SmartMarket Insight

Dodge Construction Network

Accelerating Digital Transformation Through BIM

Regional Focus:

Scandinavia

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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 Scandinavia and includes:

- A section showing key highlights of responses from BIM users in Scandinavia.
- 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.

Stephen A. Jones
Senior Director
Industry Insights Research
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).

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Industry Insights
Research Director
Dodge Data & Analytics

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: Scandinavia

Introduction

The 74 respondents from Scandinavia make up 9% of the total number of participants in the study. All but one of them, 73 respondents, identify themselves as BIM users, and they account for 11% of total BIM users in the study. About two thirds of the Scandinavian BIM users are designers (architects, engineers and consultants), while about one third are contractors. This report highlights the responses from these respondents to better understand BIM use and value in Scandinavia.

Use of BIM

As the chart at upper right shows, slightly less than half of the Scandinavian BIM users are currently using it on 50% or more of their projects. This is below the global average of 52%, although it is on a par with use reported in France, Germany and Japan. The average share of projects on which the BIM users in Scandinavia are using BIM is 48%, again slightly below the 52% average share globally.

One factor that may contribute to this finding is the relatively small share of the respondents in Scandinavia who have been using BIM for six years or more. Only 19% report this tenure with BIM use, well below every other region included in the study, and certainly below the global average of 40%.

However, the chart at upper right also reveals that the Scandinavian respondents expect to use BIM far more widely in the near future. Nearly all (92%) expect that they will be using BIM on 50% or more of their projects within the next two to three years. While that forecast is probably optimistic, it clearly demonstrates the strong value that those using BIM in Scandinavia are experiencing from its use and suggests a rigorous commitment to expanding their use of it in the future.

Collaboration With BIM

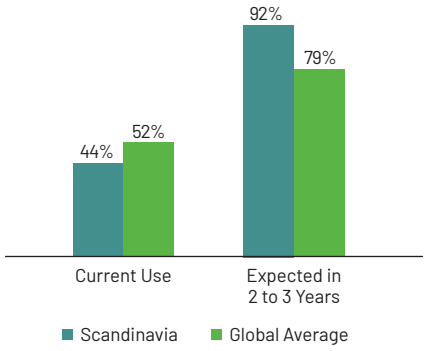
As many previous Dodge Data & Analytics studies have demonstrated, use of BIM yields the greatest benefits when many players across the project team are engaged with it and use it to collaborate. Therefore, the study examines the degree to which data is shared and the expectations for its use across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

USE OF A COMMON DATA ENVIRONMENT

Respondents in Scandinavia 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 the lower right.

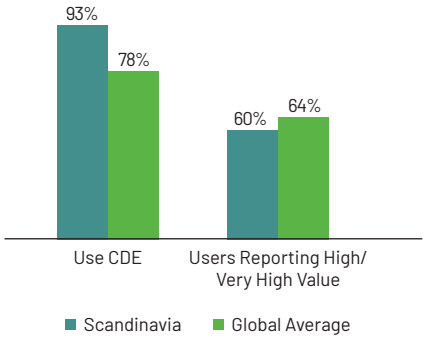
Use of BIM on 50% or More of Projects

Dodge Data & Analytics, 2021



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

Dodge Data & Analytics, 2021



Scandinavia

- Use of a CDE in Scandinavia is much higher than the global average. In fact, nearly all respondents (93%) in Scandinavia use a CDE, demonstrating that it is a standard practice in this region.
- The degree to which they believe it adds value in improving the performance of the project team is about on a par with the global average.

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 whether they expect other project team members to have full use of BIM software. The chart at right shows the responses in Scandinavia compared with those from all survey respondents.

