

A Forrester Consulting
Thought Leadership Paper
Commissioned By Unity

March 2020

Digital Experiences In The Physical World

Are AEC And Manufacturing Companies Ready
For Real-Time 3D?



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Project Director:

Josh Blackborow,
Market Impact Consultant

Contributing Research:

Forrester's Infrastructure &
Operations research group

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Executive Summary

The next generation of visualization is here. Most of the noise for cutting-edge visual experiences is currently made in the video game sector. However, some companies in nonvideo game sectors — specifically architecture, engineering, and construction (AEC) and manufacturing companies — are innovating toward a new frontier in visualization.

In October 2019, Unity commissioned Forrester Consulting to explore applications of real-time 3D outside of the video game sector, specifically with regards to industrial use cases across the lifecycle of physical products and buildings. Forrester conducted an online survey of 358 respondents with responsibility for creating 3D content (or overseeing that content creation) for their companies and/or knowledge of the 3D technology landscape to explore this topic. We found that while adoption of real-time 3D — a new way to create and deploy interactive, realistic digital representations of real-world assets — is fairly low today, those utilizing it are seeing considerable benefits, and utilization may soon be on the rise.

KEY FINDINGS

- › **Visualization in AEC and manufacturing companies needs a revamp.** Visualization techniques across the product and building lifecycles in these companies are stuck in the past. Organizations use outdated forms of visualization like physical and 2D modeling. This is causing considerable issues for many — 61% of respondents say their organizations experience challenges due to their poor visualization capabilities — in wide-ranging areas like staff training, marketing, field service, and interdepartmental collaboration.
- › **Organizations turn to real-time 3D.** Many organizations are realizing their need for modernization in their visualization approaches across the lifecycle and are turning to real-time 3D. While only 19% respondents say their firms have adopted it today, most (55%) say they will have adopted it within two years. And, 94% of those whose firms have adopted today plan to expand their adoption going forward. The vast majority of those whose firms haven't adopted still see the potential in real-time 3D: 97% believe real-time 3D would improve or revolutionize their workflows and processes. Real-time 3D in these industries may be hitting a threshold of adoption that will snowball over the next few years.
- › **Real-time 3D is providing substantial benefits at multiple stages.** Companies that are using real-time 3D today are seeing considerable benefits to their business, such as an increase in sales, decrease in costs, and improved time-to-market. These benefits are linked to use cases across the ecosystem from prototyping to marketing to field service. Use cases are wide-ranging and extend across the product and building lifecycles.

AEC And Manufacturing Companies Are Ready For A Visualization Refresh

AEC and manufacturing companies have a multitude of internal and external visualization requirements. To meet these needs, many currently employ an array of tools — both physical and digital — to create better efficiencies for their employees and better experiences for their customers. The definition of visualization has broadened to be about more than just creating pictures for humans to observe. It is now about creating digital experiences in the physical world.

Our study indicated that businesses' current toolsets may not be fit for purpose in an increasingly tumultuous landscape of customers and competitors. In surveying 358 decision makers across the manufacturing, construction, automotive, consumer packaged goods (CPG), engineering services, architecture, and energy/utilities industries, we found that:

- › **Insufficient visualization capabilities are creating challenges across the enterprise and throughout the product and building lifecycles.** From an internal operations perspective, 61% of decision makers identify visualization as a pain point. These decision makers report that their visualization issues are not isolated but, in fact, are widespread, from design/prototyping (58%) to field service (56%) and sales demonstration (61%) (see Figure 1).
- › **Tools are outdated. Insufficient capabilities stem from insufficient tools.** Our survey found that most organizations rely heavily on traditional forms of visualization like in-person interaction, physical models, and 2D visuals, especially in marketing, staff training, and field service. For any given visualization touchpoint, roughly one-third of respondents say their companies haven't updated their tools in at least three years.
- › **Outdated toolsets contribute to difficulties keeping up with customers' rising demands for richer experiences — pre- and post-purchase.** Customers are central to the need for a visualization refresh. Their experiences with the best raise the bar for all, and businesses are feeling the pressure to improve their external-facing technologies. Decision makers identify poor or nonexistent prepurchase digital product experiences as their top CX delivery pain point. The next highest ranked pain is the inability to provide real-time, high-quality support for customers seeking issue resolution. These gaps are hurting companies on both ends of the buyer cycle.

