

Accelerating Digital Transformation Through BIM

Regional Focus:

Japan



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Research Partners



Introduction

Digital transformation is sweeping the globe, and the design and construction industry is no exception. Since 2009, Dodge Data & Analytics has been conducting quantitative research about the use and value of design and construction technologies. As adoption has steadily expanded over that time, so have users' capabilities, expectations and creativity at applying digital technologies in innovative ways to derive the most value from the underlying data being captured, created and shared across the project lifecycle.

Autodesk has partnered with Dodge on many of those efforts over the years and has now done so again for a major global *SmartMarket Report* titled [Accelerating Digital Transformation Through BIM](#), which spans four continents and gathers the experiences of contractors, architects, civil engineers, and MEP and structural engineers who are currently using BIM to determine:

- Where they are in their process of digital transformation and how BIM is contributing value to that evolution.
- How they are deploying BIM and in what ways they are leveraging the data from models and processes to improve decision-making and effectively power integrated digital workflows among project team members.

About This SmartMarket Insight Report

As can be expected in any comprehensive global research, there are interesting variations in findings among the geographic areas studied. To help practitioners better understand the specific dynamics of how technology is being deployed in their region, Dodge and Autodesk have created a series of *SmartMarket Insight* reports specifically about each region's findings. This *SmartMarket Insight* report focuses on Japan and includes:

- A section showing key highlights of responses from BIM users in Japan.
- A section providing a summary of key findings from the full global study for context and reference.

Readers of this *SmartMarket Insight* are encouraged to also explore the full [Accelerating Digital Transformation Through BIM SmartMarket Report](#) to gain a complete understanding of how BIM is driving digital transformation throughout the entire global design and construction industry, and learn from the case studies, interviews and articles that supplement the data findings in that report. The report also explores the growing use of emerging digital technologies and practices in several categories, including design intelligence tools, innovative construction methods, jobsite technologies and smart building technologies.

Digital Transformation Trends in the Findings

Several key themes emerge from the global survey.

- A company's BIM intensity (i.e., the percentage of their projects where they use BIM) correlates directly to the progress of their digital transformation, the degree to which they report enjoying benefits from BIM and the ROI (return on investment) they believe their company is receiving on its investments in BIM.
- An even more pronounced correlation appears related to active use of BIM data for analysis and digital workflows. Companies conducting a higher number of the 22 data-related activities studied often report even greater positive experiences from BIM than those doing most of their work in BIM. And of course, the combination is a powerful and reliable formula for success.
- All respondents were asked to evaluate where they believe their company is on its journey of digital transformation. While the report shows that there are some variations in the responses between company-types and regions studied, there are more commonalities than differences as the entire industry moves toward a more efficient, connected and productive digital future.

Dodge thanks Autodesk for its ongoing support of important research on the digital transformation of the global design and construction industry.



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Senior Director
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Dodge Data & Analytics

Stephen A. Jones leads DD&A's Industry Insights Research division. He is active in numerous industry organizations and frequently speaks at industry events around the world. Before DD&A, Jones was vice president with Primavera Systems (now part of Oracle), a global leader in project management software. Prior to that, he was principal and a Board of Directors member with Burt Hill, a major A/E firm (now merged with Stantec).



Donna Laquidara-Carr, Ph.D., LEED AP
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Donna Laquidara-Carr currently provides editorial direction, analysis and content to DD&A's *SmartMarket Reports*. Prior to this position, she worked for nearly 20 years with DD&A's Dodge division, where she gained detailed insight into the construction industry.

Data: Japan

Introduction

The 67 respondents from Japan make up 8% of the total number of participants in the study. However, only those who identified themselves as BIM users were recruited for this study, so those 67 responses also represent 10% of total BIM users in the study. Seventy percent of respondents from Japan are designers (architects, engineers and consultants), while 30% are contractors. This report highlights the responses from these respondents to better understand BIM use and value in Japan.

Use of BIM

BIM users were asked about the percentage of projects on which they use BIM, and the chart at upper right shows the share doing so on 50% or more of their projects. It reveals that use of BIM at that intensity in Japan is only slightly below the global average.

Respondents were also asked to estimate the percentage of their projects that will include the use of BIM in the next two to three years. Japan reports substantial growth, with 73% expecting to use BIM on that share of projects in the near future. Notably, their expected growth is highly consistent with the growth in BIM intensity expected globally, since they still fall short of the global average by four percentage points.

Despite that slight difference, the findings suggest that the use of BIM will be more common in Japan in the next few years.

Collaboration With BIM

As many previous Dodge Data & Analytics studies have demonstrated, use of BIM yields the greatest benefits when many players across the project team are engaged with it and use it to collaborate. Therefore, the study examines the degree to which data is shared and the expectations for its use across the project team.

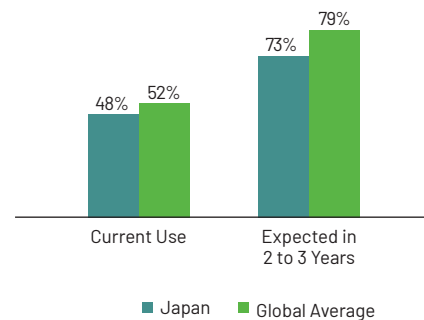
USE OF A COMMON DATA ENVIRONMENT

Respondents in Japan were asked about whether they use a common data environment (CDE) to exchange data with the project team, and those who do so were asked to rate the value of its use on a five-point scale, from no value to very high value. Their responses are compared with the global averages in the chart at lower right.

- Nearly all respondents from Japan (90%) say that they use a CDE, far more than the global average.
- However, fewer Japanese respondents suggest that using a CDE brings a high/very high value.

