The Urban Lab of Europe!

JOURNAL

PROJECT

BRISE-Vienna - Building Regulations Information for Submission Envolvement

Vienna, Austria

TOPIC

Digital transition

EDIT 06 JUNE 2023

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Piloting the BRISE-Vienna results - Journal N° 3

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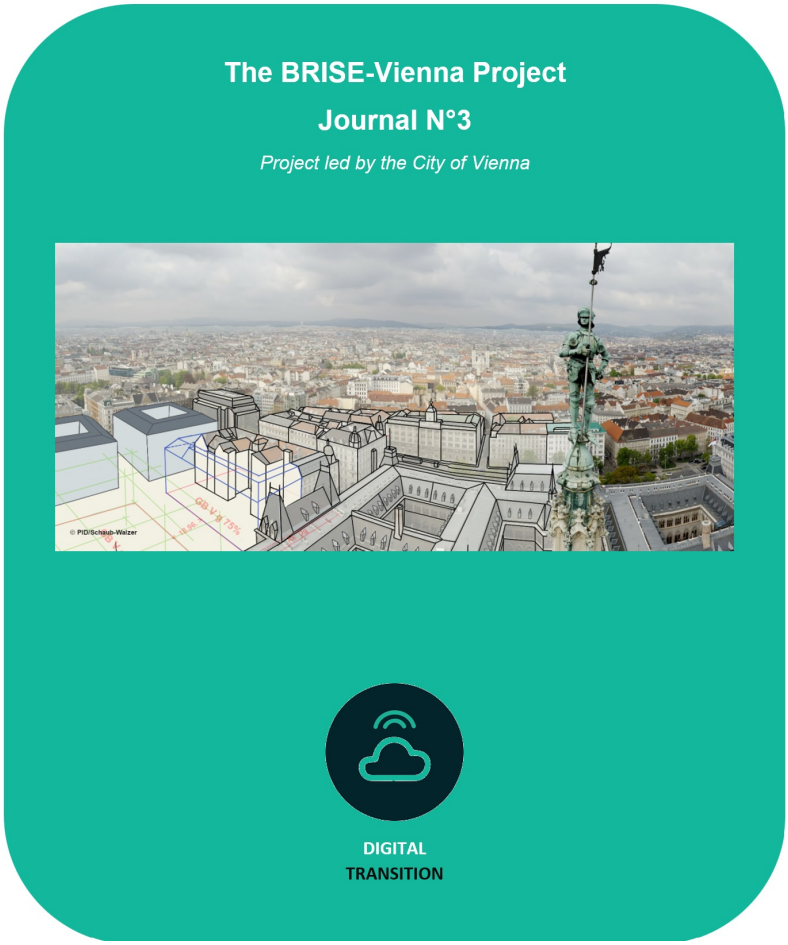

The 3rd Journal of BRISE Vienna sums-up the progress that was made throughout 2022 and highlights the steps taken to achieve the proof-of-concept for the integration of technologies in BRISE. Between June and December 2022, 13 planners and architects from Vienna participated in piloting the digital building permission process based on BIM, AI and Augmented Reality, delivering proof that the system is able to achieve significant improvements in real-life building inspection processes.

The **BRISE-Vienna** Project

BRISE-Vienna addresses the challenge of accelerating complex verification and permission procedures in city administrations. It can serve as a blueprint for those cities that experience growth and must deal with a high number of building permissions.

Vienna has been experiencing continued growth and demand for new housing over the course of the last 20 years. Between 2004 and 2019 the city has been issuing more than 13.000 new building permits per year. Behind many of them are complex verification procedures and sophisticated analyses on legal, physical, and other requirements. Like in other growing cities, today it takes well in average up to 12 months for a planner or an investor to receive a building permission in Vienna.

