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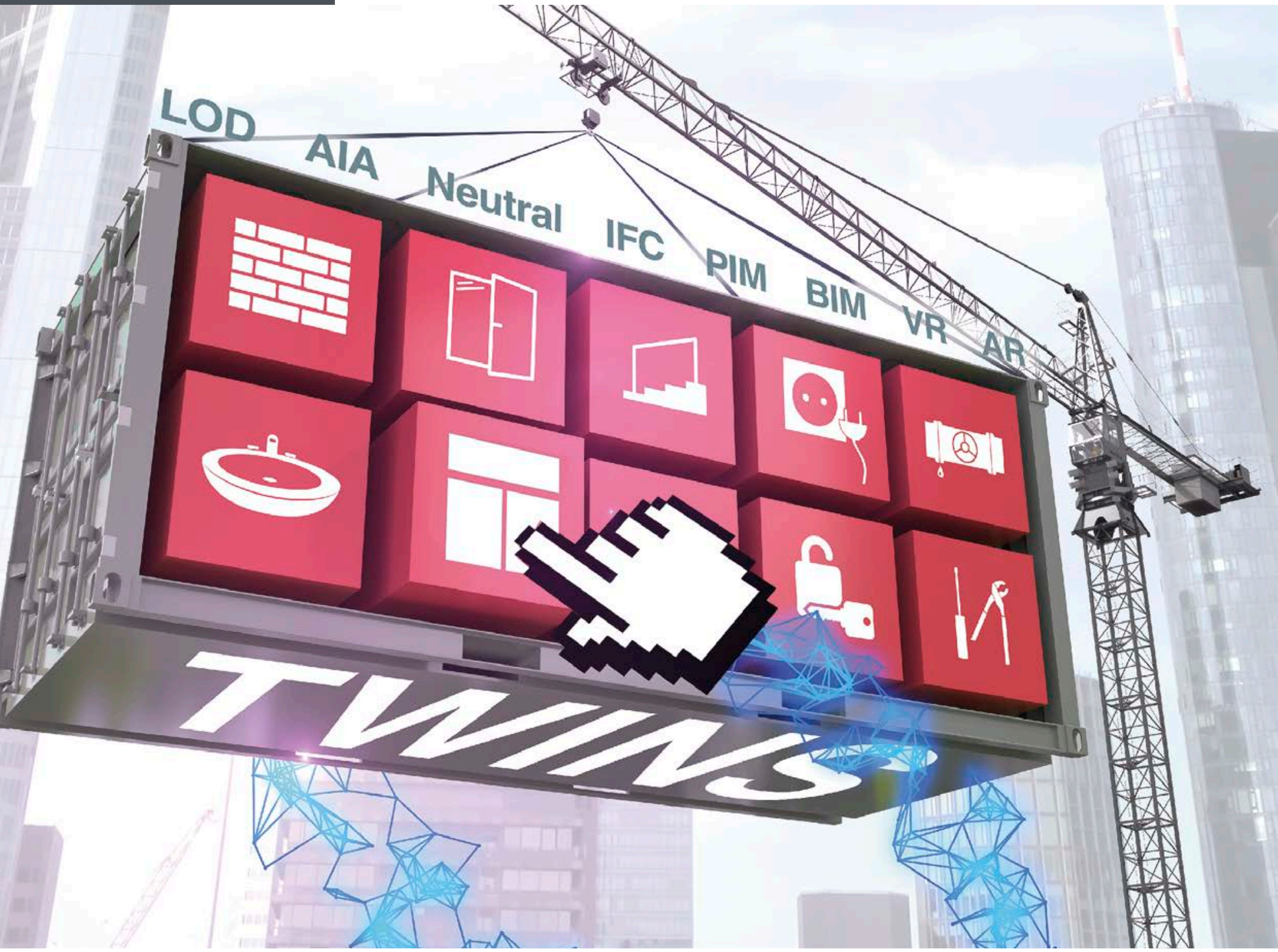
Bauprodukte digital



- Digital systems concept
- Digital revolution in the construction industry – increasing productivity with Plan.One
- Digital model vs digital twin

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products for bim

In line with the concept of cooperative BIM, Schüco pools all the information that is BIM-related

Digital systems concept

System-based construction products

Schüco has been supplying metal fabricators with aluminium systems for use in the fabrication of windows, doors, façades, sun shading and other products since the 1950s. In the 1980s, PVC-U window systems were added to the range, and then in the 90s came steel, through the company's partnership with Jansen. Schüco is continuing this tradition and providing reliable support for its partners in all phases of planning and construction, ensuring architects and developers are always involved at an early stage.

Today, digitalisation is indispensable when it comes to operating an efficient system-based business in the construction industry. For more than a decade, Schüco has been championing BIM, which has been popular for a few years now. New services have been developed in order to effectively support the ever-increasing throng of BIM users. As software and technological developments advance, these services are constantly being further developed and adapted.

But one thing remains true: a good building solution always starts with planning!