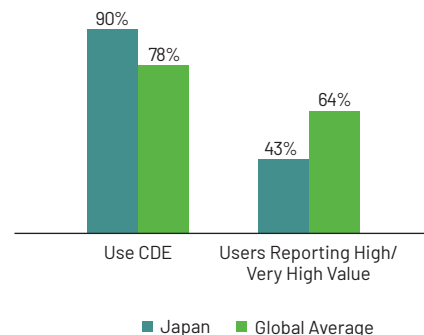
Use of BIM on 50% or More of Projects

Dodge Data & Analytics, 2021



Common Data Environment: Use and Value in Improving Performance of Project Team

Dodge Data & Analytics, 2021



Japan

It may seem surprising that the ubiquitous use of a CDE does not yield a greater estimation of its value. However, this may be in part due to it now being standard practice for many respondents, which makes it harder to estimate the value than when an approach is new or emerging.

EXPECTATIONS FOR BIM USE ACROSS THE PROJECT TEAM

Respondents were also asked about their expectations that other project team members will be able to fully use BIM. The responses from Japan are shown at right, along with the global averages.

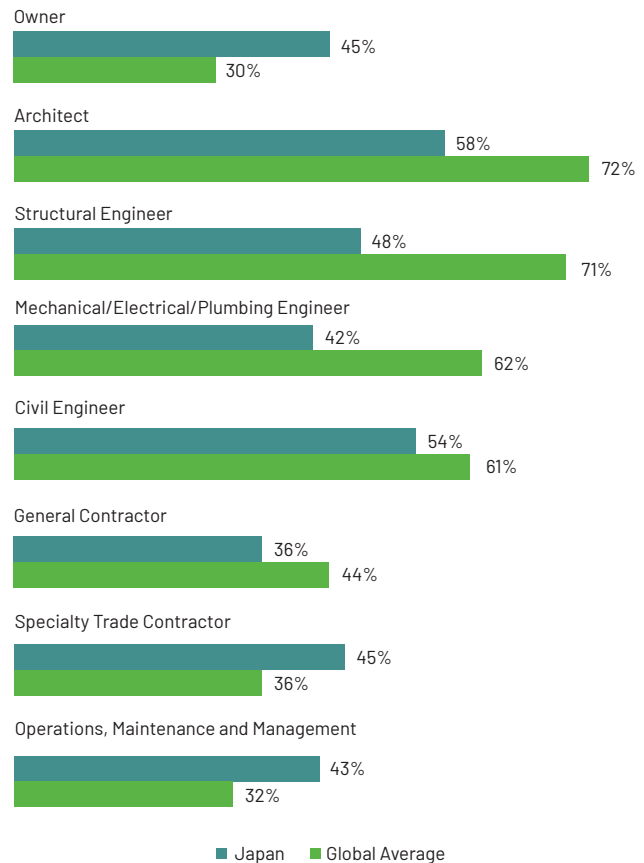
- The largest share of Japanese respondents expect full BIM skills from architects and civil engineers. However, they less frequently report this expectation than do the global respondents, especially for architects.
- In contrast, a large percentage believe that owners, trade contractors and operations, maintenance and management will have these skills, compared with the global average. It is also notable that their expectations for BIM competence in these groups exceeds the share that expect the same from general contractors.

Respondents were also asked about their level of satisfaction with the BIM skills they encounter for each of the project team members.

- Generally, between 40% and 50% of respondents from Japan report that they are satisfied with the BIM skills they encounter in other project team members.
- The only exceptions are that they are slightly more satisfied with architects (52%) and less satisfied with MEP engineers (34%).

Share Expecting That Project Team Members Will Be Able to Fully Use BIM Software

Dodge Data & Analytics, 2021



Japan

Use of Data-Driven BIM Activities

In addition to being asked about their use of a BIM process, respondents were asked about their use of specific data-driven BIM activities. Twenty-two total activities were included in the survey, although respondents were only asked about those that they are likely to use.

CURRENT USE OF DATA-DRIVEN ACTIVITIES

The top activities utilized in Japan are shown in the chart at right, contrasted with the overall share globally who use them.

- Six construction-related activities were included in the survey, and five of them are included in the list of top activities in Japan. This demonstrates the importance of BIM to the construction process among BIM users in Japan.
 - This includes the top activity, construction process presentation in static 3D, which is more widely used in Japan than in any other country/region included in this study. Presentation of the construction process in dynamic 4D also makes the list, but it is less widely adopted in Japan and not as dramatically above the global average, suggesting that this is still becoming a more common practice.
 - Another construction activity—preparation of shop, fabrication or installation drawings—is the third most widely used by Japanese respondents and also is used by a much higher percentage in Japan than the global average.
 - Part interference checks are used by nearly as many in Japan, and they also dramatically exceed global use.
 - In fact, the only construction activity which is not more widely used in Japan than globally among the five that made the top list is spatial coordination/clash detection, largely because it is so widely used in a few markets, including North America.
- Safety analysis of the construction site is an emerging activity in most markets, but it is well established in Japan, with 40% reporting its use.
- Notably, all of the other top activities fall in the category of planning. Design activities, though, are not as widely utilized in Japan as ones dealing with planning and construction are.