The BRISE-Vienna Project is now making full use of the potential of digital technologies to at least double the speed of the building verification and permission process. It aims to achieve a strong acceleration and simplification of the entire process by subjecting it to a radical digitization. In short, the following features are brought together to achieve a fast, lean and efficient process:

a. Planners and investors will no longer have to submit their building plans on paper, but rather upload their **3D Building Information Model (BIM)** in a digital format via the servers of the city of Vienna.

b. Based on the application documents the city produces a **digital 3D reference model (REM)** of a generic building which is in congruence with all existing regulations and specifications of the site.[1]

c. In an automated process the municipal auditor then **compares the 3D BIM Model of the planner with the digital reference model of the city**. By this, he can easily identify deviations from existing regulations and requirements and give direct and quick feedback to the planner.

d. Additional features – like **AI-based verification routines or AR-based visualizations for citizen engagement** – help to make sure that all actors in the process receive the maximum support.

With BRISE-Vienna, the city of Vienna will demonstrate how a municipal administration can make full use of what digital technologies can offer – but even more so, it shows the way towards a new thinking in integrated, seamless processes and efficient services for running a smart and liveable city.

Partnership:

- City of Vienna
- TU Wien – Bauingenieurwesen und Informatik - University
- WH – Media – Municipal company
- tbw-ODE – The better Way - Office for Digital Engineering - Private Company
- ZT-Kammer – Kammer der ZiviltechnikerInnen – Association of Architects and planners

There is a short video about BRISE-Vienna, which gives a good introduction and overview.[2]

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[1] Von Radecki, 2020: „The automated reference models as municipal verification tool"

[2] https://www.wien.gv.at/video/2946/BRISE-Vienna

Executive Summary

2022 was the year that BRISE-Vienna changed from idea to product. It's an unusual thing for a city to design, develop, test, and introduce a new tech-based product tailored to a core service of the city administration. Innovation in the public sector differs from private-sector innovation (see here for more details), but also in a city context eventually a new service needs to be tested in real life.

Thus, the city of Vienna together with its project partners, focused on a real-world proof of concept in 2022, piloting the BRISE tools integrated in a seamless digital process with real development projects in 2022.

Overall, the pilot has been very successful and the city was able to demonstrate the full range of BRISE technology. It included:

- Finalizing the web-interface and the integration of components
- Identification of planners and developers willing to submit BIM Models instead of paper plans
- Undergoing the full building verification and permission process with the participants in the pilot
- Identifying open issues and hick-ups in the process to improve the service
- Specifying the roadmap for introducing the service and for scaling-it to other cities and regions.

While the technology delivered what it promised, the city was able to demonstrate the automated BRISE building

verification tool with 13 real-world development projects which submitted their building plans in form of a 3D BIM Model and eventually received a building permit by the city of Vienna.

Key lessons learned in this process include a more differentiated understanding of public innovation processes (tech development can be fast and superseded the expectations, legal and administrative decision making slows down the process), evidence for time saved through automation in the verification process, a new understanding of collaboration between planners and auditors and an emerging understanding of how BRISE Vienna can be scaled to other cities and regions.

Section 1: Project Update - BRISE Vienna 2022

2022 was the decisive year for BRISE Vienna. After two and a half years of development, the BRISE technology should be fully integrated and piloted together with real users this year. To understand the project, it is helpful to imagine it as a modular set of components, which need to be integrated in a seamless digital process and workflow:

1. The AI modules for the automated analysis of textual provisions and semantic search
2. The mapping table that provides the rules of modelling for the automated 3D Reference Model in the Software "Solibri"
3. The approach for integrating key components into one digital tool with a coherent frontend

Overall, the project was able to exceed the goals set, as significantly more inspection rules could be automated than originally planned: Instead of 40% as originally planned, BRISE was able to automate 50% of all legal requirements within the Vienna Building Code. The automated inspection rules are formal building regulations of the City of Vienna that have been translated into code and embedded in digital inspection routines. These now replace the manual inspection by employees of the Vienna Building Authority MA37. Instead of several days, the inspection process itself now only takes a few minutes.

