

DesignIntelligence® Quarterly

An abstract graphic consisting of several concentric circles in various shades of gray, creating a sense of depth and movement. The circles are centered on the page and overlap each other, with the innermost circle being the darkest and the outermost being the lightest.

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DesignIntelligence™ Quarterly

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From the Management and Editors

With the world in such a state of flux—whether it’s the economy, the political environment in the U.S., global geopolitics, the A/E/C industry—DesignIntelligence believes that there are many approaches that leaders can take to secure the futures of their firms, their employees, their legacies.

Today, more than ever, leadership requires taking responsibility and acting responsively. We as leaders are responsible to our clients, our firms, our employees, our environment, our world, and so much more. For leaders, yes, it is a daunting task to make the right decisions in this complex world we live in—one that is undergoing deep and transformational challenges and changes. And as leaders, we must proactively innovate and generate solutions, taking action based on our firm’s core values and vision—as well as our own.

We live in a small, interconnected, interdependent world ... one that is getting smaller each day. And as such, we have to keep our eyes up and our focus outward. We have to look at disruptors as opportunities; technology as essential; innovation as survival.

The 4Q 2018 edition of *DesignIntelligence Quarterly* provides insights into authentic leadership to help you build a better business. Articles on industry disruption and the technology of digital twins; diversity and inclusion; smart buildings/cities and resilience planning; climate change and embodied carbon; the importance of the built environment to our economy and our environment; how international practice is evolving; the diversity of thought; and a look at the construction industry—these are just some of the highlights of this edition.

The reality is that we can build our own future, rather than letting the future happen to us. By driving our industry forward, we can effect positive change in the world. The choice is ours.

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**BUILDING A
BETTER BUSINESS**

Leadership Lessons Learned Along the Way

It's amazingly perplexing how so many top leaders pull the trigger on execution before considering the implications beforehand, the ramifications of absent readiness. Frankly, it's a quandary altogether.

DAVE GILMORE

The oft-quoted idea of “the tyranny of the urgent” is usually applicable in such situations of aimless, ready-less execution. Leaders are under pressure to make things happen, to hit ambiguous targets and perform to blurry expectations.

It's a difficult job leading a firm, a sector or a team of people. People are complex characters bringing their jumbled emotions and distorted perspectives to work with them every day. Leading them is a mix of “Tally Ho!” assertiveness and day-care herding. So, there's no questioning the landscape of challenges faced by leaders. It's part of the job.

What isn't part of the job is mindlessness. Pulling the trigger before being ready. Aiming in the wrong direction, or worse yet, thinking it's the right direction. For the record, let's just say it . . . *the tyranny of the urgent is a trap each and every leader has the choice to be ruled by or not.* Setting yourself up for false expectations, whether placed by others or placed by yourself, is where such tyranny begins.

“Taking inventory of the essential workers who serve as the binding glue of the company is the first step. The second step is understanding how best, how effectively, to value them for who they are and what they do.”

We encounter leaders regularly who are wound up in an anxious, ulcer-promoting posture simply because they have allowed false expectations to define their leadership. Most do so through self-distorting interpretations of what they think others are expecting. They can't seem to find the guts to raise their hands and ask for clarification, or better yet, debate the validity of the expectations in the first place. So, they invite false tyranny and act accordingly.

What's to be done?

- Stop! Blow a whistle on it all and get your act together!
- Stop allowing falseness to define who you are and what you do.
- Begin at the beginning with some simple statements regarding who you are, the scope of your space, what you're tasked with, and how you might go about it.
- Then translate this into a plan and pass it by trusted advisors for candid feedback and altering edits.

Hard-won lessons usually happen through difficulty and the discipline applied to learn. As we often say, there's no substitute for experience. But experience alone isn't enough to learn, enough to grow. Learning and growing only happens when we lean into the experience seeking understanding with insight.

Do you know who “makes it happen” in your organization? Not *what* makes it happen, but *who* makes it happen.

Far too often the people who “make it happen,” those who carry the daily load of operating a firm, are overlooked and left in the shadows, unrecognized and unappreciated. This happens because they just keep working, ensuring the firm keeps going. These are the folks not seeking recognition, just doing what it takes, and in so doing success is the fruit. Yet their heads-down work ethic is often mistaken for disengagement, indifference or being uninvolved. It’s absolutely critical for leaders to take inventory of these “make it happen” folks. Losing them will result in negative material impact to the firm.

Eventually everyone needs recognition for a job well done. Neglecting to do so, judging these folks as non-essential based on simplistic observations, will put business leaders in a bind when these truly essential resources disappear.

Sometimes they don’t physically disappear; they just emotionally disengage. They move down the slippery slope from disappointment to discouragement, and from discouragement to pessimism. From pessimism they cross the line to sarcasm and then land squarely in the middle of cynicism; a most unfortunate place for anyone at any time.

Taking inventory of the essential workers who serve as the binding glue of the company is the first step. The second step is understanding how best, how effectively, to value them for who they are and what they do. Sometimes it requires turning them around and climbing with them back up that slippery slope from cynicism to healthy expectations. When these folks are turned around, your firm will have the best chance ever of growing and sustaining.

I suppose one of the harder lessons learned is how to distinguish the value in the quiet faithful from the overhead of squeaky self-promoters. It begins with looking past the obvious to the resident treasure in these quiet, “make it happen” people. Busy leaders who want to do the right thing have to take the time and apply the relational discipline of getting to know the people in their organizations.

We’ve made too many mistakes judging the books by their covers. Just because a person is crusty, ill-mannered, lacking in social graces and interpersonal communication skills, we relegate them to the “unacceptable” category. We avoid engaging them just because they’re not warm and fuzzy types. And then we cross the foolish line of equating this judgment with value and label them both unacceptable and possessing little or no value to the organization.

Authentic leaders can fly in the stratosphere of vision as well as dive to the details of the day-to-day, and it’s in the day-to-day where these “make it happen” people live and breathe and do their best. This is where the rubber meets the road, where the reality of work occurs. Authentic leaders will come clean about their misjudgments and engage with the “unacceptable.” More often than not, they’ll surprise us with just how acceptable they are!

If you want to make your firm a success, you have to know the people who “make it happen.” If not, give up now because failure is on the way.

Dave Gilmore is the president & CEO of DesignIntelligence.

The Voice of Vision

You've planned ahead the best you can. In the past several years, you've identified up-and-coming younger talent to replace baby boomers as they retire from your board and executive team. As senior leadership grew to include both seasoned veterans and new members, the team set a bold and comprehensive new vision for the future.

BOB FISHER

Everyone in the room is fully bought in. The firm has a new point on the far horizon to which it can navigate. The leadership is excited to begin translating the vision into strategy and action, reshaping the firm to achieve its desired future state.

Too often, this is where it all goes wrong.

Without the right voice, even the best vision has slim chance of success. Members of the firm, lacking the right story, create their own inaccurate and negative ones. Rather than be inspired to pull together toward a common goal, practitioners and staff become confused and suspicious. Changes that should be evidence of progress toward a bright future instead become threats.

The most common issue is twofold:

1. Underestimating the importance of articulating and communicating the vision
2. Overlooking the complexity of the communication challenge

The answer to the first problem is conceptually simple, though it requires discipline to implement. It begins by embracing the idea that communication is as fundamental to the success of a vision as is the quality of the vision itself. From the beginning of the vision development process, the

leadership team commits to investing the time, effort, and skill required to properly articulate and share the story of the firm's future.

The second problem is a bit trickier. Solving it requires discernment between how a vision statement functions inside the firm and the role it plays outside in the marketplace. It also requires a sophisticated understanding of how to shape and deliver the firm's story.

“Communication is as fundamental to the success of a vision as is the quality of the vision itself.”

To better understand these issues and dynamics, let's consider a hypothetical example. Imagine a firm that has spent nearly 40 years developing a deep and focused expertise in designing traditional retail environments. Innovation has been a long-standing cultural norm. The firm's leaders and practitioners keep a keen eye on the future, developing perspectives on the rapidly changing way in which Americans search for, select and obtain goods. As a result, the firm has earned a strong reputation and grown to three locations within the Northeast U.S., where they do 80 percent of their work.

Committed to remaining on the forward edge of practice, the leaders of the firm developed the following core vision:

We will be the national leader in retail design through futures research, leveraged technology and the creation of extraordinary human experiences.

During the process of creating the vision statement, the firm's leaders developed core ideas in the vision statement in greater detail. They discussed the future evolution of retail sales, ways in which "futures research" might show up in practice and how the firm might evolve to focus on creating experiences as well as spaces.

When the vision is given voice within the firm, it speaks to motivate and align leaders, practitioners and staff. It provides a powerful destination that all can aspire to reach—to be the most forward-thinking, tech-savvy firm whose retail design for retail stretches beyond traditional limits of space and into experiences.

Leaders in our hypothetical firm know that rolling out the vision is only the beginning. They are its continual cheerleaders. Whether they speak to groups or individuals within the firm, the leaders frame discussions of the future in terms of becoming the national leader in retail design. They evaluate each new initiative by the degree to which it helps the firm

understand the future of shopping or create extraordinary human experiences. In this way, vision becomes a filter that ensures staff are aligned and the firm is making progress toward its desired state.

Taken as it is written, the firmwide vision is for the internal audience only. The language used and sentiments expressed can be inspiring when kept within the walls of the firm, but sound arrogant and presumptuous anywhere else.

The vision has an important role outside the firm as well, but it needs a different voice. Given the right external voice through marketing, the vision can be a powerful catalyst for gaining influence in the marketplace.

To do so, the vision must be translated into ideas and language that resonate with what the market wants and needs. The firm must also avoid an important pitfall: the Integrity Gap.

False expectations are the root of the Integrity Gap. Too often firms portray themselves in their marketing as who they wish to be, rather than who they are and what they can do today—often because of the powerful inspiration they feel from their own vision. In so doing, firms create an Integrity Gap between their promises and what they can currently deliver. When the inevitable delivery failure occurs, the resulting anger and disappointment in the market can have potentially disastrous effects on the firm's brand.

While the vision is not the right source for market-facing language, it has another more important function—to become the foundation for expert insight that drives influence.

How does a firm develop the external voice of its vision? How does it use communication with the marketplace to become what it aspires to be?

For our example firm, achieving national dominance in retail design comes through demonstrating a combination of national design quality and leadership thinking that distinguishes it among competitors. In order to build market influence, our firm will want to build its voice around themes

Integrity Gap

The gap between how a firm portrays itself in its marketing as who they want to be vs. who they are. The gap occurs between what they promise and what they can actually deliver.

“The vision has an important role outside the firm as well, but it needs a different voice. Given the right external voice through marketing, the vision can be a powerful catalyst for gaining influence in the marketplace.”

that align with its vision: the future of the retail marketplace, integration of technology with spaces, the power of extraordinary shopper experiences to give retailers a competitive advantage, and the like.

With persistence and focus, the firm will demonstrate the extraordinary value of its thinking. Its influence will grow as more prospective clients and stakeholders benefit from its point of view, opening up opportunities that propel it toward its desired state.

Positioning a firm for success in the future is more than simply developing vision. The vision also needs voice. To be effective, leaders must embrace the essential importance of communicating the vision and adapting to the complexities of the communication environment. The voice of vision, properly applied both inside and outside the firm, can be a powerful catalyst for a firm to achieve its highest goals.

Bob Fisher is editor in chief of DesignIntelligence.

TECHNOLOGY

The Next Revolution in the Built Environment Is Digital, Not Physical

As architects, designers, engineers and developers, we pride ourselves on early adoption of technology, embracing 3D modelling, modular housing, drones and augmented reality to compete at the cutting edge of the industry. It's ironic that while we're obsessed with digital innovation, much of the construction and building industry is still largely analogue.

SHAUN KLANN

Go to a construction site, or facilities management or a building's maintenance office, and you'll find files, folders, paper, email, USBs—thousands of pieces of information, all stored in different formats, passed through multiple hands.

As an industry, we still have work to do to truly understand and capitalize on the transformative power of digital technology, like so many other traditional industries have gone before us.

The word *disrupt* is often used, sometimes feared, but if Uber or Airbnb have shown us anything it's that these "disruptions" are simply age-old ideas with a new twist, offering more openness and transparency.

There are some universal challenges that plague the construction industry: getting an accurate, real-time view on a project at any given time is difficult; going over budget and overschedule is common for large-scale projects; and dispute resolution on claims which generally cause delays in construction—all erode trust between owners, developers and contractors.

There is a new capability that can help address some of these entrenched challenges within the construction industry. This technology is known as a digital twin.

The benefits of seeing double

The digital twin is an exact virtual replica of a physical building or infrastructure asset. It captures all the building's data—from design, project delivery to maintenance logs—simply, into a single and secure platform. Alongside this static data is a plethora of smart building and IoT sensor data, which is all then collectively harmonized and visualized contextually using the 3D geometry of the building.

This technology is not new, but its application in the built environment is.

It first hailed from NASA, where it was used to run simulations for the Apollo 13 Mission. NASA used the results of the simulation to come to the decision to slingshot the craft around the moon.

Leap forward to today, and we have seen digital twin technology evolve to embrace big data and Internet of Things to decipher an exponential amount of information, to the benefit of industries across multiple sectors and disciplines including aviation, oil and gas, and manufacturing. It also allows organizations for the first time to test and learn using new technologies or scenarios without causing interference to a physical environment or at a huge expense.

Put in the context of the property and infrastructure industries, it has the potential to truly revolutionize the status quo.

It's about saving time, money and making lives easier

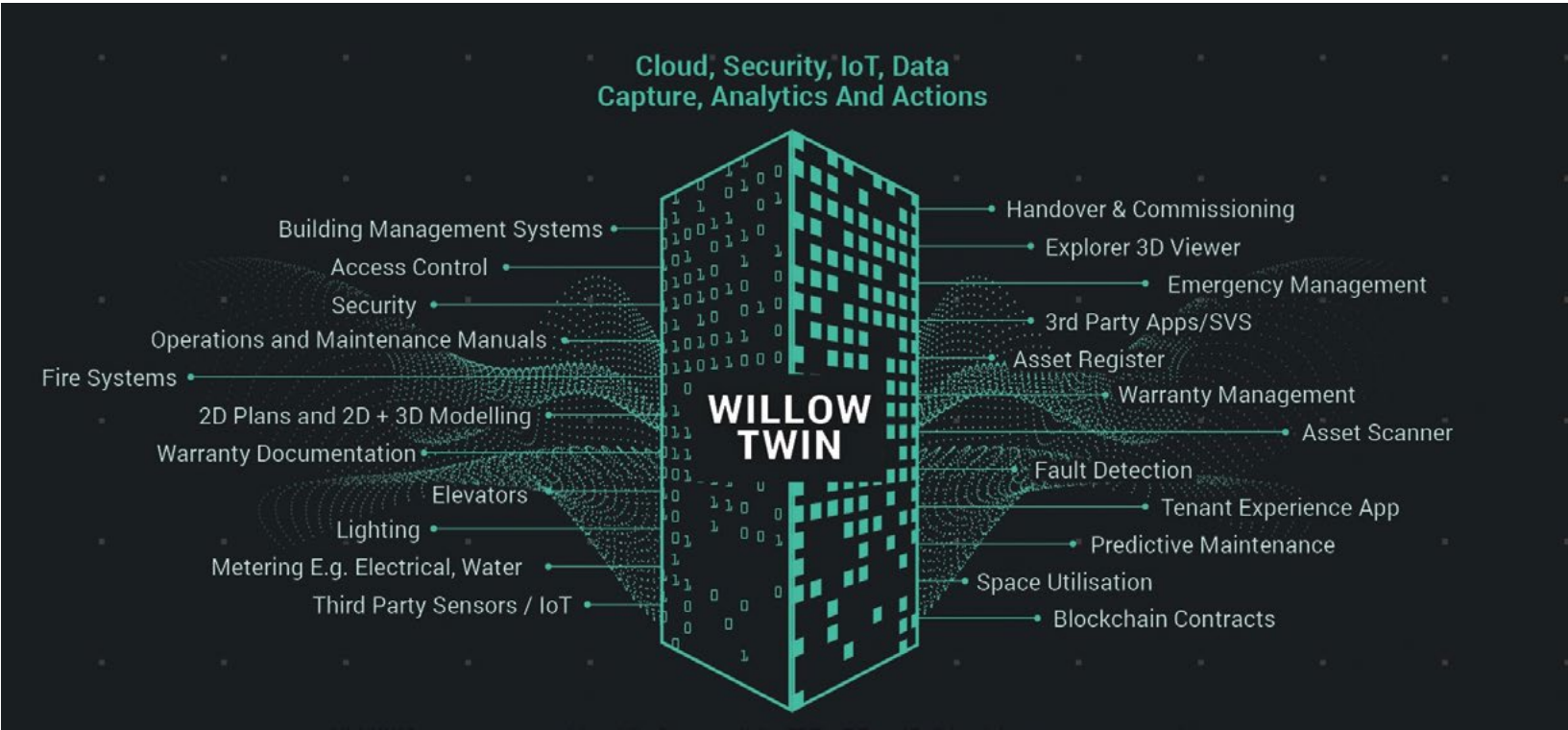
We've acknowledged that the built industry has been a little slower to maneuver and our industry does have a few challenges that are unique.

We face a few more hurdles than the average industry. Building an effective digital twin for a building or a complex infrastructure asset (an office tower or a railway system, for example) goes beyond just technical skills. It takes deep industry knowledge, true partnership and a services-led approach. From working with subcontractors to define the data standards and compliance needs, to creating, capturing and integrating static data (such as 3D models, asset registers, operating and maintenance manuals) with dynamic live data such as sensor and IoT data—this is a significant and complex endeavor.

Developers and owners can lose millions of dollars through re-works, delays and contractual disputes. In fact, McKinsey estimates that 98 percent of megaprojects suffer cost overruns of more than 30 percent; 77 percent are at least 40 percent late. Many in the industry believe that we have reached the limits of established technology like BIM systems.

A great example where a digital twin is going to revolutionize a development is Queens Plaza Park in New York City. The Durst Organization partnered with Willow to create a digital twin of the new development. It will capture more than 50,000 data inputs from Queens Plaza Park, including digital plans, 3D models and equipment, and asset information during the construction phase, to live and real time data, such as elevators and air conditioning, as soon as the building is operational.

For the thousands of contractors working on the construction of what will be Queens' tallest building, this technology is game changing. It will fast-track Durst from using USBs and paper to inputting crucial building data into one system, creating a single-source of truth for contractors, building managers and owners.



This kind of visibility of information across the entire building lifecycle is meaningful to the way in which buildings are constructed, managed and owned, and probably more significant is its potential to not just reshape the construction industry but also the built environment and the lives that it is designed to enhance.

You're only as smart as the data you capture

The built environment is a living, breathing data-generating ecosystem. Everything from the lights, to the lifts, to the air vents and every individual arriving and departing, is producing information. Capturing this and harnessing the insights will be a game changer for everyone involved from design to development.

