

# BIM Success Factors

## OVERVIEW

Enough BIM projects have been completed in recent years for the industry to be able to consistently measure the positive impact of model-based processes on key project outcomes, as well as to determine what factors contribute to and impede these positive impacts.

## SUCCESS FACTORS AND OBSTACLES

To quantify improvements related to BIM, this study establishes the percentage impact of six BIM activities on seven distinct project outcomes, from the differing perspectives of architects, engineers and contractors.

To identify the drivers behind these improvements, the respondents also rated the frequency with which they experience 10 activities that should contribute to improved outcomes from BIM and their view on the relative positive impact of each. From the opposite perspective, the study also examines the negative impact of six obstacles to success with BIM.

Combining the findings about the most positive drivers and the most negative obstacles, the study identifies four key success factors that the data indicate should be top priorities for BIM teams.

## Key Findings

**4 Infographic:** *BIM Success Factors*

## Impact on Outcomes

**5 Moderate BIM Impact:** *Project outcomes on which BIM has at least 5% impact*

**6 Variance From Average:** *Percentage that each company-type varies from the average of all respondents for impact of BIM on outcomes*

**7 High BIM Impact:** *Project outcomes on which BIM has at least 25% impact*

## Success Drivers

**8 Frequency and Value: Context:** *Percentage rating high or very high frequency and value for these factors/activities being in place at the start of a project*

**9 Frequency and Value: Process:** *Percentage rating high or very high frequency and value for these factors/activities during projects*

**19 Variance From Average for Value:** *Greatest percentage variations by company-type from the average rating for value of BIM success drivers*