Between May and November 2022, the city invited developers to participate in a real pilot project of BRISE Vienna by submitting their plans as 3D BIM models via the new digital interface to the review process. The pilot process proved on the one hand that the idea of BRISE Vienna has been successfully translated into reality and that the technology is now capable of achieving the intended goals. The feedback from the users was positive - both from the developers and architects as well as from the inspectors of the MA37 building authority, who now use a new, partially automated system for inspection. On the other hand, the pilot process has also shown that a number of challenges still need to be overcome in order to permanently transform the building inspection process.

By the end of 2022 it is possible to state, that the first 13 development projects within the city of Vienna have successfully undergone the new, digitized and automated building verification process and that - through this – significant improvements in time- and cost efficiency could be achieved on all sides. What is maybe even more important, a range of lessons were learned by all participants:

- The automated pre-verification which is available to the planners and architects, drastically saves time in the actual verification process, since the model can be digitally pre-checked several times before it is formally handed in. This saves many feedback loops which used to be normal in formal approval processes.
- Through the automated verification routine the inspection process itself changes: the inspector and the architect are becoming a team that is collaborating to achieve regulatory compliance of the new building.
- The administrative processes within the project (e.g. Security clearance) took much longer than anticipated and it was also for security reasons that the BRISE System has not yet been fully deployed within the IT-landscape of the City of Vienna.

Figure 1: shows the progress of BRISE Vienna throughout 2022 and the last milestones which are due before end of the project in April 2023.

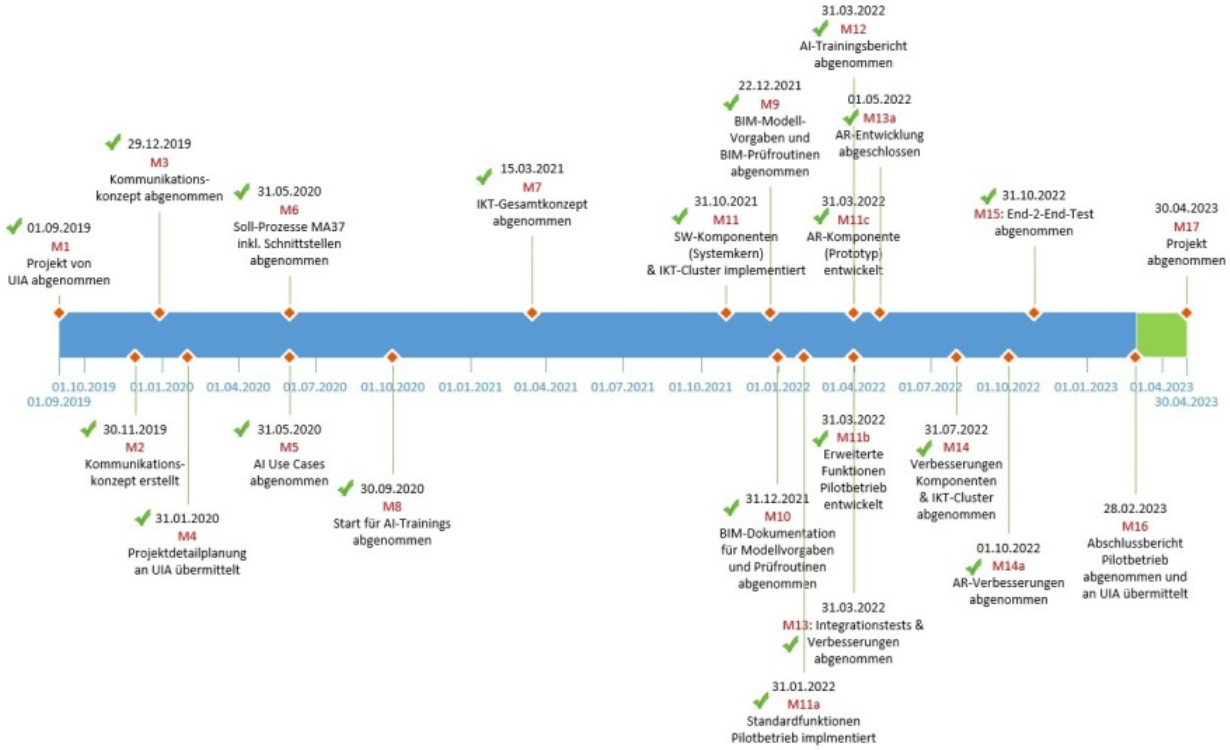

Figure 1: Milestone plan of BRISE Vienna (as of Jan. 2023)