Broaden this out to large scale infrastructure and put it in the context of a rail network. Strukton, one of the largest rail businesses in Europe, has worked with Willow to develop a digital twin of its network, enabling it to manage every element of the network to minimize downtime (stoppages or delays across the network) to 99.8 percent. Think for a moment about what this means for profitability, customer experience, managing and maintaining the network by being able to pre-empt issues before they become issues—the slowing of door closures on a single carriage indicating a maintained check may be required.

The idea of smart cities has been bandied about for years, with no real consensus of what the term means. From architecture that creates more livable environments to urban design that better connects people to their surroundings—it's all part of it. But without a digital twin platform to capture and organize all data from varied sources, the concept of smart cities is all a bit, well ... conceptual. A truly "smart city" starts with smart buildings and smart infrastructure. It's about connecting people to each other and the built environment.

Power from search and blockchain

One of the biggest ways digital twin technology is going to disrupt the industry is through its search function. It doesn't sound like the most exciting aspect, but it's going to make

people's jobs easier. When Backrub launched in 1996, nobody could have predicted in less than 10 years it would have renamed itself *Google*, redefined how we interact with the Internet and become one of the most influential companies in the world. Search is powerful and it's going to reframe the way we think of smart buildings, smart cities and smart infrastructure in the future.

For example, within Willow Twin the Explorer 3D viewer enables building managers to pinpoint information on manuals, equipment and assets exactly within a 3D view of the building. Let's look at another practical example. If you know that 25 per cent of fire dampers in a building need to be checked every year, how do you know which 25 per cent have been checked and when? With the Willow Twin, you have a permanent and searchable record of who checked what and when. It is an indisputable digital record and maintenance history. Compared to analogue records, or even digital records in the form of spreadsheets, a cloud-based, app-agnostic platform offers asset owners greater transparency.

Emerging technology blockchain offers greater transparency, for standards and compliance which enables owners and contractors to manage and even avoid disputes over contractual obligations. For example, through blockchain smart contract technology, thyssenkrupp Elevator can now manage new contracts designed with trust with their contractors. Both the building operator and contractor can see the exact availability of each elevator, the maintenance which has been conducted on each elevator and response times to alerts. All residing in the Willow Twin, this data-led approach to sharing information across the supply chain fundamentally changes the way building managers and contractors work together.

98%

OF MEGAPROJECTS
SUFFER COST OVERRUNS

77%

OF MEGAPROJECTS
ARE LATE

It's all about services

We're finally at a point where digital twins are a must have, rather than just a nice to. We've reached the tipping point where the technology is powerful and affordable enough to make it scalable. Digital twins have been made possible by three mega trends—processing power available at scale through Microsoft cloud services such as Azure Digital Twins; high speed connectivity with increased bandwidth, and sensor technology improvements and reductions in cost.

“We're finally at a point where digital twins are a must have, rather than just a nice to. We've reached the tipping point where the technology is powerful and affordable enough to make it scalable.”

The digital twin platform is about so much more than just creating digitally-enabled buildings. It takes deep industry expertise and services including architecture and digital engineering, to connecting people and devices to the built environment and it will change the way we create places that people live, work and play.

Digital twin is a platform. The real value and innovation will come from the services that are developed on top of it. For us, we believe diversity is critical, so we've opened our APIs to let third party developers create new and innovative services on our platform. There are some amazing apps that have been developed, both in-house and by our partners. From data security to customer service—it's an ecosystem that is constantly growing.

The next great innovators in this industry will be those developing digital twins and new plug-in services, and the visionaries who implement them. In an industry with such a rich heritage, it's invigorating to be here—at the cutting edge of technology and the precipice of truly innovative disruption.

Shaun Klann is president of Willow Technologies. He is currently overseeing U.S. and European operations. His tenure has touched some of the world's most iconic examples of building intelligence with landmark references that include the creation of smart building standards for the U.S. and Canadian federal governments, the world's largest deployment of building analytics, and the industry's first blockchain-enabled smart contract for building maintenance.

Industry Disruption

Leading edge organizations are constantly looking out on the horizon for new factors with disruptive potential, whether that's new technology, new players, new contracts, new constructs and more. Dennis Shelden—director of the Digital Building Lab at Georgia Tech—gives us a view into some emerging positive forces of change that will impact A/E/C.

DENNIS SHELDEN

DesignIntelligence (DI): In the Digital Building Lab, what are you seeing on the horizon around this whole idea of industry disruption from the technology angle?

Dennis Shelden (DS): I've been interested in the transformational or disruptive possibilities of technology throughout my whole career—as a student, architectural designer, engineer, software developer and entrepreneur and now academic. The possibilities of technology to change not just process but the value of design and the relationship between designer and the built environment has been one of the promises of early CAD and now BIM. These were the underlying values of the advances that happened in Gehry's practice in the 1990s and then subsequently our goal in creating Gehry Technologies. But I think in the past these impacts have been incremental or niche—demonstrating results that either had minimal real impact on projects or were isolated to the exceptionally complex.

It seems like in the last three years, technologically driven change is accelerating quickly, and I think we've hit an inflection point or a catalytic moment, where all the forces in the industry are aligned to make significant change possible. It's an incredibly interesting time to be working in the built environment in general, especially at the intersection of technology and environment.

First, this infusion of technology in our industry is indicative of the broader culture. Advanced technology is simply part of

our everyday lives and the broader vernacular of society. Concepts from technology research such as machine learning, blockchain and the Internet of Things are broad drivers of disruptive economic and social change in society at large.

There is also now a base of technological capability in the workforce—the current generation of early and mid-career practitioners has grown up with information technology, both at work and in their everyday lives. These new leaders are starting to creatively drive the profession and new applications of technology, and there is also a relatively large workforce with a technical background to adopt these advances and existing technology infrastructure that can be leveraged.

Perhaps even more significant is the growing interest in built environment innovation from outside the traditional building disciplines. Companies like Google, Amazon, entrepreneurs like Elon Musk through the Boring Company and investors like Softbank through Katerra and WeWork are heavily investing in pursuing opportunities in buildings and infrastructure.

Finally—and I think this is related—the built environment itself is becoming what might be seen as a platform for technology and data innovation. As computing has gone from the main frame to the desk top to the laptop to the mobile and now, with mobile computing, there's a direct and intimate relationship between people, technology, data

and environment. That is just going to continue. So, we are looking at getting to this smart environment, smart building, where in the future, much of computing won't involve a personal device at all; it will be a part of the environment. There is an emerging convergence between the A/E/C professions in the built environment and the technology community. It's important to see this as a trend because this is where the technology sector is going, and designers and building professionals have a unique moment to drive some of these advances.

DI: So, one of the main drivers of this inflection point is that nontraditional players are coming from the outside with a lot of investment. You also mentioned that you're seeing a lot of startup activity or an increased pace of activity. What are some examples?

DS: The tech industry has reported that in 2018 there were 3,000 construction, real estate and design-related startups that have emerged since 2017. This is an increase by a factor of ten from the year before.

"I can imagine design firms having an ongoing relationship to the environments and communities they have designed—continuously receiving feedback on operational dynamics and engaging in ongoing occupancy experience creation or organizational improvement roles with owner-occupiers."

These startup initiatives can be anything from an individual innovator in a design or engineering firm to venture investment by players inside or outside the A/E/C industry. Thornton Tomasetti is one example—a firm that is running an internal incubator and seed investment vehicle to monetize the intellectual property they develop as an engineering firm.

There are contractors like Turner and building product manufacturers like CEMEX who are developing investment funds targeted at supporting startup companies that are emerging around their business ecosystems.

We are seeing a startup culture emerging in the A/E/C community. A lot of the great innovation in software apps for design professionals—like Grasshopper plugins such as Honeybee for environmental analysis or Kangaroo for structures—are the products of individual innovators, many in prominent design and engineering firms and operating through open source business models.

DI: So with all of this new activity in investment, and all of these new startup businesses coming online and basically changing what we know about technology within the field, how is this having an effect on traditional A/E/C firms?

DS: Professional A/E/C firms have intellectual property that is a value they need to consider as part of their core strategy. How do you monetize your firm's unique knowledge? How do you protect it? How do you expand it? How do you leverage it to increase the value of your goods and services?

There are certainly issues regarding workforce requirements and engagement, both in terms of increasing demand for more skilled workers but also issues of increased automation that will eventually impact the traditional hourly services model. This may create opportunities for a more value-based way of charging for design and engineering services and constructed products.

I think the possibility of the built environment as a platform for information and technology will create profoundly new roles and opportunities in the built environment. One of the most fascinating possibilities is that this can create a new, longer-term relationship between design and the ongoing environmental behavior of client organizations and communities. This is playing out now in building controls and operations, but the potential is bigger than that. I can imagine design firms having an ongoing relationship to the environments and communities they have designed—continuously

receiving feedback on operational dynamics and engaging in ongoing occupancy experience creation or organizational improvement roles with owner-occupiers.

DI: So, you feel that the built environment is becoming a computing platform. What implications are there outside of A/E/C for that to happen? For example, how does security play into that?

DS: There are many tools, methodologies and lessons to be learned from the software community that can be applied to the built environment. I've been recently re-introduced to the concept of UX—user experience design—through some joint classes we've been holding with the school of industrial design at Georgia Tech. This is a very mature discipline with some very interesting ways of thinking about users, their personas and experiences that environmental design can learn from. There are obvious lessons of system design and productization, mass production versus mass customization that come into play when we think about buildings becoming systems for both physical and information services. And yes, the questions of data and physical security, privacy and information ownership that are playing out in the digital realm need to be addressed in the built environment, where existing solutions such as encryption can offer only part of the answer in a world of hybrid digital and physical interaction.

DI: It seems like there are some big unanswered technical questions about the built environment becoming a computing platform. When technology platforms are changing so rapidly and new technologies are constantly displacing old ones, how will we keep buildings current and communicating with one another in whatever way that humans wind up interfacing with buildings?

DS: These are big, long-term questions that I don't think we have really well-developed answers for yet. Information technology componentry advances faster than building systems, although the innovation cycle of the latter is increasing. I don't think we can accept disposable solutions for building scale artifacts. I believe that if information services become part of the built environment there will necessarily

be a tighter fitting between the designed environment and the specific requirements of the occupying businesses and communities. We have to think about buildings and infrastructure as integrated systems, where retrofitting and varying scales of permanence and reconfiguration is built into the design.

There has been an interesting resurgence recently in the design of flexible and reconfigurable space. I think that because of the speed of technology-driven change in society, owner organizations have to continually rethink the relationship between their constituents and the built environment. There seems to be a lot of interest in that idea of flexible and reconfigurable space with technology, analytics and measurement built into the continuous life cycle of the building.

DI: What's going on at the Digital Building Lab? And how is the DBL affecting or enhancing architecture, design and construction education?

DS: There are so many new and exciting initiatives at Georgia Tech around design, technology, practice and entrepreneurship it's difficult to know where to start. First, the School of Architecture has a deep heritage cutting across deep research, application in industry and education, and the DBL is part of this heritage. Since [Chair of the School of Architecture] Scott Marble joined along with me and some of the other new faculty, there has been an effort to re-imagine these research, education and industry engagement programs around issues of technology and advancement of practice at all levels. As one instance, we have redeveloped the Master of Science in Architecture degree program around five technology streams—from building information and systems to health-care design, and we're using this to connect with both industry partners and mid-career professionals. We've adopted a certificate program in engineering entrepreneurship that was jointly developed between the engineering and business schools to support students interested in careers at the intersection of design, technology and entrepreneurship.

The Digital Building Lab is first and foremost a catalyst for academic and industry engagement to foster technology-driven building innovation. Our membership includes organizations

across the building and technology professions, from designers and engineering to contractors, fabricators, building product manufacturers and software companies. Our core research model is to serve as a conduit between building professionals with project-based innovation needs, tech and product companies with emergent innovations, and the research and innovation resources of academia.

As a research and development organization, the DBL is focused on a number of big picture initiatives that I think can best be addressed by the sort of non-profit, open information model provided by academia. The first is what I have been calling “the building information superhighway.” The DBL has a deep heritage developing open data standards for the building industry including IFC (Industry Foundation Classes). We are now working with industry standards groups like BuildingSmart to extend these data standards to provide building industry specific internet and web data exchange capabilities. This is a critical advancement for building information, one that I believe can create the base-level infrastructure needed to support innovation and startup companies.

The second focus is on smart environments: smart buildings, infrastructure and cities, but more connected relationships between the built environment, occupants and the values of client organizations. This extends the building information modeling and data services work I mentioned, but also looks at new avenues for BIM to support connected buildings and organizations. We are doing some really interesting innovation around smart and connected retail, healthcare and both educational and industrial campuses.

The third focus is this idea about building industry entrepreneurship. For example, your founder, Jim Cramer, is teaching at Georgia Tech and is bringing his view about the entrepreneurship of big firms. Our chair, Scott Marble, is very focused on design firms and the future for their viability and growth.

And I’m working with A/E/C professionals who are pursuing more technology-focused intellectual property and startups. We are committed to leveraging the global access of the DBL and school to idea-generating individuals and organizations, and connecting these ideas to the entrepreneurship support resources of Georgia Tech and the tech community in Atlanta.

These three paradigms—the building information superhighway, smart environments, and entrepreneurship—are some of the key innovations we are starting to drive at the DBL and School of Architecture.

DI: What advice would you give A/E/C leaders who may not have a technical background but set strategy for their firms?

DS: Firms are starting to look at technology and disruption as a strategic topic, beyond just the use of technology tools. There are ways of engaging with technology strategically: by understanding the dynamics of disruption, identifying core capabilities, and identifying and addressing the risks and opportunities for those core services in light of disruptive macro-economic forces. It has never been a better time to have specialized expertise that can leverage the acceleration of technology and capital to scale. Recognize that your firm is creating valuable intellectual properties and that there are newly accessible business models for capitalizing on this value. Give the entrepreneurial people in your organizations room to pursue ideas, and be open to those ideas as being potentially early seeds for new business opportunities and higher value offerings.

Dennis Shelden is an Associate Professor of Architecture and Director of the Digital Building Laboratory at Georgia Tech. He previously led the development of architect Frank Gehry’s digital practice, first as Director of R&D and Director of Computing, and subsequently as Co-founder and Chief Technology Officer of the technology spin off Gehry Technologies.

Digital Twins: Sustainable Disruption

So, we have arrived. That moment when prognosticators have said the design professions will need to automate in order to remain relevant and increase their value. Are you ready?

PAUL DOHERTY

We have entered the Age of Smart Cities, where high performance urban environments are being created due to a perfect storm of economic conditions, next generation Information Communications Technologies (ICT) and massive urban migration that require new and existing cities to respond with powerful new programs, solutions and relationships between people, places and things. This requires not just smart technologies and systems, but smart thinking. The basic goal of Smart Cities is to improve the quality of life and the wellbeing of its citizens, as human capital far outweighs any other measure of a successful urban environment.

In order to plan, design, construct and operate smart cities, there is an emerging need for management tools based on city-level 3D visualization, referred to as Digital Twins.

A digital twin refers to a digital replica of physical assets, processes, people, places, systems and devices that can be used for various purposes. The digital representation provides both the elements and the dynamics of how an Internet of Things device operates and lives throughout its life cycle. Digital twins are virtual replicas of physical devices that data scientists and IT pros can use to run simulations before actual devices are built and deployed. They are also changing how technologies such as IoT, AI and analytics are optimized.

Thomas Kaiser, SAP Senior Vice President of IoT, put it this way: “Digital twins are becoming a business imperative,

covering the entire lifecycle of an asset or process and forming the foundation for connected products and services. Companies that fail to respond will be left behind.”

Think of a digital twin as a bridge between the physical and digital world. First, smart components that use sensors to gather data about real-time status, working condition or position are integrated with a physical item. The components are connected to a cloud-based system that receives and processes all the data the sensors monitor. This input is analyzed against business and other contextual data. Lessons are learned and opportunities are uncovered within the virtual environment that can be applied to the physical world—ultimately to transform your business.

“A digital twin refers to a digital replica of physical assets, processes, people, places, systems and devices that can be used for various purposes.”

We have entered a business environment where mathematical relationships of buildings and the correspondence of their spaces, ratios and angles to the culture of the occupants are now within the realm of best practice. In this regard, music and cooking metaphors work best for design and construction. Tempo and rest, flavors and colors, all create poetry in

space. How you move through space is recognition of the music of the space's time. In the end, it all comes down to composing something that reinforces how people live. As architects, we are musicians, we are not deejays playing others' music. We have to provide environments for humans to be humans.

With both new and existing cities, the data intelligence process begins with a proactive approach of identifying, capturing and managing a city's digital DNA. Because the outcome is to enable city stakeholders with tools to make better decisions, 3D visualization analytic tools are emerging as the preferred method due to their ability to take highly complex amounts of data and show results in context with the actual city.

3D visualization tools need accurate, authenticated data to "build" a 3D view of the city—the digital twin. This data resides today in a city's engineering, building, land, planning, sanitation, tax, or postal services department, or any other department where they collect and manage vast amounts of data that when viewed as a whole, create the virtual representation of a physical city. The building blocks to effectively and efficiently use this city data will ultimately reside in a city's ability to repurpose its existing data and documents associated with the built environment, which is the authenticated digital DNA of all cities. The accuracy, authentication and integration of this city data is the key to a proactive approach to entering a path to becoming a smart city. Without proper digital DNA structure and management, the connectivity from a city's "nervous system" to a "brain" will be problematic, inhibiting performance and the evolution of a city to a smart city.

Once this foundation of a digital visualization of a city is in place, cities have the ability to leverage this front end to begin viewing the data behind the digital, smart buildings. Today, cities acquire most of a building's data through some basic communication of paper and digital reporting, which can be resource intensive. What is emerging in both new and existing cities is the automation of this reporting process through programs and systems like smart meters

(water and power), cable television and telecommunication boxes, and building "black boxes" that can house and report on the health of a building for things like structural integrity to building automation system data. This can be viewed as buildings becoming servers of data, like in a computer network.

Best practices of "buildings as servers" installations use the core of the building and mechanical room as the location where this building data can best be captured, managed and reported. Think of a building's core as the "spine" or backbone of that building that can be hard-wired connected to the Internet—with a redundant backup of wirelessly connected—to communicate with an intelligent operations center (IOC). Once at the IOC, the building's data can be analyzed using the 3D city model for quick, intuitive results.

"Both large and small smart city solutions have the opportunity to assist in creating an urban environment for people to prosper in a welcoming, inclusive and open manner."

A simple example is the capturing of a building's power consumption, which is reported in real time to the IOC, measured against benchmarks and then reported with each reporting building in a green, yellow or red indicator. If the user wants to view more information on the color-coded building, they can have access by clicking on the building. Lessons learned and best practices from operating and maintaining computer networks will be required reading for many city stakeholders to realize the benefits of having immediate access to authenticated building data. Easily mapped to a computer network, the "city as a network" brings many unexpected results that cities are only beginning to discover. Using buildings and infrastructure assets as a visualization and data foundation, the use of sensors, video and mobile devices to assist with city management becomes an easier process.

This best practice of IOCs for cities elevate the value of data coming from both A/E/C and FM. Innovative A/E/C and FM firms are rethinking their value propositions when they realize that their data is being used over a longer period of time when in the context of Smart Cities rather than just in the design/construction process or just within a single building's use. New business models are emerging that put a portion of traditional A/E/C and FM fees into extended service agreements based on the amount of data used, like the music industry publishing model. Others are becoming data escrow agencies that provide data on an as-needed basis, ensuring the quality and authentication of a building or infrastructure's data.