In order to foster good support of the planning steps right from the start, Schüco offers free, easy-to-use digital services on its website for architects, façade planners, technical building service engineers and electricians. Depending on the building project and the actual planning work that needs to be delivered, developers are faced with a very wide range of questions and issues. Under "My Workplace", digital data is provided which offers targeted support in tackling these challenges. In parallel to this, Schüco employees are of course on hand to provide help in the form of technical consultancy.

Fig. 2. *Find things quickly and easily, instead of spending a long time searching.*

The aim is also to initially create a digital twin of the future building before the real construction begins, which will be important not only during planning but also for the construction and operating phase. But one thing remains true: a good building solution always starts with planning!

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– i –

Better planning

Due to the current extensive use of BIM tools in planning, it has become customary to talk about the "BIM planning method". For the aim is also to initially create a digital twin of the future building before the real construction begins, which will be important not only during planning but also for the construction and operating phase.

– ii –

Services for BIM users

Planning and building can only succeed with reliable partners who must be able to communicate quickly and easily with one another. In line with the concept of cooperative BIM, Schüco pools all the BIM-related information, data and plug-ins under the key word "BIM". The aim is to be able to find and use things quickly rather than spending a long time searching.

Experience shows that there is not (or not yet) a "distinct" way of using BIM applications. When architects download planning data, they are often not aware that this means they are running a BIM project. But what is essential is that the benefits are gradually being realised.

Planning modules for Revit and Archicad applications as well as the SchüCal plug-in for exchanging data with the metal fabricators can all be downloaded from the website schueco.com/bim. The data platform also includes specialist articles, other links and tutorials. New information and services are constantly being added. (Fig. 2)

Things that are fast and easy will stand the test of time. This also includes the new opportunities offered by so-called planning portals. These portals pool all the information relevant to planning from all manufacturers and make it available to everyone involved in planning. Developers therefore no longer have to work their way through the websites of the different manufacturers to find the information.

– iii –

Achieve more through good networking

To be able to always support private customers, investors, architects, specialist developers and fabricators in the most effective way with digital workflows and the appropriate expertise, it is necessary to establish clear digital standards and practical tools and methods.

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Good networking with others involved in the planning, construction and operation of buildings is needed for this – independent of specific building projects, too. Schüco sits on committees for the standardisation of digital processes in all aspects of BIM. Schüco International KG and its subsidiaries are also ac-

Fig. 3. *Easy-to-use digital services. (Photos: Schüco International)*

tive members of the association Bauprodukte Digital (digital construction products) and buildingSMART. The interaction of internal and external activities for a BIM-compliant data landscape is a strong and reliable foundation for sound cooperation in the construction industry.

Martin Peukert, Team Leader - Architects Data,
Schüco Digital GmbH

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Digital revolution in the construction industry - increasing productivity with Plan.One

Thoughts on navigating the technical future of construction

The construction industry faces a dilemma: if its central processes are not comprehensively adapted to the digital revolution, and soon, there could be long-term consequences for market players. On the one hand, it threatens competitiveness, and on the other, future employees in the sector, the "digital natives", demand a fully digitalised working environment. The aim of digital initiatives is therefore to simplify processes and make available tools that are familiar and well-known. This requires everyone to be ready to take a strategic approach to the topic. New stimuli are also necessary to advance existing initiatives in a targeted manner and achieve notable results.

A survey of construction companies conducted by Roland Berger brings to light an astounding paradox. Although 93 % of the construction firms surveyed recognised that digitalisation will influence all of their processes, they unanimously admitted that they did not sufficiently exploit their potential for digitalisation.

Here, the construction industry in particular is challenged to consistently pursue digital revolution, yet a study by McKinsey subsequently placed it, in comparison with other industries, second to last in the digitalisation index. The reluctant attitude is leading to corresponding results. "Productivity in the building sector has been stagnating for decades, with the average investment project being 20 months behind schedule and 80 % over budget," the company wrote in an opinion piece "Navigating the digital future".

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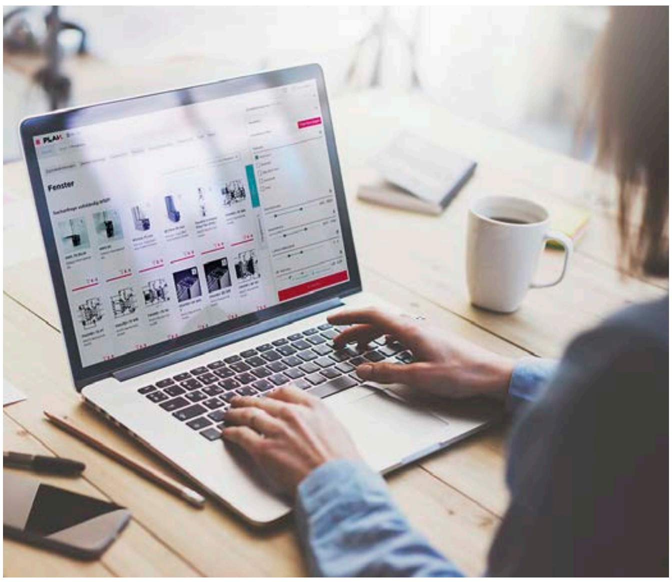

Fig. 1. Plan.One can be used both in the web browser and as a plugin for familiar BIM planning software.

