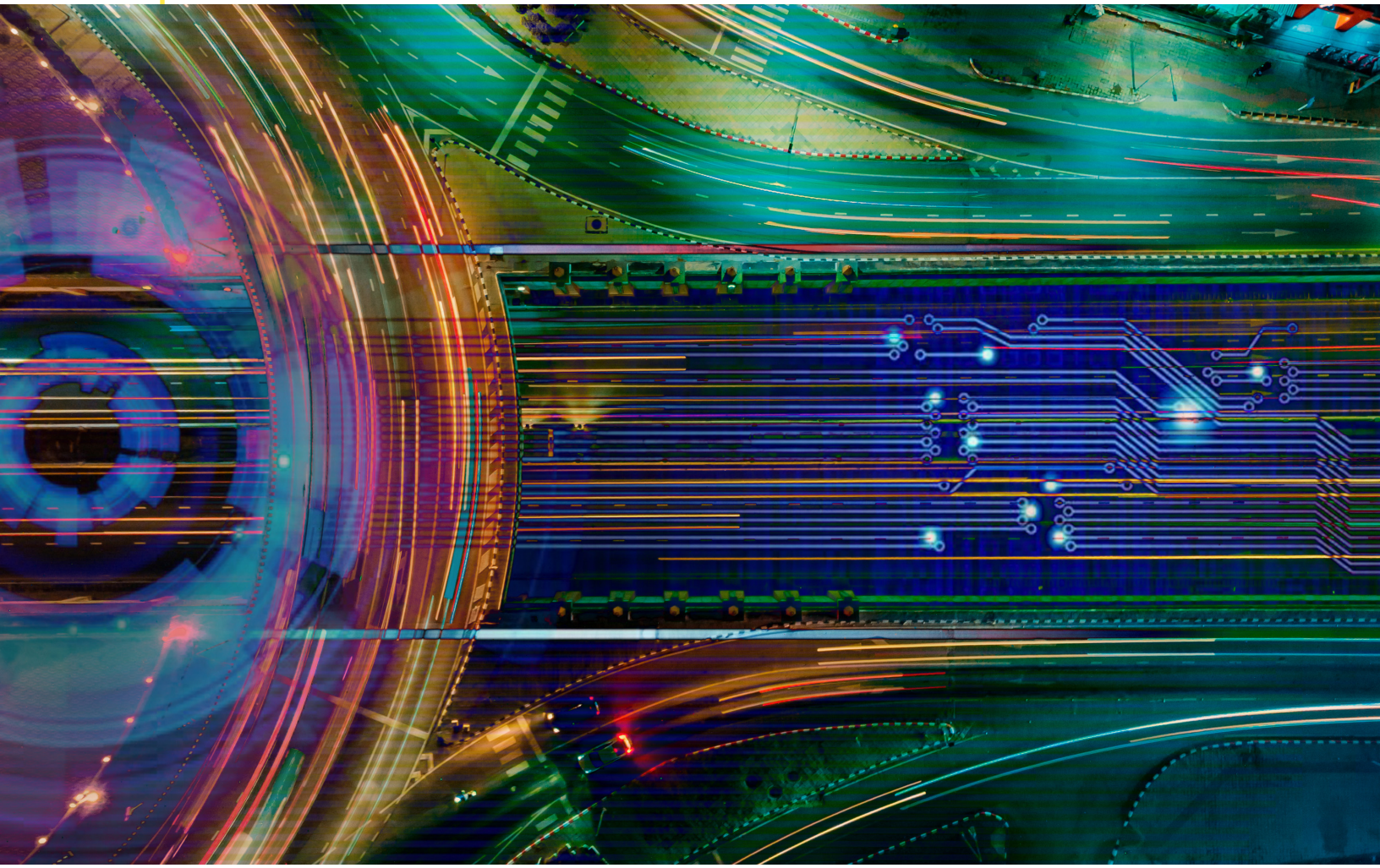
10 STRATEGIC TECHNOLOGY TRENDS

FOR THE INFRASTRUCTURE INDUSTRY IN 2022



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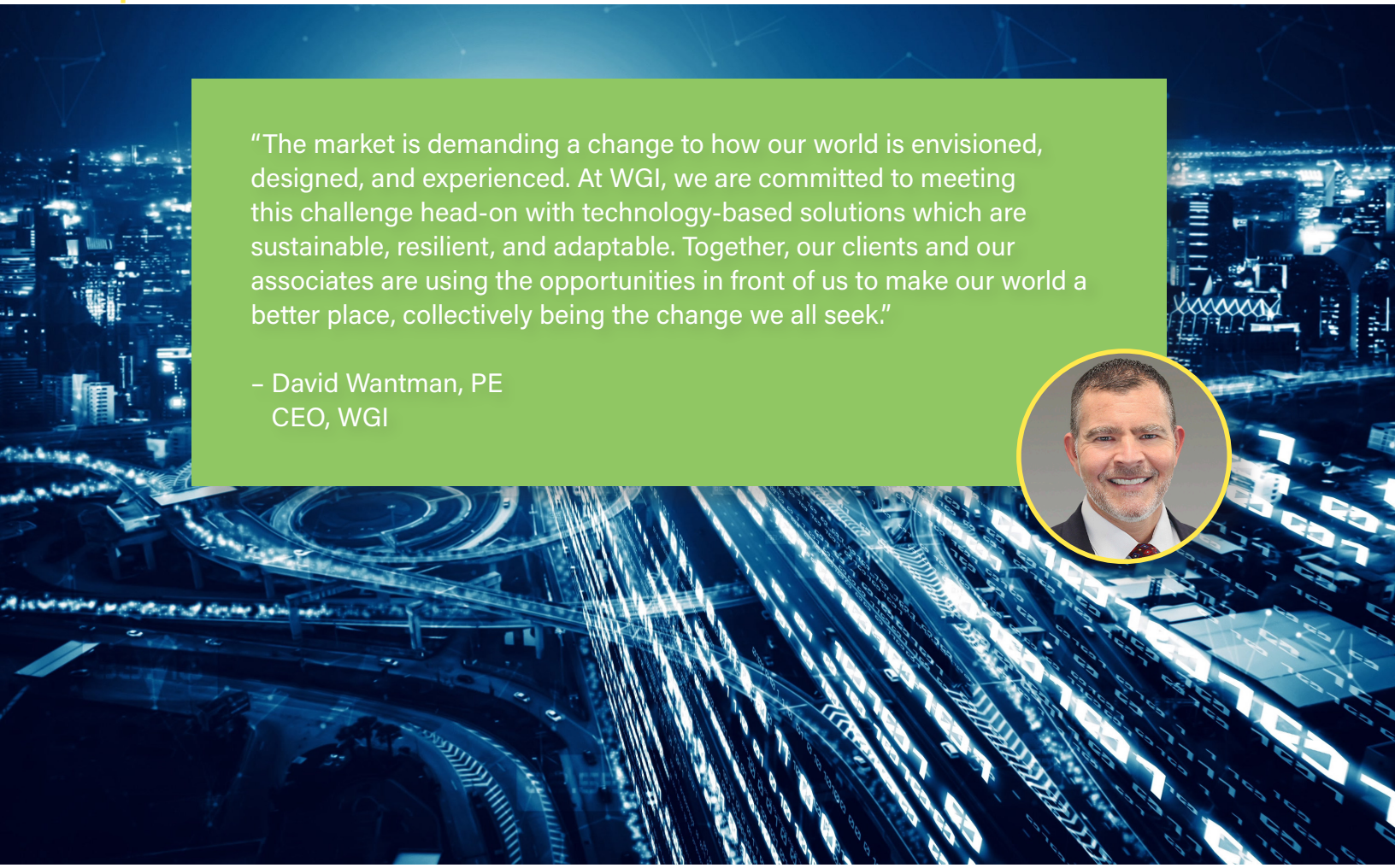
Compared to early adopters on the road to digital transformation such as the high-tech and finance industries, the infrastructure industry — meaning the "built environment" of human-made places and spaces in which we live, work, and play — has been one of the later adopters.

While the built environment is one of the least digitized, it also represents the largest market opportunity for Silicon Valley as well as industry players such as Architecture, Engineering, and Construction (AEC) firms and management consultancies with a **$21T annual market** worldwide and an annual spend of $1.4T in the U.S., representing 4% of US GDP.