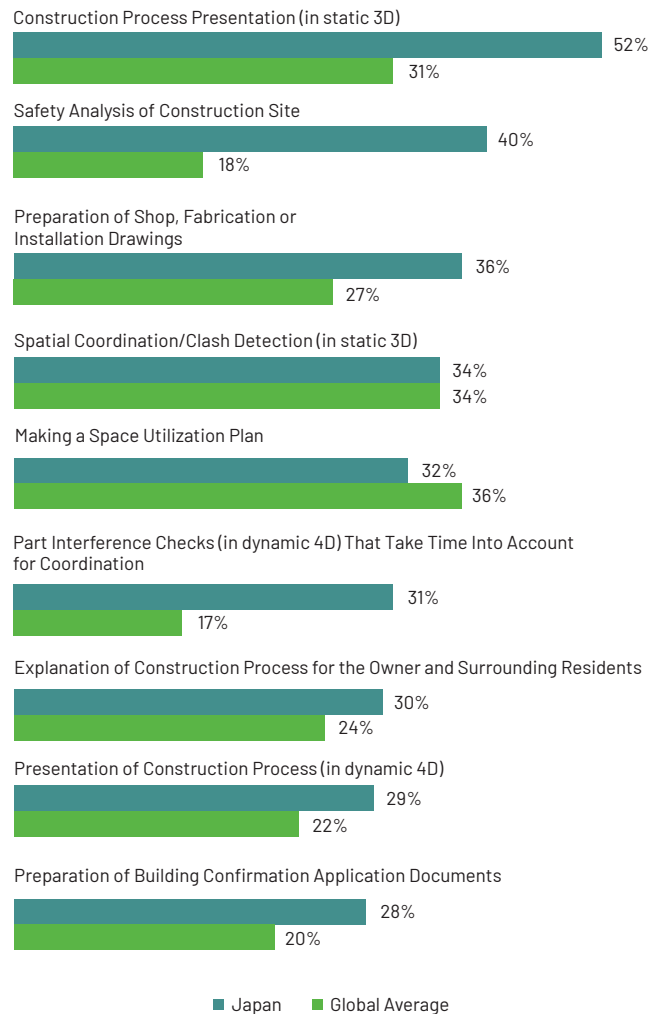
ANTICIPATED FUTURE USE OF DATA-DRIVEN ACTIVITIES

Respondents were also asked about the top activities that they want to use in the next two to three years. In Japan, the following items top this list, selected by 25% or more of those not currently using them:

- Explanation of the construction process for the owner and surrounding residents

Top 10 Data-Driven BIM Activities in Japan

Dodge Data & Analytics, 2021



Japan

- Constructability evaluation (the only construction activity that isn't among the top list)
- Preparation of shop, fabrication or installation drawings
- Enabling factory production and prefabrication

The list makes it clear that Japanese respondents plan to continue to engage with BIM largely during the construction process.

Top BIM Benefits

The study included a thorough look at the benefits that BIM users gain from its use. Each was asked to rate the degree to which they experienced potential benefits on a five-point scale, from none to very high.

- Designers (architects, engineers and consultants) were asked to rate 22 benefits in four categories—business, sustainability, risk reduction and operational efficiency.
- Contractors were asked to rate a different list of 22 benefits in five categories—business, quality, cost, schedule, and health and safety.

BIM BENEFITS EXPERIENCED BY DESIGNERS

Most designers in Japan who use BIM experience the eight benefits shown at right.

- Risk reduction benefits top the list, including improved project forecasting, improved ability to manage complexity and safer environments.
- Business benefits such as reduced overall design time, improved win rate, increased recognition as an industry leader and attracting and retaining top talent, are also among the most widely selected.

BIM BENEFITS EXPERIENCED BY CONTRACTORS

While based on a smaller sample, it is still very notable that over 60% of the contractors in Japan are experiencing 10 benefits at a high/very level.

- The top benefit is a business-related one: increased bid efficiency, but it is also the only business benefit to make the list.
- Several quality benefits are among the top ones in Japan, including reduced rework during construction, improved handover experience and reduced defects at handover.
- Health and safety benefits are also widely experienced in Japan, including reduced number of manhours onsite, reduced environmental impact and reduced insurance premiums.
- The remainder are schedule benefits. Fewer Japanese contractors report cost benefits from their use of BIM, but their experience of all other types of benefits is evident.

Top BIM Benefits Experienced at a High/Very High Level by Designers in Japan

Dodge Data & Analytics, 2021



Top Benefits Rated High/Very High by Contractors in Japan

Dodge Data & Analytics, 2021

Increased Bid Efficiency
Reduced Rework During Construction
Reduced Number of Manhours Onsite
Reduced Environmental Impact
Reduced Insurance Premiums
Improved Schedule Control
Improved Plan-to-Actual Ratio
Improved Subcontractor Qualification
Improved Handover Experience
Reduced Defects at Handover

Japan

BIM Investments and ROI

INVESTMENTS IN BIM

The top BIM investment that those in Japan anticipate making in the next two years is developing collaborative BIM processes with external parties, reported by 45%. Nearly as many (42%) report plans to invest in developing internal collaborative BIM procedures. Around one third expect to make other investments, such as in BIM training (37%), BIM solutions (38%), developing custom 3D libraries (38%), new/upgraded hardware (36%) and software customization/interoperative solutions (33%).

PERCEIVED BIM ROI

Per the chart at right, a much higher share of respondents in Japan expect to have a positive ROI on the investments they make in BIM than do respondents globally, and they are measuring ROI on a higher percentage of projects. Notably, nearly two thirds (64%) expect to see a positive ROI from BIM of 25% or more.

Digital Transformation

BIM is a critical component of a company's process of digital transformation, but it is also one of many potential technologies and approaches emerging in the design and construction industry that promise to improve project and business outcomes.

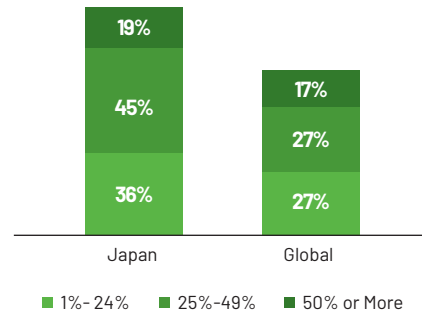
STAGE OF DIGITAL TRANSFORMATION

To better understand where the design and construction industry stands in terms of its process of digital transformation, respondents were asked to place themselves at one of five points along a spectrum, from haven't started yet to having achieved full digitalization. The chart in the middle column shows the responses from those in Japan compared with those from the entire study. The global averages include both those of BIM users and nonusers, but all the respondents from Japan are BIM users.