– i –

Digital technologies create competitive advantages

The pressure is obvious, but has not led to appropriate strategies. One reason for this undoubtedly lies in the industry‘s persistently favourable order situation, a result of low interest rates and high investment. In a study carried out in partnership with Deutsche Telekom, TechConsult found that half the companies surveyed were satisfied to an above-average degree with turnover and new client wins. One might think of this as a good starting point from which to engage more strongly with digitalisation, but possibly also as a reason to, as it were, place such projects on the proverbial back burner.

In fact, in the construction industry the digital revolution is revealing a whole range of opportunities. The industry is, for example, working to make the specification and implementation of construction projects more efficient, to increase the central focus on the customer and to develop digital capabilities and business models. These are however seeing only slow progress, for reasons including information security and data protection. In some of these areas, this is due to navigating legal requirements, while others require decisions on company policy.

The fact is that whoever is early to adopt the use of new technologies will obtain a decisive competitive advantage, not only by means of increased productivity, but also improved capabilities. There is however also the fact that digitalisation requires employees who are ready and able to engage with it, and technical solutions that will enable them to do so.

– ii –

Digital processes make way for creativity

Architects design living and working spaces. They walk a tightrope between extreme demands on function and quality on the one hand, and the available means and provisions on the other. Not least for this reason, creativity plays a decisive role in the search for optimal planning, but less and less space for this is left by functional and administrative tasks, as well as intensive consulting with clients on new possibilities, for example in the area of smart homes.

In order to manage this complex array of tasks, it is essential to have standards to fall back on. This applies to both the products used and the available tools for planning and project management, which have changed considerably in the last decade and continue to do so. From drawing board, to CAD model, to BIM project, all the stages of development face the common challenge of simplifying processes.

– iii –

Digital natives demand modern tools and techniques

The requirements of the "digital native" do not just extend to using digital tools for their work. They require tools that allow them to find the familiar environment of their private lives in the everyday professional space as well. Without a doubt, this does not include leafing through product catalogues and receiving cost estimations by fax, yet these are still common practice in most architect offices.

What would professional tools that appeal to young architects and specifiers look like? To start with, they are all available online 24/7, that is, even after the official office closing time. Additionally, they provide immediate results, since users are used to, and therefore expect, platforms that respond in practically real-time, like E-commerce software for example.

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Searches to compare products of all kinds are now carried out on portals such as Check24, Verivox, Idealo or a variety of others. They look up the offers of hundreds of manufacturers or service providers, present them in overview, and in doing so transparently depict a large portion of the market. They also provide the necessary channels of communication to contact the provider in case of a decision to purchase, and might also simultaneously conduct the business transaction, including order confirmation, payment, etc.

Not so in the world of architects and specifiers who, in a survey by Plan.One, as a result spend an entire third of their time on product searches and selecting appropriate parts for their construction project. This results in not just enormous financial costs, but also constricts the time desperately needed for creative or planning tasks, as well as for consulting with clients on increasingly complex possibilities.

– iv –

BIM - the driving force for digitalisation in the construction industry

The current level of information and service provided by manufacturers of construction products is lagging far behind the development seen in other sectors. It simply does not meet the expectations of clients. The ability to compare products is frequently impaired by manufacturer-specific naming of product properties alone, but a lack of standardised classification also contributes to poor transparency.

There are now tools available which are suited to both make the market more transparent and to optimise planning and management processes. Here, BIM plays a central role, and enables entirely new working and business models for the construction industry. The potential of BIM has been recognised by all involved; only the implementation is still lacking. According to the TechConsult study, in 2017 BIM was used by only 15 % of the surveyed companies, although, for example, public sector clients expect the use of BIM in future tenders.

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The lack of implementation is also obvious in the lacking qualifications of architects and engineers, where a limited number of opportunities and constricted resources impede further development. Last year, this drove the Federal Chamber of German Architects and the Federal Chamber of German Engineers to work together to provide training in BIM to foster the digitalisation of value chains. This is initially concerned foremost with creating common standards.