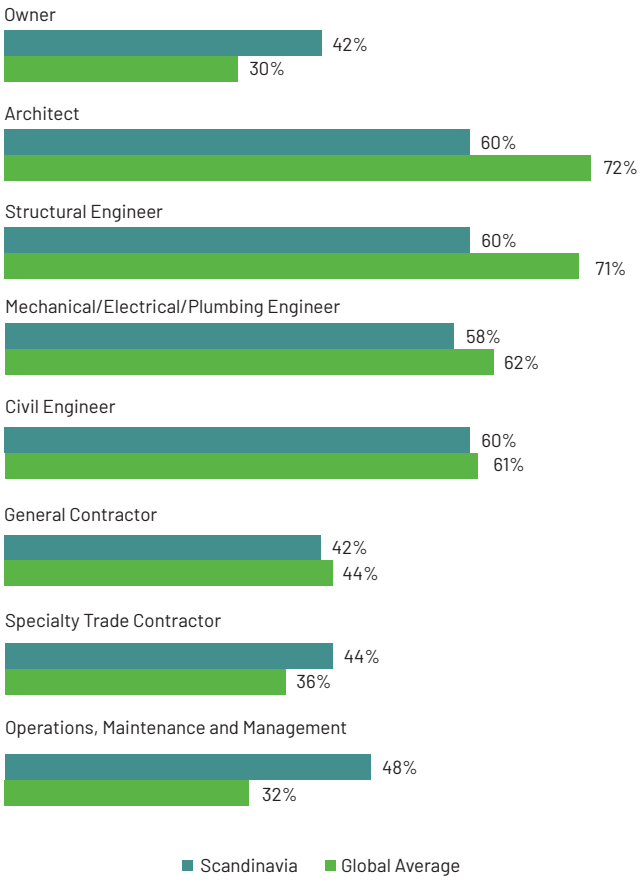
- Scandinavians most frequently expect members of the design team to be able to fully use BIM, with little differentiation between architects and the various types of engineers.
- However, their expectations about BIM skills in architects and structural engineers is much lower than the global average, although the share expecting BIM skills among MEP engineers and civil engineers is largely on a par with global expectations.
- In contrast, they have a much higher expectation of BIM skills among owners and those in operations, maintenance and management than do the global respondents.
- They also have somewhat higher expectations that specialty trade contractors will have BIM skills, and slightly more of them believe trade contractors will have these skills than general contractors.

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

- Scandinavians are generally more satisfied with BIM skills across the project team than most other regions, particularly for owners, structural engineers, civil engineers, general and specialty trade contractors, and operational maintenance and management. In each case, the share who are satisfied with the skills they encounter notably exceed the global average, with around half to two thirds reporting satisfaction.

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

Dodge Data & Analytics, 2021



Scandinavia

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 Scandinavia are shown in the chart at right, contrasted with the overall share globally who use them.

- The chart reveals that use in Scandinavia of each individual activity is not extensive, with only a 10-point difference between the highest to the lowest, and none used by more than about one third of respondents.
- However, despite the modest use of each of the various activities, 99% of Scandinavian BIM users report using at least one, significantly more than in North America (65%), Germany (73%), France (88%) and the UK/Ireland (88%).
- Generally, the use of the individual activities corresponds roughly to the global average, although Scandinavians use part interference checks more and spatial coordination/clash detection less than is the norm.

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 Scandinavia, the following items top this list, selected by 20% or more of those not currently using them:

- Material management by classification code
- Enabling factory production and prefabrication
- Constructability evaluation (which already has high levels of use in this region)
- Various design checks

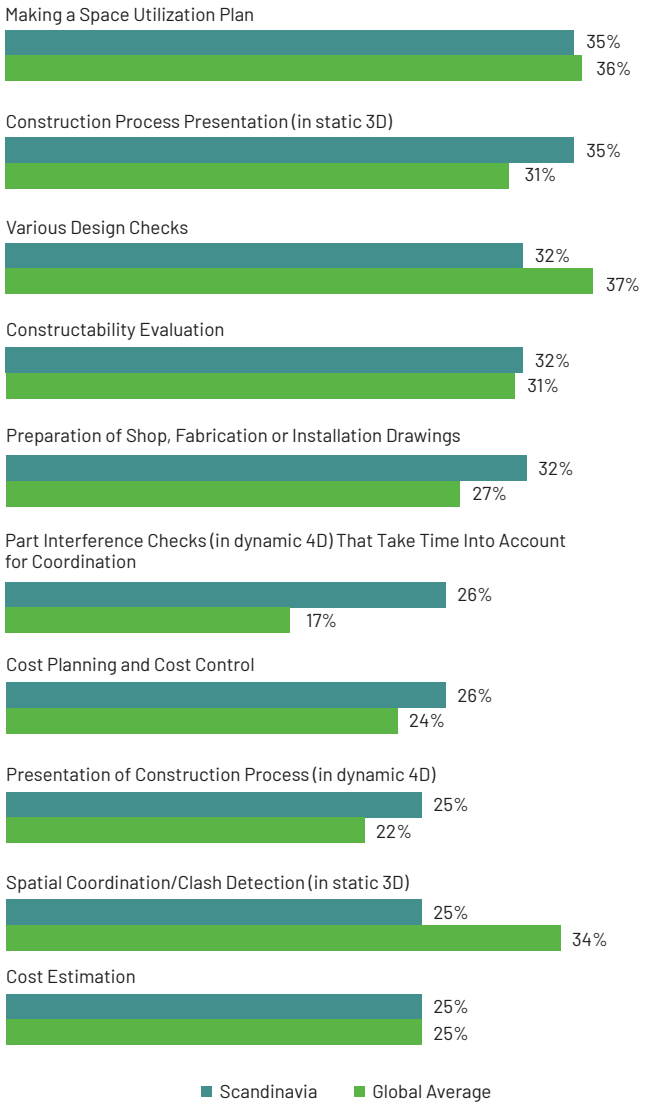
Top BIM Benefits

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.