Policy Context

BRISE-Vienna fits well into the strong focus, which EU policies have put on local governments and digitization. The Urban Agenda for the EU currently is the strongest joint policy initiative on EU level driving the sustainable transformation of cities and urban societies throughout Europe. It is structured into 16 Partnerships, driving change, innovation and policies at the local level, but also on national and EU level. Vienna is the coordinator city for the "Partnership on Housing" under the Pact of Amsterdam[1]. Another key partnership has developed around the "Digital Transition"[2] of cities and regions and it has put forth a set of goals and actions within an action plan, also formulating expected results from the partnership.

BRISE-Vienna is set to contribute to key results of the Digital Transition Partnership within the Urban Agenda for the EU. Especially to the following three:

a. **Better, more accessible and personally customized public services to citizens, incl. accessibility of digital public services to disabled and elderly citizens:**

   BRISE-Vienna demonstrates how bureaucratic process can become user-friendly, easy and quick by means of digitization. The expected results, but also the process, how Vienna and its partners are aiming to achieve their results, can provided important impulses to cities across Europe and may be referred to as best practices by the Urban Agenda.

b. **Better competences to develop public services based on new technologies:**

   BRISE-Vienna has brought together an interesting consortium of city officials, university researchers, experts and highly specialized companies collaborating to develop a new digital product for the city. A key component is the integration of municipal staff into the development process. At the end, a range of departments with hundreds of municipal workers will have contributed to the BRISE-Vienna tool and digital process – and many of them will apply AI-based solutions in their daily work, knowing they have contributed to training it. This approach is exemplary and should be promoted among the Digital Transition Partnership.

c. **More efficient and inclusive urban planning processes:**

   BRISE-Vienna solves a real-world issue. Because of the project many families will be able to receive housing earlier and more conveniently. Streamlining and digitizing the process of granting building permissions will double the speed of issuing building permits. This is an impressive demonstration of how technology can serve to plan and build cities more efficiently.

[1] https://futurium.ec.europa.eu/en/urban-agenda/housing/pages/housing

[2] https://futurium.ec.europa.eu/en/urban-agenda/digital-transition/action-plan/digital-transition-action-plan

Section 2: Mapping BRISE Vienna against the established UIA challenges

The following section will highlight challenges which have arisen in BRISE-Vienna throughout the year 2022 and it will depict, how Vienna has found ways to solve them.

1. Leadership for implementation

The management of BRISE Vienna is faced with a number of challenges arising from the complex nature of the project. In fact, BRISE has made significant progress in providing a fully integrated digital solution to improve a hitherto lengthy and bureaucratic process. On the way to achieving this goal, not only the staff involved in the project, but more importantly the policy makers, citizens and stakeholders involved in the adjacent processes and systems had to fully grasp the importance of the project, the potential of the technologies involved and the impact on the whole organisation and service delivery. In short, the project stakeholders had to develop an understanding of digital transformation as such and of the project activities in BRISE in particular, sometimes requiring highly specialised knowledge.