AEC and manufacturing companies are exhibiting a need for a visualization revamp, both to solve current shortfalls and to expand their production possibilities as a business. Survey results indicate that some are turning to emerging technology.

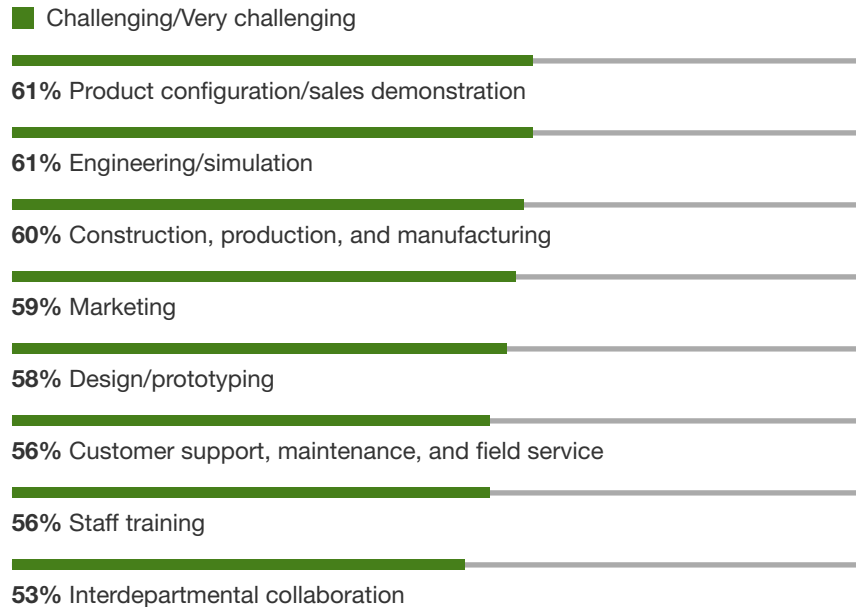


61% have challenges with visualization.



Figure 1

“You indicated that your organization has insufficient visualization tools. To what extent is this a challenge in each of the following areas?”



Base: 228 decision makers responsible for engineering, innovation, design, R&D, and operations who at least have knowledge of the 3D technology landscape

Source: A commissioned study conducted by Forrester Consulting on behalf of Unity, October 2019

The Shift Toward Real-Time 3D

Most companies are looking to emerging technology as a potential avenue to increase their own effectiveness across all visualization touchpoints. For example, 80% of decision makers see definite or high potential for emerging technology to improve competitiveness in construction, production, and manufacturing. Three out of four expect the same for engineering/simulation and design/prototyping. Roughly 70% foresee high emerging technology impacts on the rest of their visualization touchpoints: marketing, staff training, interdepartmental collaboration, and sales demonstrations. Leaders believe real-time 3D has the potential to improve their existing use cases for visualization while also creating a range of new opportunities to explore.

- › **What is real-time 3D?** Like a video game, real-time 3D lets people move within, and interact with, an engaging, immersive digital reality in a way that renderings alone cannot. Firms use real-time 3D to create and deploy interactive and immersive digital experiences representing real-world assets (e.g., physical products or buildings) combined with information from data sources such as enterprise databases and internet-of-things (IoT) sensors. Also called digital twins, these representations look and behave like the real-world asset and can be placed within contextual environments and simulated scenarios (e.g., a skyscraper project shown within a city at various times of day). They can be distributed across multiple platforms, such as computers, mobile devices, and virtual reality (VR). Firms can also use real-time 3D to overlay digitally created content and data on top of the real world in augmented reality (AR).

55% of industrial leaders say they will have adopted real-time 3D within the next two years.