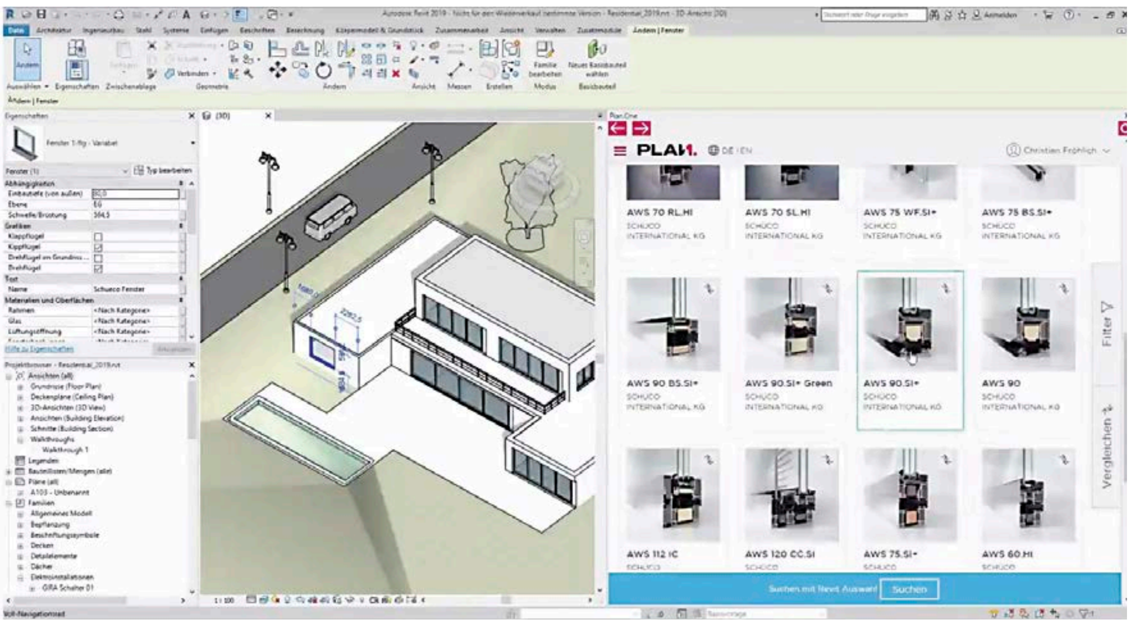

Fig. 2. Plan.One takes a decisive step forward in enabling relevant product data to be integrated into existing BIM planning software at the click of a mouse.

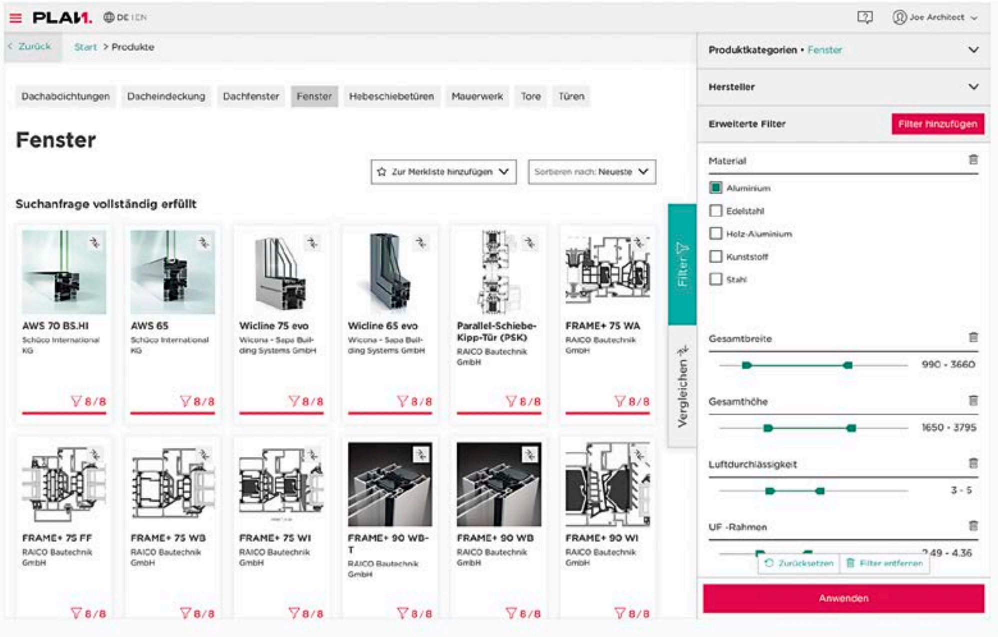

Fig. 3. *Plan.One - product search window. (Photo/image.: PLAN.ONE)*

— V —

Plan.One – the digital bridge between manufacturers and specifiers in the construction industry

Digital revolution in the construction industry is a goal that can only be accomplished by cooperation between different stakeholders. That is as true for manufacturers, suppliers, architects and specifiers as it is for property developers and the public sector. Stonewalling is not a long-term strategy to remain competitive. What is needed is an ecosystem that provides comparable, standardised data and allows the unification of complex processes without interruptions. This is the only foundation from which the desired goals can be achieved in regards to costs, quality, deadlines and, not least, creativity.

The search and comparison platform Plan.One was developed with the clear objective of increasing productivity in the construction industry using digital processes, and overcoming the many obstacles that stand in the way. It bridges the gap between the expectations of architects and specifiers on one hand and the capabilities of manufacturers on the other by using innovative technologies that digital natives now expect in their professional environment.