Top 10 Data-Driven BIM Activities in Scandinavia

Dodge Data & Analytics, 2021



Scandinavia

The most highly rated benefits among designers in Scandinavia are shown in the chart at upper right. Since the number of contractors using BIM who responded to the survey in this region did not exceed the minimum statistical threshold of 30, a table with their top benefits is shown at lower right, all of which were rated at a high/very high level by over two thirds of these contractors.

BIM BENEFITS EXPERIENCED BY DESIGNERS

Over 70% of designers experience 13 benefits at a high/very high level.

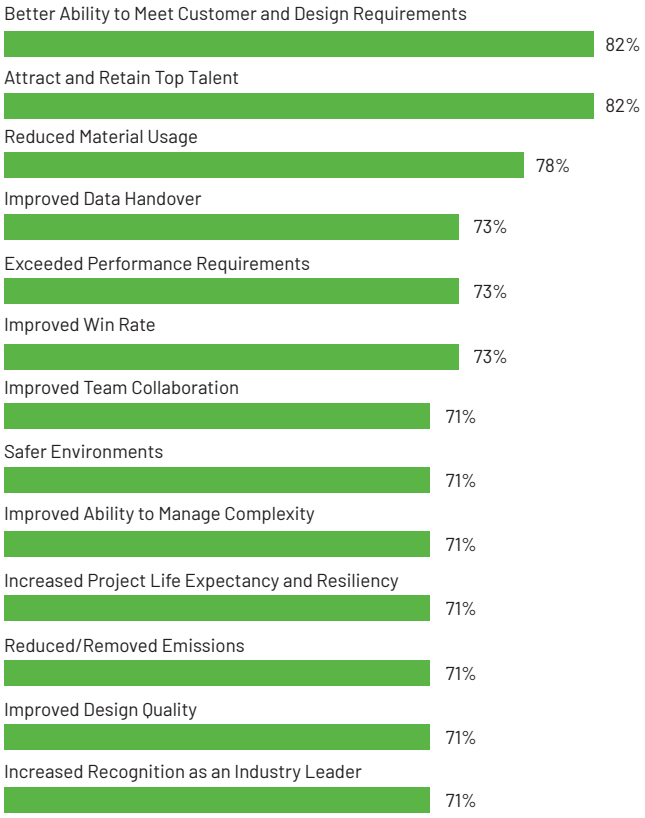
- Four business benefits are included in this list.
  - Scandinavia has the highest share of all regions that report that they experience attracting and retaining top talent and increased recognition as an industry leader to a high/very high degree.
  - They are the second highest region for improved design quality (second only to Australia/New Zealand) and improved win rate for designers (second only to Japan).
- All four of the sustainability benefits included in this list are more widely reported in Scandinavia at a high level than in any other region/country: exceed performance requirements, reduced material usage, increased project life expectancy and resiliency, and reduced/removed emissions. In addition, Scandinavians dramatically exceed the global average and most other regions in the share (69%) who find they experience a high/very high increased ability to consider environmental impact during design. No other region compares to Scandinavia in the use of BIM to achieve sustainability benefits.
- The remaining top benefits demonstrate that designers are experiencing significant BIM benefits to reduce their risk and increase their operational efficiency.
  - One of the top benefits, better ability to meet customer and design requirements, helps designers to reduce risk. Scandinavia has the highest share of any region/country reporting this at a high/very high level. Improved ability to manage complexity also helps reduce risk.
  - Two of the remaining top benefits help to improve operational efficiency for the designers: improved team collaboration and improved data handover.

