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DIGITAL ARCHITECTURE

Whether it is a new building or a retrofit, digitalization is making the lives of architects, builders and contractors easier and more efficient. In this issue, we ask architects the benefits of digitalization for architecture and the challenges faced by them.

"Digitalization can help practices overcome setbacks due to the resulting disruption in coordination, communication, and collaboration."

SEAB: How is digitalization used in architecture?

GAUTAM: Digitalization is a means to ensure effective design development and execution by leveraging digital technology. It streamlines processes and optimises workflows, saving costs and time. Digitalization offers an array of possibilities for revolutionising coordination, collaboration, and communication of design. For instance, immersive technology and VR can liberate the design process from limitations such as geographical constraints, tedious design discussions that result in confusion and mismatch of expectations, delayed design modifications, and static 2D communication tools such as 2D drawings and static renders. The applications of digitalization are not limited to designers. By bringing together all stakeholders in the industry, digitalization can revolutionise design education and design execution as well.

SEAB: What are the main benefits of digitalization in architecture?

GAUTAM: The architecture, engineering, and construction (AEC) industry is choked with tedious and fragmented workflows, a phenomenon currently exacerbated by the pandemic. Digitalization can help practices overcome setbacks due to the resulting disruption in coordination, communication, and collaboration. It can bridge the gaps between various stakeholders by offering real-time design modifications and virtual collaborations. With geographical location no longer a barrier to work and progress, the tools of digitalization ensure both time and cost-efficiency. The application of digital technology extends beyond the realm of the architecture and design domains, to design education and offers a roadmap for an enhanced understanding and skill development amongst students and budding professionals.

Gautam Tewari, Co-creator, Trezi

Photo: © Trezi

Trezi uses immersive technology and VR that allows its users to make real-time decisions and design modifications irrespective of geographical locations, making collaborations in design fruitful and effective. Photo: © Trezi

SEAB: What are the new trends or digital tools for architecture?
GAUTAM: With the advancement of technology, we now have digital solutions for every step of the design process. Softwares aid us from the conception of design to its execution. Additionally, with the involvement of a number of stakeholders with diverse software preferences, the design process becomes chaotic and unorganized. However, the need for a unified platform that allows for seamless collaboration is simultaneously being addressed through platforms such as BIM and immersive technologies such as VR.

SEAB: What are the problems faced by architects when they use digital processes?
GAUTAM: Architects and designers often suffer at the hand of software with limited capabilities. Most software offers 2D outputs for communication in the form of static renders or drawings, making information highly inaccessible to clients. The current tools do not offer scope for real-time modifications, making design exploration and stakeholder meetings highly tedious. Since the design process and communications occur on multiple platforms, the two activities leave large gaps for misinterpretation and miscommunication. As a result, architects and designers shy away from the complete utilization of technological solutions and rely on sketching and verbal communications, making physical meetings a necessity.

SEAB: Have you deployed any digital technologies for your projects?
GAUTAM: I have been practicing architecture for over 20 years. My design experience in firms has usually been dominated by the shortcomings of the technological tools we were utilising. This is what steered me towards bridging this gap and creating Trezi. With the help of immersive technology and VR, Trezi allows its users to make real-time decisions and design modifications irrespective of geographical locations, making collaborations in design fruitful and effective.

"Computational tools and modern software, while still relatively untapped, have opened up new horizons for architects and designers."

SEAB: How is digitalization used in architecture?
SACHIN : Design and construction involve several stakeholders and how they communicate and coordinate has been fundamentally altered with widespread digitalization. Next-generation software has created new workflows, replacing sequential processes with a hands-on, collaborative approach from the start, shifting most of the efforts to the pre-planning phase.

These tools offer a clear framework for developing structure, services, and form, streamlining the designing and planning process. At the same time, they contrast with traditional practices where a rough outline to finer details could be arrived at with the possibility of subsequent changes.

SEAB: What are the main benefits of digitalization in architecture?
SACHIN: Computational tools and modern software, while still relatively untapped, have opened up new horizons for architects and designers. Digitalization has widened our understanding of space, allowing us to reinterpret old methods and learn new ones to plan and design better. It has also provided fresh impetus to architects to analyze a building's environmental impact, carbon footprint, and energy consumption and overall efficiency and look at sustainability through a critical lens. Besides, these tools provide the opportunity to re-evaluate design for economic viability by running parallel cost analyses.

SEAB: What are the new trends or digital tools for architecture?
SACHIN: With the exponential growth of technology in recent times, computer-aided design (CAD) has revolutionized workflows in the design and construction industry. Similarly, Building Information Modeling (BIM) has emerged as a reliable software for collaborative work. With the advent of parametricism, previously inconceivable designs are now fast becoming a reality, resulting in highly efficient solutions that minimize resource consumption while providing maximum occupant comfort.

The building industry accounts for a significant chunk of global carbon emissions. Digitalization offers a roadmap to script a new chapter focused on sustainable and responsible design practices.


Sachin Rastogi, Founding Director and Principal, ZED Lab

Photo: © ZED Lab

SEAB: What are the problems faced by architects when they use digital processes?
SACHIN: Digitalization is a double-edged sword; it needs to be utilised prudently for designing the buildings of the future. A rather unwanted byproduct of digitalization has been that it undermines the idea of 'Form Follows Function,' in favour of a 'Function Follows Form' approach to design. This approach is driving practitioners to incorporate

unnecessary ornament for solely aesthetic purposes, limiting its true potential to merely the building façade or outer skin. Also, design execution processes have yet to catch up with the digitization-enabled freedom that architects and designers are capitalising on. Moreover, the economic costs associated with the assembly and construction of digitally conceived buildings currently pose stiff challenges for the architecture, engineering and construction (AEC) industry.