If using the cloud to conduct and automate these services in a big data environment, the costs and technology complexity usually associated with these solutions are negligible, making the business case easily adoptable. As these types of emerging

business models mature and the market begins its pull cycle for digital DNA services, the rewards for innovative A/E/C and FM companies will be substantial, potentially outperforming existing fee-based contracts.

Cities are a mirror to the values of our age. Both large and small smart city solutions have the opportunity to assist in creating an urban environment for people to prosper in a welcoming, inclusive and open manner. When people, places and things begin to seamlessly and transparently communicate, interesting things begin to happen. This is the promise of smart cities.

Getting smart cities right is our generation's greatest challenge and the best legacy we can leave to our children.

Paul Doherty is president and CEO of The Digit Group, Inc. and a senior fellow of the Design Futures Council.

TALENT

Supporting Women in Architecture: Building a Talent Pipeline

Architectural history includes many early examples of women practicing architecture. “Early” is a relative term: the first female professional architect in America, Louise Blanchard Bethune, achieved that distinction in 1881. Bethune and other women in the field remained a rarity for many decades hence. A hundred years later, roughly one in four architecture students was a woman; today it’s closer to one in two.

LAURA MILLER & KATHERINE BALL

This gradual but massive demographic shift will ultimately yield a more balanced pool of leaders across the industry—at least in theory. The profession as a whole, however, is still male-dominated, particularly at the leadership levels. The imbalance shifts precipitously with each milestone. Comprehensive research in recent years underscores the common issues many female architects have experienced firsthand. Inflexible schedules and the 24/7 studio culture celebrated in architecture schools are not conducive to work/life balance, and the deadline-driven work makes navigating family responsibilities difficult. A substantial wage gap, coupled with implicit bias which has historically favored male designers and leaders, can make it difficult for women to advance, even with the same level of experience as their male counterparts. Further, lingering issues of discrimination against women which should have faded along with their bygone eras continue to surface in pockets of the A/E/C industry, creating frustrating work environments and widening gaps at each level of advancement.

Though two out of every five architects are women, nationwide women make up only 17 percent of firm principals. Further, the wage gap between males and females expands with every career milestone and is most significant at the principal level. We have much work to do to rectify this ongoing disparity and promote diversity at all levels of the field for every minority group.

Fortunately, though a snapshot of current statistics is frustrating, the pipeline of talent has never been stronger. Large-scale efforts are underway to cultivate diversity within the A/E/C industry, and real change is happening at firms of all sizes worldwide. What is driving this change? The steadily growing number of women entering the profession means that the industry will continue to add new voices and valuable perspectives to the conversation, and these voices will advocate for equity in ever greater numbers.

“[LS3P’s] leaders not only want to support women at every career stage, but also find authentic ways to put this support into practice. Colleagues talked about the challenges women have in promoting themselves, and the importance of cultivating an empowering support network.”

Equity by Design (EQxD), the organization whose research and advocacy grew from the 2012 Missing 32% symposium, continues to shine a light on the gulf between the roughly 50 percent of women in the general population and the

roughly eighteen percent of women who are licensed architects, AIA members and senior leaders in their firms. The AIA itself has embraced equity and human rights as one of its seven core values and is an active participant in, and advocate for, meaningful change. Although this change across the profession may at times appear glacially slow, efforts toward gender equity are visibly gaining momentum as a new generation of emerging professionals enters the industry.

Celebrating and Embracing Change: One Firm's Principles in Practice

LS3P, an architecture, interiors and planning firm operating from eight offices across the Southeast, has been in business for more than 55 years. Since the firm opened its doors in 1963, the firm's culture has constantly evolved with the times. Male-dominated in the early days like most architecture firms of the era, LS3P now boasts an impressive roster of female talent at every level of practice. Sixty-five percent of LS3P's entry-level staff are now women, and 51 percent of the experienced staff. While women still make up a smaller number of licensed architects (28 percent), principals (18 percent), and senior leadership (12 percent), LS3P's Executive Vice President of Practice Katherine N. Peele, FAIA, is optimistic about the future. "When I look at our incredibly deep bench of talented women entering the profession, I see a valuable pipeline," she explains. "As these women gain experience and continue to grow into leadership positions, we will continue to see greater representation at all experience levels with each passing year."

Peele has, herself, lived through the common "pinch points" in an architecture career which create challenges, particularly in juggling the demands of family and work in deadline-driven studio culture. She believes the best way to address these challenges is to support and encourage women at every stage of their careers, and that process starts with open, honest discussion. Peele, along with LS3P's Human Resources Leader Heather Pierce and a rotating panel of the firm's female senior leaders, recently initiated a Supporting Women in Leadership (SWiL) cocktail hour called "Sip and SWiL"

to share research on equity (both national trends and the firm's internal data), talk about the firm's goals, and create a supportive venue for telling stories and talking about challenges. Discussions are co-ed and consist of a brief overview of research, statistics, and goals followed by a panel discussion with open-ended Q & A.

"LS3P believes in creating a flexible, supportive work environment with benefits to support employees at every stage," Pierce explains. "We absolutely want our policies to support women, but our policies also support parents of all genders, or people caring for aging parents, or anyone looking for a better work/life balance and a healthier lifestyle." In creating an ongoing dialogue about the challenges and opportunities inherent in navigating the field of architecture, the firm has created a welcome transparency for all employees in the process.

"The steadily growing number of women entering the profession means that the industry will continue to add new voices and valuable perspectives to the conversation, and these voices will advocate for equity in ever greater numbers."

From these initial SWiL discussions held at each of the firm's offices, common threads emerged. Leaders not only want to support women at every career stage, but also find authentic ways to put this support into practice. Colleagues talked about the challenges women have in promoting themselves, and the importance of cultivating an empowering support network. The firm shared concrete steps already underway, such as regular ongoing internal pay and recognition audits to ensure equity in both salary and career advancement in relation to years of experience. Many team members talked about a desire to promote greater representation of all minority groups in the profession, citing the significant benefits of inviting multiple perspectives to the table.

Building a Scaffold: Girls Leadership Academy of Wilmington

As we make authentic headway in increasing diversity in the profession, not just for women but for all minorities, we are collectively learning powerful lessons about the power of representation and about reaching people early enough to support them along the path from education to architectural practice. When our children and youth see people who look like them in the A/E/C profession, they begin to internalize and envision possibilities for their own career paths.

The Girls Leadership Academy of Wilmington (GLOW) believes in encouraging its students to dream big. As the first single-gender charter school in North Carolina, GLOW Academy is dedicated to preparing each of its middle and high school students, many of whom will be first-generation college graduates, for “successful college admission, college graduation and citizenship through life.” GLOW Academy’s mission extends far beyond academics to focus on the whole student, with core values of high academic expectations, social and emotional development, leadership development and college preparation. The school is serious about closing opportunity and achievement gaps and currently has 300 students in grades 6-8. The school will continue to welcome another incoming class of 100 sixth graders each year until the school reaches a capacity of 700 students in grades 6-12. Principal Laura Hunter sees this deliberate growth as a huge asset. “At the very heart of what we do it’s all about knowing our kids, knowing their families, and knowing each other,” she believes. “Nobody falls through the cracks, nobody is invisible, everybody knows your name, and everybody knows where you come from. We are a family.”

To accommodate this growth in a short amount of time, GLOW Academy turned to LS3P for help designing a new facility. LS3P not only eagerly accepted the design challenge, but also seized the unique opportunity to show the all-female students what an all-female design team can do. The project team included architects, an interior designer, and a construction administrator from LS3P; landscape architect Christine Hilt from CLH Design, PA; structural engineering intern Jenn

Tepper from Woods Engineering, PA; mechanical designer Kay Lynch from Cheatham and Associates, PA; and pre-construction assistant Cameron Scibal, site project coordinator Ashlin Ivey, and site superintendent Taylor LaRosa from Monteith Construction Co. The team was passionate about coming together to showcase the power of collaboration and bring their best to the design, and the students were excited to see women in the A/E/C industry in action. GLOW Academy founder Judy Girard appreciated both the commitment of the team and the caliber of the design. “The design team came into our school, got to know our girls, listened to our faculty and created an inspired learning environment.”

“Team by team, project by project, firm by firm, however, the industry is steadily moving the needle toward a long overdue balance.”

The team worked closely with the stakeholders and students at every stage of the process, making sure that the work was both visible and inclusive. Designers did a “deep-dive” into the school’s mission and culture, meeting with Girard and President/CEO Tod Godbey as well as the students and teachers for design inspiration. GLOW Academy challenged the team to create an inspiring, economical design to accommodate flexible project-based learning and integrated technology and allow for planned growth as grade levels are added. The solution blends pre-engineered structures arranged around a central courtyard and a unique aesthetic that is strong and feminine without being “girly,” an important distinction for the students. Every space within the campus is designed as a learning opportunity, from the outdoor classroom near the raingarden to learn about ecology to the exposed building structure to see real-world applications of physics and geometry.

LS3P Associate Daniela Ayers, Assoc. AIA, is passionate about the school’s mission as well as the opportunity to integrate the best of what architecture can do for the people who will inhabit it. “We are so excited to create an environment that

will help students who really need and deserve this new learning space develop into leaders,” she explains. “To reflect the strength and positive energy of these young women, we designed the space with graceful and elegant lines in powerful materials such as steel, and we customized the layout with interesting interior angles and high-impact, inspirational graphics.” The five-building, 14-acre campus is scheduled to open in time for the start of the 2019/20 school year.

One Step Closer to the Future

Ultimately, the GLOW Academy project has yielded powerful lessons for the designers as well as for the students, their families and the community. While Ayers was thrilled to show the students what a team of women could accomplish when together, she was overwhelmed by how much support she received in the process. “Sitting around a table at our design meetings was incredibly fulfilling,” she remembers. “The way that our team of women worked together to expand on each

other’s ideas, celebrate successes and build each other up has been such an amazing experience. The result is not only an excellent design for the client and the students who will learn in these buildings, but also genuine empowerment for all of us who participated in the process.”

Reaching diverse voices in architecture is a multifaceted endeavor. The substantial pipeline of talented women in the field did not develop accidentally; it took decades of steady progress. Team by team, project by project, firm by firm, however, the industry is steadily moving the needle toward a long overdue balance.

Laura Miller is vice president | principal | studio leader at LS3P.

Katherine Ball is associate | creative writer | researcher for LS3P.



Diversity & Inclusion: The New Approach Needed to Avoid Cultural Irrelevance

Discussions of diversity and inclusion have been taking place in our industry for years. But the question remains: are we making any progress?

CHRIS STULPIN

Unfortunately, the way we approach diversity hasn't kept up with the rapid changes we're seeing in our culture, such as the ways our population is evolving, the fact that we live in a post-demographic society, or the expanding gig economy that's influencing our desire for greater flexibility. We can no longer afford to think of diversity in terms of the groups we're born into, but must shift our language to discuss the more meaningful differences we bring to the workplace—differences in the ways we work, think, solve problems and approach situations. Recent research from Deloitte supports the need for a broader definition of diversity, stating that high-performing teams are both cognitively and demographically diverse. There's much more work to be done regarding diversity in order to move on to the most critical element: inclusion.

“To design spaces that are relevant to all, we must do a better job of bringing more diverse perspectives to the table within our own firms—and making sure they're not simply silent representatives, but genuinely equipped to drive the discipline forward.”

The relevance of design in a changing cultural landscape

In today's cultural and political climate, we don't have to look far to find examples of severe division in America. We've drawn lines between ourselves based on race, gender, political party, sexual orientation, religious beliefs, values, abilities, and the list goes on. A quick dose of any news broadcast depicts a nation divided against itself, where, after years of conversation about the need for true equality and the importance of inclusion, we still fail to provide real and meaningful opportunity to entire groups of people. Some industries are certainly having a harder time with this than others—and the architecture and design discipline has long been one of them.

The good news, though, is that cultural change is taking place at a scale and a speed that we've not seen before. Fundamental shifts are happening in society today that are creating new ways in which we live, work and play. Industries must embrace diversity to remain relevant to the clients and communities they serve. This is especially true for architecture and design professionals, as we help shape the environments in which greater diversity and inclusion can take place. To design spaces that are relevant to all, we must do a better job of bringing more diverse perspectives to the table within our own firms—and making sure they're not simply silent representatives, but genuinely equipped to drive the discipline

forward. “The true impact of a diverse workforce comes from an organization’s ability to cultivate an environment that reflects the unique perspectives of every member of their team. Everyone has a voice and a part to play in an inclusive environment,” said Joline Manning, Chief Human Resources Officer for Tarkett North America.

“We can no longer afford to think of diversity in terms of the groups we’re born into, but must shift our language to discuss the more meaningful differences we bring to the workplace—differences in the ways we work, think, solve problems and approach situations.”

Why is the design industry so critical?

The lack of diversity and inclusion in the architecture and design field has significant repercussions, both for the future of our communities and the financial success of our design firms. The planning and design of a community is so influential to the way its citizens interact with each other. It is not only our privilege, but also our obligation to create spaces and city plans that celebrate diverse heritages. According to Alfonso Medina, Founder of T38 Studio Source, as quoted in an article published by *Curbed*, “There are so many aspects to the practice of architecture; it’s not just designing a building. It’s also understanding how communities work and how master planning can have an impact in the lives of so many people. And when people are from different backgrounds, they are the ones who really understand how their communities work, and how they could make them better.”

Beyond what could be argued as an ethical duty, research suggests that giving diversity and inclusion real prominence in our strategic thinking is an absolute requirement for economic survival. In studying the importance of diversity to

the information technology industry, researchers at Deloitte have found that “organizations with inclusive cultures are twice as likely to meet or exceed financial targets as those without, three times as likely to be high-performing, six times more likely to be innovative and agile, and eight times more likely to achieve better business outcomes.” Design firms that fail to diversify the faces (and the thought processes) around their tables will eventually lack relevance and put themselves out of business.

What’s been done so far

Some progress has been made in capturing the current state of certain corners of the design and construction professions. Equity by Design, for example, has conducted its Equity in Architecture Survey, and is currently analyzing 2018 results from nearly 15,000 responses. According to the latest numbers reported by the National Architectural Accrediting Board, we are making improvements with regard to the number of women enrolling in architecture school (up five percent between 2008 and 2015). But ethnic diversity is still quite disparate in architecture programs across the country. When you consider the American Latino population is expected to grow by 57 percent between 2015 and 2050, and Muslims will make up 30 percent of the world population by 2050, it becomes clear that, without a change of course, architects and designers will continue to fall behind in their ability to represent the society they serve. Gathering information on where we stand is the first critical step to moving forward, but our ongoing research must consider the new, broader understanding of both demographic and cognitive diversity, as well as the flexibility needed to support every employee.

Where we must go from here

First, we’ll need to gather better data to help us understand *post-demographic diversity*. Which areas of diversity have we been overlooking? Who has been alienated from the industry, costing us broader representation of thought? To help with this, Tarkett is exploring new industry research that will benefit our entire community.

Once we know who is missing, we can start to understand why they've not considered architecture and design a viable career option, or perhaps, why they've chosen to enter and quickly leave the field. Our new research will help provide a successful plan of action that consider all barriers to entry, and provide a comprehensive plan to address them. We predict such a plan could begin with the protection of art programs in underprivileged elementary schools, proactive university recruitment programs, working partnerships between industry professionals and academia, an updated curriculum that celebrates the work and contributions of a more diverse group of innovators, and the creation of happier, more flexible workplaces to support this diverse new workforce and improve retention. This can't be a one-size-fits all solution, but an inclusive new atmosphere that considers the individual needs and differences of each employee, bringing our efforts to a diversity of one.

The future is ours to create

Design is a uniquely empathetic endeavor; the best designs come from a true understanding of our clients and the end users of our spaces. If we are not able to represent end users during the design process, we will continue to lose ground for diversity and inclusion, not just within architecture classrooms and firms, but in every hospital, workplace, storefront and learning environment we create. As an industry, we can choose to work together and take proactive measures for greater inclusion, or wilt into the shadows of cultural irrelevance. None of us disagrees with which of these is the correct path forward. But we have to fight the temptation to just make this a check-the-box numbers game. Stay tuned. More work and conversation to come.

Chris Stulpin is chief creative officer for Tarkett North America.

FROM SUSTAINABLE,
TO RESILIENT,
TO REGENERATIVE DESIGN

Cities: Key Players in the Fight Against Climate Change

I remember the first earthquake I felt after moving to California. I knew it was a thing that happened, but it still seemed conceptual until I saw the windows shaking in the supermarket across the street, followed by the lights over my desk and then everything else in the building. The most jarring thing was the idea that the *terra firma* I had grown up depending on and taking for granted was suddenly suspect. It shook assumptions and beliefs just as much as walls.

BRENDEN MCENEANEY

This is why climate change feels so insidious to me. The systems and patterns of climate and the various life support systems that depend on them are fundamentally changing in ways that we didn't design for, and the predictions suggest that incremental shifts could give way to more drastic changes in the not-distant future. And while they are punctuated by extreme events, like earthquakes, the persistent march toward change happens largely in the background while we go on unaware.

This presents a design challenge for our physical infrastructure as underlying conditions like temperature, precipitation and sea level are breaking out of the boundaries we thought we understood. But it also creates a threat to the daily human functioning that defines our communities. Worse air quality, hotter temperatures, more storms and fires, new diseases—these issues impact health, education and business in increasingly dire and unpredictable ways. Moody's is beginning to consider climate risk when evaluating municipal bond ratings. Researchers have used Zillow data to show that properties in coastal areas vulnerable to storms and sea level rise are already seeing a climate penalty to their value.

Thinking optimistically, we have a set of solutions that can avoid the worst of the damage. Thinking realistically, it's a

good thing that climate adaptation and resilience are now understood to be necessary parts of the plan. Thinking functionally, cities are key players in both adaptation and mitigation. And I don't mean just the familiar dense urban places whose brand precedes them. I grew up in a city of 25,000 people, which happens to be the sixth largest city in New Hampshire but is smaller than many college football stadiums on game day.

The key is to think about this city in its original sense as a beneficial, voluntary communion of social creatures. In the A/E/C industry, we often reduce a city to the municipal employees and elected officials. This makes sense because they play critical roles in how buildings get built. Even in that narrow view, employees and elected officials are a diverse and often unaligned group. I worked for the City of Santa Monica, a small city with lots of resources that has been globally recognized for its work on sustainability. Even there, with a great staff and community buy-in to the mission, it was difficult to move basic improvements forward on things like efficiency because people are busy, people are unique, people respond to different drivers, and no city ever has enough time or money to do what they need. But people are resilient too, and they quickly adapt to changing conditions. I learned in Santa Monica how powerful policy could be as a tool, and the

city was one of the earliest adopters of green building requirements. We saw a similar pattern again and again. Pilot projects generated great results and momentum but lacked the scale we needed for change. Broad policy mandates generated impact at scale but were often opposed because of fear or uncertainty. The pilots informed sensible policy, and often the loudest critics before adoption were the best at figuring out how to comply and the first to tout their sustainable leadership after the fact.