BIM BENEFITS EXPERIENCED BY CONTRACTORS

Seventy percent or more of the contractors in Scandinavia experience the benefits included in the table to a high/very high degree. The list includes critical key performance indicators for contractors like improved schedule and cost

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

Dodge Data & Analytics, 2021



Top Benefits Rated High/Very High by Contractors in Scandinavia

Dodge Data & Analytics, 2021

Reduced Number of Constructability Issues Onsite
Improved Schedule Control
Improved Subcontractor Qualification
Improved Cost Control
Increased Bid Efficiency
Improved Stakeholder Engagement

Scandinavia

control, improved subcontractor qualification (which is also a cost benefit), and improving quality through a reduced number of constructability issues. Many Scandinavian contractors also report key business benefits like increased bid efficiency and improved stakeholder engagement.

BIM Investments and ROI

INVESTMENTS IN BIM

Three types of expected , near-term BIM investments top the list in Scandinavia, each selected by more than 40% of BIM users: BIM solutions, developing internal collaborative BIM procedures and BIM training. It is notable, though, that all types of investments in this region, including hardware and software, are expected by 30% or more of Scandinavian BIM users in the next two years. This is another indicator of the region's overall engagement with BIM.

PERCEIVED BIM ROI

Per the chart at right, a higher share of respondents in Scandinavia expect to have a positive ROI on the investments they make in BIM than do respondents globally, especially in the 25% to 49% range. Also, they are measuring ROI on a higher percentage of projects than is the practice globally.

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.

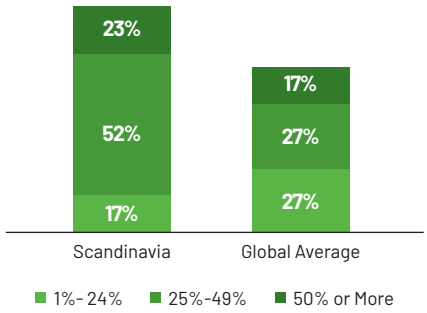
STAGE OF DIGITAL TRANSFORMATION

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 at bottom right shows the responses in Scandinavia compared with those from the entire study. These responses include both those of BIM users and nonusers.

- More Scandinavians place themselves on the advanced end of the scale than is generally reported globally.
- Conversely, fewer Scandinavians place themselves at the lower end of the scale than do the global respondents.
- These findings suggest that Scandinavia may be farther along in its overall journey toward digitalization than many other regions. However, the majority in this region are still working toward this goal.

BIM Users Experiencing Positive ROI From Their BIM Investments

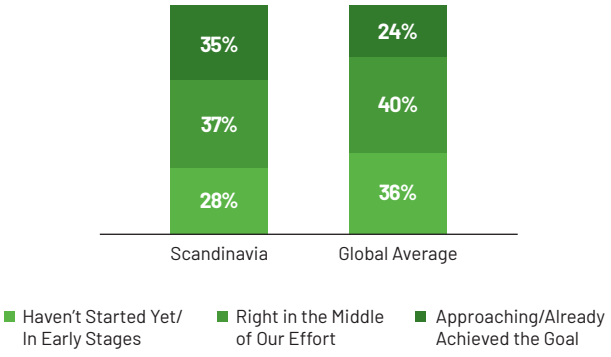
Dodge Data & Analytics, 2021



Share of Projects With Formal Measurement of ROI on BIM
Scandinavia: 48%
Global: 36%