- While the share of those at the less advanced end of the scale is larger in Japan than globally, it is worth noting that only 3% of respondents in Japan report that they haven't started their efforts yet, and 42% say that they are in the early stages.
- It is also notable that the 18% in Japan at the more advanced end of the scale all state that they are approaching the goal. No Japanese respondents believe that they have already achieved a state of digital transformation.
- Thus, while the findings in Japan appear to be slightly behind those globally, it is worth noting that they all cluster in the

BIM Users Experiencing Positive ROI From Their BIM Investments

Dodge Data & Analytics, 2021

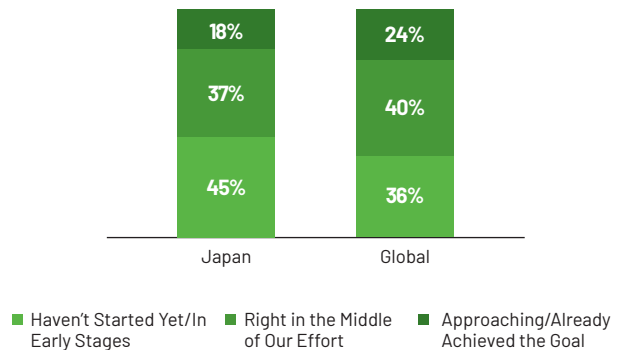


Share of Projects With Formal Measurement of ROI on BIM

Japan: 46%
Global: 36%

Stage of Digital Transformation

Dodge Data & Analytics, 2021



Japan

middle of the scale, suggesting that this market is well on its way in the process of digital transformation.

USE OF EMERGING TECHNOLOGIES/APPROACHES

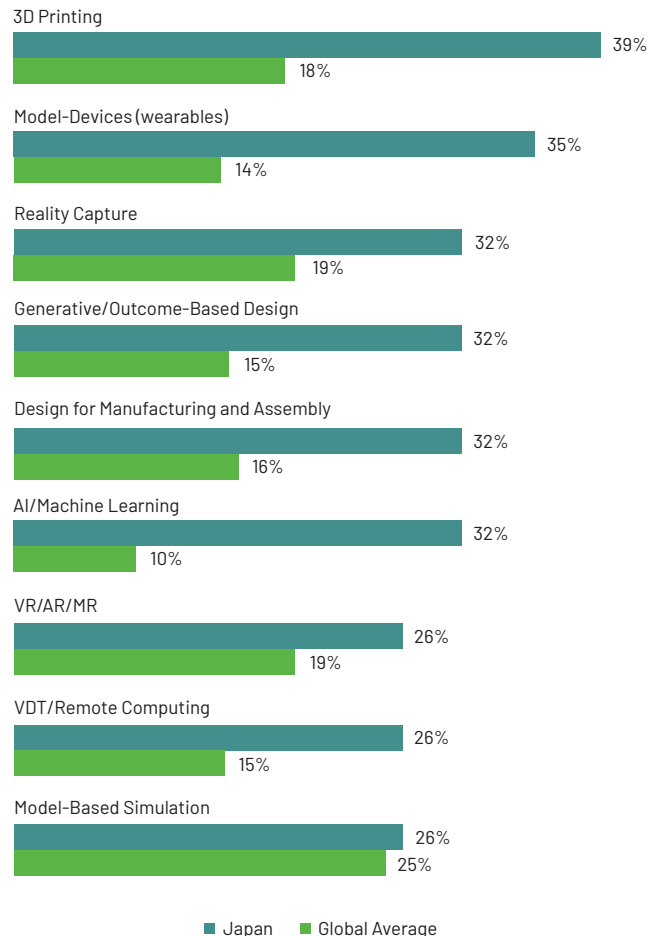
The study also included 17 emerging technologies/approaches associated with digital transformation and asked respondents to indicate which ones they are using now. The top nine for Japan are shown in the chart at right, contrasted with the share reporting that they are using them globally.

- The top six technologies in Japan are much more widely adopted there than they are by survey respondents in general.
 - All of the top three involve technology that can be directly implemented at the jobsite: 3D printing, model-devices (wearables) and reality capture. This again supports the previous findings that much of Japan's digital investment is focused on the jobsite.
 - The Japanese are also highly invested in technologies and processes that hold the promise for transformation of fundamental work processes in design and construction, including generative/outcome-based design, design for manufacturing and assembly and AI/machine learning.
 - Many of the most popular technologies in Japan, including model-devices, reality capture, design for manufacturing and assembly, AI/machine learning and VR/AR/MR are also among the most promising for improving safety on the construction site.
- Respondents were also asked about the technologies/processes they intend to begin to use in the next two to three years. The top ones in this region, selected by over 20%, are:
 - Generative/Outcome-Based Design (selected by 32%, the most of any region)
 - VDT/Remote Computing (also selected by 32%, far more than in any other region in the study)
 - Robotics/Automated Vehicles
 - Sensors, M2M Technology
 - Model-Based Simulation
 - Cloud Computing
 - VR/AR/MR
 - IoT

The prevalence of the technologies in use and the large share who anticipate using additional technologies in the future suggest a strong engagement with the process of digital transformation in Japan, stronger, perhaps, than that suggested by their self-estimation of their progress in this area.

Top Emerging Technologies/Approaches in Use in Japan

Dodge Data & Analytics, 2021



■ Japan ■ Global Average

Data: Summary of Global Findings

Global Summary Introduction and BIM Usage/Skills

Introduction to Global Summary

The next four pages provide highlights of the findings of the full global study, titled *Accelerating Digital Transformation Through BIM SmartMarket Report*.

BIM Usage and Skills

The chart at bottom left shows how many BIM users, by company-type, currently use it on most of their projects compared with how many plan to be doing so within two to three years. Findings clearly forecast significant growth by all.