Cities and states across the country have been moving forward on climate policy. Energy benchmarking, green building codes and climate action plans have gone from exception to rule in a short period of time. Here in California, the conversation has shifted from energy to carbon, and the policy issues on the horizon involve some complex challenges that knit together several sectors. With the state pushing forward more aggressive renewable energy commitments, electrifying everything and moving away from natural gas is becoming a key component of the climate strategy. Electric vehicle infrastructure has blurred the lines between the buildings and transportation sectors. As our buildings and grid get cleaner and more efficient, more attention is being paid to embodied carbon and life cycle emissions from the materials we use to build our buildings and infrastructure.

But cities are not just defined and determined by the policies they adopt and the people who make and implement those policies. Neighborhood associations, business leadership, cultural traditions, sports leagues—these are the fabric of communal identity and action in cities from New Hampshire to New York. These groups can be ad hoc or informal, but often they are established as non-profit organizations that play important roles in how communities establish a vision, navigate change and retain an identity over time.

When I worked at the Urban Land Institute (ULI), we helped cities develop plans to adapt to impacts from climate change. ULI, itself a nonprofit think tank for the real estate industry, usually worked directly with city staff on these projects, but an important part of the process was engagement with key community groups who could give context and history, but

more importantly could mobilize buy-in for action. Finding that core leadership at all scales in a community ended up being an important indicator of any plan's success.

Leadership and momentum derived from the community fabric is essential as we adjust to a warmer planet. While we must keep pressing forward on mitigation solutions, cities around the world are already facing daily impacts from climate change that will cost lives, homes, jobs and dollars. Cities are looking at their critical infrastructure to determine how to minimize shocks and stresses.

A conventional perspective would start with gray infrastructure: if we are running out of water, let's build a bigger reservoir. But some of the more successful projects have been rethinking this approach, combining green and gray infrastructure in ways that generate multiple co-benefits to the community. Waterfront parks can be designed to flood safely, providing a community amenity during normal days while adding flood protection during storm surges. Microgrids with renewables and storage can help even out utility grid fluctuations under normal conditions and can provide critical power needs during power outages.

“Cities are not just defined and determined by the policies they adopt and the people who make and implement those policies. Neighborhood associations, business leadership, cultural traditions, sports leagues—these are the fabric of communal identity and action in cities from New Hampshire to New York.”

Perhaps every generation feels like the world is changing faster than it did before. New technologies and platforms present solutions to the climate challenge but are often incongruous with the timescales in which cities evolve. In my work

at Integral Group, we take our innovations in high performance buildings and apply them in district- and city-scale solutions. Based in the Bay Area, we are surrounded by the values and culture that Silicon Valley has become known for: fail fast, disrupt, break things. These mantras have led to incredible new businesses and entire industry sectors, but they also suggest an appetite for risk that's incompatible with the fundamental, mission-critical nature of municipal operations and community life. Innovation and change, especially by the private sector, is absolutely necessary for us to solve climate change. It will also happen to us whether or not we are ready for it.

Advances in data science and sensor costs have enabled predictive analytics and truly intelligent controls at the system, building, district and grid scale. This allows for finely tuned operations that save energy and carbon but it also opens the door to distributed downscaled solutions, like demand response at the retail level, or vehicle-to-grid software optimizing battery charging over thousands of points. Beyond energy, employers are leveraging this increase in information to incorporate health and wellness planning into their buildings with real-time information on air quality, activity, daylight levels and other elements that affect productivity, recruitment and retention.

Mobility is undergoing a seismic shift, with Uber, Lyft, Tesla, Lime and Byrd all playing a part. Some studies show that ride share is increasing vehicle miles traveled and traffic, but we can also envision a future with all-electric autonomous vehicles—emissions free and powered by renewables. The price of those renewables as well as battery storage has dropped rapidly to the point where it outcompetes traditional fossil-powered plants.

New industry clusters, accelerators and incubators are popping up around cleantech, which means a lot more than solar PV these days. While many of these are still focused on energy, materials and carbon sequestration will see

increased importance and investment as the climate situation becomes worse. Emily Kirsch, CEO of Powerhouse in Oakland, likes to say that energy is becoming decentralized, decarbonized, digitized and democratized. I've found that's a good shorthand for much of the change that is going on around us right now.

“Perhaps every generation feels like the world is changing faster than it did before. New technologies and platforms present solutions to the climate challenge but are often incongruous with the timescales in which cities evolve.”

The large and small cities where we live are beautiful, messy, dynamic, complex places that are shaped by innumerable intersecting forces. And yet despite that chaos, we still can and should craft our communities deliberately to reflect our values, aspirations and collective vision. While the death and life of our cities has been influenced by external trends—the rise of car culture, urbanization, baby booms—it is our interventions that matter. Instead of being scarred by freeways and redlining policies, we need to be building healthy, affordable, transit-oriented housing supported by green infrastructure.

Climate change has emerged as a new force shaping our communities, one that will change everything and change the way that everything changes. We have some technical solutions, but by leveraging the great power in our cities through policy, leadership and innovation, we not only can prevent further damage and adjust to the coming impacts but can find a way for everyone to be healthy and prosperous, and to thrive.

Brenden McEneaney is principal, urban innovation, for Integral Group.

Smart Buildings: The Future of Sustainable Design

Advances in technology are ushering in an exciting new interactive era for the built environment. We now hold in our pockets more computing power than what launched us to the moon and back in the sixties, and it will enable building occupants to increasingly interact with buildings in ways not previously imagined.

Buildings are becoming more occupant aware, and can now be configured to know where people are located inside of the building, their personal preferences—and can respond accordingly. New services can be created through the explosion of data that can be collected from buildings—providing rich actionable information to occupants and building operators alike—indicating both how a building is being used and how it is performing. Simple, intuitive building apps allow the occupant to be more building aware; to reserve a room, workspace or parking space on the fly; to indicate whether they are happy with the internal environment; and to learn about building locations that may better meet their changing needs.

To help unlock the potential from the building technology standpoint, we are witnessing the evolution toward physically and virtually converged building systems including security, building management systems and lighting control, and a leveraging of low-cost sensor arrays that can be deployed within spaces at greatly increased granularity relative to today's business as usual. Local and cloud-based aggregation of this data provides a key to discovering usable information and gaining new insights about the space and its occupants.

Where is the nexus between smart buildings, smart phones and sustainability within the built environment? One example is in the area of building operational energy performance.

The old paradigm for understanding and benchmarking building energy performance across different typologies and locations relied on utility bill data entered manually into databases developed and used by private enterprises and more open platform, public tools. The databases provide value at a macro scale, but are archaic, often incomplete or inaccurate, sometimes statistically questionable, and do little when it comes to enabling a deeper dive into understanding an individual building's performance.

The remedy that is now maturing within many markets is the increasing deployment of energy sub-metering in buildings with backend platforms that manage and store the data, provide analytics and a graphical means of visualizing the information. These enable improved energy management, but are not yet fully scalable to all buildings given costs relative to energy cost reductions. And, with utility sub-metering alone the opportunity of understanding and linking to how occupants impact building performance by their individual and group behaviors is not easily discerned. With more data rich, occupant-aware buildings, operators of buildings and design practitioners are poised to be much more informed than ever before. Once it's easier to understand what's going on in a building, we can take the right actions in terms of sustainability, whether it's turning off the lights or making a repair to eliminate waste. And, we have an opportunity to not only improve an existing building's operational performance,

but as design practitioners we can, through maintaining a “relationship” with the buildings we have previously designed, gain an increased understanding of how to better design future buildings.

As we step into this new era for the built environment, it is important to keep in mind key factors that could hamper both progress and sustainability. We must recognize at both a building and societal scale that the fossil fuel world we’re living in is finite in terms of how long it can last. Whether you want to believe the science that says there is climate change or not, we’re doing something that the earth’s natural carbon-cycle isn’t prepared for—and that is, putting a billion years’ worth of sequestered carbon dioxide into the atmosphere in a very short stretch of time. Properly attaching a societal cost down to individual and building levels to address macro changes is a political and economic challenge, but as models are developed, the incentives for deeper reductions in building energy use will find drivers to help enable smart building deployments.

But sustainability runs deeper than just energy, and societal and direct economic benefits can be increased in smarter buildings by orders of magnitude if space efficiencies and indoor environmental quality and occupant health opportunities are captured. Demand within the competitive marketplace is already there, and growing. Depending on how and who has access to more in-depth building performance data, and the types of core smart or “smart ready” building services offered by landlords, future tenants will be able to make better, more competitive choices when leasing space. Just as the objective of energy performance disclosure laws today is to create an incentive for building owners to improve operational energy efficiency because they are being compared against peer properties, the services and the deeper level of performance metrics available in the occupant-aware building will make tenants savvier.

As these potential “beyond utility bill savings” strategies are proven in smart buildings, there is opportunity to address the much larger, and challenging, issue of dramatically improving performance in existing buildings. Lacking a complete and

aggressive modernization, energy efficiency improvements are incremental in the existing building stock as capital renewal of aging assets occur. Owners generally lack economic incentives to make improvements beyond a simple life cycle cost analysis using energy savings alone. The chances for an improved return on investment and a more compelling business case—to creating a competitive advantage in the marketplace relative to peer properties—could lie in capturing the benefits that smart buildings are poised to provide.

“We must recognize at both a building and societal scale that the fossil fuel world we’re living in is finite in terms of how long it can last.”

Many have spoken about the “3-30-300” associated with the smart building business case. This has been effective in explaining, and changing mindsets around, the enhanced sustainable return on investment. The “3” in this equation represents the utility cost for a building on a square foot per year basis. A retrofit energy-saving project in an existing building might save ten percent of that, or 30 cents a square foot per year. At approximately one magnitude of cost greater, the “30” represents the cost per square foot of rental space. A deeper knowledge of tenant space usage characteristics, as determined through data collected using smart building technology, could help justify an increase in tenants’ space efficiency as part of a new fit-out of a building space. If this savings is even only ten percent, and it can be shown to enhance or change operational efficiency, that could result in savings of \$3 per square foot per year. Finally, the building can be a catalyst for giving employees the means to create the space they want based on their preferences, resulting in increased health and wellness and productivity, working against a cost for people of \$300 per square foot. This focus on the health and comfort of a building’s occupants is a new priority for the next generation of buildouts. There is a lot of interest, especially among more progressive companies, to emphasize the wellbeing of employees, even if the benefits are,

for now, indirectly measurable. Once that value proposition is understood in existing buildings, then there is a whole new economic model.

Despite these advances, the psychology of people can still make or break a culture of sustainability. Entrenched power and political systems can hinder progress; there will be people who see its benefits and move forward, and people who don't. Even when their values seemingly align with environmental awareness, it's not always their top priority in many situations. Even where there is the clear desire to create a better future for their children, the impact of investing in their environment somehow gets abstracted, out of the operative decisions made by business entities consisting of those same parents. Society—and the A/E/C industry—seems wired for selfishness in the present over concern about short-term business and personal gain rather than on posterity and the true costs associated with decisions made that have long-term negative, clearly non-sustainable ramifications. Can the power unlocked through smart buildings address a small part of these barriers? Maybe.

“Society—and the A/E/C industry—seems wired for selfishness in the present over concern about short-term business and personal gain rather than on posterity and the true costs associated with decisions made that have long-term negative, clearly non-sustainable ramifications.”

Another concern and potential barrier is around the privacy and security of this richer connectivity with people and buildings. People still have a fear of letting the world (or those managing the search engines) know who they are, where they are, and their preferences, at least on a constant basis. There are also questions about how to deal with large amounts of

data on people and buildings in a way that is interoperable; what if the systems invested in become obsolete? What if the proprietary system suddenly stops being supported and you end up with a data swamp no one knows how to use? These are fundamental concerns.

In spite of these psychological and societal barriers, changes are happening all around us and we're recognizing and embracing that changes are inevitable. So our focus can and should be about trying to design occupant-aware buildings for building-aware occupants. We can focus on providing better and smarter buildings, since we can anticipate the occupants will let everyone know, by their actions, whether we are successful.

Smart building technology is not limited to inside the walls of a building. Smart districts, neighborhoods, and the grid should ideally be a part of a more seamless whole. There are many possibilities surrounding the technological interactions and exchanges at a building-to-building, or building-to-neighborhood, or building-to-utility grid level. And district-scale solutions are increasingly being recognized as a way to further unlock sustainable and more resilient opportunities.

By integrating these new frontiers of data into sustainable actions that both protect the environment and the wellbeing of occupants, the future of building design holds exciting prospects beyond physical construction. If we can open minds to these possibilities and set a progressive pace for the market, the smart building will soon be as much our reality as the smart phone. The responsibility, however, does not lie solely in an intelligent building and the data it collects; people still must be cognizant of our environmental reality and do their part to conserve resources. I am grateful for the companies who have made a sustainable future part of their organization's vision, and hope many more will join their ranks in the years to come.

Tom Marseille is senior VP of building systems for WSP.

An Interview with NBBJ's Margaret Montgomery

Margaret Montgomery talks with DesignIntelligence about priorities for her practice, reducing the carbon footprint of the built environment, materials disclosure, the impact of nature on humans and more.

MARGARET MONTGOMERY

DesignIntelligence (DI): What are the priorities in your practice right now? What are you most focused on?

Margaret Montgomery (MM): We have a large international practice that is truly a networked set of studios with a lot of smart, highly motivated people. Generally, we want high-performance projects to be the norm in the practice, so we do everything we can to ensure that's possible. But we do that more on the side of encouragement, peer pressure, great examples, tools and other initiatives rather than "thou shalt do this"—except for the reporting.

We use the COTE Top 10 Criteria as early as possible in a project as a way of encouraging teams to talk about big ideas related to sustainability. Our belief is that, given those 10 big questions, at least one of them will resonate with the purpose of that project in a way that helps build a stronger project story and can create or amplify a valuable design strategy on that project. Whether it is about well-being, climate resilience or some issue specific to that particular project, we believe the COTE Top 10 is valuable.

As long-time signators to the 2030 Commitment, we're always focused on energy performance—making sure the teams know what to do, and giving them the tools and the ability to do that work. Over the past year, we've also been upping the percentage of projects that are using energy modeling as a design tool. We have standardized Autodesk Insight 360, which allows the teams to do quick, internal modeling very early in a project.

This past year, we took our modeling from 30 percent to 70 percent of projects because of the Insight tool. Our goal is that soon all projects with early concept schematic models developed through the tool will go on to use deeper energy modeling cycles as the impetus for better performance throughout the project. Even for those projects where full modeling scope is not possible, we can make a difference in the beginning. The factors that architects direct most closely—massing and orientation, glazing percentage, façade design and performance—thus set a foundation for better performance.

This year we're honing in on aggregating our approach to material transparency and performance. We are looking at embodied carbon for materials in a way that's new. We're fortunate to be working on a project that's an early tester for the EC3 carbon tool, so carbon has been more of a focus than a full environmental impact assessment.

We're also talking with some clients about fuel-shifting to electricity where possible—with zero-carbon goals on the horizon, we can help shift the critical mass to build a cleaner electric grid and reduce dependence on natural gas in many cases.

DI: How do these priorities within the firm map to your opinion of what we, as an entire profession, or A/E/C as an industry should be focused on?

MM: We are absolutely aligned with the priorities I believe the industry should be following, although we need to do more.

We think that, in general, high-performance, sustainable projects are the only future that is viable for our profession and our clients. Zero carbon is viable for many projects, and we're able to steer clients toward a high-performance achievement that's possible for them. Transparency and material selection for reduced environmental and health impact are easier every month. Planning and site development for resilience and for a healthier urban ecosystem are equally critical.

DI: You mentioned materials transparency and standardizing as a priority for the firm. What are you doing about that?

MM: This is a challenge because it's such a big topic. We're putting tools in place and tweaking our specification standards in areas where we can knowledgeably improve our standard options. For example, if we have a spec section in which we want to include a product, and we have enough manufacturers that are willing to disclose what's in their product (and even others that aren't), we can require that disclosure.

We as a firm, as well as the industry, are in a transitional place where it seems that the key action is to get that disclosure and to learn what we can about the products we're specifying. When enough product manufacturers are willing to share that information, the products will continue to get better. We'll be able to ask why a particular chemical is in a product, does it need to be there, and more.

Transparency and disclosure is very important for the environmental footprint and the health footprint, and it's analogous to energy disclosure: unless we know the EUI and nuances of energy performance, we can't make things better. We can't improve what we're putting in our projects from a materials standpoint unless we know what's in them. Our designers are becoming more aware of what they're specifying with materials and finishes.

We're getting a bit more sophisticated about reducing the carbon footprint of our projects, as well. Here in Seattle, which is a center point for the Carbon Leadership Forum, work is being done to address the issues around carbon. For example, what are all the concrete mixes? What's the lowest-carbon

concrete mix we can use for that particular structural purpose? How can we make sure that we are fine-tuning those mixes for the lowest carbon while maintaining performance.

Our firm, as well as the industry, is finding that the largest carbon and environmental footprint tends to be in the structure and envelope materials. The health footprint, the complicated chemistry, and the disclosures tend to congregate around the finish materials and that end of the spectrum.

“Grounding projects in their place is important so that we don't lose that sense of connection and place. Connection with nature becomes more and more difficult because people aren't engaging with nature as we've done in the past.”

DI: What are some issues or aspects of sustainable, resilient, regenerative design that we are not tackling that we should be as an industry?

MM: Carbon is such a critical issue, and if we don't tackle it as a high priority, we won't have time to tackle anything else—especially if we don't get it right. But, on a good note, if we think about ecological systems and creating a smaller carbon footprint or using less energy, hopefully they're symbiotic and one is not going to negate the other.

Resilience is a term and a need that resonates with a lot of people, partly because of climate change and carbon. At our firm, we are trying to raise awareness about resilience and carbon. In the beginning of a project, we use morphed climate files so that we can look at our projects with an eye toward current climate patterns, and what it might look like in 2050 or 2080. This will help to influence the decisions that we make now about a project. So keeping resilience at the forefront is important for all projects, but especially for those projects, like healthcare, that are mission-critical to their communities.

Grounding projects in their place is important so that we don't lose that sense of connection and place. Connection with nature becomes more and more difficult because people aren't engaging with nature as we've done in the past. Peter Kahn at the University of Washington talks about "environmental generational amnesia"—which basically proposes that the environmental condition we experience in our childhood is what we consider the "norm," and that each successive generation considers a more degraded condition normal. As more and more people today grow up in cities, the less connection we have as a species with the nature that actually supports our existence. It's hard to care about something you don't know. That is a challenge.

We've been learning a lot as an industry about designing space and the importance of, for example, material choices and how they impact indoor air quality. The connections between wellness, well-being, health and sustainable buildings have an impact on people, especially a cognitive impact.

DI: What are we doing as an industry that might be called wasted activity? Are there areas of focus that may have been useful before, but aren't useful any longer?