Stage of Digital Transformation

Dodge Data & Analytics, 2021



Scandinavia

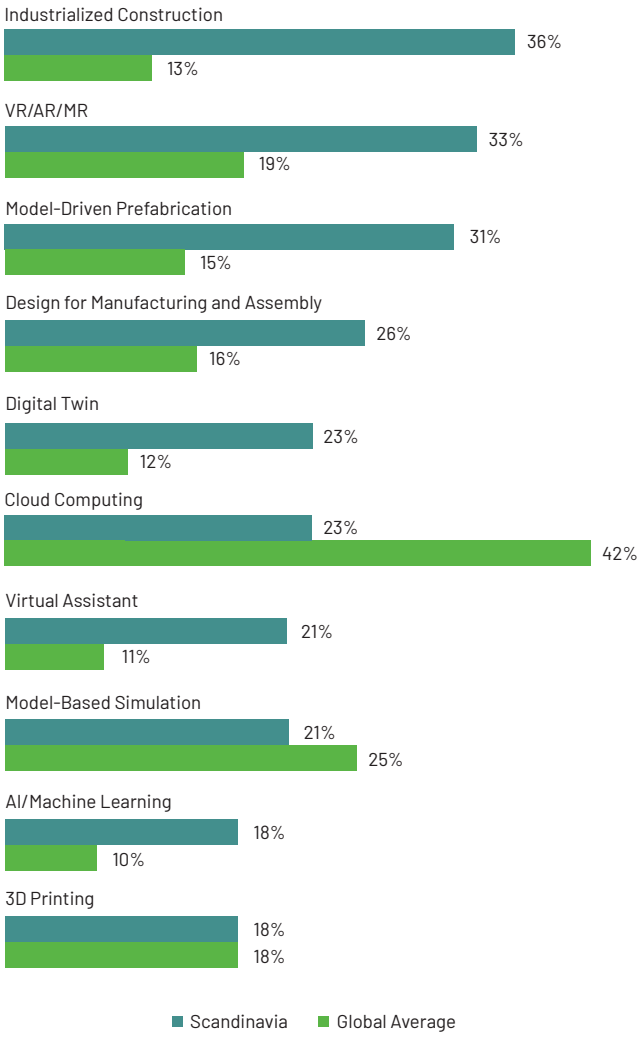
USE OF EMERGING TECHNOLOGIES/APPROACHES

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 10 for Scandinavia are shown in the chart at right, contrasted with the share reporting that they are using them globally.

- Over 30% in Scandinavia report that they are currently using industrialized construction, virtual/augmented/mixed reality (VR/AR/MR) and model-driven prefabrication. Use of all of these approaches and technologies are also significantly higher than the use reported in the study overall.
- Over 20% are also using design for manufacturing and assembly (DfMA), digital twins, cloud computing and virtual assistants. Again use in Scandinavia is notably higher than use globally, with the exception of cloud computing, where it is much less.
- The other category with wider use in Scandinavia than is reported in the rest of the study is AI/machine learning.
- All of these findings demonstrate that the Scandinavian respondents are in fact more advanced than the general average in terms of digitization of their processes, which corresponds well to their self rating.
- 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, with one quarter or more respondents expecting to use them, are:
  - IoT (internet of things) Devices
  - Model-Based Simulation
  - Robotics/Automated Vehicles
  - AI/Machine Learning
  - 3D Printing
  - Sensor and M2M Technologies

Top 10 Emerging Technologies/Approaches in Use in Scandinavia

Dodge Data & Analytics, 2021



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

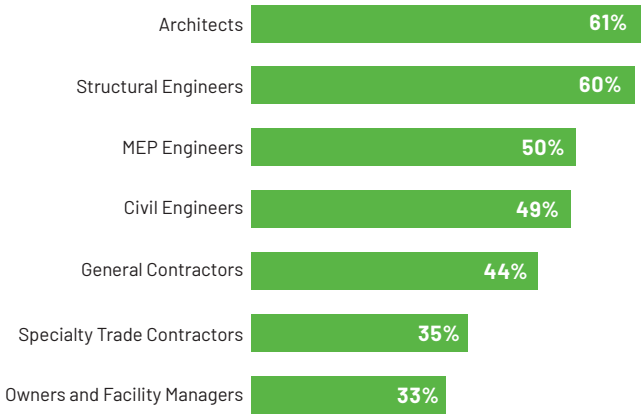
The research evaluated usage of 22 activities that leverage BIM data for improved decision-making and digital workflows. The chart at bottom right shows two levels of engagement with that full set of activities by company-type and size.

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.

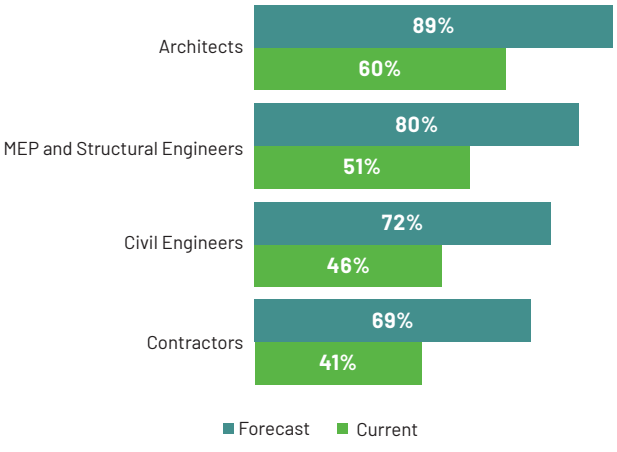
All BIM Users' Satisfaction With BIM Skills of Each Type of Project Team Member