Many of the strategic technologies that we know well from deployments in high-tech, finance, and other industries, such as AI/ML and data analytics, are now permeating the infrastructure industry as well as other unique technology enablers specific to architecture, engineering, and construction.



"The market is demanding a change to how our world is envisioned, designed, and experienced. At WGI, we are committed to meeting this challenge head-on with technology-based solutions which are sustainable, resilient, and adaptable. Together, our clients and our associates are using the opportunities in front of us to make our world a better place, collectively being the change we all seek."

– David Wantman, PE
CEO, WGI

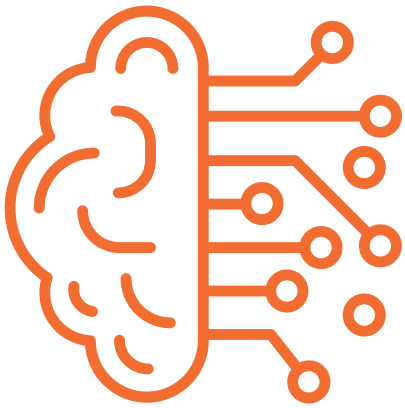
There's a conversation and a convergence occurring with Silicon Valley and startups becoming more educated about the industry, and AEC firms becoming more digitally savvy. AEC firms are doing this to take the grit out of the system across their internal processes and innovate how they deliver services to clients. VCs, such as **Shadow Ventures**, are funding infrastructure-specific startups in construction and real estate tech that are tackling complex problems in the industry.

As this conversation and digitization continues, below are 10 strategic technology trends that we believe will be transformative for the infrastructure and AEC industry in 2022.

10 STRATEGIC TECHNOLOGY TRENDS FOR THE INFRASTRUCTURE INDUSTRY IN 2022

- AI/ML
- Data Analytics
- Hyperautomation
- AR/VR
- LiDAR
- Platform Business Models
- Digital Twins
- Autonomous Vehicles and Robotics
- 3D Printing
- Blockchain

1 ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (AI/ML)



As with most other industries, AI/ML is one of the most transformational technologies for the infrastructure industry, featuring at the top of many organizations' **emerging technology heat maps**. In 2022, use cases will continue to expand into transportation, urban planning, and Building Information Modeling (BIM), as well as across a wide range of corporate functions from sales and marketing, to finance and HR. In the BIM space, **ClearEdge3D**, for example, utilizes AI to help automate tedious scan-to-BIM workflows such as as-built pipes and other structural elements. For internal corporate processes, AI/ML will be applied to use cases as diverse as win-loss analysis, work order tracking, contract workflows, and MarTech.

"Using the Software as a Service (SaaS) model, Artificial Intelligence as a Service (AIaaS) is now accessible to companies with a modest budget and little-to-no experience with AI technology. Artificial Intelligence (AI) coupled with related technologies Natural Language Processing (NLP) and Machine Learning (ML), will change the AEC proposal process. It will encompass use cases across business development, proposal selection and go/no-go; submittal preparation and staffing; quality control; submittal after-action; and ongoing competitive analysis. However, AI will not fully automate the proposal process. AI should do the tedious, time-consuming work: selecting the proposal, identifying relevant materials, recommending the best team, and reviewing the submittal for accuracy and content. This will allow proposal teams more time to craft creative and compelling content. In 2022, AEC firms should explore the advantages of using AI for business development and CRM before tackling larger, more sensitive datasets."

– Blake Wallace
Data Engineer
WGI Tampa

WGI UNLEASHED PODCAST EPISODE 52
Click here to listen to the full interview

2 DATA ANALYTICS

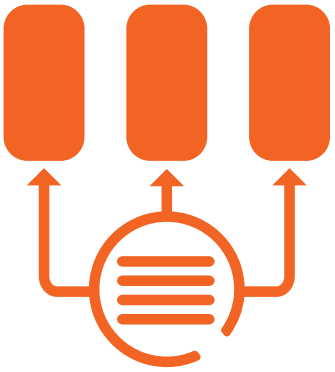
With **95.5% of data going unused** in engineering and construction, there is immense opportunity for service providers to use data analytics to deliver and monetize insights. In 2022, in addition to solving pressing issues such as **transportation planning and traffic operations,** we can expect data analytics to play a crucial role in helping organizations and agencies understand and plan for the effects of climate change and other natural disasters. They can use these analytics to determine insights in support of their sustainability, resilience, and adaptability strategies — particularly in most affected coastal areas. Specialty vendors will play a vital role due to their understanding of stormwater modeling and prediction using highly specific and time-proven algorithms.