Plan.One enables searches for construction products to be carried out rapidly and intuitively across manufacturers, and presents them in an objective and comparable manner. This has advantages for all involved. Manufacturers can easily and cheaply provide up-to-date product information around the clock, while architects and specifiers can get a rapid overview of the available range of products for upcoming projects, compare them, and make an informed decision.

The platform does however go one important step further and enables relevant product data to be transferred into current BIM planning software, for which a BIM model is not absolutely necessary. Alternatively, the parameters can be written into generic objects. This reduces the obstacles to working with BIM planning tools of the still sparse availability of BIM objects, as well as the sometimes excessively large amounts of data.

Stonewalling is not a long-term strategy to remain competitive. What is needed is an ecosystem that provides comparable, standardised data and allows the unification of complex processes without interruptions.

Plan.One forms the basis to do away with time-wasting and error-prone offline product searches, and concentrate more on activities that provide a competitive advantage: developing creative ideas, ensuring high quality, meeting deadlines and adequately advising clients on their options and possibilities. In short, designing the entire construction process to be more efficient.

www.plan.one

Digital model vs digital twin

A critical examination of a critical term

The term "digital twin" often appears in connection with the BIM method. But what's it all about? Will it only be possible to create buildings from digital twins in future? And if so, what will the approaches be?

– i –

Prototype or copy?

Architectural models often accompany the design processes in construction, as a precursor to the real building. For architects, who need to work out the design, structure and proportions as well as the functional relationships within a planned building, the construction and use of models are of great significance. It is often much easier to communicate design aspects to clients, structural engineers and some contractors using a model instead of drawings. In addition to its very pragmatic purpose, the architectural model also has a non-material value for the people involved: it shows both a preliminary result of the ideas and wishes, as well as possible solutions which can then be implemented in the construction. It also allows you to get an image in your head of the actual building you are aiming to achieve. (Fig. 1)

Most architects plan in 3D from the outset and the spatial model is used to generate all of the drawing derivations. With increasingly sophisticated software and hardware, today we are in a position to model freely, make configurations with building components and mix both working methods too.

Planning steps that are aided by models can make it easier to arrive at decisions and achieve objectives. A wealth of information, effects, options and variables needs to be weighed up against each other, particularly in large building projects.

Hence models are usually not just a precursor to the real building, they also constitute intermediate steps for creating high-quality, sophisticated buildings. This doesn't just apply to competitions; the use of models is also expedient in the project itself. When combined with material samples or material collages that have been specially prepared for the building project, architectural models form a practical and unambiguous basis for discussion and coordination. The model and the real samples of materials and products create a fixed connection in the minds of everyone involved. This coordination process is often additionally supported by material locations in drawings. Depending on the discussion location and situation, a mixture of analogue and digital coordination aids of this kind is used in practice. There is no one standard formula for these communicative/creative processes. (Fig. 2)

Depending on the purpose for which a model is required and in which project phase it appears, there is a fine line between the architectural and building model. If the former is still very close to the architect's matters and concerns, then a building model fulfils a completely different purpose. The architecture takes more of a back seat here, with the focus being on the ideally real, actual appearance, spatial and functional relationships, individual components, and genuine-looking materials and colours. The difference between the two models lies in their configuration. The aim of the architectural model is to be more abstract and support the creative design process, while the building model, which is used by the estate agent, for example, should look as real as possible.

However, this line between the two model types is often blurred and different depending on the building work. For example, investor-driven projects such as hotels are likely to have building models which claim to be highly

Fig. 1. *Architectural model of a bank building*

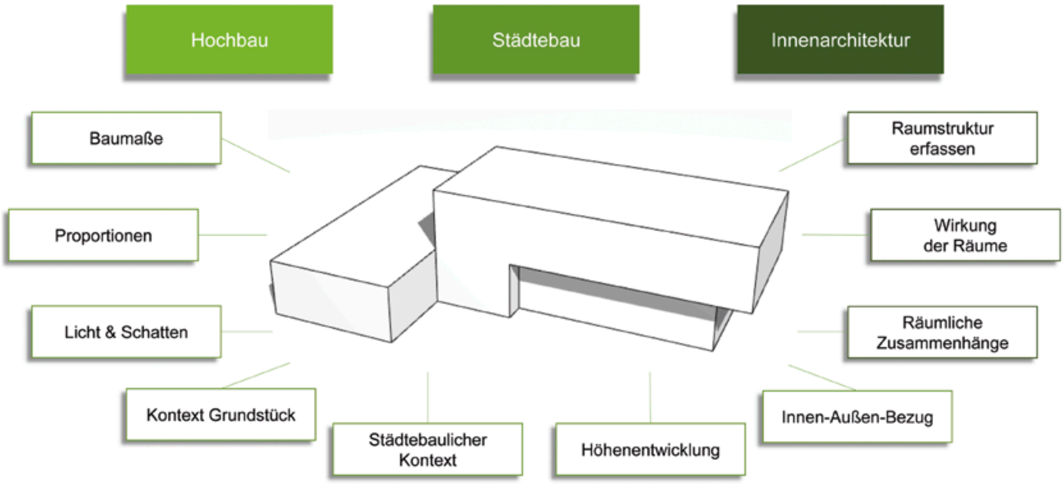

Fig. 2. Working out services in the model

realistic. For building projects that lend themselves to the art of the architect, such as museums or planning competitions in inner-city areas, architectural models have taken a fixed position in the planning process.