Dodge Data & Analytics, 2021



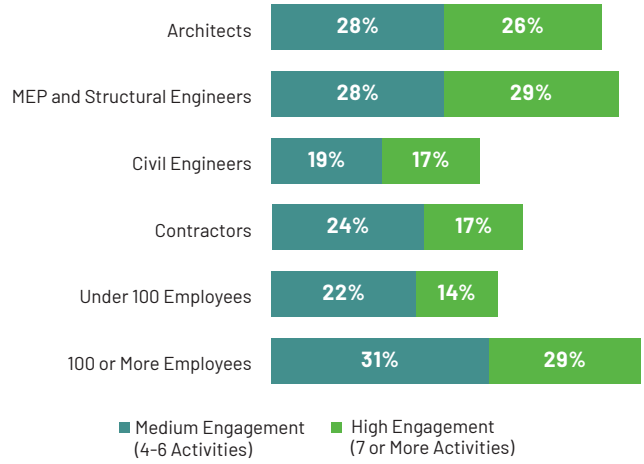
Current BIM Usage on 50% or More of Projects Compared With Forecast (2-3 Years)

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

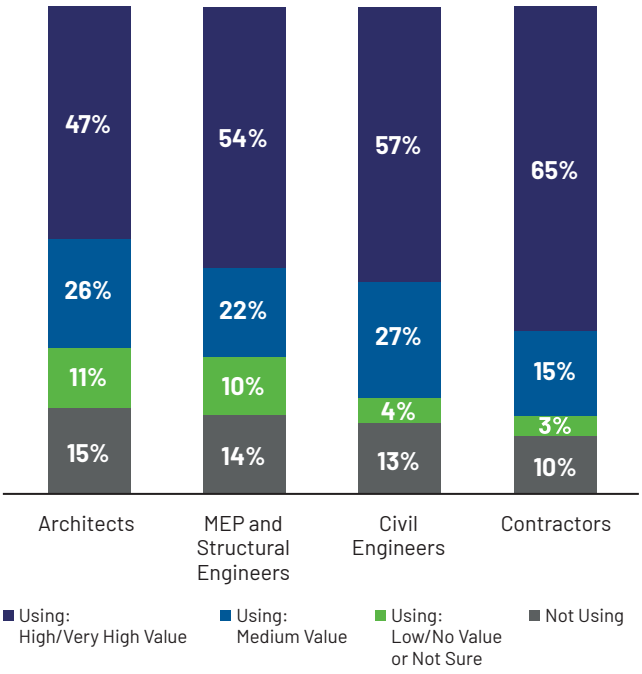
The survey examined BIM users' experience with 41 separate benefits received from their use of BIM.

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 contactors, 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.

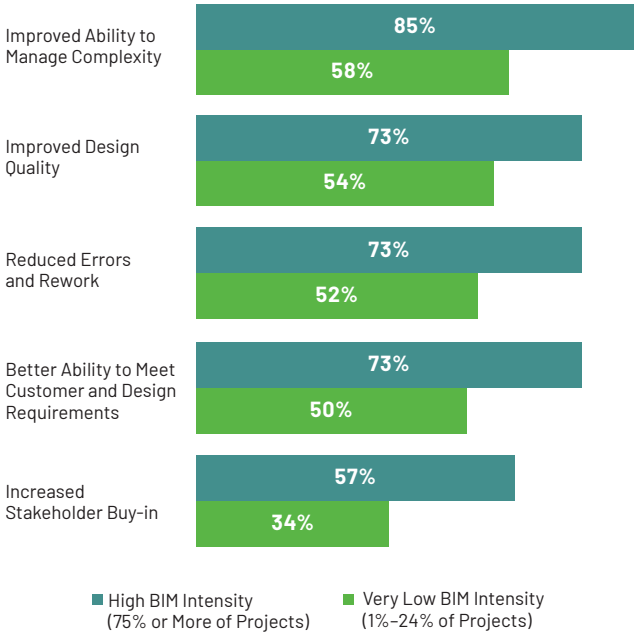
Use and Value of a Common Data Environment by Company-Type

Dodge Data & Analytics, 2021



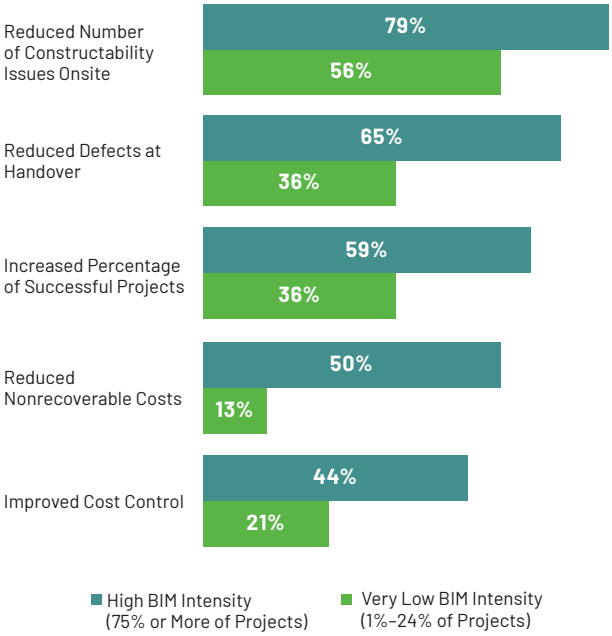
Impact of BIM Intensity on Top Five BIM Benefits for Architects and Engineers