"For 2022 and beyond, the trends toward real-time analytical tools for water systems operations and asset management, applying satellite data, AI, and data modeling, will evolve in the form of smart water technologies, per EPA, AWWA, and multiple water-industry publications. In the wake of climate change impacts, the criticality of the sustainability and resiliency of water infrastructure will push the capabilities of software, hardware, and cloud computing to provide immediate information on system performance and cybersecurity monitoring, as well as dynamic data analysis for proactive decision making based upon risk modeling.

Prioritizing investments in infrastructure remediation, based upon machine learned and resultant predictive analytics of water system conditions, will be required for utilities to justify expenditures to their stakeholders and comply with funding resources, while ensuring water systems reliability. As an engineering consultant, WGI intends to leverage our presence in the market by prioritizing our capabilities in smart water technologies, gaining expertise with operations and asset management software applications, decision processes, and data visualization tools, as well as offering digital water solutions facilitation, from selection to implementation, to clients."

– Leigh Thomas, PE
Director, Public Infrastructure - Water
WGI Austin

3 HYPERAUTOMATION



According to Gartner, organizations utilizing hyperautomation across core internal and client-delivery processes will see up to 30% enterprise-wide operational cost savings by 2025. For AEC firms, this will provide a powerful means to improve efficiencies and reduce costs across their often manually intensive workflows. In 2022, we'll see leading AEC firms use both specialty automation tools as well as the built-in automation features of their core tools, such as **Autodesk** and **Bentley** design suites, as well as CRM and ERP tools to advance their hyperautomation strategies. By taking a holistic approach across all tools and processes, these organizations will go far beyond quick wins and point solutions and start to enable enterprise-wide returns on their automation investments.

Hyperautomation In Construction Will Go Through Different Phases

"I think the utilization of hyperautomation in construction might go through different phases: a corporate phase where tasks might be more general that can fit any company and not just construction (such as billing, invoice creation, and processing); a discovery phase where there is a utilization within the construction environment from both projects and companies' perspectives; and finally, the integration phase.

Today, I do not see many of the construction companies yet have the level of technical maturity to deal with and even understand hyperautomation. In 2022, therefore, we will enter a discovery phase across many new technological trends, including hyperautomation. This phase will lead the industry to enter into an educational stage, which I believe already started a couple of years ago and was expedited during the pandemic. Now, in areas such as hyperautomation, my feeling is that construction companies will depend more on solutions that will come from the startup community to bring innovative solutions to their corporate and project operations and needs, and in 2023 and 2024 this will start to boom!"

– Prof. Ibrahim S. Odeh
Global Leaders in Construction Management (GLCM),
University of Columbia

4 AUGMENTED AND VIRTUAL REALITY (AR/VR)

Beyond its initial traction within the consumer space and in regards to inspection, maintenance, and repair functions, AR/VR is now evolving towards engineering-grade accuracy and GPS-level positioning and placement within the physical world so that architects and engineers can provide clients with on-site visualizations of their projects. In this manner, they can explore how their projects fit into the physical environment and its surroundings, and evaluate from multiple perspectives. In 2022, these 3D visualizations will be utilized more to improve the customer experience with government agencies and departments during each phase of the project to analyze project alternatives, minimize conflicts, and communicate project information to the public.

AR/VR Will Help Communicate Complex Visual Challenges In The Engineering Industry

"As work continues to accept the potential of remote delivery, AR presents a unique way to experience, explore, and communicate complex visual challenges in the engineering industry. Helping to turn the diverse data sets we create into a successful visual medium to communicate to increasingly involved communities will be a differentiator for developers and municipalities seeking to fortify their community driven decisions."

