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The Launch of Smarter Construction

The construction industry cannot keep up with the demand for housing. This is largely because construction sites are not efficient enough. New technologies and business models could succeed in cutting this Gordian knot.



There's no doubt that the shortage of housing in major cities will increase all the more over the next decades. The UN estimates that by 2050, seven billion of the world's ten billion people will be living in cities. New metropolitan centers of unprecedented size will arise. There are currently more than thirty megacities of more than ten million inhabitants. Living space is becoming ever more scarce. According to an analysis by the World Economic Forum, around 1.6 billion more homes will be needed in the next thirty years alone. Moreover, people in many urban centers are at a turning point. They no longer want urban planning to focus on cars, but instead want greener and more sustainable policies. At the same time, buildings are facing ever greater demands—they are supposed to be smarter, more energy-efficient, and offer universal access. All these considerations are directly linked to the following question: What should construction be like in the future?

Construction sites of the future will produce hardly any exhaust gases or noise pollution. They will be much safer and more orderly. Above all, they will be faster and more efficient. Electrified excavators controlled remotely by camera will be connected with construction machinery featuring sophisticated sensor systems that let them proactively notify manufacturers of any technical problems. Drones will fly overhead to register progress at the site. And driverless trucks will deliver entire prefabricated building modules just in time, which will be assembled in short order by robots. A large part of the work will be done in factory halls before the ground is broken. Skilled workers at the site will assume largely coordinating functions or work "hand in hand" with the robots. And virtual dashboards will always be available to let them monitor and guide construction progress in real time.

Lego construction principle

"Modern technology has taken modular construction to new heights. We can produce buildings in more individualized ways and on considerably higher levels than ever before. We can reduce complexity by a factor of ten, and overcome some of the traditional divisions

of labor among the trades and replace them with strong value-adding partnerships," says Brühl. In the USA and Canada, the Sto Group and its network of partners have been making modular interior walls and façade components since 2013, which are furnished with insulating materials, plaster, paint, brickwork, natural stone, or stucco elements and then delivered for assembly. What does this mean for total construction times? "It shortens the construction time for something like a hotel project from one and half years to six months," says Brühl.

Inspired by the shipbuilding and automotive industries

According to Mikael Hedberg, CEO of the Finnish Admares start-up, construction sites should essentially become assembly sites as soon as their foundations and basements are completed. "We're moving construction sites into factories, because automated production of modularized building complexes is the only way to significantly improve the quality and reduce the costs in the real estate sector," he says. He expects this approach to cost up to 30 percent less than conventional construction methods. It would shift 80 to 95 percent of the value-adding processes from construction sites to industrial production facilities, and bring enormous changes to the traditional building sector.

Working with Porsche Consulting

Admares: Digitalizing the Construction Industry

Can a modular approach help to produce buildings faster, more economically, and with higher quality? The founder of the Admares company is convinced it can. Mikael Hedberg wants to manufacture buildings in the same way that cars are currently produced in factories. In 2021, the first pilot project will be launched in the New York borough of Brooklyn. A three-story commercial building with a rooftop terrace will be made on the basis of fully digitalized planning. Admares's modular approach will enable production of 95 percent of the building's sixteen modules at the factory. Connecting the modules at the site is expected to take only forty-eight hours. Experts from Porsche Consulting are supporting the young company (founded in 2016) in designing the product, processes, and organization, and in planning its smart factory.

Hedberg sees numerous advantages to that. "There will be less noise, traffic, and dirt for nearby residents," he notes. "And we'll reduce construction waste by 60 to 70 percent." There are positive effects for construction workers and tradespeople as well. Employees without specialized knowledge can be trained quickly. And they can work in factory halls that are protected from wind and weather, and where large numbers of components are made under industrial conditions in accordance with a logical system developed by architects and engineers. By 2022 at the latest, Hedberg wants to start up the world's first factory that will produce entire ready-to-use hotels, residential buildings, and hospitals. All sections of the buildings will be produced in the factory, along with key products such as fixed furniture, windows, doors, and bathroom modules. All pre-fabricated sections will then be joined on the main assembly line before being transported to the construction site. At the site itself only the final minor steps will be carried out, such as connecting the building's room modules and core elements. That comprises only 2 to 10 percent at most of the entire construction process.