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

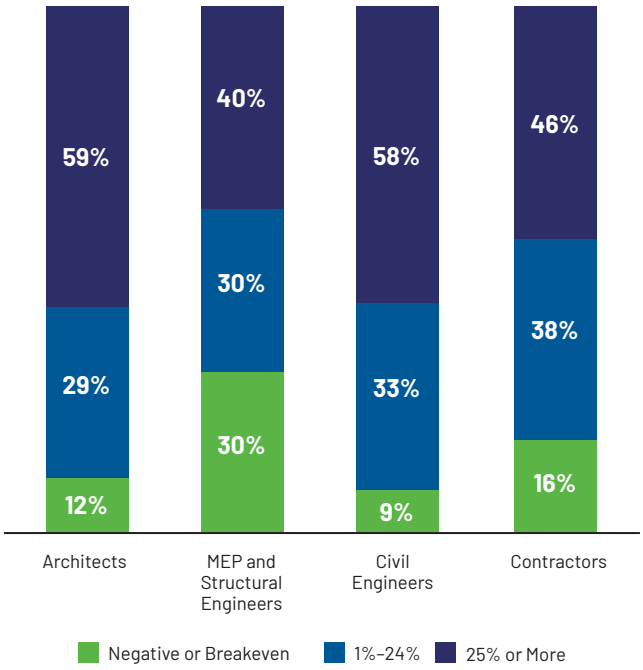
The chart at right shows this analysis by company-type. While architects report somewhat higher ROI than contractors, civil engineers differ notably from MEP and structural firms. This points to a need to focus on helping these professionals engage more successfully with BIM.

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.

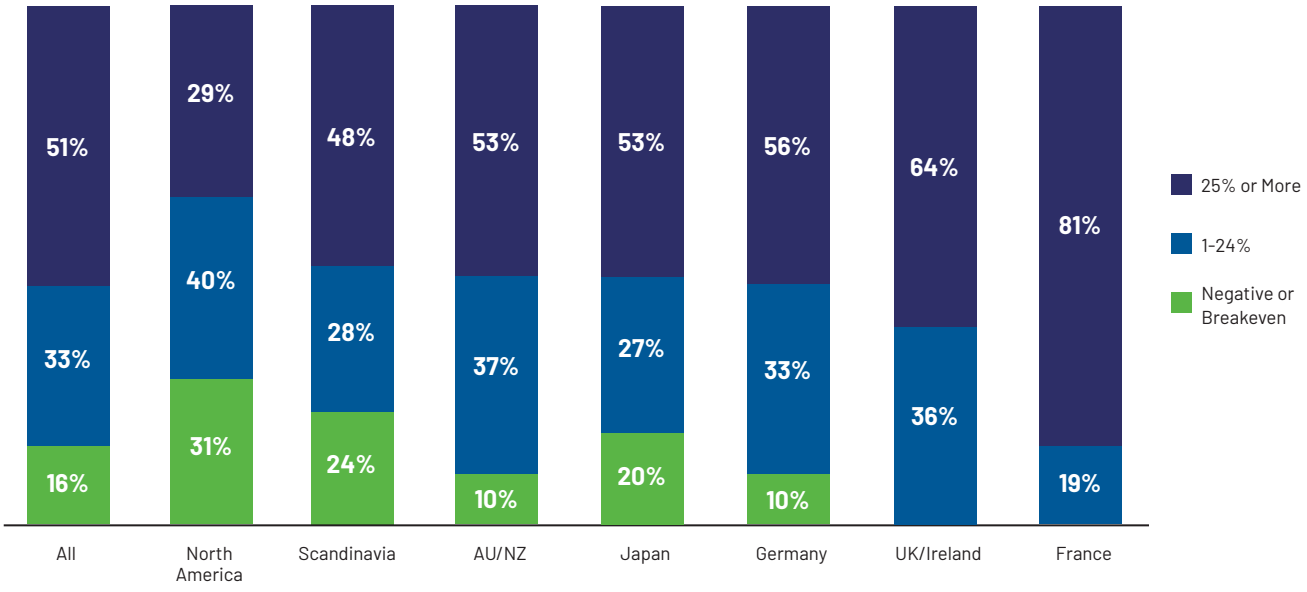
Perceived ROI of BIM by Type of Company

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.