MM: There are opportunities where communication and shared resources would help us internally as a firm, as well as industry-wide. In this way, we're helping the professions as a whole by not having to reinvent everything at a firm level. There is a level of sharing in the industry that has historically been better in the sustainability realm than it has been in any other part of our industry. Our competitive edge is more about what we do with that shared knowledge. Because we're all creative people, the more we can share best practices about how we do certain things, the better off we'll all be. If we start from a higher common platform, then we'll all go further.

DI: What do you think we should let go of as an industry?

MM: A lot in our industry has been the same for a long time, so there are certainly some things we should ditch. For me, one of those things is the idea that there's a certain way a

building should look in order for it to be perceived as beautiful architecture. Personally, I would love to let go of that uniformity of what's considered beauty. In other words, what's beautiful in one culture or climate shouldn't necessarily be beautiful in an entirely different culture and climate.

DI: Where do the ideas of being practical and being effective intersect best for sustainability?

MM: In a project, if we're doing things in the right way, we shouldn't need to add anything. We shouldn't need to add money. We should be able to reallocate resources in a smarter way to do almost everything we want to do. So, for instance, if we create a better conceptual design with the right window/wall ratio, better orientation and massing that works with its place for passive energy flows, and we put the effort into better architecture, we should be able to spend less money on mechanical heating and cooling. To me, that's pragmatic and effective because we're conserving first-cost resources and getting more from our client's money. The goal is to do that while also creating a more comfortable, more livable place for everyone who experiences it.

DI: In the years that you've been practicing sustainable design, what changes have you observed in clients' viewpoints?

MM: It's a shifting baseline. For instance, the idea of paying attention to energy use—which 10 or 15 years ago wasn't ordinary—is important to the majority of our clients today. Where once a client might say, "LEED Gold is our standard," now when the next version of LEED Gold unfolds, there's a period of discomfort and the baseline shifts. Then we absorb a new level of performance as the norm. Certification systems, disclosure ordinances, zoning requirements or incentives for certain certifications, and more—all tend to nudge the baseline up. The level of sophistication has grown, and I credit the influence of transparency to allow more data-based decision making.

Many of our clients recognize the value of creating space that helps them and their people be more comfortable and perform better. This was an idea that probably didn't resonate

well a few years ago because there weren't enough studies to show the connection between what we thought intuitively were good things for people and outcome-based goals.

DI: Are there ways in which what clients value is changing?

MM: Yes. Our current culture is a lot more sophisticated about what makes a good space. We do a lot of work in the tech sector, and they have high standards for recruiting and retaining talent. Environmental ethics is part of that, and a lot of younger people really do care about that. So I think the shifts that we see are indicative of society at large.

“Carbon is such a critical issue, and if we don't tackle it as a high priority, we won't have time to tackle anything else—especially if we don't get it right.”

DI: What important trends do you see happening?

MM: Technology continues to accelerate. A good example is electric vehicles or self-driving vehicles and how they might influence city-making. It may not be any different than any new thing in the past, really, in that we have a chance to make something that's really good, or we have the chance to make some mistakes that could be really damaging. But does the new thing make our lives better? Or is it something that seems like it makes our lives better, but then it actually has some unintended consequences?

That theme of unintended consequences is the cautionary side of what I see happening in all of these new advances and developments. For example, we all want to use better materials that are the result of better chemistry. It's good to get rid of something bad in a material, but what are the unintended consequences of the replacement? So whatever we do, there's the need to be careful and thoughtful, and that goes counter to the speed with which everything accelerates and happens in our lives.

I also see a lot more focus on issues around carbon. Even if it's not coming from our federal government, it's definitely welling up everywhere else.

Another trend I see is the realization of the issue of embodied energy of buildings and products. We had such a big nut to crack with energy use, especially in operational energy use in the building sector. Today, the systems that we choose are beginning to change for the better. We're getting more conscious of how we deal with building envelopes. Now we need to think about what we're building with.

Transparency trends are also going to grow. Hopefully, we can use those to make a better built environment and make better products. We're learning some of the cause-and-effect around what makes us healthier and happier. I hope that we don't turn those into automated metrics that take away the soul of what we do, because I don't think we can't just push a button and design something that will make us happy.

DI: What makes you hopeful? What challenges you?

MM: What makes me hopeful is the human spirit and the desire to make things better. That, I think, just never quite gives up. You see it a lot lately in various movements outside of the building industry as well as all of the groundswell around addressing climate change. At the core, I believe we all want to make the world a better place. The challenge is how hard it is sometimes to find a common understanding or a way to communicate that gets us all headed in the same direction.

Margaret Montgomery is NBBJ's global sustainable practice leader. She leads initiatives and projects with the goal of creating healthy places that reunite people with nature. Employing strategies that range from biophilia and indoor air quality to zero net carbon design, she encourages teams to improve building performance, ecosystem vitality and human experience on each project.

Innovation with Community in Mind

Designers, planners and engineers will tell you we stand at the cusp of a new era in city building. Growing economic disparity, increasingly frequent natural disasters, and technological advances in mobility have had a major impact on how we approach projects.

These large trends will fundamentally change the places where we live, work and play, and it's essential that we embrace the best ideas to address them successfully.

Resiliency/Sustainability: The best resilience planning doesn't just build barriers, it makes new connections

Climate change represents the most significant challenge the world faces. Visceral reminders arrive with disturbing frequency, from California's record wildfires (spurred by intensifying drought) to two Category 4 hurricanes hitting the U.S. within a month. And the 2018 IPCC climate study shows we've drifted dangerously close to a dire tipping point, with far-reaching implications for our communities. There has been plenty of talk on resilience planning in recent years, but the fact is that the practice remains in its infancy—and has a long way to go.

While hard infrastructure plays a central role in resilience planning, integrating it into a network of green infrastructure and community education magnifies its effectiveness and delivers much broader community benefits.

As thinking around resilience planning evolves, there's a strong case for baking it right into community design, not segregating it as an afterthought. A holistic strategy that unites social, economic, environmental and organizational

ANTON GERMISHUIZEN & NANCY MACDONALD

systems doesn't just cost less, it also increases livability in cities. This is the approach we took for the Tottenville Beach reconstruction plan in Staten Island, NY, featured as a "living lab" at the 100 Resilient Cities 2017 Urban Resilience Global Summit.

Staten Island, like much of the Eastern Seaboard, suffered significant damage from Superstorm Sandy in 2012. The storm brought 16-foot tides and six-foot waves to the borough's shores, sweeping structures from their foundations and tragically taking 24 lives.

To improve resilience to future storms in Tottenville, we developed a plan in partnership with Rebuild by Design that took a layered approach. Redundant structural elements, ecological enhancement, and green infrastructure will work together to allow the area to resist influxes of water and to recover from them more quickly. The real key to success, however, lies in extensive community engagement. This meant taking the time to understand community needs and desires and adjusting designs to reflect residents' feedback. Shaped by residents, the final plan has helped build a sense of ownership and stewardship, which helps increase social resilience. The design most importantly protects the local residents from the wrath of nature. It also protects the value of nearby homes and keeps Tottenville Beach accessible to everyone—making the neighborhood much more attractive to residents and future buyers.

The design professions are still in the early stages of defining a path toward resilient cities, but several things have become clear. We need to use available funding more wisely to deliver projects that make our communities safer in emergencies and improve quality of life the rest of the time. The industry needs to champion expanded funding, the breaking down of siloes that hamper resilient ideas, and creation of projects that benefit communities.

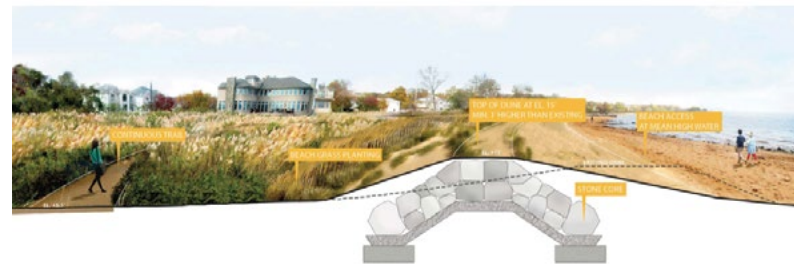
There is a need for more research and more evidence of the benefits of resilience thinking in planning and design. Resilience thinking should be integrated into professional training for the next generation of planners, landscape architects, and engineers, and cities need to rethink the tender process to reward holistic solutions that add value to projects and enhance a community's resilience. And we need to establish industry best practices that transcend design, planning, and facility and site management.

Social Equity: Radical approaches to preserving and revitalizing public housing

Over the last two decades, many cities have welcomed new development spurred by a rising demand for urban living. The trend has proved a mixed blessing, since it has also made housing in “superstar” cities like Seattle, San Francisco, and Boston prohibitively expensive, forcing low-income residents out of the center of the city, which makes it harder for them to get to jobs, social services, and networks of family and friends.

At the same time, public housing—often a life raft for low-income households—has endured a slow-motion crisis as state and federal funding for housing have dried up. Stantec led the planning and design for a project that could point the way to a solution to this problem. We're working with a private developer and a housing authority on an audacious transformation of the 1,110-unit Bunker Hill Apartments into a one-billion-dollar mixed-income and mixed-use community that will become Boston's newest neighborhood.

Working closely with existing residents and the larger community, we completed a master plan for the renamed One Charlestown. Because the site is a 15- to 20-minute walk to



Engaging the community not only made the Tottenville Beach resilience plan more suited to residents, but it also increased a sense of stewardship and social resilience.

transit, it doesn't qualify as transit-oriented development (TOD) under city rules. That limits development to 2,850 units based on parking and traffic impacts on the dense surrounding neighborhood served by narrow 19th-century streets.

Stantec prepared a “last mile” shared autonomous vehicle (SAV) strategy to link One Charlestown to transit. Robust SAV access to transit would support a 25 percent increase in market rents and cut required parking by 33 percent. Functioning as TOD would also let One Charlestown add up to 500 housing units with no extra parking or trip generation.

Technology/Mobility: Shared automated vehicles can support urbanization, promote inclusion, and improve transportation options

The pending SAV revolution is still in its infancy, which makes this the perfect time for planners, engineers, city officials and citizens to ask, “What kind of city do we want?” With countless scenarios floating around—from exacerbated sprawl to soaring demand for urban living—it's not too early to map out a vision for

an efficient and livable future. We're helping Chamblee, a rapidly urbanizing suburb of Atlanta, do just that with a far-reaching study of how the community can establish itself as a regional hub for smart mobility. The city would launch the initiative with a first mile/last mile automated shuttle to MARTA's Chamblee.

“Integrating urban systems, sustainable planning principles and technology plays a central role in the design of healthy, equitable communities.”

Ultimately, we see SAVs unlocking opportunities to improve urban places by making land use more efficient. The most immediate benefits of SAV integration will come in the areas of biking and walking, parking and more efficient development. In Chamblee and elsewhere, we advise clients to study these areas first.

1. Biking and walking

Most projections suggest that SAVs will allow cities to reduce the amount of land devoted to street rights-of-way and parking. That would create more space—both physical and political—for dramatically improving the way streets serve pedestrians and cyclists. Adding inviting new public spaces, more facilities for walking and biking, and new development—to help finance these improvements—would yield a range of benefits, from gains in public health and more vibrant street life to greater equity and big greenhouse gas reductions.

2. Parking

If most residents can zip around via SAV fleets, cities and developers can dramatically redirect the resources they devote to building and maintaining parking lots and garages, which recent research suggests are dramatically overbuilt. Other estimates suggest the United States has anywhere from three to eight parking spaces for every car. This would free developers to add high-value new buildings on the footprint of old parking infrastructure, development that can help finance an enhanced public realm.

We're helping Chamblee and other clients think creatively about the transition to SAVs, how to use freed-up land for the greatest benefit, and how SAVs will improve the ways people move in, out and around the city.

3. Infill development

To ready themselves for SAVs, cities need to rework their codes now to encourage mixed-use infill development. Using overlooked or underused spaces in central districts creates a virtuous circle, assuring more customers for SAV fleets, which introduce more mobility options for everyone. (Coincidentally, denser development also increases walking, which brings its own suite of benefits.) Importantly, infill development makes more efficient use of existing infrastructure—a fiscal boon for local governments—and supports existing networks of businesses and amenities.

Every project we undertake begins with the goal of improving our communities. We see resiliency, social equity and smart mobility as having the power to change the way we live. As we look to what lies ahead, we're making sure we incorporate the best ideas possible to ensure that our work fully addresses the challenges of today—and lays the foundation for the cities of tomorrow.

Anton Germishuizen is Senior VP, Buildings, of Stantec. He fosters a commitment to design excellence and the growth of Stantec's design culture. He remains actively engaged in the marketing and design of projects, with a particular focus in the civic sector. A strong proponent of interdisciplinary integration in design, he is the co-author of *10M: Toward an Integrated Approach to Design*.

Nancy MacDonald is VP, Urban Planning Lead, of Stantec. Her fascination with cities drew her to the world of planning. She loves the way they change, grow and fit together, combining diverse human, built and environmental elements to make something greater than the sum of its parts. She says that with the right mix of people and disciplines, there's no limit to what a great planning team can achieve for communities and clients.

PERSPECTIVES

Building a Changing World

The University of Arizona is embarking on a multidisciplinary, university-wide research initiative as part of its new strategic plan. The journey around *Building a Changing World* began just over a year ago when the College of Architecture, Planning and Landscape Architecture (CAPLA) initiated its strategic planning exercise.

DESIGNINTELLIGENCE

In describing the initiative, Dean Nancy Pollock-Ellwand stressed the central importance of the built environment to our economy, environment and culture. She explained that the first step is to sensitize people, organizations, other disciplines and institutions to the fact that their cities are designed, that their health and wellbeing is intimately connected to the environments that they live within, and that new technologies will be rapidly altering the way we build and inhabit our world in the coming decade.

DesignIntelligence talked with University of Arizona President Robert C. Robbins and Dean Pollock-Ellwand about *Building a Changing World*.

DI: Dr. Robbins, we understand that the *Building a Changing World* research initiative is a major effort for the University of Arizona. What originally inspired it?

RCR: *Building a Changing World* is a university-wide multidisciplinary research initiative that emerged from the University of Arizona strategic planning process this past year. The strategic plan articulates the UA's collective ambition to embrace the central challenges and opportunities facing our society from the seismic technological shifts that are at our doorstep. With that future-oriented perspective on our mission and goals as an institution, it became clear that the built environment must be an area of critical focus due to

the impact on the world's resources, health, and wellbeing. University-wide multidisciplinary research in the built environment will also be a great differentiator for UA. It is one that we deliberately seek because it will combine our great strengths in design and planning with public policy, environmental sciences, energy, water, engineering, transportation, optical sciences, business, medicine, data sciences, public health, geography, building science, and materials.

DI: We understand that the initiative has a connection to the ideas Klaus Schwab developed in the Fourth Industrial Revolution. How does *Building a Changing World* overlap with the Fourth Industrial Revolution?

RCR: It is natural that the built environment would be one of our pan-university focuses because so many of the Fourth Industrial Revolution's technological shifts will happen within and around our buildings, our cities, our work places and homes. Artificial intelligence, the Internet of Things, responsive design, and automated construction sites, to name a few, will have multifaceted effects on the built environment. This includes the way we design, the way we build, the way we respond to crises, and even the way we make decisions about health, planning, and policy. *Building a Changing World* requires a fully integrated approach to these complex research problems; and we are committed to that as an institution. We are excited to know that the University of Arizona will be

the first university in the United States to develop a robust university-wide ecosystem supporting research, teaching, and service for the built environment.

DI: Dr. Pollock-Ellwand, how does the *Building a Changing World* research initiative fit into the strategy for the College of Architecture, Planning, and Landscape Architecture (CAPLA)?

NPE: The College is, like the University of Arizona, bringing its strategic planning process to an end with a launch of the CAPLA Plan set for the first of 2019. The driving vision for CAPLA is *Building a Changing World*, aligning perfectly with the University in its declaration that *Building a Changing World* will also be one of its Grand Challenge research initiatives. In fact, it was the college's research task force that first recognized the huge void in foundational knowledge in the built environment and articulated the need for a robust multi-disciplinary approach to building that knowledge.

Therefore, the College, like the University, is embracing the same powerful principle to approach complex issues of the built environment in an integrated and highly collaborative manner. This alignment of purpose will help fuel the work of the College and the University in its objective to seek curricular, research and service innovations in the built environment.

DI: What role will CAPLA play in the *Building a Changing World* research?

“The first step is to sensitize people, organizations, other disciplines and institutions to the fact that their cities are designed, that their health and wellbeing is intimately connected to the environments that they live within, and that new technologies will be rapidly altering the way we build and inhabit our world in the coming decade.”

NPE: We provide an important design and planning perspective in the research collaboratives that will be forming in the University around key built environment issues in a changing world. We already have strengths in transportation, sustainable markets, responsive design, policy, health and wellbeing, design-build, and performance design research, among others, and plans to build more focus areas. The research areas across campus for the built environment will include pressing issues in the coming years around livable cities, the trillion-sensor future, crisis response, evolving design processes, effective decision-making policy, and environmental performance and lifecycles. We know this integrated, pan-university approach will bring currency and applicability to some of the most pressing issues for the design and planning professions but also to the world at large. Complex issues in the built environment require this kind of commitment from educational institutions, and we know that our college and university will be at the foreground in North America, providing new knowledge and perspectives.

DI: How does the *Building a Changing World* research initiative align with the broader strategic goals of the university?

RCR: The second pillar of the strategic plan is named “Grand Challenges: Tackling the Critical Problems at the Edges of Human Endeavor.” This research-focused pillar reminds us that we are a public land-grant institution with a dual mission that brings together education and the need to address important societal challenges. Considering the built environment in the U.S. that consumes and wastes enormous amounts of resources, negatively impacts health and wellbeing, and impacts the environment and crisis response, there may be no more important grand challenges related to human endeavor than those related to *Building a Changing World*.

We proudly serve the residents of the state of Arizona as educators and researchers and through our outreach. Being located in the U.S. Southwest, within the Sonoran Desert and close to an international border, we are also well-situated to consider a much broader world community that must become more resilient to climate change, adaptable to cultural movements, and responsive to new perspectives that will bring innovation.

Our first strategic pillar is all about “driving student success for a changing world.” The University of Arizona would not exist without its students, and our research enterprise fuels the quality educational experience that allows our students to build their capacity as change agents and disruptive thinkers. These are the kind of people that will drive positive impact in the world. Students who graduate to do the work of *Building a Changing World* will have to be more flexible of mind; well-versed in working in multidisciplinary teams on complex problems; and so comfortable with uncertainties that they will not only flourish but also become leaders in the future. We will prepare them for this future through the integration of student success and research initiatives like *Building a Changing World*.

DI: How will this initiative help shape the way you educate architects, planners, and designers at the university?

NPE: The College’s vision of *Building a Changing World* is embodied in all aspects of its new Plan. There are many innovations now being charted. These include new interdisciplinary course offerings; a relaunch of its community-based scholarship center, fueled with a new commitment for collaborative projects; curricular shifts that will embed research into the professional curriculum; and venues to share integrated built environment opportunities across the full range of University of Arizona disciplines—from medicine and business to fine arts and data science. Creating a built environment ecosystem across the University of Arizona will be the concern of all fields. We know this will make for very fertile ground in the College as well as for the professions it serves in architecture, planning and landscape architecture; in addition to the fields of heritage conservation, real estate and sustainable development that the College also contributes. Students coming to our College can look forward to gaining the knowledge, skills and values that will assist them in *Building a Changing World*.