- › **While adoption is currently low among AEC and manufacturing firms, even nonadopters see the value.** Many have plans to invest. Our study indicated that only one in five of industrial companies has invested in real-time 3D. However, within two years, 55% of decision makers say they will have adopted, and 86% of nonadopters today believe real-time 3D would add value to their organizations. A tipping point may be rapidly approaching. Most nonadopters recognize value across the major visualization touchpoints like design/prototyping (78%), engineering/simulation (75%), construction/production/manufacturing (75%), and product configuration/sales demonstration (75%). A majority still view even the lower-ranked responses of customer support (67%) and interdepartmental collaboration (65%) as valuable opportunities for real-time 3D (see Figure 3). These decision makers admit that they struggle or fail to replicate the capabilities of real-time 3D with their existing tools. For example, 71% of respondents say they cannot replace physical models and prototypes with virtual renderings at the same efficiency as real-time 3D (see Figure 2). Overall, 97% of nonadopters believe real-time 3D would improve or revolutionize their workflows and processes.
- › **Those whose firms have adopted report significant benefits.** While those whose firms haven't adopted real-time 3D see plenty of potential, those implementing it today report unlocking even greater value (see Figure 3). Their newfound abilities to, for example, render 3D imagery in context (87%), simulate previously impossible testing scenarios (84%), and visualize on multiple devices (84%) have added considerable value. Regarding visualization touchpoints across the enterprise and throughout the product cycle, over 90% of adopters say real-time 3D is valuable or very valuable for design/prototyping (95%), staff training (94%), product configuration/sales demonstration (94%), engineering/simulation (93%), and construction/production/manufacturing (92%).
- › **Real-time 3D is part of a larger ecosystem.** Nearly all (94%) of those whose firms have implemented real-time 3D say their companies are expanding their investment. Most adopters are already using real-time 3D across multiple touchpoints in the business, and they cite a better manufacturing process, better designs, and easier collaboration between areas of the business as top benefits. Real-time 3D is not just a series of scattered use cases; it is part of creating a product or building and can be embedded at each key stage of the lifecycle to bring that product/building to life. Adopters find that the more places along this ecosystem in which they implement real-time 3D, the more seamlessly these processes are integrated as it provides a more interactive medium for collaboration and communication.

94% of those who have implemented real-time 3D are expanding their investment.