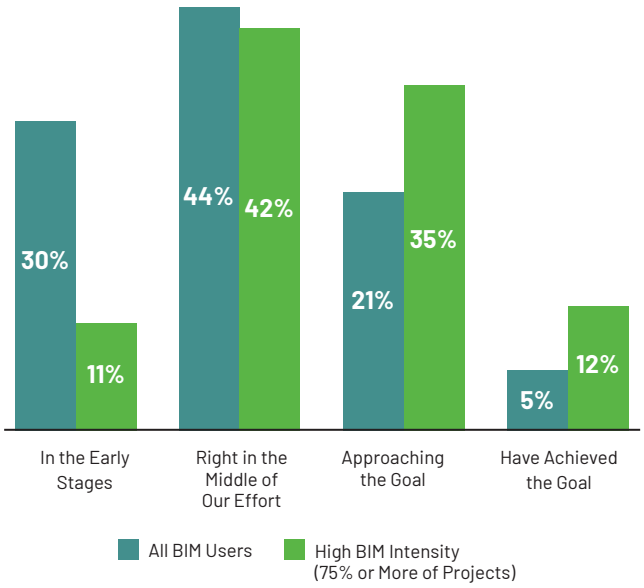
All Respondents' Progress on Digital Transformation by Region

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.

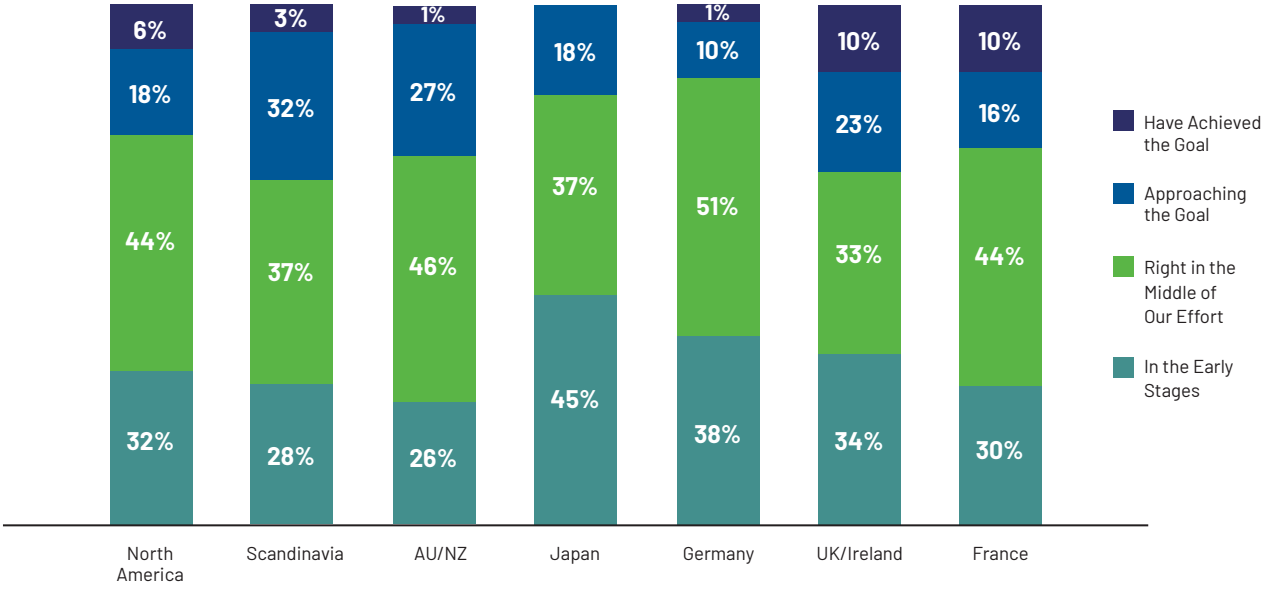
BIM Users' Reported Progress on Digital Transformation

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 74 in Scandinavia.

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 74 from Scandinavia, and 576 were asked about the technologies/processes they use and plan to adopt, with 39 from Scandinavia 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

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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

SmartMarket Insight

www.construction.com

Dodge Data & Analytics SmartMarket Reports™ and Insights

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