interactions between humans, buildings, and the environment. Scientific research at the IBO covers the topics of life cycle assessment, pollutant prevention, digitization of data for e.g. BIM and product databases, building assessment and ecological optimization, circular economy, indoor air quality, plus-energy buildings and quarters as well as comfort. IBO GmbH offers services in these specialist areas and operates baubook GmbH together with the Vorarlberg Energy Institute.	www.ibo.at
IC CONSULENTEN ZIVILTECHNIKER GESMBH	As one of the largest engineering companies in Austria, iC group is an internationally active expert group for complex engineering projects and technical-interdisciplinary overall solutions. Services include: <ul style="list-style-type: none"> ● Integral BIM based general planning including BIM coordination ● BIM technical planning for building construction and infrastructure ● BIM data management and data competence over the entire building life cycle ● BIM based construction site management (project control, construction supervision): cost and schedule tracking (5D), as-built documentation ● CAFM consulting and BIM based data migration ● Digital model-based inventory of buildings ● Digital production processes along the entire entrepreneurial value chain with integration of the project participants (collaboration using platform technologies) 	www.ic-group.org
KS INGENIEURE ZT GMBH	KS Ingenieure ZT GmbH was founded in 1991 and has been active for 30 years as a leading company in the fields of structural design, construction management and construction supervision with approx. 80 employees. The current focus on BIM allows design workflows to be streamlined and effectiveness and precision to be increased from start to finish.	www.ksingenieure.com

COMPANY	DESCRIPTION	CONTACT/WEBSITE
LEYRER + GRAF BAUGESELLSCHAFT M.B.H	With annual sales of approximately € 450 million and an average of 2,300 employees, the Leyrer + Graf Group is one of Austria's leading construction companies. The range of services extends from building construction and civil engineering to energy and telecommunications, to wood technology. Networked planning and digitalization are increasingly being used to handle the wide range of construction projects. BIM pilot projects have already been successfully implemented and innovative methods are continuously integrated into the construction process.	www.leyrer-graf.at
M.O.O.CON GMBH	M.O.O.CON offers management consulting for identity-creating and sustainable buildings, processes and working environments. The service portfolio includes various tools for future-oriented construction projects with and without BIM support, including hybrid project management.	www.moo-con.com
MENSCH UND MASCHINE AUSTRIA GMBH	MuM consults and trains in the area of CAD, CAM and BIM solutions. As a certified buildingSMART training partner, the "bimready" program with the BIM competence levels construction, coordination and management is offered. As support for BIM implementation, further specializations, workshops, such as the AIA/BAP writing workshop, as well as individual consulting are offered.	www.mum.at
ODE – OFFICE FOR DIGITAL ENGINEERING	ODE is a BIM service provider with more than 10 years of experience in real BIM projects and extensive activity at the forefront of research and development. BIM implementation in companies and projects, the creation of BIM codes and contracts, as-built surveys using 3D laser scanning and associated modeling, as well as the "digital construction site" are the focus of the work.	www.ode.or.at
PICHLER & TRAUPMANN ARCHITEKTEN ZT GMBH	The architectural firm Pichler & Traupmann Architekten ZT GmbH is one of the pioneers of Building Information Modeling in Austria and has been successfully realizing its projects based on BIM methodology since 2013. In the implementation of diverse construction tasks and a wide variety of typologies, collaborative, digitally linked work by means of shared data models is an essential part of the design philosophy.	www.pxt.at
PILZ & PARTNER ZT GMBH	Pilz & Partner ZT GmbH, with offices in Vienna, Graz and Bad Aussee, has established itself within just under three years as one of the largest civil engineering firms in Styria. Around 35 employees implement projects throughout Europe and regularly take part in training courses to further improve the company's work.	www.pp-zt.at

COMPANY	DESCRIPTION	CONTACT/WEBSITE
PLANDATA GMBH	Plandata develops digital solutions for BIM-supported building construction. The portfolio ranges from strategic consulting and the development of company standards to the implementation and training of users. In addition, Plandata develops its own digital products and software solutions for lifecycle-oriented, BIM-supported building construction. Its clientele includes planning offices, medium-sized contractors, building owners, operators, manufacturers, and technology groups.	www.plandata.eu
PLANRADAR	PlanRadar offers B2B software-as-a-service. Customers worldwide manage documentation, communication, task, and error management through the PlanRadar platform.	www.planradar.com
SCHLUDER ARCHITEKTEN ZT GMBH	The company has been dealing with the topic of BIM and BIM-supported tendering since 2015, especially in regard to efficiency in planning and execution. Across all planning phases, the technology, adapted to the respective requirements of the project, is used from the very beginning. With "Campus Landgutgasse", the company has worked together with iC consultants on a pilot project for a public client, in which the experience gained will be used as a basis for future BIM projects.	www.architecture.at
SIDE – STUDIO FOR INFORMATION DESIGN GMBH	SIDE's vision is to digitize the design, construction, and real estate industry end-to-end, making it more efficient. The main service offerings: <ul style="list-style-type: none"> ● Implementation – Strategy development for introduction of digital processes in the company ● Project support – BIM management/overall coordination ● SIDE Academy – BIM trainings and certifications (ASI, TÜV, buildingSmart) 	www.side.gmbh
SIEMENS AKTIENG- SELLSCHAFT ÖSTERREICH	The Siemens Smart Infrastructure Sector intelligently connects energy systems, buildings, and industries to further develop and improve the way we live and work. One part includes solutions, products and services for building technology such as fire detection and security building automation and control. Since 2017, Siemens Austria has fully integrated Building Information Modeling as an integral planning method within the company. Therefore, BIM projects with building technology from Siemens can continue to be implemented in-house and Siemens can be part of forward-looking innovative projects of the future.	siemens.at/bim