You could say that the architectural model is more of a prototype of the real building, while the building model is a copy of it.

Regardless of which task an architectural or building model is to fulfil, there is a benefit to its immediate presence. You don't need any fancy media in order to use it. You simply place the model on the table or take it in your hand. However, it cannot be infinitely copied or viewed simultaneously by lots of people in the cloud. The analogue model – that is both the architectural and building model – is therefore being used less and less in favour of better digital alternatives such as 3D printing.

Digital architectural models suddenly appear perfectly formed on the screen, even when they are not fully geometrically complete. Some clients therefore also assume that such a perfect-looking model means that everything has already been planned out. Driven by increasingly sophisticated computer applications, higher expectations – that is, to be better and faster – will increasingly be pushed onto developers.

– ii –

Digital models – complete design freedom?

The digital model has become a matter of course in 3D CAD programs. Most architects plan in 3D from the outset and the spatial model is used to generate all of the drawing derivations. With increasingly sophisticated software and hardware, today we are in a position to model freely, make configurations with building components and mix both working methods too.

Software templates for creating specific assemblies and components make design work effective for the user thanks to the copy and multiply function, leaving previous analogue planning steps to be forgotten.

However, we should not overlook the fact that it is still not possible – and/or doesn't need to be – to fully map the geometry of all components in a building structure during planning using free modelling and the fixed, defined configuration. The effort required to carry out everything in 3D is too much for many users and can also result in slow and sluggish files, depending on the software and working method used.

It is also impractical to display certain components in 3D, for example fixings, foils, adhesives and even insulating materials. In these cases, people prefer to define these components as pieces of information and create a building model that is factually complete despite being geometrically incomplete. Digital architectural models suddenly appear perfectly formed on the screen, even when they are not fully geometrically complete. Some clients therefore also assume that such a perfect-looking model means that everything has already been planned out. Driven by increasingly sophisticated computer applications, higher expectations – that is, to be better and faster – will increasingly be pushed onto developers. (Fig. 3)

The requirements from the BIM method mean that digital planning will increasingly become digital construction. Before the real construction is built, a virtual version needs to be made. This means that everyone involved in the project needs to move closer together. After all, precise, feasible models that not only look perfect but are also consolidated in terms of content still need to be created.

It is remarkable what can currently be achieved in a very short space of time using architect planning software such as Revit or Archicad in standardised building projects. However, as soon as there are complex deviations from rectangular shapes and additional requirements (with regard to engineering, physics, manufacturer information or specific product geometries), things get more complicated. Plug-ins are required, and specific components need to be modelled using other software and imported back. What is still missing here is planning programs which can map different specialist areas of activity and associated planning steps even better. Special disciplines such as façade works planning should also be supported by the architect programs in a more practical way. For complex shapes, developers still often use standard CAD software or engineering software, which enable parametric 3D mapping of even the most difficult components. However, their file size does not allow them to be used in digital building models.

When it comes to the precise, actual implementation of BIM projects, it makes sense to import data directly from the building product manufacturers into the models.