Figure 2

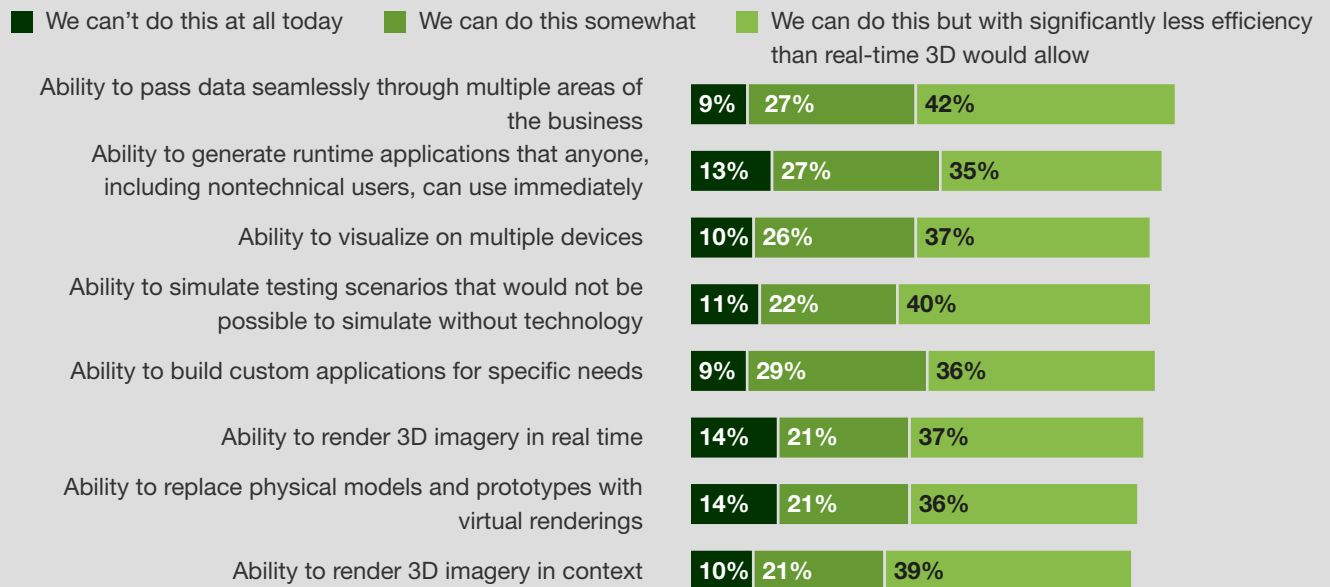
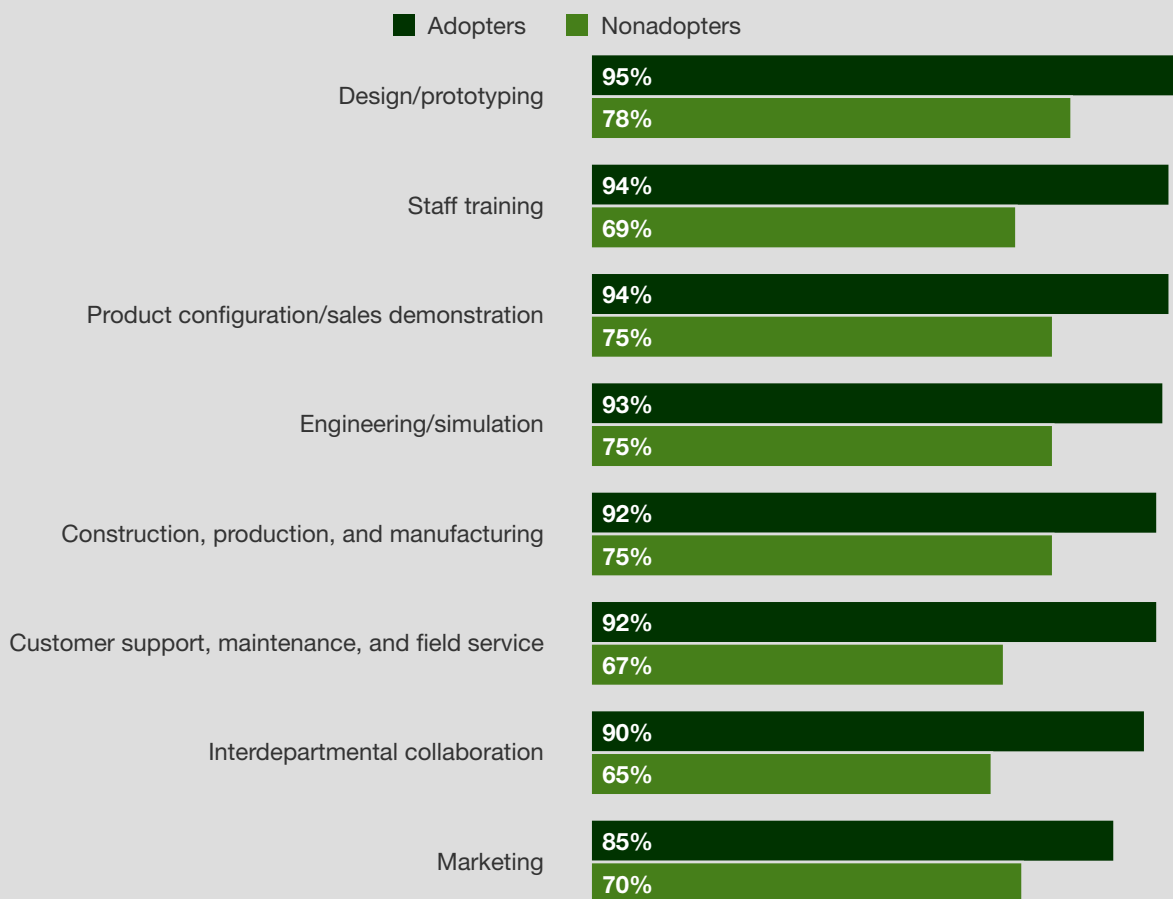