COMPANY	DESCRIPTION	CONTACT/WEBSITE
SMART CONSTRUCTION AUSTRIA GMBH	Smart Construction Austria GmbH is an association of six medium-sized Austrian construction companies whose network is built on open and transparent cooperation to jointly strengthen themselves for the future and the digital transformation of the construction industry. Among the goals pursued are the advancement of research and development and the promotion of innovations in the construction industry. The focus is on topics such as lean management and BIM.	www.smart-construction.at
SOLID ARCHITECTURE ZT GMBH	The company solves challenging and sensitive design tasks and works primarily in the areas of commercial and public buildings, corporate architecture as well as bridge planning and exhibition design. For years, the use of BIM has been an indispensable tool for both internal and interdisciplinary planning and execution within the framework of general planning contracts. This also includes specialist and overall coordination as well as BIM-based tendering.	www.solidarchitecture.at
SWAP ARCHITEKTEN ZT GMBH	In addition to BIM planning, SWAP has been involved in computational design for years. Thus, several tools have been developed for the Revit-based BIM environment, which facilitate the work of planners, architects, and the cooperation with building owners. With the building site or floor plan configurator of the self-developed software EVA- Rapid Layouting it is possible to visualize room programs in an early project phase and to check first variants in floor plans or building masses, interactively with displayed characteristic values in real time. The IVAN application is a virtual environment in which one can enter the 3D model online using Web VR or VR glasses. The 3D data are loaded directly from the CAD via an interface into a cloud and are immediately available, interactive editing options of the 3D model in virtual space are already under development.	www.swap-zt.com www.rapidlayouting.com www.ivanize.com

COMPANY	DESCRIPTION	CONTACT/WEBSITE
TEAMGMI INGENIEURBÜRO GMBH	teamgmi offers planning and simulation services for innovative building technology and energy concepts. The focus is on combining comfort with energy efficiency and creating unconventional overall solutions. Digital planning plays an essential role in what we do, as process-related interfaces from conception to execution and operation can be optimally designed with it. The added value of BIM solutions is also noticeable for customers.	wien.teamgmi.com
VALUE ONE HOLDING AG	Value One, headquartered in Vienna, develops, and operates exceptional real estate and urban quarters. More than 180 employees work in the three business units Development, Operations, and Investments to implement the company's visions. In the past 20 years, Value One has realized real estate worth around two billion euros. By 2024, more than 15,000 people are expected to live and work in them. Among other things, the company was involved in the realization of the Viertel Zwei urban development area in Vienna and the MILESTONE premium student apartments throughout Europe.	www.planradar.com
VASKO+PARTNER INGENIEURE ZIVILTECHNIKER FÜR BAUWESEN UND VERFAHRENSTECHNIK GESMBH	The range of services provided by BIM Management includes, among other things, the establishment and administration of central CAD data management, the establishment and maintenance of project-specific interdisciplinary data structures, the generation of BIM models, research, and development in the field of data interfaces and new planning and communication tools.	www.vasko-partner.at
WA BUSINESS & SERVICE CENTER GMBH	WA Business & Service Center GmbH is a subsidiary of the Vienna Business Agency. The purpose of the company is the development, construction, utilization, and operation of special real estate. These properties are constructed with a high demand on building quality as ecological showcase projects with life cycle orientation. The technology centers (TZ) in aspern Seestadt, the Hygiene Center of the City of Vienna and the passive office building Energybase were realized.	www.wirtschaftsagentur.at
ZECHNER & ZECHNER ZT GMBH	Zechner / Zechner implement projects of different size as architects and general planners. In the process, the specialist models of various disciplines are coordinated by means of BIM and subjected to the respective required use cases. The company supports clients in formulating their BIM requirements and monitors the entire BIM process as overall BIM coordinator up to the as-built model.	www.zechner.com



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Technology reports are available on the following topics:

- AAL (Ambient Assisted Living)
- Additive manufacturing
- Big data and AI
- Blockchain
- City Logistics
- Cloud computing
- Data4Good
- e-Commerce
- e-Government
- e-Health
- Enterprise Software
- Entertainment Computing
- FinTech
- Green Building
- HR-Tech
- Intelligent automation and robotics
- Intelligent production
- Internet of Things
- IT-Security
- Food
- Mobile Computing
- Prototyping – from conception to product
- Rainwater in the city
- Technologie erleben
- Urban energy innovations
- Urban mobility
- User Centred Design
- Visual Computing

The digital version can be found at
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REACT-EU ALS TEIL DER
REAKTION DER UNION AUF DIE
COVID-19-PANDEMIE FINANZIERT.



Europäische Union Investitionen in Wachstum & Beschäftigung. Österreich.

The Project „Fit für die Zukunft“ contributes to the development of corporate research and innovation activities in Vienna, encourages cooperation and awakes enthusiasm for research and innovation among young Viennese. Additional information on the www.efre.gv.at/en

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