Engagement With BIM Data

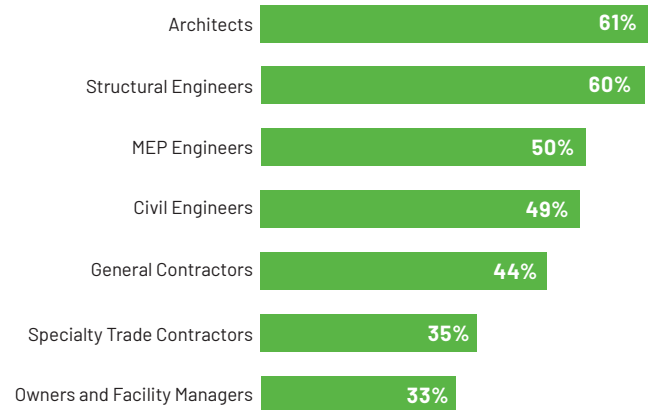
The research evaluated usage of 22 activities that leverage BIM data for improved decision-making and digital workflows. The chart at bottom right shows two levels of engagement with that full set of activities by company-type and size.

Satisfaction With BIM Skill Levels

The chart at right shows how many BIM users are currently satisfied with the level of BIM skills they encounter from each company-type shown. The findings point to a broad industry need to enhance BIM skills across the project team.

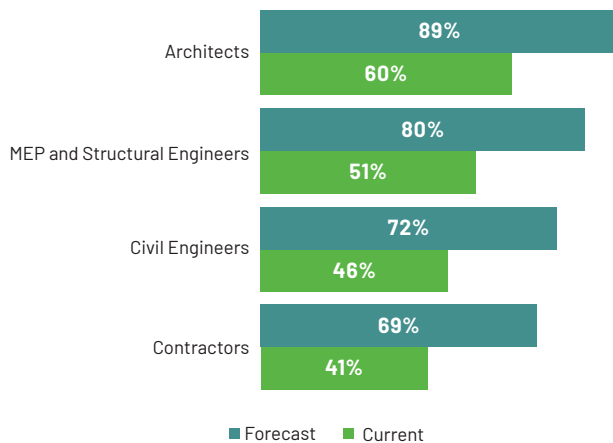
All BIM Users' Satisfaction With BIM Skills of Each Type of Project Team Member

Dodge Data & Analytics, 2021



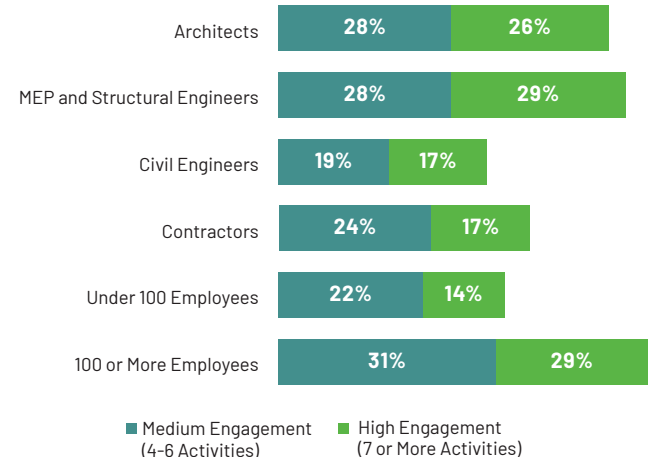
Current BIM Usage on 50% or More of Projects Compared With Forecast (2-3 Years)

Dodge Data & Analytics, 2021



Engagement With Data-Related Activities by Company-Type and Size

Dodge Data & Analytics, 2021



Summary of Global Findings

Use of a Common Data Environment and BIM Benefits

Common Data Environment

Nearly all BIM users use a common data environment to exchange data with their project teams, with contractors reporting the greatest value from its use.

Benefits of BIM

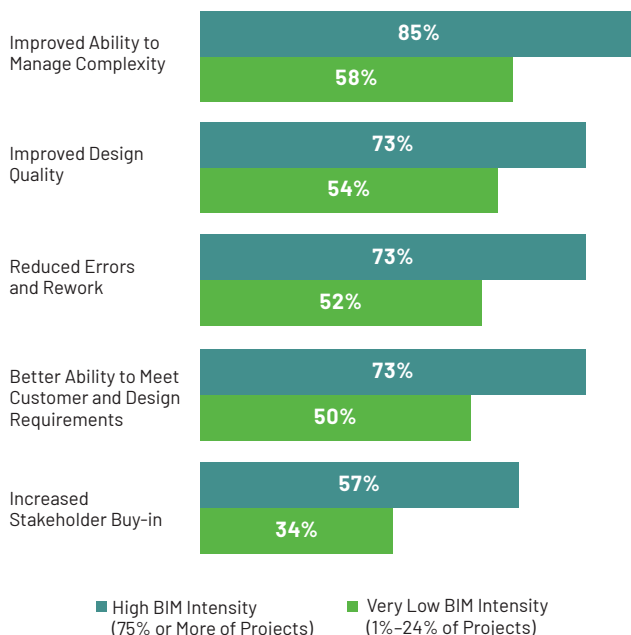
The survey examined BIM users' experience with 41 separate benefits received from their use of BIM.

The findings reveal a strong correlation between BIM intensity and the experience of BIM benefits. The charts at bottom show the top five benefits reported by designers (architects and engineers) and contractors, comparing the percentages doing 25% or less of their work with BIM to those doing more than 75%.

The compelling differences shown in these charts provide an explanation for the findings on the previous page about the dynamic pace at which current users are planning to increase their BIM intensity. More BIM means more benefits.