## Obstacles to Success

**11 Obstacles:** *Combined frequency and negative impact of factors that impede BIM success on projects*

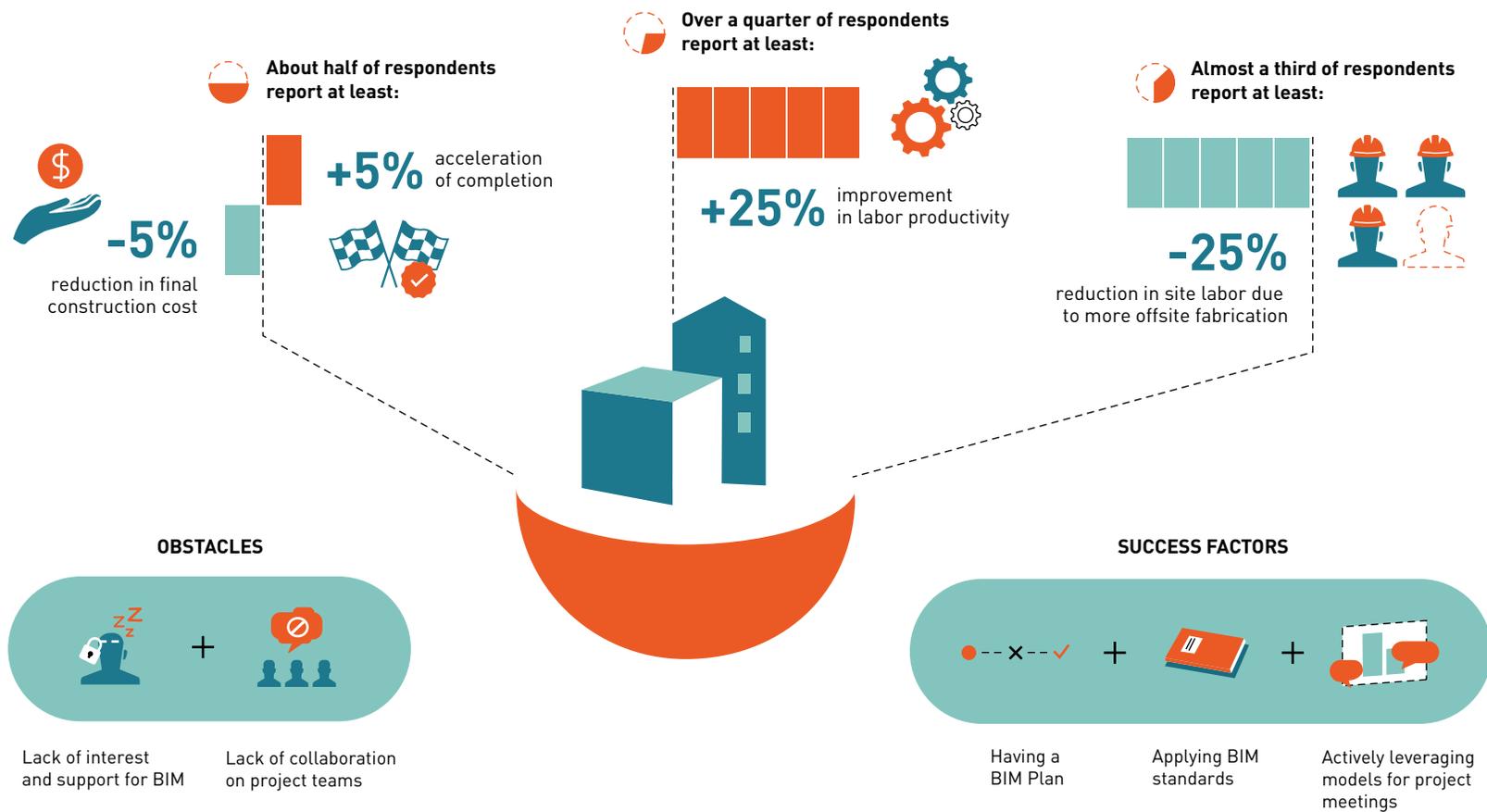
## Top BIM Success Factors

**12 Most Impactful Factors:** *Success factors with greatest net combined impact of added value from occurrence and negative impact from absence on BIM projects*

# Key Findings

## BIM SUCCESS FACTORS

BENTLEYTECH RESEARCH SERIES REPORT No. 01 BIM SUCCESS FACTORS



# Impact on Outcomes

## MODERATE IMPACT OUTCOMES

BIM users who experience some amount of impact from BIM on these five outcomes also identified the degree of that impact as being in one of these ranges: less than 5%, 5–10% or more than 10%. The chart shows the percentage of all respondents who experience more than a 5% improvement.

### DOWNSTREAM IMPACT OF UPSTREAM MODELING

The high percentage (70%) experiencing **Fewer RFIs During Construction** at a rate of 5% or more demonstrates BIM's impact on reducing uncertainty. This positive indicator of process improvement is also a likely influencing factor on the results for **Improved Labor Productivity**, shown on page 7 of this study.

### REDUCTION IN COST, SCHEDULE AND MATERIAL WASTE

About half of the BIM users rated each of these factors strongly. Material waste is generated

by onsite construction and often by rework. So the **Reduced Material Waste** can be seen as an indicator that BIM is reducing rework, and likely is connected to the finding on page 7 of this study about **Less Site Labor Due to More Offsite Prefabrication**.

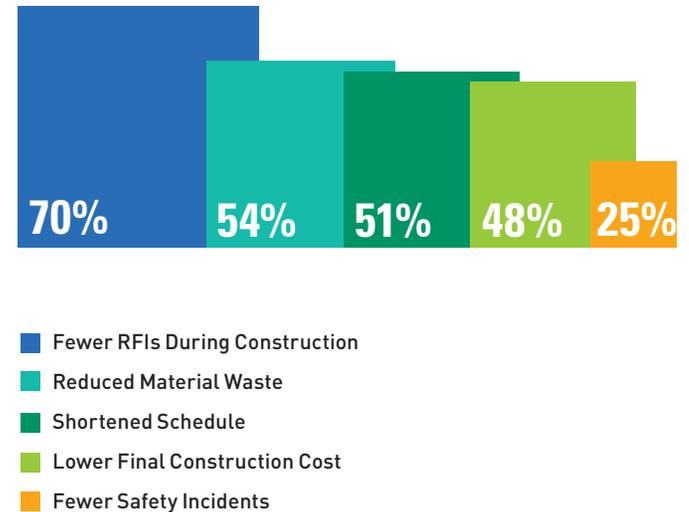
**Shortened Schedule** and **Lower Final Construction Cost** have been two of the most anticipated outcomes for BIM since its introduction. The fact that half of the respondents now report at least a 5% impact on both is an exciting finding and a harbinger of greater future gains.