This posed a challenge because the stakeholders do not have specialised knowledge, or if they do, it is only in one of the different knowledge areas of the project. **Leadership in BRISE therefore had to put a focus on communication, development of mutual understanding as well as shared learning.** To fulfil this role, a number of high quality project documents, explainer videos, simulations and other multimedia content have been developed over the last few years, and several workshops, trainings and formats of collaboration between stakeholders have been developed and conducted, with quite respectable success. In 2022, however, the pilot process brought an additional challenge to the project: **the first external beneficiaries of the project - contractors, planners and architects - were to be invited to participate in a pilot project to test and evaluate the system.**

This required a new quality of leadership, as **external stakeholders were now to be informed, guided and supported to apply a new system for the first time**. This is not only a communication challenge, but also a political one, as first impressions and public feedback will have an important impact on the project and its outcome - as well as on the leaders involved.

The core challenges for leadership in BRISE Vienna in 2022 can be summarized as follows:

a. Ensure that quality, timeliness and reliability of the technical system is kept.

b. Inform and onboard a range of pilot participants (planners / developers / architects) with real-world planning projects.

c. Guide and support the pilot partners to a satisfying result, which proves to be more efficient than the manual verification procedure.

d. Keep the public informed and the administration motivated.

After the pilot process was completed, participants gave consistently positive feedback and expressed satisfaction with the process. This result was achieved through good project and process management, but even more so through the right prioritisation. The management of BRISE Vienna gave the pilot submissions top priority in the review process and supported the administrative staff to focus on the review and successful approval of the pilot buildings. The process was accompanied by an information campaign with a dedicated website, clear communication and high visibility at the political level. By winning over politicians and decision-makers of Vienna such as Kathrin Gaàl (City Councillor for Housing) or Klemens Himpele (CIO of the City of Vienna) as minds and advocates of the project, **the leadership of BRISE Vienna succeeded in positioning BRISE as the most important lighthouse initiative in Vienna** combining the topics of housing and digital transformation.

2. Public Procurement

Procurement is not a particular challenge within BRISE, since most of the deliverables are being produced by the involved project partners. Only one important component has been tendered out to be delivered by an external organisation: the overall Integration of software components based on the WP6 specifications of the overall IT concept. It may be stated that it does not present a particular surprise that the tender process as such could have been somewhat swifter and the approvals by the awarding office could have arranged a bit quicker. Overall, these challenges, however, are of a generic nature and they present themselves in virtually all awarding public

organisations. BRISE staff agreed to lobby for a higher priority of the project at the Vienna procurement office. The issue as such is of rather low impact and relevance.

3. Integrated cross-departmental working

BRISE Vienna has adopted a well-functioning approach for integrated, cross-departmental working. The project organization has been described in detail in the BRISE Journal N° 1 and it has proven useful and resilient throughout the year 2022. A going back to normal after the COVID Pandemic helped to boost personal and direct collaboration, which posed a challenge to the cross-departmental working in 2021.

As the project progressed in 2022 one challenge stood out which could be solved through a deep integrated, cross-departmental working: **the development and execution of automated verification procedures**.

As mentioned in the project update above, the staff involved in developing the automated verification routines aimed to translate 40% of all legal provisions of the Vienna Building Code into digital verification routines. This not only required an understanding of the technology used to automate legal texts, it also required a close collaboration between the involved teams from the city administration, the Technical University and the service provider ODE. Even legal texts are often ambiguous in what they say, which represents a challenge for codification. **While a human inspector is able to interpret ambiguity on a case-by-case basis, a machine has to adopt clear and non-ambiguous rules. The challenge for the team thus consisted in deciding for a clear interpretation of several ambiguous legal provisions and embedding it in the digital verification routines.**

The knowledge of experienced inspectors and members of the city administration proved to be of invaluable importance in this process: as it shows, when faced with this challenge, people resort to precedence and historic events to better understand the origin and meaning of a specific regulation or law. By facilitating the exchange between the project team and long-experienced members of the building verification team, a deep understanding of the provisions at hand could be achieved. Members of TU Vienna and ODE highlighted the importance of understanding the historic origins of a regulation for taking the right decisions with respect to automizing the inspection.