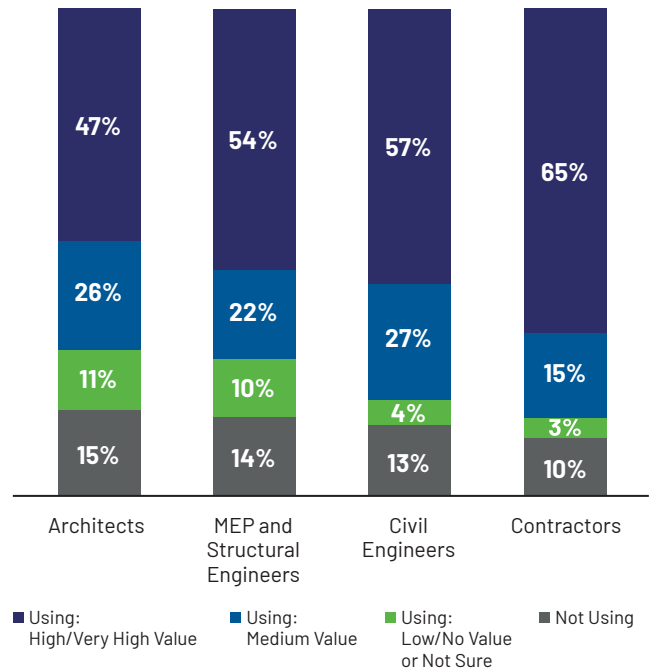
Impact of BIM Intensity on Top Five BIM Benefits for Architects and Engineers

Dodge Data & Analytics, 2021



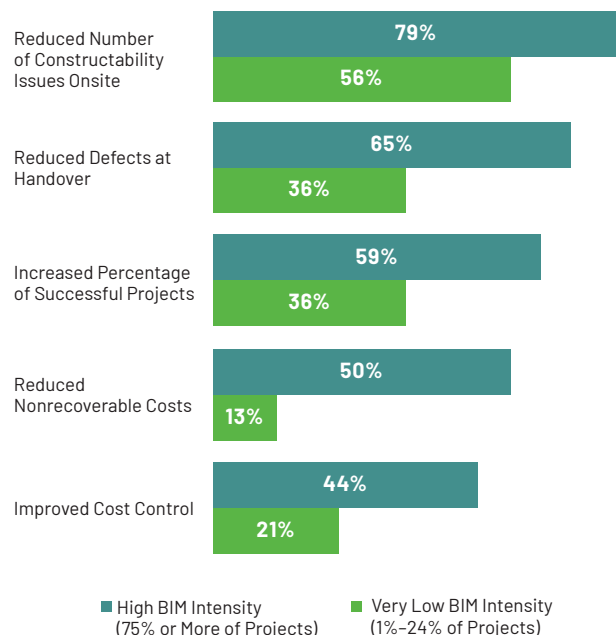
Use and Value of a Common Data Environment by Company-Type

Dodge Data & Analytics, 2021



Impact of BIM Intensity on Top Five BIM Benefits for Contractors

Dodge Data & Analytics, 2021



Summary of Global Findings

Perceived ROI of BIM

There is no standard, globally accepted way to measure the ROI (return on investment) of BIM. In studies of BIM users over the last 12 years, Dodge has asked them to select which of seven percentage ranges they best believe represents their company's ROI on its BIM investments to that point. This is referred to in Dodge reports as the perceived ROI on BIM. The charts on this page combine several of the seven range options into three broad ROI tiers.

Perceived ROI by Company-Type and Region

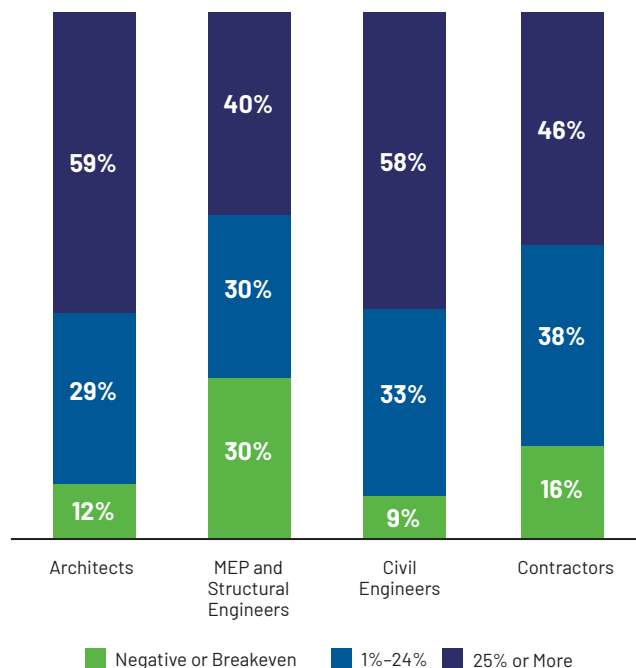
The chart at right shows this analysis by company-type. While architects report somewhat higher ROI than contractors, civil engineers differ notably from MEP and structural firms. This points to a need to focus on helping these professionals engage more successfully with BIM.

The chart at bottom shows the analysis by region and provides the overall response as a baseline for comparison.

- 48% or more report a good (at least a 25%) ROI in every region studied except North America, which also shows the highest number at negative or breakeven (31%).
- This contrasts sharply with France and UK/Ireland, where no users report negative or breakeven.