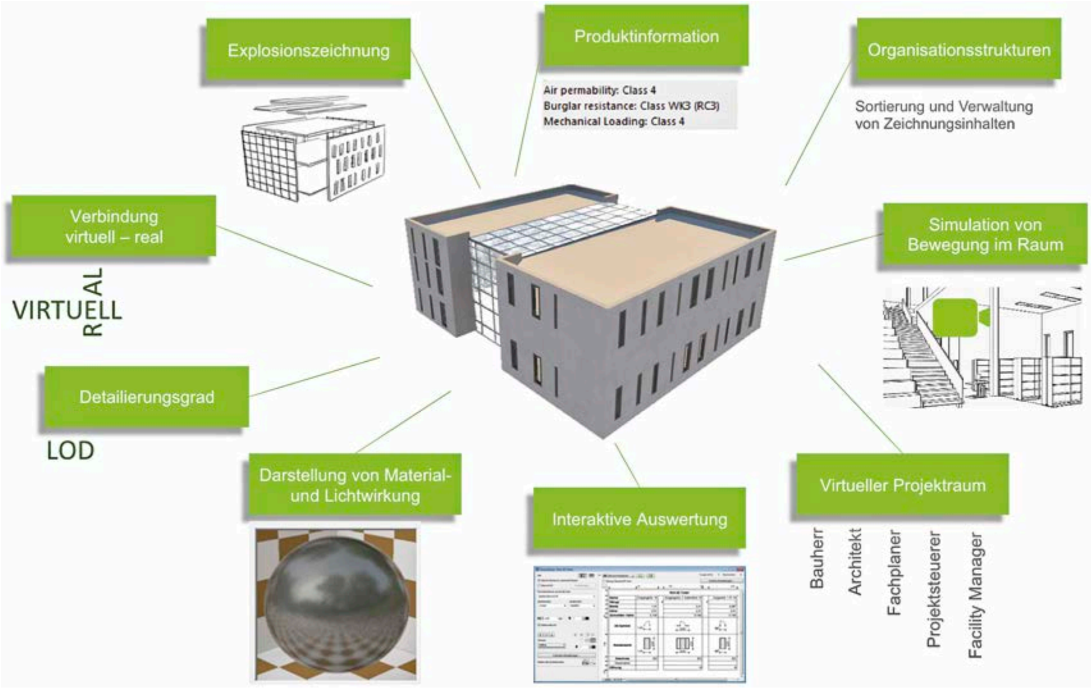

Fig. 3. *Digital added value in the model*

This creates a need for interfaces between the manufacturer's software and/or Product Information Management (PIM) systems and the architect's planning software. This also shifts the consultancy work for correct use of a component and product into the digital model.

Virtual reality (VR) and augmented reality (AR) are particular examples of networked work. These need to be further sounded out and integrated in the day-to-day work of planning teams. Not everything from the games or car production industry is so easy to adapt for planning and construction. Planning procedures in the creative process which actually need to be allocated to the area of the architecture model – i.e. prototype – should also be in focus, as well as detailed building models which need to be tested and optimised gradually during the planning process.

Not everything from the games or car production industry is so easy to adapt for planning and construction. Planning procedures in the creative process which actually need to be allocated to the area of the architecture model – i.e. prototype – should also be in focus, as well as detailed building models which need to be tested and optimised gradually during the planning process.

Interdisciplinary teamwork is a particular opportunity here. Networked communication and work which allow the individual specialist models to be coordinated with one another and perfectly connected at the right time is to be made much easier thanks to the Industry Foundation Classes (IFC) format supported by the Open BIM Collaboration Format (BCF). This enables model-based communication between multiple users and provides information about the status, location, line of sight, component, comment, user and time in the IFC data model. (Fig. 4)

Fig. 4. *AR demonstration: a user wearing the DAQRI Smart Helmet at BAU 2017*

– iii –

"Digital twin" for digital consistency?

Originally stemming from digitally supported fabrication processes and the described software and data-based process of product and systems to be fabricated, the term "digital twin" often crops up in conjunction with the BIM method. Understood in the industry as a software-based copy of processes, products or projects and systems, the principle of the digital twin could also work really well with the building lifecycle management system described in the BIM method. However, it must be pointed out that today's fabrication methods for buildings are not yet fully comparable with those of industrial series products. It is therefore also feasible that other suitable principles and process models could be established for construction too.

With BIM-oriented project management software, which maps building components and construction stages as well as services and also links the roles required for this, the basic idea of the digital twin can be realised. Namely, when the software offers the option to process building component information directly from a digital building model and assign services and roles to it. Individual software products are now becoming diverse interaction or transaction platforms which aim to provide all-round support for digitally-based processes and interactive working methods. The driving forces here are new building models and collaboration scenarios that have only become possible thanks to the digital world.

The term "digital twin" is also used for the digital model of the planned building – as an end product – and for the individual components installed in it. It is the virtual representative of the building as an interplay of multiple "intelligent" building components. In this kind of data structure, the building, its rooms and all components as well as associated information would need to be firmly linked to the real world, firstly in order to result in finished real products and secondly to make the completed building usable for its operation. Pilot projects that have been implemented or are still being implemented exist in the area of hospital construction, for example, with more or less claim to completeness. There are still many issues here in terms of content and technology and there is still a need for development. The image of the iceberg, which illustrates that there is still a lot hidden under the water line, springs to mind here.

When it comes to product data, the manufacturers and software businesses have to work incredibly hard. After all, how are we supposed to plan if not with the actual building product data? Nobody knows their product better than the manufacturers themselves. In order to create digitally consistent building models, it is therefore essential to provide developers with specific manufacturer product data. For the manufacturer, depending on the product segment and level of digitalisation, these are sometimes already present in fully structured data models, but often also in partially structured and unstructured systems. In order to enable full use of digital product data, an ever-growing number of portals for BIM-compatible product data has established itself over the past few years. However, a full data portfolio for all trades has not yet been achieved. On the one hand, this is due to standards that don't exist yet. On the other hand, it is down to the different options and how prepared the manufacturer is to push ahead with the creation of digital planning data in advance. Some data portals are already well established, while others are in lengthy beta stages or can only be accessed by closed user circles with known requirements. This appears to be due to the fact that the stakeholders in the various planning and construction segments have completely different requirements for their data landscape. Large or small user groups, manual or industrial building work, constant or ever-changing groups of partners – this variety poses huge challenges to software and data providers. Often, the business model of the data provider needs to be tested first and readjusted so that it works in practice. (Fig. 5)

– iv –

What are the options for implementation?