As a result, the audit rules were developed differently and in many cases the degree of automation was put into perspective. For example, a tiered system of automation was introduced in the audit, where different levels of automation could be assigned to audit routines. A distinction was made between:

1. Automated
2. Partially automated
3. Graphical assistance

The deeper understanding of the regulatory context also allowed for a differentiation: certain parts of some automated verification rules were made adjustable, in order to give the testers more freedom to work within the system.

Other challenges in the integrated, cross-departmental working could not be solved in such a productive way – especially where core features of the IT System of Vienna were potentially impacted by the new system.

4. Participative approach for co-implementation

The solutions developed throughout the BRISE-Vienna project, have an interface with a variety of internal and external stakeholders: **planners and architects** upload their BIM Models in a new online interface (instead of sending paper plans to the building authority), **staff of the building authority** (MA37) interacts with the subjects under verification via a new, digital interface, and **neighbours and other interested citizens,** will be able to visualize the future scape of a new building via augmented reality in an app or via a browser on their tablet. These new interfaces require great UI/UX design and a significant amount of user testing and participation.

In 2022 first designs were developed and the interaction with the users and beneficiaries was tested throughout the pilot phase. Whereas BRISE Vienna did not execute a classical participation process (citizens are not the primary target group of BRISE Vienna), there were a few important lessons to be learned from the first direct and intensive interaction with the planners, developers and architects that participated in the BRISE pilot process.

At the core of it sits the insight that with higher automation and digitalization of the building verification process **the role of the inspector will undergo a fundamental change**. Where the old, manual process was favouring unilateral and binary communication, **the new process requires a stronger collaboration between the users at both ends of the verification process**. The traditional, paper-based process foresaw a provision of 2D plans to the city administration and after a few weeks (or months) the architect would receive a response which would either consist in a formal building permit (usually after several iterations) or in a refusal stating the reasons and

asking the architect to improve the model. The new digital BRISE tool now drastically shortens this feedback loops and brings in the element of an automated verification process. Through a digitally supported system the inspector is able to give quick feedback or even to discuss the 3D model in a joint session with the architect. BRISE thus furthers the process of inspection to become more collaborative and therefore more efficient.

In 2022 this process was tested and piloted for the first time with surprising results on both sides. Architects and planners highlighted the increased requirements for transparency which the 3D BIM Model demands before even submitting a first version of the model. Unspecified elements which the 2D plans allowed, can no longer exist in the 3D version. This leads to a higher quality of plans in the first place and allows for a swift and efficient communication with the inspector. The staff of the building verification team highlighted the potential to discuss requirements and changes with the planners and architects by jointly looking at the 3D model.

5. Monitoring and Evaluation

The pilot process in 2022 for the first time provided evidence that**the goal of BRISE Vienna is potentially achievable**. The core of the promise, BRISE makes, is to**accelerate the building verification and permission process by 100%**. This figure is quantitative, rather easily verifiable and will prove that the new combination of digital tools is saving resources and time.

However, in order to arrive at scientifically backed statements about the degree of achievement of this goal, a statistically significant number of cases (250+) will have to have used the new digital process and tools. This will not happen within the period of the project. Thus, a full verification of the project goals can only happen ca. 2 – 3 years after the project has ended.

Project partners have acknowledged that important monitoring results and conclusions about the project success, can also be achieved with a few sample cases which represent archetypic buildings and ground situations. To this end, in 2022 BRISE Vienna identified 13 real-world pilot projects which were admitted to the test and verification of the system. This represents a sufficiently large number of pilot cases to arrive at first conclusions whether or not the project will be able to achieve its goals.

In December 2022 the evaluation of the pilot projects is ongoing. Thus, an analysis of results will be given in the final Journal for the BRISE project in 2023.

6. Communication with local partners

The main challenges in communicating about BRISE with local partners lie within the complex and challenging technical nature of the project. While project participants are excited about the possibilities of the project, it is difficult for outsiders to understand the benefit and the implications of BRISE. In light of machine learning, data usage and AI, concerns and often irrational fears drown out the benefits and advantages of the system.