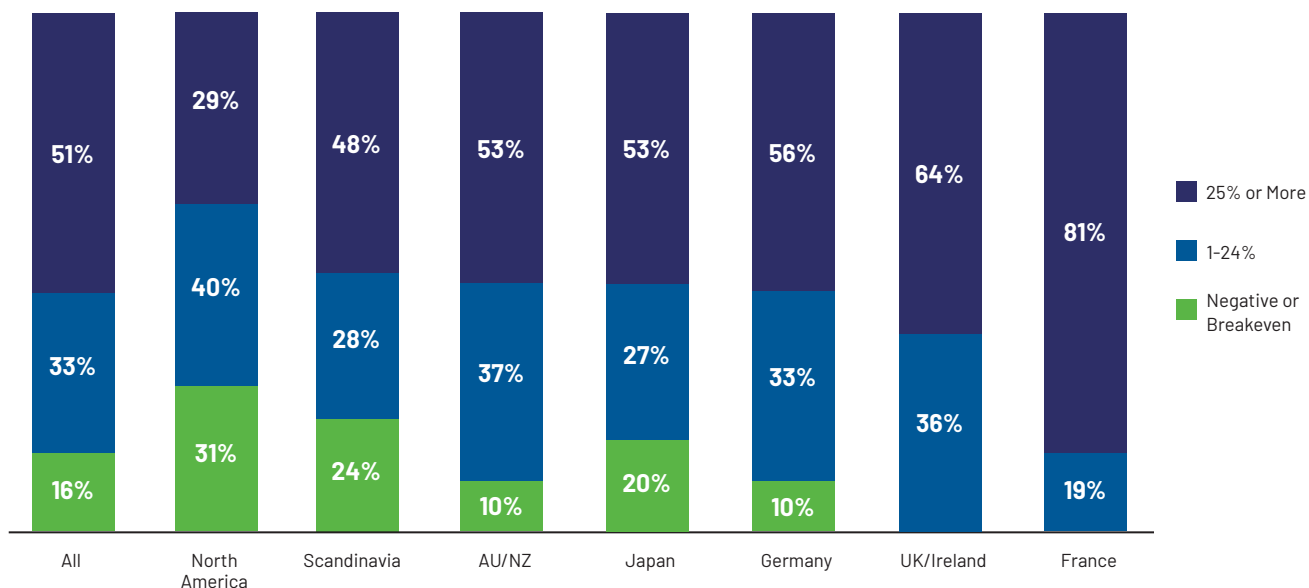
Perceived ROI of BIM by Type of Company

Dodge Data & Analytics, 2021



Perceived ROI of BIM by Region

Dodge Data & Analytics, 2021



Summary of Global Findings

Digital Transformation

While the overall global design and construction industry is clearly going through a comprehensive digital transformation, the pace varies widely by company. All respondents to this survey (BIM users as well as nonusers) were asked to assess where they believe their company is in its digital journey from one of four stages shown in the charts on this page.

BIM Users' Progress on Digital Transformation

The chart at right focuses just on BIM users. It compares all BIM users with those using BIM on at least 75% of their projects (high BIM intensity). The findings show how more BIM use correlates directly with overall digital transformation.

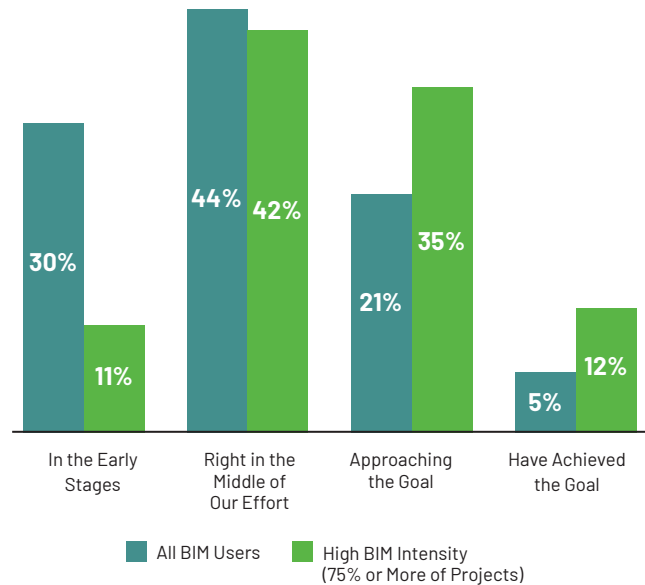
All Respondents' Progress on Digital Transformation by Region

Digital transformation is impacting all companies in the industry whether they are currently using BIM or not. The chart at bottom shows the averages of how all respondents from each region studied believe their transformation is progressing. The aggregate of all responses is also shown for comparison.

While there are variations, in general each region is fairly close to the average for all, suggesting that there is more commonality than difference in everyone's path toward our exciting digital future.

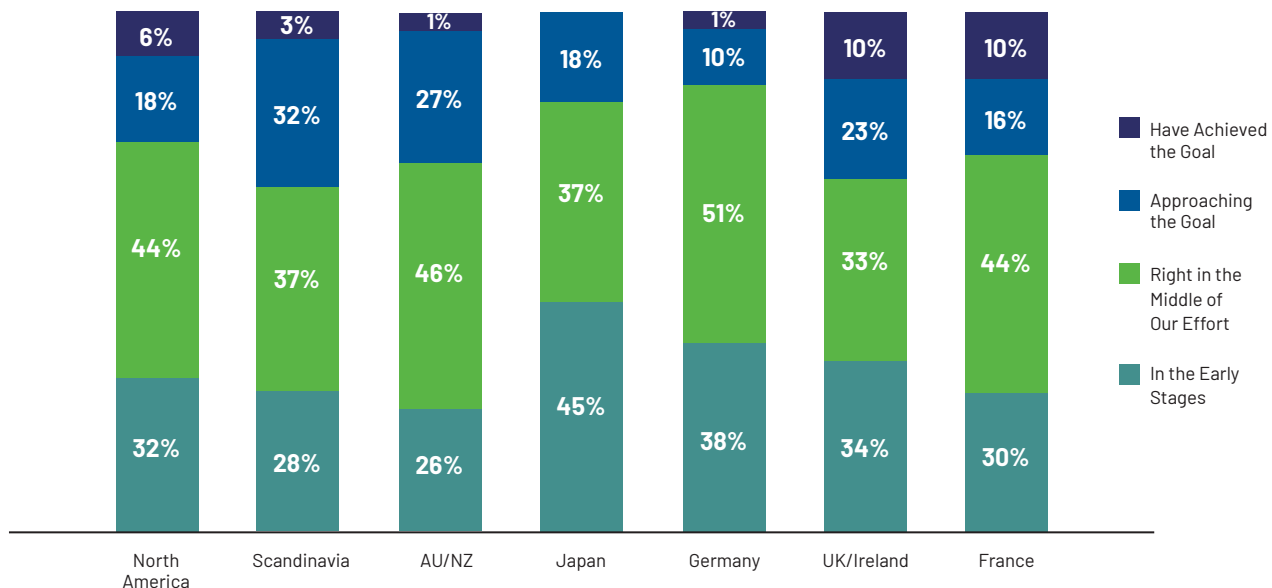
BIM Users' Reported Progress on Digital Transformation

Dodge Data & Analytics, 2021



All Respondents' Reported Progress on Digital Transformation by Region

Dodge Data & Analytics, 2021



Methodology

This global study was conducted to assess the extent to which BIM has been embraced in major regions of the world, including the experience of those who have used BIM in terms of related activities they employ, the benefits they receive, the ROI they get from BIM, the BIM engagement they expect and experience from other team members on projects. The study also examined digital transformation in general, and the current and future use of emerging technologies and processes in particular.