As ever, preparation for a building project always starts with the design. Teaching how to develop this and check its quality is usually still based on the principles of model construction. Architects hone their abilities and skills by using architectural models correctly. There is a similarity with artistic creation, such as sculpture. This solid grounding is still irreplaceable. However, the analogue model – well-founded, substantial, honest – will willingly become obsolete in favour of a digital model. 3D printing offers good support here.

Digital models as the basis for design can become data bases for the entire project. A cubic model that is initially rough can gradually be developed into a fully detailed building model with all components. To this end, there are very good tools offered by the various pieces of construction software. The model can run through different pieces of software. However, suitable interfaces for the exchange of geometries and information of a native and alternative kind have not always proven to be worthwhile and all too often mean that double the amount of work needs to be done, and models need to be recreated or reworked.

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Developers are therefore increasingly using the Industry Foundation Classes format (*.ifc, see also ISO 16739). In the professional world, this is already deemed worldwide to be the favoured choice for the exchange of geometries and different attributes between BIM-oriented digital professional models. With further additions to product classifications and parameters for actual building components, it can be considered to be "the" BIM exchange format.

Interdisciplinary planning with the use of other dimensions (4D-7D) is being used by many design teams with increasing success. The demand for a BIM method that is as uniform as possible is considered to be a factor for increased efficiency and future proofing.

In practical terms, not everything can be fully implemented at this stage, as standards are missing or the software interfaces do not fully function yet. It is increasingly a case of needing to generate complete data models using the information required for this. The digital model will form a solid data basis from which construction can begin. The range of digital tools is very comprehensive and is further enhanced by the world of software applications. (Fig. 6)

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The need to make construction digital and embrace the construct of the "digital twin" is rapidly leading to the assumption that the only "right" way of doing things is to ensure consistency at every possible point – from laying the foundations to tearing down the building. With "big data", it all works in theory. However, we still need to scrutinise in practice whether it is always expedient to do each and every planning task with a database connection. Depending on the building project and construction segment, the type and application of digital tools are not always the same. Each task requires a procedure

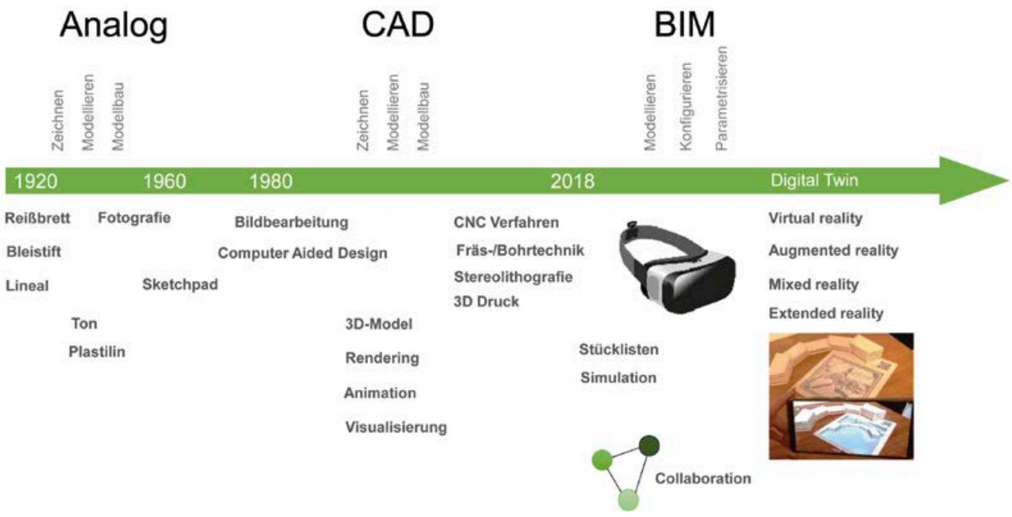

Fig. 5. *Evolution in model construction (illustrations/images: Schüco)*

that is suitable for its purpose and scope, as well as the appropriate tools for this. Mixtures and partial quantities of analogue, digital and collaborative working methods therefore still prevail.

The need to make construction digital and embrace the construct of the "digital twin" is rapidly leading to the assumption that the only "right" way of doing things is to ensure consistency at every possible point – from laying the foundations to tearing down the building.

Experience will show when each expense is justified, where the path will lead and whether a "digital twin" will really always be necessary.

Martin Peukert, Schüco Digital GmbH & Bauprodukte digital manufacturer initiative

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Fig. 6. *Illustration of the idea of a digital twin (images/illustrations: 1 Brockmeyer + Rüting architectural practice, Bad Lippspringe; 2–6 Schüco)*

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