To counter this pattern in communication, project communications will break down BRISE best practices according to different user groups and facilitate an easy and very practical communication. At the same time, project communication suggested to collaborate with influencers from different communities and have them report about BRISE and its potential.

7. Upscaling

As stated in the BRISE Journal 2021, a direct transfer of BRISE to other cities and regions in Europe is highly unlikely. BRISE is not a stand-alone piece of software which can be downloaded and installed like Excel or PowerPoint. It is a bundle of technological components that need to be tailored to a regulatory framework via automated verification routines.

However, in 2022 higher clarity has been gained on what elements of BRISE can be transferred and scaled to other cities and regions and under what conditions.

First, the TU Vienna has developed a maturity mode for digital building verification processes[1]. It structures the degree of digitalization along different stages of maturity and thus helps to understand the current state of a given city, region or country and it serves to specify realistic goals and milestones in an individual context:

- Level 0: analogue 2D submission
- Level 1: Digital submission
- Level 2: openBIM approval procedure (BRISE)
- Level 3: openBIM authority procedure (BRISE + X)

Second, for individual components of BRISE the scaling- and replication potential could be defined together with the interest of participating partners like TU Vienna or ODE. These read as follows:

- Templates on the basis of the BRISE Vienna verification routines have been developed as plugins to the commercial software "Solibri" and will be provided under a license by TU Vienna and ODE
- TU Vienna is thinking about publishing the AR platform as an open-source tool
- The automation of the reference model is ready to be provided as a stand-alone system
- Several AI-based elements can be provided as components for other systems

Taken together, this provides the basis for a structured approach to scaling the results of BRISE Vienna to other cities, regions and countries. The main challenge to be overcome, however, is the expert's dilemma in this process. To this date. the core expertise and knowledge of the technological components and their interactions lies with 5 individuals. Thus, it is imperative to systematize and publish the results in a way that replication and scaling becomes possible irrespective of a participation of these 5 particular valued individuals.

To this end, a proposal has been presented to UIA for delivering a replication package at the end of the project.

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[1] See Schranz et. Al, 2021: "Digitalisierung und Standardisierung der Immobilienwirtschaft unter Anwendung von BIM am Beispiel eines Neubaus: Bio-Institut der HBLFA Raumberg-Gumpenstein (Link)

Section 3: Key learning points

Summing up, in 2022 BRISE-Vienna was able to prove the viability of the technology integration. During the pilot process the general functionality of the system could be demonstrated and first, promising results were achieved.

The following points are the key take-aways from 2022:

1. **Tech-innovation follows an exponential curve!** Setting-up the general tech development and innovation process in the beginning is time-consuming and little progress seems to happen. Creating new technologies and tech-based services (like AI-based routines and verification models) takes a long time in the beginning. Once the principle has been identified and learned by the participants, however, speed increases disproportionally and allows for overachieving the goals.
2. **Automation of inspection tasks comes with a modification of the roles of the inspector.** Whereas the Vienna building police (MA37) used to be a black-box for the planners and developers, it now starts to become a partner. A machine-based verification of BIM Models requires a new type of collaboration and coaching by the inspection unit who now has time to give upfront advise and to interact more frequently with the planner, since the technology took over the lengthy task of inspection.
3. **Direct replication of city-led innovation is more difficult than expected.** Especially when -like in BRISE-Vienna - technology and local regulation are woven together, there can be no direct "copy-and-paste" approach to scale the results to other cities and regions. However, process blueprints and a modular approach can result in a replication package that combines consulting and tech-adoption to help scale the innovation.
4. **The experts' dilemma represents a serious challenge for city-led tech innovation.** Although coordinated by the city of Vienna, most of the in-depth knowledge about AI, BIM Modelling and automation of checking routines stays with the academic or private project partners, pushing the city into a soft lock-in if the results of the project are to be rolled out on large scale. Coaching, training and the provision of detailed documentation can help to relativize this dilemma on city level.

Digital transition

See on UIA website