This research was administered online from October 2020 to March 2021. The survey data was collected from the Dodge Data & Analytics Architect and Contractor Panels, the Dodge Database of construction professionals and memberships of partnering associations (AMCA, Australian Constructors Association, CIBSE, CICES, CINOV, COMIT, GBC Finland, GBCA, Norwegian GBC, Planen Bauen 4.0, RICS, RIL, USGBC and UNSFA). The Dodge Data & Analytics Architect and Contractor Panels contain representative samples of architects and contractors across the US. The panelists are identified by many categories, including size, region, types of projects undertaken and specialty.

Respondent Profile

REQUIREMENTS

Respondents were required to be employed by an architecture firm, site design firm, construction company, engineering firm or consulting company, and located in Australia, Canada, France, Germany, Japan, New Zealand, Scandinavia, UK or the US.

BIM USERS

Most of the analysis focuses on respondents who report that their

company uses BIM. In total, 641 respondents report using BIM in this study, including 67 in Japan.

The following definition was provided for BIM to identify those using it: Building Information Modeling (BIM) is a process that begins with the creation of an intelligent 3D model and enables document management, coordination and simulation during the entire lifecycle of a project (plan, design, build, operation and maintenance).

BIM USER PROFILES

The responses of BIM users in the global study include a cross section of types of job roles and company sizes.

• Types of Job Roles:

- Architect: 37%
- Construction Professional: 32%
- Civil Engineer: 12%
- Building Engineer (structural, mechanical, electrical, plumbing): 10%
- Consultant: 5%
- Other: 5%

• Size of Company by Number of Employees:

- Very Large (500 or more): 23%
- Large (100 to 499): 30%
- Midsize (50 to 99): 17%
- Small (Fewer Than 50): 29%
- Prefer Not to Answer: 1%

Seventy percent of the BIM users primarily work on vertical buildings and 30% on infrastructure projects.

Finally, the study also explores the differences in responses among BIM users in the seven regions/countries included in the study. Because of a high number of smaller companies in the responses from North America, weighting was applied to make the proportion of North American respondents in varying size categories (by number of employees) match those of respondents located in regions other

than North America.

- North America: 34%
- France: 12%
- Australia/New Zealand: 12%
- Scandinavia: 11%
- Germany: 10%
- Japan: 10%
- UK/Ireland: 10%

DIGITAL TRANSFORMATION

The questions on digital transformation include responses from BIM users and nonusers. 843 total responses were received on the stage of digital transformation, with 67 from Japan, and 576 were asked about the technologies/processes they use and plan to adopt, with 31 from Japan for this question.

Resources

Organizations, websites and publications to help you get smarter about BIM and digital transformation.



Dodge Construction Network

Main Website:

www.construction.com

Dodge Construction Central:

www.construction.com/products

Market & Competitive Intelligence:

www.construction.com/products/construction-market-data

Sweets:

www.construction.com/products/sweets

SmartMarket Reports:

www.construction.com/toolkit/reports

ACKNOWLEDGEMENTS:

We would like to thank Autodesk for their ongoing partnership with Dodge to bring intelligence about BIM and the digital transformation of the design and construction industry.

We thank all of our research partners for their participation in the survey process to help make sure the industry is better informed. These include the Air Conditioning & Mechanical Contractors' Association (AMCA), Australian Constructors Association (ACA), the Chartered Institution of Building Services Engineers (CIBSE), the Chartered Institution of Civil Engineering Surveyors (CICES), Federation CINOv, COMIT (Construction Operation & Maintenance through Innovative Technology), Finnish Association of Civil Engineers (RIL), Green Building Council of Australia (GBCA), Green Building Council Finland, Norwegian Green Building Council, Planen Bauen 4.0, Royal Institution of Chartered Surveyors (RICS), US Green Building Council (USGBC) and UNSFA (L'Union des Architectes).

We thank all those who shared their insights and experiences, including the thought leaders featured in this report and those who provided us with case studies or shared their insights in our feature articles.



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Premier Partner

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Research Partners

Air Conditioning & Mechanical Contractors'

Association: **www.amca.com.au**

Australian Constructors Association:

www.constructors.com.au

Chartered Institution of Building Services

Engineers: **www.cibse.org**

Chartered Institution of Civil Engineering

Surveyors: **www.cices.org**

Federation CINOv: **www.cinov.fr/la-federation-cinov**

COMIT (Construction Operation & Maintenance through

Innovative Technology): **www.comit.org.uk**

Green Building Council of Australia:

<https://new.gbca.org.au>

Green Building Council Finland: **<https://figbc.fi/en>**

Norwegian Green Building Council:

<https://byggalliansen.no>

Planen Bauen 4.0: **<https://planen-bauen40.de>**

RIL (Finnish Association of Civil

Engineers): **www.ril.fi/en/ril.html**

Royal Institution of Chartered Surveyors: **www.rics.org/uk**

US Green Building Council: **www.usgbc.org**

UNSFA (L'Union des Architectes): **www.unsfa.fr**

Other Resources:

BIMForum: **bimforum.org**

buildingSMART International: **www.buildingsmart.org**

Construction Innovation Hub:

<https://constructioninnovationhub.org.uk>

Global BIM Network: **www.globalbim.org**

Lean Construction Institute: **leanconstruction.org**

National Institute of Building Sciences Building Information

Management (BIM) Council: **www.nibs.org/bimc**

■ Design and Construction Intelligence

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