Figure 3

Real-time 3D utilization perceived as valuable or very valuable across visualization touchpoints



Base: 290 decision makers responsible for engineering, innovation, design, R&D, and operations who at least have knowledge of the 3D technology landscape

Source: A commissioned study conducted by Forrester Consulting on behalf of Unity, October 2019

- › **The top barrier to adoption is more of a misperception than a reality.** If most nonadopters believe real-time 3D would add value, what's stopping them? The No. 1 barrier to adoption for respondents is cost. However, this concern is somewhat unfounded: Cost savings is the No. 1 business benefit for real-time 3D adopters (56%), and increased sales are the second highest (53%) (see Figure 4). In other words, real-time 3D is helping companies reduce cost, grow revenue, and increase their bottom lines.

Adopters and nonadopters alike recognize the value of real-time 3D, and the top obstacle in the way of adoption may be a perceived roadblock rather than a real one. This data indicates a shift toward future acceptance of real-time 3D use cases within AEC and manufacturing companies. While prevalence is still low today, real-time 3D adoption may be beginning to snowball: 81% of respondents say that they would be more interested in investigating real-time 3D if they discovered that one of their top competitors was adopting a new use case. And, considering that more than half (55%) of respondents report that their companies will have adopted real-time 3D in the next two years, the industry may soon be reaching a tipping point.

What Are The Key Use Cases For Real-Time 3D?

Up until this point, we've been speaking of real-time 3D technology in the aggregate. What does adoption look like in practice? We asked respondents to choose the most relevant use cases to their industries (architecture, engineering, construction, or manufacturing) (see Figure 5).

- › **Architecture.** Respondents from architectural companies are predictably quick to recognize the value of design-related use cases like experience-based design (44%), model or design review (40%), and design visualization for concept validation (40%). Escaping the confines of a computer screen figures highly in a range of use cases including — explicitly — collaboration through immersive design review (35%), AR for facility management (31%), event XR engagement (31%), and immersive real estate purchase (27%). Respondents don't just fixate on a small set of use cases, either: Decision makers in this space see themselves using real-time 3D to address 4.7 different use cases, on average.
- › **Engineering.** Just like architects, engineers recognize the power of real-time 3D to bring their work to life: Forty-seven percent highlight model or design review as a good use case. Following that clear frontrunner are a wide range of use cases, with decision makers in this space picking 4.2 different use cases on average. Understanding how designs perform in real-world conditions grabs interest, as structural engineering (29%) and computational fluid dynamics simulation (24%). Unsurprisingly, the ability to experience complex and dangerous environments virtually is also of interest, as training and safety for maintenance teams (29%), interactive training (28%), training and safety (28%), safety/security parameter (28%), and scenario analysis (26%). The ability to inject data from the real world also proves interesting, as IoT data analysis (24%), digital twin for operations and maintenance (16%), and AR for facility management (14%).

Figure 4

“Which of the following business benefits has your organization experienced from utilizing real-time 3D technology?”



Base: 68 decision makers responsible for engineering, innovation, design, R&D, and operations who at least have knowledge of the 3D technology landscape
Source: A commissioned study conducted by Forrester Consulting on behalf of Unity, October 2019

Figure 5

“Which of the following specific real-time 3D use cases are relevant to your organization?”

Architecture

- 1. Experienced-based design
- 2. Model or design review
- 3. Design visualization for concept validation



Engineering

- 1. Model or design review
- 2. Showroom or presentation to clients
- 3. Training/safety for maintenance teams



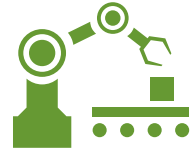
Construction

- 1. Construction simulation
- 2. Showroom or presentation to clients
- 3. Interactive product configurators



Manufacturing

- 1. Prototyping
- 2. Presentation to clients
- 3. Training and guidance



Base: 358 decision makers responsible for engineering, innovation, design, R&D, and operations who at least have knowledge of the 3D technology landscape.