– Russell Yeager, PE
Director, Civil Engineering
WGI San Antonio

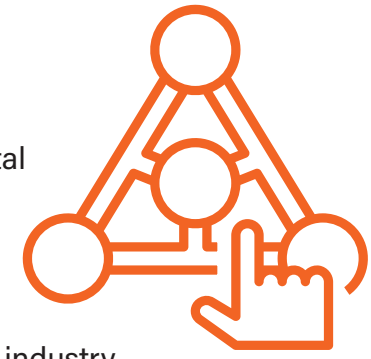
5 LIGHT DETECTION AND RANGING (LiDAR)

Already a staple for autonomous vehicle navigation, LiDAR (Light Detection and Ranging) has long been used for surveys of physical infrastructure to capture a 3D point cloud of the environment such as a building, bridge, or street, as well as for inspections of assets like pipelines, telegraph poles, and railcars. In 2022, the use of LiDAR will evolve to harder-to-access areas such as the near-shore environment where traditional LiDAR cannot penetrate. Green laser LiDAR is a more recent technology that enables surveyors to scan the shoreline with the LiDAR, penetrating and filling in the zero-to-10 meter "depth gap" in coastal mapping, revealing the submerged topography. The technology has use cases for government agencies such as the USGS for fluvial channel and floodplain mapping, mapping barrier islands for storm response studies, and more.

"Handheld LiDAR scanners and apps will continue to improve. The quality of scans should improve with updates and new algorithms. The updated algorithms will be able to process existing raw point clouds with greater accuracy. This will result in better scan definition and details. With the proliferation of Apple devices with LiDAR capabilities (iPhone 12 Pro, 13 Pro, and iPad Pro), it gives scanning ability to anyone. This will help AEC firms with site-visit documentation, equipment-detail capturing, and so on. This will also make LiDAR scanning even less expensive and more user friendly."

– Peck Sukphisit
BIM Manager
Specialty Structures
WGI West Palm Beach

6 PLATFORM BUSINESS MODELS



In recent years, due to the size of the industry, we've seen several attempts to pursue platform business models for smart cities and smart infrastructure, as well as process innovations such as offsite and modular construction. Many of those recent attempts have stalled such as GE Predix (which was perhaps too early for its time), Alphabet-backed Sidewalk Labs (which pulled out of a $1B smart city contract in Toronto), and Katerra (which received $865M in venture capital investment in 2018 to target offsite and modular construction and is currently in bankruptcy). While the industry has yet to become "Uberized," in 2022 we can expect to see continued efforts by major players, as well as startups, to become go-to platforms for the industry, with each coming at the problem from a different perspective.

7 DIGITAL TWINS

For many years, digital twins were the realm of vendors such as **Microsoft** (Azure Digital Twins) and **GE** (Predix), and the target audience was software developers. Engineers were busy using their own 2D and 3D software such as CAD, GIS, and BIM tools. We're now seeing partnerships across the divide, with players such as Microsoft and Bentley coming together to offer **city-scale digital twin solutions** for urban planning and smart cities. **Autodesk Tandem** is also offering APIs and developer tools with the same objective of creating a broader ecosystem. In 2022, partnerships like this will continue to evolve into broader, multi-partner ecosystems offering rich forms of visualization and integration, with the digital twin at the heart of the model. The challenge for owner/operators and AEC firms will be how to support multiple platforms and where to invest as the market matures.

"AI in traffic control is our pathway to the futuristic dream we all hold for transportation. Currently, AI is being integrated into traffic-signal systems to maximize traffic flow and reduce operating costs for agencies. In the near future, there will be great advances in smart operating systems, decision support systems, and data services as we see more advanced computing tools such as digital twin traffic models and next-level quantum processing become more commonplace."

– Acey Roberts, PE
Traffic Operations Division Manger, WGI Tampa

8 AUTONOMOUS VEHICLES AND ROBOTICS

Autonomous vehicles are the poster child of the built environment, and production deployments are gaining traction in areas that can be carefully controlled such as planned communities. One example is Move Nona's creation of the **largest and longest autonomous vehicle network** at one location in the U.S, which includes five routes and eight shuttles, connecting nearly 10 key destinations. In 2022, we can expect further refinements to AV deployments providing additional levels of safety and security and more practical operating speeds. Drones and robotics will continue to be widely adopted for performing surveys, inspections, and automating repetitive and often dangerous tasks.