DI: How might this initiative change the way that different areas of the university work together?

RCR: *Building a Changing World* will demand a highly integrated approach to research, an approach which the University of Arizona has already established and distinguished itself as a world leader. For instance, since 2001 our BIO5 Institute has been doing the work of the Fourth Industrial Revolution, well before Klaus Schwab coined the term. Its success is an example of what we can accomplish by bringing together researchers from different disciplines of agriculture, medicine, engineering, pharmacy and science, taking on challenges that transcend one area of inquiry. The *Building a Changing World* research initiative will follow this robust tradition of interdisciplinary collaboration. It will also necessarily amplify the number of perspectives assembled because the built environment demands a very broad collaboration that spans the environmental, economic, cultural and societal realms of inquiry.

DI: What benefits and opportunities do you expect the *Building a Changing World* research initiative will create for the university? Beyond the university?

RCR: This initiative has the potential to create new integrated ways of thinking about design and planning that negotiates the introduction and amplification of technology into the physical and biological realms of built environment. This has global potential. Our plan has identified key areas of collaborative investigation that includes livable cities, the trillion-sensor future, crisis response, technology and changing design processes, decision policy, and built environment performance and lifecycles. Aligned with the fourth pillar of the Plan, “UA Global: Engaging the World,” here at the University of Arizona, this research initiative will create new opportunities for our students, faculty, and staff, to leverage their expertise in addressing the global challenges of *Building a Changing World*.

Dr. Robert C. Robbins is president of the University of Arizona.

Dr. Nancy Pollock-Ellwand is dean of the College of Architecture, Planning and Landscape Architecture at the University of Arizona.



The Evolving Nature of International Practice

Many firms aspire to do international work. The projects tend to be large-scale, complex and high-profile, offering rich opportunities for innovative design. Such work can quickly help elevate a firm's reputation, and it can also be lucrative, especially since most projects require only Schematic Design and Design Development (SD/DD) services, which are generally more profitable and less risky than Construction Documents and Construction Administration (CD/CA).

SCOTT SIMPSON

International work can be glamorous, helping to attract younger staff to the firm, and for those who enjoy travel, it can be enlightening and educational as well. For some major U.S.-based firms, international projects comprise a healthy percentage of their business. For example, according to recent research by DI Research*, projected 2018 revenues from non-domestic projects accounted for 17 percent of total revenue at Gensler, 21 percent at HOK, and 43 percent at SOM. Clearly, international work is an important aspect of the U.S.-based design business, and it is trending up each year.

Lots of firms would like to jump on this bandwagon, but there are reasons for caution. Over the past decade, as international work has expanded to unprecedented levels, there have been a number of important changes. First, and most obviously, the market has matured greatly. In decades past, leading U.S. firms were sought out for their unique expertise in highly technical and complex building types, such as healthcare facilities. They could offer specialized knowledge that was simply not yet available to local clients in developing countries.

For example, in the 1980s, Saudi Arabia constructed a number of sophisticated, western-style medical centers in such cities as Jeddah, Riyadh and Al Baha. Fees were generous and schedules were extremely tight, since during the oil boom, speed of delivery was more important than

controlling cost. The government paid a premium not only for design and construction, but also for trained personnel to staff and run the facilities. Today, the medical infrastructure is largely established, and local firms have gained sufficient knowledge and experience to enable them to effectively partner with foreign firms or even provide the required full services themselves. This narrows the market for outsiders to some degree.

This same phenomenon is true for office buildings, hotels, airports and schools. In China, the state-sanctioned Design Institutes have become much more proficient and are now training world-class professionals who can do excellent work domestically without foreign assistance. Also, many young Chinese architects who trained in the U.S. have repatriated to start their own firms. Their language skills and knowledge of local culture give them a big leg up when competing with U.S. firms.

Bottom line: while the international marketplace is strong and growing, so is the competition. This reduces the need for international clients to seek U.S. expertise. Also, many of the larger firms have successfully established offices in foreign countries, effectively making them "local" in the mind of the marketplace. This lowers the cost of operations, since foreign labor is generally much cheaper than comparable

U.S.-based labor. It also erases the difficulties of working across several time zones (not to mention greatly reducing travel time and overhead costs). The trend toward M&A (mergers & acquisitions) has resulted in the creation of larger, more extensive, and more effective multi-office networks which can leverage their knowledge, contacts, staffing and marketing expertise.

Another big, and equally obvious, change is geopolitical in nature. The Middle East and China in particular have seen the emergence of new leadership, a phenomenon which also holds in Turkey, India, South America and many African countries. These new leaders have set different agendas for their national building programs, and in some cases, prefer to use local rather than internationally-based professionals. China, for example, is making a huge investment in infrastructure (both domestically and in Africa), which requires a different skill set than design-driven architecture. Politics also introduces a level of uncertainty into the market, as centrally managed or autocratic governments may shift priorities or preferences on short notice.

“There’s no doubt that international practice can be exciting, invigorating and profitable, and it can also be a great way to grow your business. While there are potential pitfalls, those who are strategic and patient rather than impulsive and short-sighted will be successful. Remember to stay resilient and nimble.”

Add to this the effect of the financial markets. Currency swings can be dramatic and sudden. For example, when the Brexit resolution was unexpectedly passed in the UK, the value of the British pound promptly fell from about \$1.50 to \$1.10 (a drop of 27 percent). It was a great time to buy London real estate with U.S. dollars, but not so great if you were a U.S.-based firm operating in the UK, as business

promptly plummeted and many projects were delayed or cancelled outright, causing widespread layoffs. The Euro suffered a similar decline in value (mostly because of the uncertainty of the Greek credit crisis). It has recovered somewhat, but is still below pre-Brexit levels. Currency swings affect the ability of clients, both private and public, to undertake projects. Any firm with a serious interest in international work would do well to take these factors into account.

In the midst of all this change, some things have remained relatively constant. For example, different countries operate with different legal systems. In some, for all practical purposes, there is no legal recourse to effectively and fairly resolve disputes. In others (China is a good example), the law of contracts and the protection of proprietary information can be problematic. So being savvy about local laws and regulations remains at the top of the list for firms considering overseas work.

Ditto for the tax implications. It’s important to carefully study the prevailing tax laws in various jurisdictions and know how they are interpreted and applied (this can vary widely, even in the same country), as well as understand the regulations for repatriating any profits that might be generated (much more difficult in some countries than in others). U.S. tax law is also a major factor; it has undergone significant revision in the past few years. It may be great to do a big new project in an exotic location, but if your profit disappears due to unanticipated currency swings or taxes and cannot be easily transferred back to the U.S., then your efforts may be for naught.

Finally, with the advent of increasingly sophisticated design technology, plus the promise of additional productivity gains from such things as 3-D printers, drones, artificial intelligence and robotics on site, the nature of professional practice itself is changing quite fast. One impact of technology is to shrink or even eliminate the effect of distance. With proper coordination, work can be done collaboratively with multiple far-flung partners across the globe with the push of a button. Indeed, a U.S.-based firm can actually produce a substantial amount of “international” work without ever leaving the home office.

With all this in mind, what's a smart firm to do? Here are a few tips:

1. **Hone your value proposition.** Firms that want to work overseas must differentiate their services in a compelling way compared to potential competitors. What do you offer that others don't or can't?
2. **Be able to explain your firm's worth in locally relevant ways.** Why drive across town for a gallon of milk if there's a grocery store around the corner?
3. **Cast a wide net.** Actively seek partnerships and collaborations with other firms in other countries; this is the best way to leverage your expertise quickly and effectively.
4. **Focus on U.S.-based clients which have foreign interests,** then ride their coattails overseas.
5. **Do your homework.** Bone up on the relevant legal systems, contract laws, tax regulations, currency exchange rates and so forth. *"Know before you go."*
6. **Be prepared to invest.** All startups are expensive, and this is particularly true when establishing foreign operations. Spend wisely, concentrating on the things that really matter. Be realistic about cost vs. value.
7. **Consider working with foreign firms and/or clients who want to do business in the U.S.** This is a kind of "international practice in reverse" and may well lead to additional opportunities overseas.

"Over the past decade, as international work has expanded to unprecedented levels, there have been a number of important changes. First, and most obviously, the market has matured greatly."

There's no doubt that international practice can be exciting, invigorating and profitable, and it can also be a great way to grow your business. While there are potential pitfalls, those who are strategic and patient rather than impulsive and short-sighted will be successful. Remember to stay resilient and nimble. Things have changed a great deal in the past decade (just think back to 2008, when the big recession swept across the globe like a tsunami). If the past is the prologue, the pace of change will certainly accelerate going forward. Will you be ready?

**For more information about DI Research, go to:
www.di.net/sponsored-research/*

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GLOBAL INSIGHTS

“Modernise or Die”—A Look at the Future of the Construction Industry, Part 1

David Ronksley—managing director of C2R Consulting (a DFC Australia member firm)—talked with Mark Farmer, founding director and CEO of Cast Consultancy about the future of construction. This is part one in a two-part series.

DAVID RONKSLEY WITH MARK FARMER

David Ronksley (DR): I'd like to kick off our discussion with your “Modernise or Die” report. Were you surprised with your findings, or did it reinforce what you'd already suspected about the industry?

Mark Farmer (MF): Much of what I concluded, particularly in the first part of my report, was probably more about going over old ground but needed to be covered to inform my analysis. When I was carrying out the analysis to work out the underlying symptoms of failure, all that we know is wrong with our industry in terms of low productivity, adversarial nature of working, fragmentation, low spend on innovation, ideas, etc. had been covered many times before. But if I were to pick out one thing that I wasn't expecting to be as big of a potential issue that it might be was the demographic profile of the industry and the resource quantum.

This report was specifically focused on the labour model in the UK. It wasn't necessarily about doing a report on technology or even collaborative working. My focus is actually on the government targets for output relative to our productivity levels and the mismatch. About two months into my research, I was getting worrying statistics on basic demographics from the census data and some additional deep dive projections on what may or may not happen.

Then, in June 2016 we had the referendum here in the UK for Brexit, which suddenly created another risk because in the UK, particularly London, we are very dependent on EU migrant labour. Will that labour stay here? So, it was interesting that pure labour resourcing emerged as a major issue to an extent that I hadn't considered.

“In June 2016 we had the referendum here in the UK for Brexit, which suddenly created another risk because in the UK, particularly London, we are very dependent on EU migrant labour.”

I've been in the industry for a long time, and I know that it's a highly cyclical industry. I've been through two major recessions in my career, and our industry sheds labour and rebuilds labour in line with those cycles. This brought me to the conclusion that there's an underlying structural issue and not just a cyclical issue, particularly in relation to our ability to further inflate the labour force in future cycles. We can shed labour, that's very easy—you just lay people off, as our industry is very good at doing. My biggest concern now, though, is

the next upward cycle. When that happens, we will struggle to get the numbers of people we need to deliver what the government is expecting in terms of critical national infrastructure, and social infrastructure as well as schools, hospitals and housing. There will also be the private commercial work that developers and investors commission. That was the one thing that came out my report. It's probably the one theme I speak about most, as well, in the two years since my report.

DR: Your observation about the challenge of demographic shifts is interesting. Can you go into more detail about the implications on the construction industry?

MF: It is my main concern. It feels different this time and still, even now, I'm not sure people know how serious an issue it is. The basic premise is we are potentially going to lose 20–25 percent of our workforce in the UK in the next decade. Japan is an interesting international example of where they are ahead of us on their ageing profile, and they've lost a third of their workforce in the last 15 years through ageing. So, this is coming—it's not that it might happen, it is *going* to happen. It's just a matter of pace and scale.

To address it, we can either increase the number of people coming into our industry—and we already struggle in the war for talent—or we increase productivity. Preferably we do both.

So that realisation reframed the whole debate and that's where “Modernise or Die” as a title came from. My concern is that all of the stress and strain is starting to show in the industry, and it has accelerated since my report was published. It comes down to skills—to the quantum and competence of resources and the ability to deliver what the country needs in terms of real assets.

DR: Yes, and in some ways, I think Australia is ahead of that curve having seen the construction boom coming and the influx of additional construction resources.

MF: Exactly. This came up in discussions I've had in Australia and New Zealand. There seems to be a generational pattern here and it is internationally generic.

There's a societal shift as the next generations are increasingly unwilling to do the manual labour aspects of construction—like working in adverse environments where it's cold, wet and windy. They all want to be working more with technology and in better environments such as an office, which is just not possible in the current model.

That's a big risk because site construction is hands-on and labour intensive. Ultimately, this is what's driving migrant dependency in some countries that are sourcing labour from where the cultural backdrop and work ethic is different. People in developed economies are increasingly put off by the element of hard work, which is why we have become so dependent on overseas labour where they don't have that aversion. If we didn't have overseas bricklayers and dry-liners in London, there wouldn't be half of the buildings that are currently being built.

It's a big issue, and it's one that I suppose we can't change; we have to work with it. We have to recognise that the next generation may be less willing to pick up a trowel or a sledgehammer and do the physical work. It means we will still struggle to attract talent until our industry does work in a different way—like higher productivity, more manufacturing and technology, etc. That in itself is still a challenge, but we've got to attack it if we are going to solve productivity and the whole construction image issue.

“We can either increase the number of people coming into our industry—and we already struggle in the war for talent—or we increase productivity. Preferably we do both.”

DR: The report is now two years old. Have you seen any significant changes?

MF: I'm a bit nervous about saying that there's been a change. What I will say is there seems to be a bit of a mood shift and

it's not just due to my report. There are a few major events that have happened in the UK that I believe have acted as catalysts for change.

First, the Grenfell Tower fire last summer has put a big focus on our industry. There's a public inquiry in London that is probably not going to paint a pretty picture of our industry. It will look, amongst other things, at how that refurbishment project was designed and constructed as well as what happened in the occupancy phase. I think it's going to paint a fairly bleak picture of what we do in our industry, probably reinforcing a lot of those symptoms of failure I talk about in my report.

That's the way the industry is, and there's no point in anyone being surprised about it. It just happens to have created a situation that no one thought would be possible and, ultimately, it's the worst-case scenario.

Second, with Carillion—which is the largest UK construction company—going bust, suddenly everyone is thinking, “What's going on here?”

All of this is compounding awareness, causing people to question whether we can continue as we are. I talked a lot about “Modernise or Die” for the first year after its release, and people asked, “What's he talking about?” It was more about rehearsing the narrative that we've got some big problems in order to build that awareness. Then Grenfell happened; then Carillion. And there are ongoing issues being reported every week in the trade press. It's all building to a point where we have to change how we do things.

In answer to the question, “Have things changed?” I am seeing the beginnings of change. It is very early, but some interesting things are beginning to happen that involve significant disruption to the way in which we will deliver. Certainly, in my world of residential, where my business focusses, things are taking shape that maybe in a few months or a year will start to reshape our industry. It involves industrialised construction, digital lead manufacturing and technology platforms. It also involves more collaborative working and vertical integration.

DR: Is this already happening elsewhere in the world?

MF: There's a new housing manufacturing business in California called Kattera, which is a technology-led platform. So, it's all about product platforms and a big digital library. What's interesting is they are vertically integrated end to end. They are a designer, a manufacturer and a constructor, and then they sell it at the end.

“The basic premise is we are potentially going to lose 20–25 percent of our workforce in the UK in the next decade. Japan is an interesting international example of where they are ahead of us on their ageing profile, and they've lost a third of their workforce in the last 15 years through ageing. So, this is coming—it's not that it might happen, it is *going to happen*.”

DR: The blockchain of the construction industry?

MF: Yes. There are no consultants, no tier one builders. There aren't even many subcontractors. I believe there will be a similar model here, and that presents a challenge to our industry because it is highly fragmented. There are consultants, developers, contractors and subcontractors, and they're all used to being brought together in one-off clusters for one-off jobs doing what we always do.

What I sense is that some of these disruptors are saying, “I'm not going to go near that. I'm doing it a different way. I'm going to take the risk of a big fixed entry capex cost, buying a factory and equipping it. I'm going to employ everyone. I'm not going to subcontract it. I'm going to put everyone on the payroll and I'm going to trust my instinct.”

We could have some massive crash-and-burn scenarios with this approach. My instinct tells me, though, that if the technical fundamentals of the business, process and product are

right, many will be successful this time. The pent-up demand for housing and the benefit of delivering housing differently—through a manufactured process that delivers better quality—creates real opportunity. If volume is achieved, it gets cheaper ... whilst everyone (at the moment) still thinks pre-manufacturing is more expensive. There's an inflection point that we can get to by just driving the volume and diluting the fixed establishment costs.

So, I am very confident that disruption is going to take place. Will it change our industry at large? That remains to be seen.

DR: The barriers to entry are huge, aren't they? And it is risky, with a need for deep pockets.

MF: Absolutely. What's interesting, though, is where these businesses are coming from. They're institutionally financed with long-term money or increasingly, private equity. The fact that PE money is coming into manufactured housing tells me that the analysts have realized that there's an opportunity here.

DR: And New Zealand's a bit ahead of the game in that, isn't it?

MF: Yes. In New Zealand, there is a government-sponsored program called KiwiBuild. It is acting as a bit of a stimulus for offsite manufacturing. The NZ government is quite keen to use it as a means to drive innovation in the construction industry to address challenges with their labour force. That has attracted some overseas interests, institutional capital and private equity interest into New Zealand's construction sector. Money doesn't come into any market unless there's an ability to make a return, and in New Zealand, the demand and opportunity is for affordable housing.

From New Zealand, as well as the wider international sphere, money is being put into ventures that would then respond to that kind of program. We have a version of that in the UK, but it's not all about the government program here, with institutional finance being used to build PRS Private Rental Sector portfolios known as "Build to Rent." There is also North American investment in the equivalent of what they would call multifamily housing.

DR: Are there political concerns over where the funding is sourced?

MF: This will be the recurring theme—whether it's Australia, New Zealand, UK or elsewhere—about where the money comes from to bankroll some of these disruptive platforms. Where the work is done is an important distinction. You might have a new venture that is foreign financed, but the actual factory production might be done in the country where you want the homes to be built—which makes it more politically acceptable. Most governments are actually encouraging foreign direct investment—provided it's not just shipping things from overseas, landing at the docks and installing them, because the government would be losing all or most of the value-add for its economy.

My concern is that we are moving in that direction. There are a few such volumetric modular/container-led ventures that are active in the UK, Australia and New Zealand that have that model of "We'll just build it in Asia, we'll put it on a container ship and transport it into position." We live in an internationalist economy, and we shouldn't be promoting anti-competitive behaviour, but also in reality it's a lost opportunity for local supply chains to modernise. The construction industry has been very good in most economies acting as an economic powerhouse for employment, for economic growth, for wages. If, all of a sudden, the disruption of building differently actually means that the "building differently" is all happening 5000 miles away, then that to me is not right. There's a more effective way of building things differently and doing it more efficiently with foreign money, which means we are still actually delivering value locally.

In the second installment of this story, we'll talk more about delivery, technology and reskilling our people.