Modern shipbuilding processes gave Hedberg his inspiration. Cabins are prefabricated and lifted onto luxury liners by cranes, deck by deck, until all the sections are then joined into a whole. Another example is the automotive industry. "When customers order a Porsche sports car, they can choose one of a large number of possible configurations," he says. "You won't get identical 911s rolling from the production line. Our customers should also be able to use a configuration system to design their buildings individually, and see the price and timetable for any given variant."

BIM: Top-value twin

Digitalization is revolutionizing planning processes in the construction sector for both the trades and industry. "There will be fundamental changes to our planning and design work in the future, and we'll benefit from other sectors' digital technologies in the process," says Brühl. As the Sto Group's vice president of digital building solutions, this expert is dealing directly with the transformation himself. As he notes, "Most construction sites still base their planning on 2D-supported documents." A more modern

approach is to have a “digital twin” of each building project, generated by a process known as BIM (building information modeling). The core of BIM is a three-dimensional digital model that contains all the construction details and documents all the processes throughout the building’s life cycle, including everything from progress at the construction site to subsequent modernization. With interfaces to all the skilled trades and stakeholders involved, work can take a more concerted form. BIM platforms will also soon be offering docking options for construction machinery and their data. Systems of these types open up enormous opportunities. As just one example, German companies could guide construction sites in China without being physically present.

At a glance

Building Information Modeling—The Digital Twin

Pipe systems, doors, electrical sockets, cables, energy efficiency, thermal insulation, elevator speed—BIM (building information modeling) platforms register every detail of a construction project and use the data for simulations. Ideally, they involve all participants in the project, including specialized trade businesses, suppliers, and regulatory authorities. The modeling process offers site owners and clients a virtual inspection experience. With the help of VR headsets, they can explore all the rooms as if they were actually present. They can view structures from all sides and zoom in to examine details. This gives them a better sense of the planning. BIM is already common in Scandinavia, the UK, and the USA. As of 2020, this method is now required for new public infrastructure projects in Germany.

Excavators without excessive noise

Data, Facts and Figures

The Construction Boom in Numbers

- The global volume of construction work is estimated at \$9 trillion and is expected to reach \$15 trillion by 2025.
- The highest volumes are seen in China, India, and the USA.
- Construction activity increased by 15 percent in the EU from 2014 to 2019.
- Germany is the largest European construction market, with a nominal volume of €430 billion in 2019.
- The world’s 100 largest construction companies had a combined overall revenue in 2019 of more than \$1.463 trillion.
- Chinese corporations account for 44 percent of revenue in the top 100, and six Chinese companies are in the top ten.

All construction experts agree that in order to increase productivity, construction machines need higher levels of automation and the ability to communicate with each other. That will make these expensive machines more efficient, and allow them to be used around the clock. “Numerous assistance systems are supporting drivers today, which means the machines are already partially automated,” says Kaub. “These digital assistants make it possible for less experienced workers to operate the machines too.” That could be one answer to the shortage of skilled construction workers. Many parts of the world now use driverless dump trucks to make rounds and transport raw materials on set routes, for example at mines in Australia and South America.

Tested key technologies

Data as a new business field

At a glance

The Construction Sector and Covid-19

The repercussions of the Covid-19 crisis for the construction industry are not yet clear. The industry's cycle is such that the impact will come relatively late, so the full effects will only be felt over the coming years. In the middle of 2020, many companies are still living off order books that were already full. Furthermore, the construction industry was not shut down as completely as other sectors. Only regional sites were closed, on account of disruptions in supply chains or shortages in personnel due to quarantine regulations, border closures, and canceled flights. However, more than half of the construction companies in Germany anticipate long-term risks to their contracts for commercial real estate. They also expect a large share of government-funded projects to be postponed. The global market for construction machinery and vehicles will slow down and rental models will become more popular. Yet at the same time, the Covid-19 pandemic could promote greater use of new industrial and digital technologies such as modular construction and building information modeling.

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