"Electric-vehicle adoption is going to skyrocket thanks to (1) massive federal investment in charging-station installations, and (2) big deals for rental/shared fleets. In October, Hertz announced the largest Tesla buy for 100,000 rental cars by the end of 2022, and Envoy technologies inked deals with hotels to provide electric car rentals on-site. This will normalize electric cars more effectively than dealership test drives. However, quick electric-vehicle adoption will further strain the federal funding mechanism to quickly fund infrastructure — the 'gas tax' — accelerating difficult conversations on per-mile fees and tolls. Moreover, electric cars will not solve congestion, parking woes, inefficient land use, or the cost burden of car ownership for many households."

– Lisa Nisenson
VP, New Mobility and Connected Communities
WGI West Palm Beach

9 3D PRINTING

In the construction industry, 3D printing is picking up significant traction as a go-to construction methodology, including off-world design and construction projects in conjunction with NASA. Gantry systems, like those used by **ICON**, can print up to a 3,000 square foot home with a print speed of 5-10 inches per second. The benefits of 3D printing over traditional construction techniques are that it's faster, produces less waste, combats future supply chain and construction labor shortages, and accommodates more design freedom. In 2022, we'll see the industrialization of 3D printing for the built environment as it moves from predominantly single-home projects to community projects. ICON, for example, plans to build a 100-home community in the Austin area in 2022. We'll also see greater leverage of this technology in fulfilling societal objectives of sustainability, resiliency, and energy-efficiency, as well as support for under-served communities, including the homeless.

"We are amidst a fourth industrial revolution, where automation and data are driving innovation across all business sectors. 3D printing is a process to utilize data directly from BIM to robotically construct resilient structures faster, more economically, and using less raw material than traditional construction methods. 3D printing will take on a critical role in the construction industry as implementation of this technology directly combats supply chain issues and construction labor deficiencies that currently dominate the industry and significantly drive up prices. In 2022, our industry will leverage this technology to build a structure in space as well as fulfill societal objectives for inclusive and affordable options for under-served and workforce communities across the globe."

– Eric Luttmann, AIA
Director, Architecture
WGI Tampa

10 BLOCKCHAIN

In the built environment, blockchain is probably the least understood in terms of industry use cases and therefore is often overlooked. However, there are some bright spots among companies such as **DigiBuild** aiming to bring blockchain use cases specifically to the construction industry for additional risk management and visibility. While blockchain technology will often be lower on people's radars within the infrastructure industry, 2022 will be an important year for continued learning, proof of concepts, and a cadence of case studies showing substantial business benefits.

"In 2022, I believe AEC firms will trend toward the use of blockchain to retain data ownership, which can then be released and monetized in the wild. Many of them own hundreds of terabytes of data that could be made available to the public through blockchain, while they retain control of who uses that data and collect proper fees and royalties for its use. Blockchain can be used to encourage data sharing by providing referral fees to users that promote the data, helping grow the data client base. Blockchain is the next-generation 'subscription service' without the subscription."

– Sandor Laszlo, PE
Regional Manager Technology, Geospatial/SUE
WGI Pennsylvania

CONCLUSION:
ENABLING ADAPTABILITY FOR CITIES AND COMMUNITIES

Overall, these strategic technology trends will be key ingredients as city planners, contractors, consultants, and CXOs prepare their future visions and purposefully architect and design their communities to support common goals such as economic growth, quality of life, health and wellness, diversity, equity and inclusion, safety and security, mobility, efficiency and resilience, and sustainability.

In the words of former professional ice hockey player, Wayne Gretsky, it's important to, *"skate to where the puck is going, not where it has been."* Building upon this strategy and then taking it even further, communities need to incorporate intrinsic agility in their designs and operations so that their future solutions can adapt in real-time to ever-changing goals.

This is exactly where these strategic technology trends fit in. When applied in combination with one another, these technologies will create a digital infrastructure enabling the adaptability that's needed for cities and communities to be ever responsive to continuous waves of both digital and physical disruption.

LET'S TALK.

For more information about this study or to have a conversation with one of our experts, please contact us:

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