Mark Farmer is founding director and CEO of Cast Consultancy and the author/researcher of *Modernise or Die: The Farmer Review of the UK Construction Labour Model*.

David Ronksley is managing director of C2R Consulting.

Diversity of Thought, with a Common Purpose

DIALOG is a design practice that is rooted in and works across Canada. While large geographically, Canada is actually fairly small by any other measure—yet Canadians are diverse and have a wide-ranging perspective. Even though our regions are sparsely populated, we have our regional differences.

When we talk about our approach to design and design practice, we have described our A/E firm as “an architecture, engineering, urban design, planning, landscape architecture and interior design firm.”

But recently, as we were working through a strategic planning process, it became much more important to us to describe the firm simply as a “design practice.” This is a much more all-encompassing descriptor of how we and the industry go about solving the problems of today. Today’s problems need solutions from a number of different perspectives—not just from an architectural, structural, mechanical, electrical perspective. Design has many more constituent parts today than it’s had in the past. Our practice and our teams are being formulated that way. At DIALOG, we stopped trying to list the number of disciplines we have in our practice because we are now hiring a more diverse range of subject matter experts such as anthropologists, data experts, healthcare practitioners and more. We will only see more of this in the industry—this bringing together of nontraditional experts that we may not have thought were a part of the design world before. This is what is required to solve the design problems of today and of the future. In this way, we are broadening the foundation from which design is created.

A useful comparative illustration to describe this perspective is the idea of a mosaic vs. melting pot.

The mosaic perspective is where each constituent part of the practice maintains its own identity, strong in its own particular perspective or area of knowledge, but each contributes in its own unique way that creates a much different, meaningful, rich and larger picture. To fold that example into design—this creates a more meaningful and rich solution to a problem. Canada prides itself on having an historical approach to immigration and multiculturalism that is rooted in this *mosaic vs. melting* pot analogy. The cultural mosaic is based on a belief that Canada as a whole becomes stronger by having immigrants bring with them their cultural diversity for all Canadians to learn from. This is in stark contrast to a melting pot approach whereby assimilation and cultural homogeneity is sought.

The mosaic perspective shapes our practice, embracing both diversity and collaboration as key parts of the practice—these two must go hand in hand. Having collaboration with a bunch of like-minded thinkers only gives us one thing—capacity. But having collaboration with a very diverse range of thought gives a much more meaningful solution.

Conversely, it is pointless to have a diversity of perspective while the people work in their own corner by themselves. We’re not leveraging the power of either collaboration or diversity unless we have a diverse group of thinkers that actually collaborate. These are two key ingredients to having

a multidisciplinary design practice. The constituent parts are important, but the way they work together is what creates the magic.

This is where the profession is going, I believe.

But this brings up an interesting question, and that is, how does all of this work practically? This is one of the struggles of a firm that is intentionally bringing together professionals from diverse backgrounds with broad experience. When we initially started working toward this type of practice, we wondered if we were actually building a powder keg because we were bringing together people with ideas that can be so at odds with others, at times.

Years ago, I read a book titled *The Starfish and the Spider* [written by Ori Brafman and Rod Beckstrom] that talked about the power of decentralized organizations. The premise of the book is that a starfish has a decentralized nervous system—if one of its legs is cut off, the starfish can regenerate another leg. Not so with a spider. The starfish represents the decentralized model, which is an interesting model to study in business. But generally, most businesses are a hybrid of centralized and decentralized. I would say that DIALOG is far more decentralized than centralized.

To make it work practically, everyone must understand the common goal, the common purpose. For DIALOG, it drives home the notion that we are a purpose-driven organization—and that purpose is *meaningfully improving communities*. As an organization, we're aligned around that purpose. It is the glue that holds us together. It is the reason we design. With that alignment around our purpose, we can arrive at a solution from completely different perspectives.

Recently, we had a summer student who designed an app for us. I asked him what was the most important thing he learned at DIALOG over the summer. His response? “The most important thing I learned this summer was that in order to help someone solve a problem, first you must understand their perspective on the problem and how it might be radically different from your perspective on the problem.

“If I just provide somebody with my solution without understanding their perspective,” he said, “then I’m just driving toward my solution. And you don’t end up with a good solution that way. I didn’t go to work for a structural engineering firm; I went to work for a multidisciplinary firm. I had fun working with a whole bunch of designers who saw the same problem in a very different way than me,” he said.

But again, it’s about having that common purpose in front of you that you’re focused on. That’s the key to making a multidisciplinary, radically diverse type of decentralized organization work.

“Recently, as we were working through a strategic planning process, it became much more important to us to describe the firm simply as a “design practice.”

When we landed on our purpose to meaningfully improve the wellbeing of communities, we realized that was an easy thing to say, but how would we know when we were actually improving communities? This is a hugely complex task to undertake. With a multidisciplinary team gathered around that common purpose of improving communities, there has to be a determination of what we’re going to try to effect or impact. This was the whole impetus for creating the Community Wellbeing Framework—which was a deep research project we undertook with the Conference Board of Canada.* The framework helps us as a practice answer the question of determining whether we’re improving communities and the effectiveness of our solutions.

As our summer student said, the design mandate around this common purpose is to truly listen to the client to understand the client’s problem. And many times, that may mean listening in a very deep way because the client may articulate a problem that’s quite different from what they originally thought was the issue. By listening and understanding the client, we can deliver a solution that solves their problem.

Over the next few years, as we work ever more toward this idea of the mosaic, our firm will continue to evolve and look more and more multifaceted. All of this diversity of thought and approach doesn't have to necessarily happen under one roof. But it is a way of working that will also evolve to look much more interactive and engaging as opposed to even the way we may have approached a project even ten years ago.

I'm frequently asked if our business model will have to change to adapt to this new approach and way of solving problems. I would say that the model has changed but very slowly. The overarching business model of providing consulting services and getting paid for services probably won't change. But how we get paid based on the value we bring as opposed to our time spent has already changed—and it will continue to change where we're much more of a value-based service as opposed to a time-based service.

For the Canadian market, there's increasingly a focus on and an understanding that for the sake of long-term investment, we as an industry have to be thinking about the wellbeing of stakeholders. For example, our federal government has recently mandated that all new government buildings have a zero-carbon target. They are clearly mandating more than just environmental sustainability—they are looking at the health and wellness of building users as being at the forefront of any design solution. But we're also seeing this approach with developers—in that we are understanding the value of the public realm that creating a better space for people is a commercial- and business-oriented move. Same old, same old just doesn't work any longer in our rapidly changing environment, whether it's a developer, an institution or a government.

The globalization of our profession is here to stay. One of the challenges in our profession and with our clients is that everybody every day is comparing precedents or ideas to what is happening around the world. We no longer have to wait for a project to be published anymore. Everyone is always looking

globally for benchmarks and precedents, including clients and clients' clients, investors and users. So, I believe that the borders of nations don't exist in the design profession any longer, other than the regulatory environment—and those boundaries will exist in the regulatory environment for the foreseeable future.

“When we landed on our purpose to meaningfully improve the wellbeing of communities, we realized that was an easy thing to say, but how would we know when we were actually improving communities?”

It is incredibly encouraging when we take seriously our role in the built environment. If we believe that great design can change the world, and we want what we design and build to have a positive influence, why would we build or design something that would have a negative impact? The absurdity of what we've done to the planet for generations is mind boggling, especially since we have the capacity to do the opposite. This isn't a criticism of what I and others have done in the past. Rather, I believe it was a lack of awareness. But now that we're aware that we can have a positive impact on the wellbeing of people, communities, and the environment, let's put all of our energy into making everything we do positive.

** For more information about the Community Wellbeing Framework (published by the Conference Board of Canada in collaboration with DIALOG), visit: dialogdesign.ca/community-wellbeing.*

Jim Anderson is an architect, principal and current Chair of DIALOG. He believes deeply in building a purpose-driven firm; one that's founded on our collaborative and multidisciplinary approach to building stronger communities throughout Canada and the U.S.

**2018 MULTINATIONAL
DESIGN AND ENGINEERING
FIRM FEE SURVEY**

The Global Business and Practice of Architecture and Engineering

This year, for the 20th year in a row, we surveyed architecture firms during the summer months and asked them to provide an updated projection of their total gross fees for non-domestic work for the calendar year 2018. In 2017, we began surveying engineering firms as well.

DESIGNINTELLIGENCE

If we look in the rearview mirror to 1998, the top five firms in non-domestic fee invoicing were HOK, RTKL, WATG, Gensler and NBBJ. Collectively, they invoiced just over \$154 million from their non-domestic projects. In 2008, those in the top five invoiced \$753 million for non-domestic work (with an annualized growth rate of 11.1 percent). Those firms were HOK, SOM, Gensler, KPF and HDR. Over that ten-year period, the top five collectively grew by almost 400 percent. For 2018, the projected non-domestic billing for the top five is \$1,082,219,244. Of our survey respondents, the top five in non-domestic billing for 2018 are Stantec, Gensler, Jacobs, CallisonRTKL and Perkins+Will.

Even though there is spreading anxiety and uncertainty in the global equity markets, with slowing growth globally (except for the U.S. economy, which as of this writing is still strong), the majority of architecture firms surveyed—65 percent—are

“bullish” about the five-year horizon of global practice, with 27 percent indicating “neutral” and 8 percent indicating “bearish.” For 2017, 57 percent of firms surveyed were “bullish,” 39 percent were “neutral” and 4 percent were “bearish.” Forty-three percent of engineering firms surveyed are bullish on the five-year horizon; 50 percent are neutral, and 7 percent are bearish.

U.S.-based multinational architecture firms are working in almost every developed and developing country in the world. For architecture firms responding to our survey, the top hottest countries/regions for 2018 are China, the Middle East/North Africa, Asia (outside of China), Western Europe, Mexico, South America and India. For engineering firms responding, the countries are Asia (outside of China), China, Canada, Middle East/North Africa, Western Europe, India, Mexico, Eastern Europe and Oceania. Our research indicates an increase in design firms that consider Asia (including China and “Asia outside of China”) as a hot region for business. But a word of caution here: there are a number of fault lines in the geopolitical landscape in China—the country’s massive (and increasing) debt load, the tariff escalations between the U.S. and China, as well as the concentration of power in the hands of one man: President Xi Jinping. There is a major storm brewing with China as well: the overt persecution of religious sects (i.e., re-education centers for those arrested and detained for their religion) that will draw human rights and ethical ire from the West. Firms must be watchful of the impact on potential business development and backlog.

**MOST FIRMS SAY TALENT
(ACQUISITION, DEVELOPMENT AND RETENTION)
IS THEIR NUMBER ONE CHALLENGE:**

77%

ENGINEERING FIRMS

63%

ARCHITECTURE FIRMS

Seventy-two percent of architecture and design firms reported or projected non-domestic revenue in the office/mixed use sector for 2018. This is an increase of more than nine percent over 2017 and 4 percent over 2016. Interestingly, the government/public sector declined to 36 percent in 2018 vs. 88 percent in 2017. However, the government/public sector will surely see exponential growth in the coming years due to increased spending on housing and smart city projects in developing countries. Stay tuned.

Challenges in the global practice of architecture include talent (acquisition, development and retention) say 63 percent of firms. Next is business development effort (59 percent of firms); contracts, delivery, risks and finances (51 percent of firms); commoditization of architecture services (45 percent of firms); and client and stakeholder expectations (41 percent of firms) round out the top five challenges for architecture firms. For 2017, the top five global challenges for architecture firms were: contracts, delivery, risks and finances (66 percent); business development effort (60 percent); talent acquisition, development and retention (58 percent); commoditization of architecture services (48 percent); and geopolitical/government transparency (28 percent).

For engineering firms responding, the top five challenges in global practice include talent (acquisition, development and retention) at almost 77 percent; commoditization of engineering services at almost 71 percent; business development effort at 59 percent; contracts, delivery, risks and finances at 53 percent; and geopolitical/government transparency at 47 percent.

While the global outlook for the A/E/C industry in 2019 is still good, there is some softening in the global economy. Whether in good times or bad, though, we must keep an eye on trends because of how they will impact your firm and the overall industry. For example, we hear very often from firms about the talent shortage (or talent war). While you may have enough people right now, you may not next year. The U.S. Census Bureau says that millennials only stay at a job for 2 to 2.5 years at most. For average workers, it's about 4.5 years. So that means, in five years, many of your staff may have moved on to greener pastures. Millennials have very different

expectations and desires from their jobs, careers and employers than generations of workers past.

Of course, technology is constantly changing and evolving, and we're seeing massive disruption within the industry as well as with our clients. Building IoT (or BIoT), cloud data, automation, AI and much more will enhance the industry and create more productivity. These advances also have the ability to impact profitability.

Legislation and regulatory issues, the economy (both global and U.S.) and geopolitics, social trends and climate change, markets (like government spending, healthcare delivery and housing trends, the higher education sector and more) and disruptors (especially those from other industries)—all of these factors (and more) are important in helping our firms and our industry to survive and even to thrive.

“Even though there is spreading anxiety and uncertainty in the global equity markets, with slowing growth globally (except for the U.S. economy, which as of this writing is still strong), the majority of architecture firms surveyed—65 percent—are ‘bullish’ about the five-year horizon of global practice.”

Leadership is about seeing things as they are and then looking out to what could be—and then taking the steps and the actions to get where you want to go. Environmental scanning should be done often, continuously even, not just once a year at the strategic planning table. The problems associated with innovation and with a changing industry are common to every professional practice. This applies to A/E/C around the globe.

We are in the midst of a world, a marketplace, that is competitive, that is demanding innovation, change and equality. Let's put in place the actions we need to take to drive the change the world needs. Let's design and build our own future instead of just letting the future happen to us.

Methodology

Every year since 1998, DesignIntelligence has ranked multinational firms in terms of non-domestic gross revenues. This information provides a view into many influential firms that are exporting design services and the trends in non-domestic market sectors and geographic areas.

During the summer months, we asked firms to report their projected year-end revenues based on invoicing to date plus contracted backlogs.

The 100 firms identified in previous DI research were invited to participate in the multinational design firm fee survey as well as all firms who have responded in previous years. Data was self-reported by the firms.

A total of 50 firms qualified for inclusion as having projected revenue for 2018 from non-domestic sources. Survey responses were validated by our team of research analysts and outliers

were fact checked with the individual respondents. These 50 firms account for over \$1.86 billion dollars in architecture, engineering and design non-domestic revenues.

For additional benchmarking questions, contact DI research:

Mary Pereboom
mpereboom@di.net

MULTINATIONAL DESIGN FIRMS

Projected 2018 Year-end Gross Revenue (top 30)

Rank	Projected Billing	Projected U.S. Billing	Projected Non-Dom. Billing	% of Total
1 Stantec*	\$483,566,864	\$146,600,002	\$336,966,863	69.7%
2 Gensler	\$1,340,306,668	\$1,117,054,286	\$223,252,381	16.7%
3 Jacobs*	\$600,000,000	\$400,000,000	\$200,000,000	33.3%
4 CallisonRTKL	\$358,000,000	\$186,000,000	\$172,000,000	48.0%
5 Perkins + Will	\$600,000,000	\$450,000,000	\$150,000,000	25.0%
6 Skidmore, Owings & Merrill	\$298,486,000	\$170,478,000	\$128,008,000	42.9%
7 HDR	\$446,000,000	\$322,000,000	\$124,000,000	27.8%
8 HOK	\$441,000,000	\$347,000,000	\$94,000,000	21.3%
9 Wimberly Allison Tong & Goo	\$82,000,000	\$18,000,000	\$64,000,000	78.0%
10 HKS	\$400,000,000	\$355,000,000	\$45,000,000	11.3%
11 NBBJ	\$180,000,000	\$144,000,000	\$36,000,000	20.0%
12 Studios Architecture	\$87,000,000	\$58,650,000	\$28,350,000	32.6%
13 Goettsch Partnership	\$34,000,000	\$8,500,000	\$25,500,000	75.0%
14 Arquitectonica	\$63,000,000	\$41,500,000	\$21,500,000	34.1%
15 Adrian Smith + Gordon Gill	\$20,000,000	\$1,000,000	\$19,000,000	95.0%

MULTINATIONAL DESIGN FIRMS

Projected 2018 Year-end Gross Revenue (top 30)

Rank	Projected Billing	Projected U.S. Billing	Projected Non-Dom. Billing	% of Total
16 Ennead	\$60,000,000	\$45,600,000	\$14,400,000	24.0%
17 SB Architects	\$25,871,000	\$12,394,000	\$13,477,000	52.1%
18 ZGF Architects LLP	\$203,861,285	\$190,701,386	\$13,159,899	6.5%
19 Robert A.M. Stern	\$72,000,000	\$59,000,000	\$13,000,000	18.1%
20 Sasaki	\$62,000,000	\$50,000,000	\$12,000,000	19.4%
21 Pei Cobb Freed & Partners Architects	\$14,500,000	\$3,900,000	\$10,600,000	73.1%
22 Epstein	\$35,000,000	\$25,000,000	\$10,000,000	28.6%
22 Karn Charuhas Chapman & Twohey	\$16,000,000	\$6,000,000	\$10,000,000	62.5%
24 Smallwood Reynolds Stewart Stewart & Associates	\$24,125,850	\$14,906,775	\$9,219,075	38.2%
25 Steelman Partners	\$35,000,000	\$25,900,000	\$9,100,000	26.0%
26 Ghafari	\$26,000,000	\$17,000,000	\$9,000,000	34.6%
27 MG2	\$54,200,000	\$45,600,000	\$8,600,000	15.9%
28 Cuningham Group	\$76,160,000	\$68,480,000	\$7,680,000	10.1%
29 SmithGroup	\$212,042,600	\$205,257,200	\$6,785,400	3.2%
30 Beck	\$54,000,000	\$47,644,000	\$6,356,000	11.8%

All 2018 figures are year-end projections by the responding firms, with the exception of publicly held firms (denoted with *).

Figures provided for publics are actuals for the prior year.

Data is based on 50 firms responding with non-domestic based revenues.

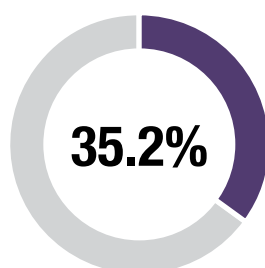
Ties in rankings are denoted in bold.