SEAB: Have you deployed any digital technologies for your projects?
SACHIN: The boys' hostel building designed by ZED Lab for the St. Andrews Institute of Technology and Management is a structure that draws its primary inspiration from the form and use of the basic building block – the brick.

By reinterpreting Indian vernacular architecture and applying ideas and techniques relevant to current times, the design of the hostel block creates a sense of community and reflects the contemporary university buildings in a new light.

The use of software technology is pertinent to the design of the brick *jaali* that circumscribes the building providing thermal insulation and ingress of diffused natural light. The *jaali* is arrived at as a result of combining traditional building wisdom with new software such as the application of Ecotech, Grasshopper, Ladybird and Rhino.

To optimize the design for best results, we ran parametric simulations on each brick to derive a composition that comprises arrangements of bricks rotated and then placed at regular intervals. The jaali façade has 1" thick steel bars fixed on R.C.C. beams using Hilti chemicals. A single steel bar pierces through the customized bricks manufactured with holes to hold the arrangement. No cement mortar was used to construct the envelope that spans 250 feet in length and 21 feet in height.

The boys' hostel building designed by ZED Lab for the St. Andrews Institute of Technology and Management in Gurugram, India. Photo: © Andre J Fanthome | Studio Noughts and Crosses

"We embrace digitalization to further improve the quality of our services to our clients."

SEAB: How is digitalization used in architecture?
FREDERICO: When discussing the usage of digitalization in architecture, it is common to focus on the design (from inception to completion, e.g. both the design and design documentation stages). However, the digital transformation we are experiencing expands across all industry sectors and human activities; it is a global phenomenon that is rapidly changing the way we live and work.

Therefore, we should consider 3 classes of usage:
• "architecture-exclusive usages" – Related to the implementation of digital technologies in architecture practices and processes;
• "imported-usages" – related to user daily use of digital technologies that made their way into architecture, and;
• "AEC related usages" – referring to usage arising from activities shared across the AEC (Architecture, Engineering, and Construction) sector.

The 1st category includes activities such as the automation of architecture design documentation activities, the usage of computational design to inform the architecture design, the immersive or mixed-reality experiences, the usage of BIM processes to develop the architecture project, the usage of computational simulation to optimize

Photo: © Aedas

architecture solutions, etc.

For the 2nd category, we can include activities such as the use of messaging software over mobile devices (such as WhatsApp or MSTeams, etc.), the usage of voice recognition to compose messages and text, the simultaneous editing of documents by multiple users, the application of videoconferencing, the rise of social media and digital networking, the usage of digital agendas (often stored in the cloud), the usage of cloud-based services and virtual desktops.

As for the 3rd class, examples such as 3D printing for parts and buildings, design for fabrication and digital fabrication, the usage of robotics scanners to verify on-site construction progress, the adaptation of multidisciplinary "live" collaborative BIM, the usage of could point surveys, etc.

The West Kowloon Terminus, designed by Aedas using digital technologies. Photo: © Aedas

SEAB: What are the main benefits of digitalization in architecture?

FREDERICO: Digitalization aims at using digital technologies to improve the way we work. In architecture, some of the oft-identified main benefits are:

- Optimize project efficiency;
- Optimize internal business efficiency;
- Create new and better experiences through virtual and mixed reality;
- Improves collaboration.

I like to believe that as architects, we embrace digitalization to further improve the quality of our services to our clients, increase our business efficiency, and to reduce avoidable risks - all to create a built framework for a better society. Through the creation of "built ecosystems" that are rooted in circularity, we could integrate "green/blue / grey-structures", enhance "urban biodiversity", and ensure the wellbeing of our population – this extends to animals.

SEAB: What are the new trends or digital tools for architecture?

FREDERICO: Machine Learning (ML) and Artificial Intelligence (AI) are one of the leading tools in architecture that are getting more and more popular. In recent years, we have seen an exponential increment of new AI / ML tools and users' engagement with these solutions, which has given rise to the concept of "human-machine co-authorship" in the AEC sector.

In terms of new trends:

- In the construction side of the spectrum, the latest trends in digital technologies, such as offsite fabrication, DfMA (Design for Manufacturing and Assembly), construction robots, and 3D printing have the potential to radically transform the industry, evolving it from "construction" to "assembly".
- The idea of the "digital delivery process", which in Singapore is referred to as "integrated digital delivery"; it aims at integrating and digitalizing the built environment value chain.

SEAB: What are the problems faced by architects when they use digital processes?

FREDERICO: One can argue that many of the problems faced by architects when dealing with digital processes occur before they start using them; at the implementation process, the lack of skills and knowledge are often the major challenges.

At the organization level, according to a 2018 survey among architects in the UK, the major challenges for architectural practices/organizations that want to transform to digital businesses are:

- Cost;
- Lack of senior management commitment/sponsorship;
- Unwillingness to radically rethink the way we operate;
- Slow decision making or excessively cautious.

SEAB: Have you deployed any digital technologies for your projects?

FREDERICO: Aedas is an early adapter of Digital Technologies, and our efforts are recognised e.g. the Autodesk Hong Kong BIM Award 2010 for the West Kowloon Terminus, the 2013 1st Runner Up in the Singapore BCA 48 hours BIM international competition (1st Singaporean company), or the 2016 GRAPHISOFT's "Algorithmic Design Meets BIM" competition.

Part of our 3 years Digital Delivery Road Map is to keep pushing the boundaries of digitalization, computational design and VDC+O. Aedas Singapore is working in close collaboration with the world-leading software developers to create a state of the art CDE (common data environment, with BIM as the single source of truth) - which has been described as "unique" among design consultancies for its original approach, innovative proposals, and high level of complexity.