Source: A commissioned study conducted by Forrester Consulting on behalf of Unity, October 2019

- › **Construction.** Showing progress on big, expensive, multiyear projects tops the bill in the construction industry too, with construction simulation (54%) and showroom or presentation to clients (50%) dominating use cases for this industry. Respondents identify 4.4 use cases on average, with training a clear area of interest as training and safety (42%), interactive training (38%), or training and safety for maintenance teams (26%). Finding techniques to avoid people or things getting in one another’s way also scores highly, with job site coordination (38%) and clash detection (36%). Physical spaces are becoming increasingly connected and sensor-enabled, ensuring that interest in IoT data analysis (currently 26%) will inevitably grow.
- › **Manufacturing.** Prototyping (41%) tops the list of use cases in manufacturing too. But if we just look at manufacturers who have already implemented real-time 3D, something interesting happens: Their interest in general prototyping falls (to 28%) while their interest in almost every other use case leaps ahead of that expressed by nonimplementers. Experience-based design (46%), training and safety of service technicians (44%), presentation to clients (41%), human machine interface (HMI) development (41%), immersive design review (38%), and interactive product configurators (36%) are popular among implementers of real-time 3D in manufacturing, among a set of 8.2 use cases per respondent, on average. We also see data-driven interaction with machines and processes get more important. Twenty-three percent of implementers (and 19% of nonimplementers) explicitly call out IoT-based experience, but connected customer experience ranks fourth for implementers at 41% (19% for nonimplementers): Those connected experiences only work once that IoT connection is in place.

Key Recommendations

Forrester's in-depth survey of senior decision makers about industrial use cases for real-time 3D yielded several important recommendations:



Approach real-time 3D visualization as a multi-use-case opportunity. Organizations implementing real-time 3D visualization solutions recognize the opportunity to deploy them in supporting multiple use cases across the business. Manufacturing decision makers interested in using this technology name just under six potential use cases on average: Those that have implemented real-time 3D tools report more than eight actual use cases on average. Once these tools are available, people find ways to use them that reach far beyond the product design department, reducing costs, simplifying collaboration, and ultimately supporting the creation of better products.



Learn from the few who do it, not just the many who talk about it. Almost across the board, decision makers whose companies have invested in real-time 3D visualization report more value, more benefits, and more potential use cases in their business than those at firms that have yet to implement. For example, leaders at companies that have invested in real-time 3D are much more likely to see it delivering value to designers, technicians, and customers than their peers who have not yet done so. Obvious use cases like product design or engineering prove even more valuable than noninvestors expect, but so do less obvious use cases. For example, 65% of noninvestors expect real-time 3D tools to be valuable in supporting interdepartmental collaboration. But, among those who've tried it, the number jumps to 90%.



Invest to save. The top reason given for not adopting real-time 3D visualization tools is their perceived cost. But cost savings and increased sales top the list of benefits reported by decision makers whose firms have already implemented these tools. Respondents highlight savings across their business, from reductions in their energy bills (29%) to slashing product wastage (45%), reducing the time and money spent on making and testing physical prototypes (58%), and general savings on the cost of making the finished product (66%).