MULTINATIONAL DESIGN FIRMS

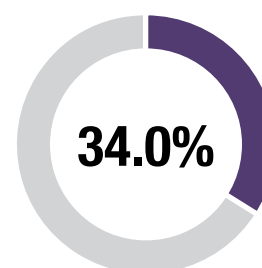
Projected 2018 Year-end Gross Revenue (31-50)

Rank	Projected Billing	Projected U.S. Billing	Projected Non-Dom. Billing	% of Total
31 Leo A Daly	\$120,502,000	\$114,502,000	\$6,000,000	5.0%
32 Cannon Design	\$158,282,000	\$153,085,000	\$5,197,000	3.3%
33 WD Partners	\$41,100,000	\$36,800,000	\$4,300,000	10.5%
34 DLR Group	\$206,665,000	\$202,965,000	\$3,700,000	1.8%
35 Elkus Manfredi	\$90,000,000	\$87,000,000	\$3,000,000	3.3%
35 GBBN	\$32,000,000	\$29,000,000	\$3,000,000	9.4%
35 tvs design	\$29,000,000	\$26,000,000	\$3,000,000	10.3%
38 Fentress	\$46,500,000	\$43,800,000	\$2,700,000	5.8%
39 Ratio	\$37,700,000	\$35,430,000	\$2,270,000	6.0%
40 Clark Nexsen	\$54,315,000	\$52,500,000	\$1,815,000	3.3%

FOR THE TOP 30 FIRMS, THE PERCENTAGE OF GROSS REVENUE THAT REPRESENTS NON-DOM. WORK



FOR THE TOP 30 PRIVATELY HELD FIRMS, THE PERCENTAGE OF GROSS REVENUE THAT REPRESENTS NON-DOM. WORK



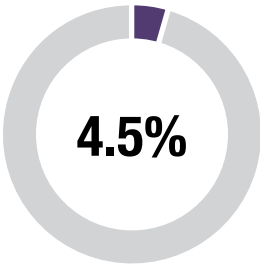
MULTINATIONAL DESIGN FIRMS

Projected 2018 Year-end Gross Revenue (31-50)

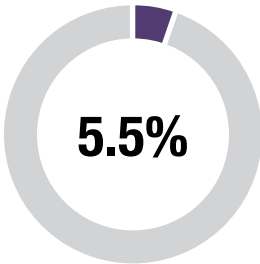
Rank	Projected Billing	Projected U.S. Billing	Projected Non-Dom. Billing	% of Total
41 Overland Partners	\$12,000,000	\$10,728,595	\$1,271,405	10.6%
42 bKL	\$17,341,251	\$16,120,135	\$1,221,116	7.0%
43 Cooper Carry	\$73,800,000	\$72,700,000	\$1,100,000	1.5%
44 Dahlin Group	\$25,000,000	\$24,000,000	\$1,000,000	4.0%
45 Ayers Saint Gross	\$45,000,000	\$44,370,000	\$630,000	1.4%
46 HGA	\$132,500,000	\$132,000,000	\$500,000	0.4%
46 Kahler Slater	\$17,100,000	\$16,600,000	\$500,000	2.9%
48 OZ Architecture, Inc.	\$30,000,000	\$29,650,000	\$350,000	1.2%
49 Planning Design Research Corporation (PDR)	\$15,200,000	\$14,900,000	\$300,000	2.0%
50 FXCollaborative	\$35,031,527	\$35,024,527	\$7,000	0.02%

All 2018 figures are year-end projections by the responding firms, with the exception of publicly held firms (denoted with *).
Figures provided for publics are actuals for the prior year.
Data is based on 50 firms responding with non-domestic based revenues.
Ties in rankings are denoted in bold.

FOR FIRMS 31-50, THE PERCENTAGE OF GROSS REVENUE THAT REPRESENTS NON-DOM. WORK



FOR FIRMS 31-45, THE PERCENTAGE OF GROSS REVENUE THAT REPRESENTS NON-DOM. WORK



MULTINATIONAL DESIGN FIRMS

2018 Greatest Non-Domestic Billings by Percentage (20% and above)

	WW Gross Revenue	Non-US Gross Revenue	U.S. Gross Rev	% of Total
Adrian Smith + Gordon Gill	\$20,000,000	\$19,000,000	\$1,000,000	95.0%
Wimberly Allison Tong & Goo	\$82,000,000	\$64,000,000	\$18,000,000	78.0%
Goettsch Partnership	\$34,000,000	\$25,500,000	\$8,500,000	75.0%
Pei Cobb Freed & Partners Architects	\$14,500,000	\$10,600,000	\$3,900,000	73.1%
Stantec*	\$483,566,864	\$336,966,863	\$146,600,002	69.7%
Karn Charuhas Chapman & Twohey	\$16,000,000	\$10,000,000	\$6,000,000	62.5%
SB Architects	\$25,871,000	\$13,477,000	\$12,394,000	52.1%
CallisonRTKL	\$358,000,000	\$172,000,000	\$186,000,000	48.0%
Skidmore, Owings & Merrill	\$298,486,000	\$128,008,000	\$170,478,000	42.9%
Smallwood Reynolds Stewart Stewart & Associates	\$24,125,850	\$9,219,075	\$14,906,775	38.2%
Ghafari	\$26,000,000	\$9,000,000	\$17,000,000	34.6%
Arquitectonica	\$63,000,000	\$21,500,000	\$41,500,000	34.1%
Jacobs*	\$600,000,000	\$200,000,000	\$400,000,000	33.3%
Studios Architecture	\$87,000,000	\$28,350,000	\$58,650,000	32.6%
Epstein	\$35,000,000	\$10,000,000	\$25,000,000	28.6%
HDR	\$446,000,000	\$124,000,000	\$322,000,000	27.8%
Steelman Partners	\$35,000,000	\$9,100,000	\$25,900,000	26.0%
Perkins + Will	\$600,000,000	\$150,000,000	\$450,000,000	25.0%
Ennead	\$60,000,000	\$14,400,000	\$45,600,000	24.0%
HOK	\$441,000,000	\$94,000,000	\$347,000,000	21.3%
NBBJ	\$180,000,000	\$36,000,000	\$144,000,000	20.0%

All 2018 figures are year-end projections by the responding firms, with the exception of publicly held firms.
 Figures provided for publics are actuals for the prior year.

NON-DOMESTIC MARKET SECTORS

2018 Non-Domestic Revenue Reported by Market Sector

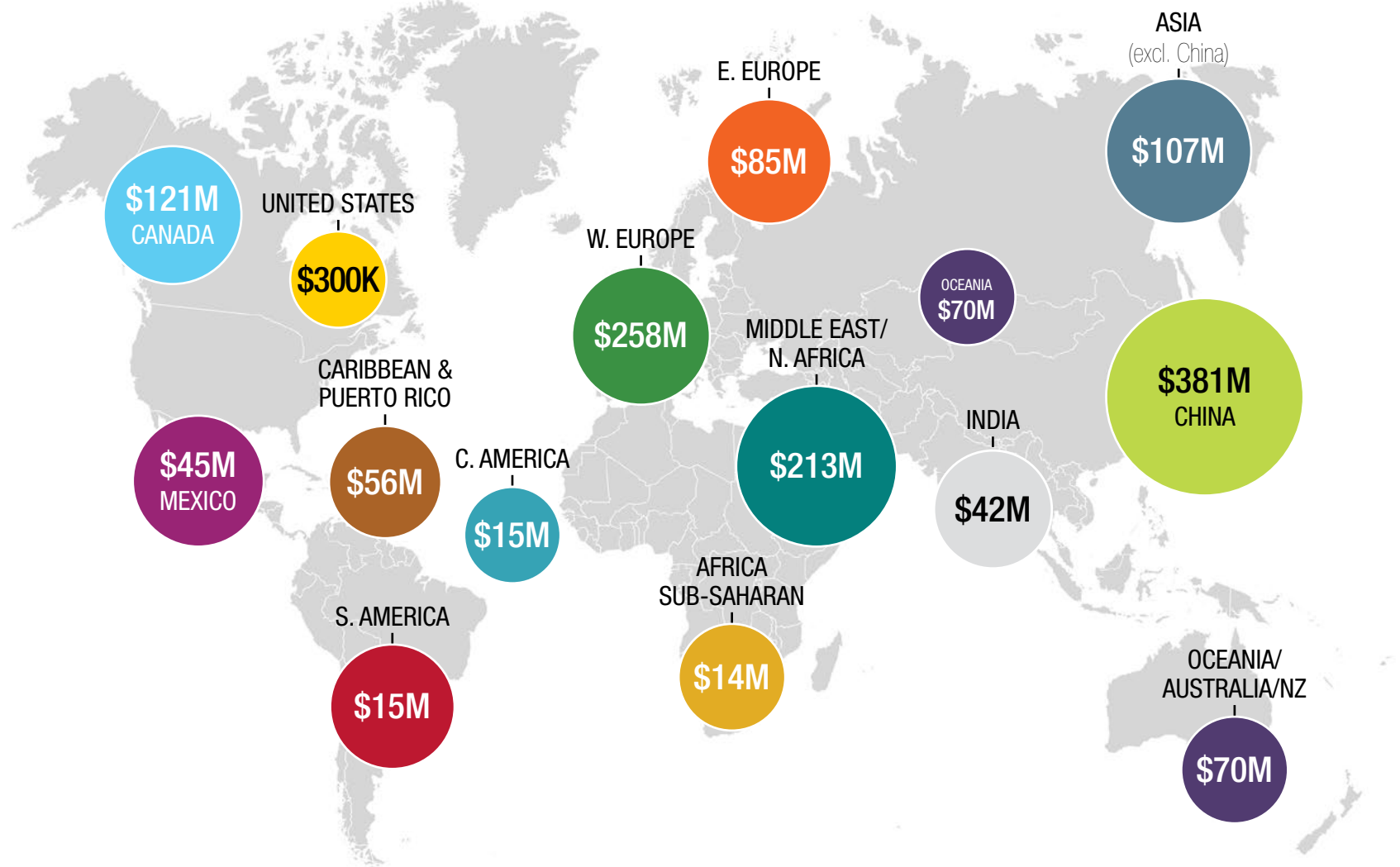
	Projected Non-Dom. Billing	% of Firms
Office/Mixed-Use	\$457,572,611	72.0%
Healthcare	\$230,891,395	38.0%
Residential-Multi Family	\$224,572,598	48.0%
Hospitality	\$196,491,924	54.0%
Government/public	\$137,680,346	36.0%
Education: Higher Ed	\$94,328,443	40.0%
Education: K-12	\$91,979,253	18.0%
Retail	\$82,963,452	44.0%
Laboratory	\$58,340,568	18.0%
Industrial	\$51,042,837	12.0%
Aviation	\$41,104,240	18.0%
Transportation	\$37,037,376	12.0%
Sports	\$26,146,024	18.0%
Science/technology	\$24,800,000	2.0%
Planning	\$21,486,990	10.0%
Cultural/museums	\$20,357,115	18.0%
Entertainment/gaming	\$16,981,695	8.0%
Residential-Single Family	\$12,254,508	10.0%
Convention Centers	\$6,531,024	10.0%
Religious	\$2,495,722	4.0%

* Percentage of all firms reporting/projecting non-domestic architecture and design revenue in this market sector.

** Based on 2018 projections for privately held firms and 2017 actuals for publicly held firms.

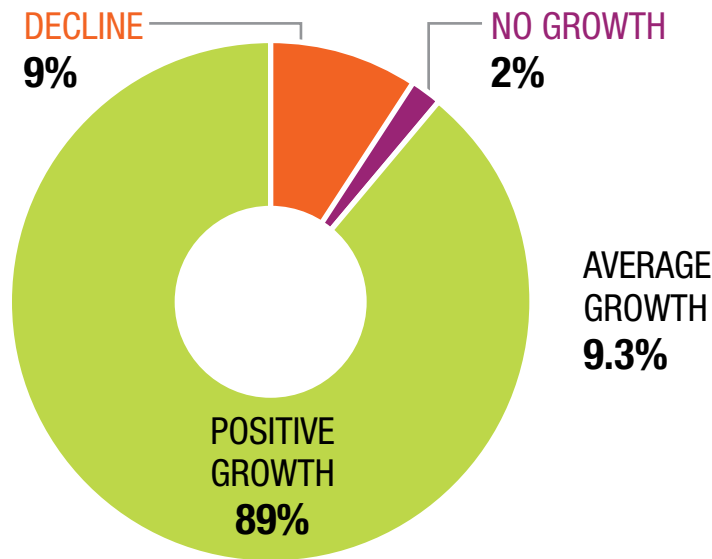
NON-DOMESTIC GEOGRAPHIC LOCATIONS

2018 Non-Domestic Revenue Reported by Geographic Location

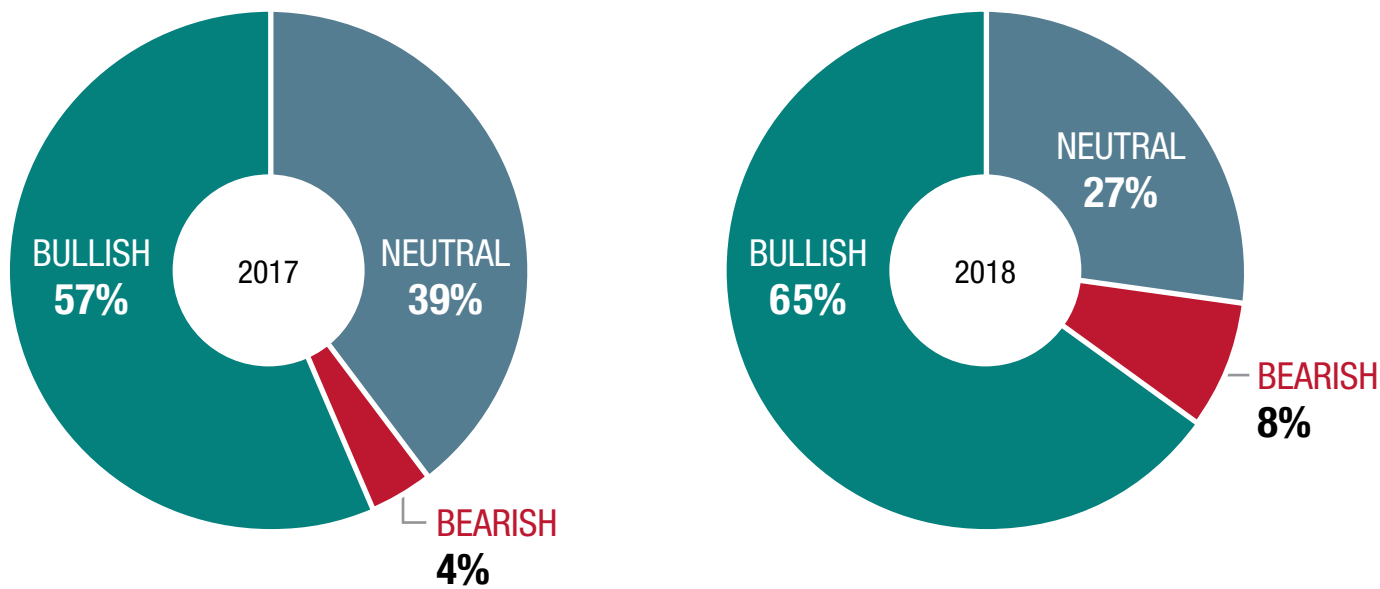


GROWTH PROJECTIONS FOR PRIVATELY HELD FIRMS

What percentage of growth or decline do you anticipate for non-domestic gross revenue in 2019?



Five year horizon: Opportunities for architects abroad, are you Bullish, Bearish or Neutral?



CHALLENGES

Challenges in the Global Practice of Architecture

	% of Total*
Talent acquisition, development and retention	63.0%
Business development effort	59.0%
Contracts, delivery, risks and finances	51.0%
Commoditization of architecture services	45.0%
Client & stakeholder expectations	41.0%
Geopolitical/government transparency	29.0%
Technology use & security	27.0%
Building standards/regulatory compliance	22.0%
Mergers & acquisitions re-shaping industry	14.0%
Sustainability adaption	8.0%
Other: Global Competition	2.0%
Product Safety	2.0%

* Percentage of firms indicating this as a top challenge in global practice of architecture.

MULTINATIONAL ENGINEERING FIRMS

Challenges in the Global Practice of Engineering

	% of Total*
Talent acquisition, development and retention	76.5%
Commoditization of engineering services	70.6%
Business development effort	58.8%
Contracts, delivery, risks and finances	52.9%
Geopolitical/government transparency	47.1%
Building standards/regulatory compliance	41.2%
Technology use and security	41.2%
Client & stakeholder expectations	35.3%
Mergers & acquisitions re-shaping industry	23.5%

* Percentage of firms indicating this as a top challenge in global practice of engineering.

MULTINATIONAL ENGINEERING FIRMS

Market Sectors

	% of responding firms working in market sector	Avg % of engineering work in this market sector
Aviation	15.4%	5.5%
Civil infrastructure	23.1%	14.0%
Convention centers	7.7%	24.0%
Cultural/museums	15.4%	3.5%
Education	30.8%	19.5%
Government/public	53.8%	37.1%%
Healthcare	53.8%	40.4%%
Hospitality	38.5%	21.0%
Industrial/technology	15.4%	14.0%
Laboratory	23.1%	13.0%
Office/mixed use	53.8%	17.4%
Parking	-	-
Religious	-	-
Residential/single-family	7.7%	1.0%
Residential/multi-family	30.8%	15.0%
Retail	46.2%	24.0%
Sports	15.4%	4.0%
Transportation	23.1%	17.7%
Other	53.8%	20.4%

Notable Quotes
Louis Henri Sullivan
1856–1924

“What the people are within,
the buildings express without.”

“Once you learn to look at architecture not
merely as an art more or less well or more or
less badly done, but as a social manifestation,
the critical eye becomes clairvoyant.”

“The building’s identity resided
in the ornament.”

“Form follows function.”

**“I know we should be
winning way more than
we have been. The
clients keep picking
firms that are far less
qualified than we are.”**

“So how do we convince them?”

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2019 Leadership Summit Events

Each year the Design Futures Council gathers together around a series of essential themes ruddering the A/E/C industry. The gatherings are always titled as Leadership Summits or Forums. Each gathering is attended by leaders from property development, architecture, design, engineering, construction, finance, banking, building product manufacturing, academia, and more. The overarching goals for these exchanges are:

- relational connectedness among attendees,
- challenging the status quo of design and delivery,
- presentation of thought-leading content that alters perspectives,
- staging the questions every industry leader should be asking,
- and more.

The schedule of DFC events for 2019 is:

Leadership Summit on Technology & Applied Innovation

January 16–17, 2019 (La Jolla, CA) - In this environment of rapid change in technology, architects, engineers and constructors must deal with fundamental shifts in what they will be asked to do, how they will work and the value they will produce. This event brings together A/E/C leaders to explore new developments and innovation in technology and how it impacts the professions.

Leadership Summit on Design Education & Talent

June 2019 (Cincinnati, OH) - We frequently hear from firms that talent is one of the number one challenges they face. At this DFC Summit, we will discuss past approaches, present trends and future requirements that are facing design educators, all from the perspective of the academy and professional firms.

Leadership Summit on Environmental & Social Responsibility

September 2019 (Minneapolis, MN) - As the Design Futures Council stands at the intersection of the A/E/C industry and environmental and social responsibility, we bring together great minds to explore and exchange ideas in hopes of breakthroughs that will literally change the world. The Leadership Summit on Environmental & Social Responsibility is a call to action for A/E/C to take the lead to measurable environmental sustainability, as well as looking at the economics of it all.

Leadership Summit on Global A/E/C

October 2019 (Moscow) - At this global Summit, we will discuss what's happening in the world of A/E/C, where the value of our industry is headed, what will professional practice look like in the future, and more.

Leadership Summit on the Business of Design

November 2019 (New York, NY) - Each year, the Design Futures Council convenes senior executives from across A/E/C to explore essential issues of strategic importance to running a better business.



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