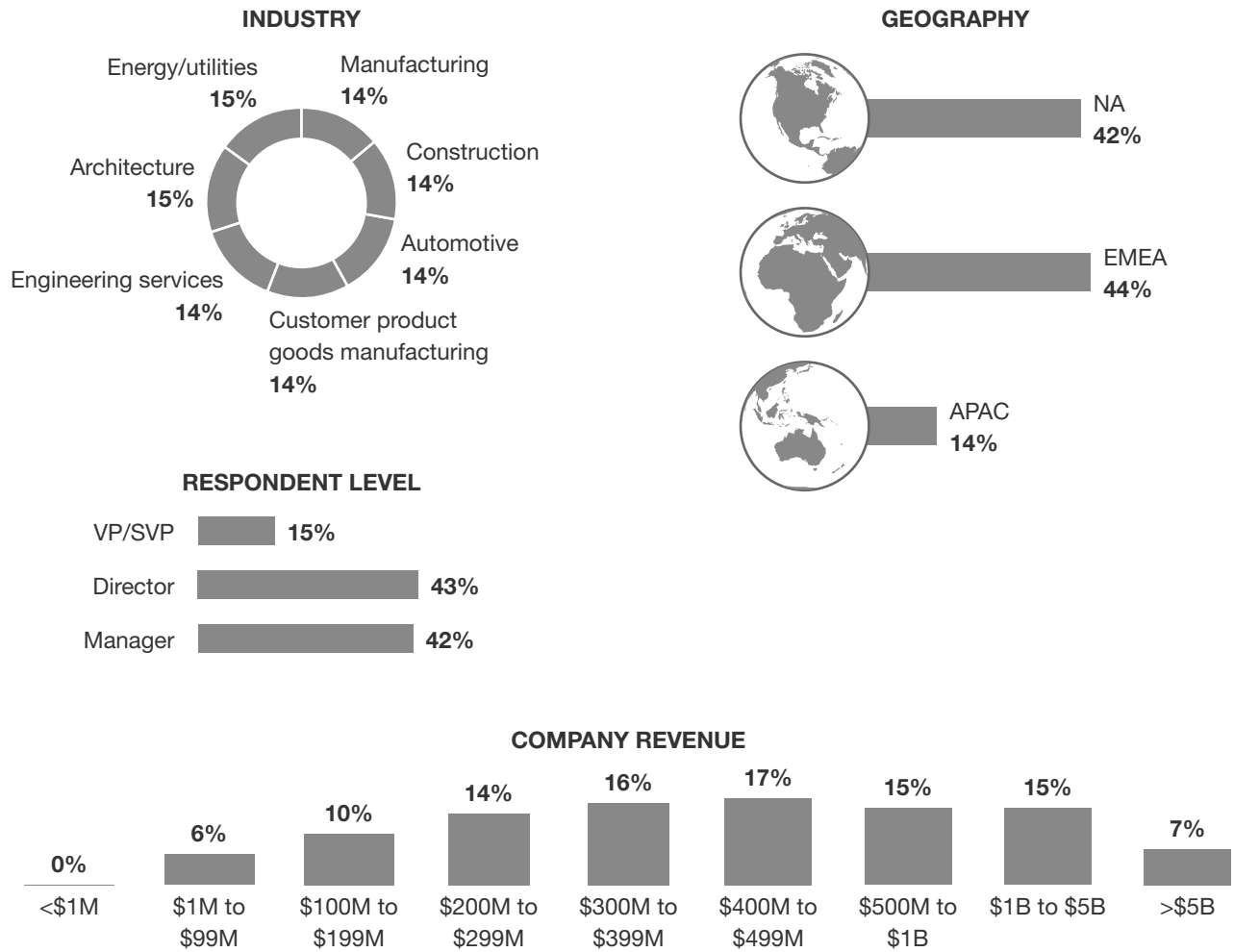


Select your first use cases to pull ahead. Despite the ability to utilize real-time 3D technologies at multiple stages of bringing a product or building to life, real-time 3D technologies are not widely used today, especially outside of specific engineering and simulation use cases. But over 80% of survey respondents would be more interested in implementing specific real-time 3D use cases if their competitors were to do so, and 55% say they will have implemented within the next two years. Choose the use cases that matter to your business and get on with implementing them to pull ahead of the competition: Most of them will then rush to follow your lead.

Appendix A: Methodology

In this study, Forrester conducted an online survey of 358 decision makers (at the senior manager to SVP level) responsible for engineering, innovation, design, R&D, and operations. All respondents have responsibility for creating 3D content (or overseeing that content creation) for their companies and/or knowledge of the 3D technology landscape. The study was completed in October 2019.

Appendix B: Demographics



Base: 358 decision makers responsible for engineering, innovation, design, R&D, and operations who at least have knowledge of the 3D technology landscape.

Source: A commissioned study conducted by Forrester Consulting on behalf of Unity, October 2019