### SAFETY INCIDENTS

While it is encouraging that a quarter of users report at least **5% Fewer Safety Incidents**, the direct relationship between BIM and safety is still emerging when compared with these other outcome impacts.

## Moderate BIM Impact

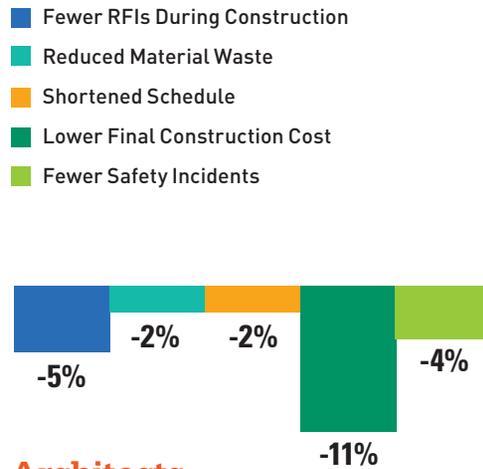
Percentage reporting that BIM has at least 5% positive impact on these project outcomes



# Impact on Outcomes

## COMPANY TYPE VARIANCES

The chart shows how much the response of each company type varies from the average of all respondents for the five outcomes.

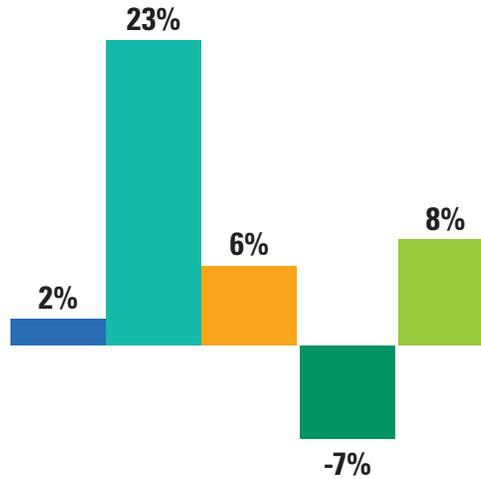


### Architects

Architects are generally slightly lower than the total average in rating the impact of BIM on the five moderate outcomes. The most variance (-11% below average) is found with **Lower Final Construction Cost**. This may reflect their distance from the detail of day-to-day construction budget management and, therefore, less of an opportunity to see firsthand the direct connection between model-based processes and cost reduction.

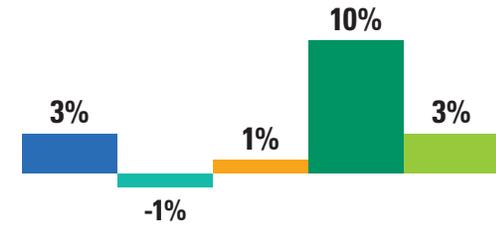
## Variance From Average

Percentage that each company type varies from the average of all respondents for impact of BIM on outcomes



### Engineers

Generally higher than average, engineers are most positive (23% above average) about the impact of BIM on **Reduced Material Waste**. Similar to architects, engineers are lower than average in their identification of **Lower Final Construction Cost** from BIM. Interestingly, engineers are highest among the professions in citing **Fewer Safety Incidents**. This may be because the sample contains a large proportion of structural engineers, and falls are a particularly serious problem among those related trades.



### Contractors

Close to average on all the outcomes, contractors' strongest variation (10% above average) relates to **Lower Final Construction Cost**. This finding makes sense because of their direct involvement with and responsibility for the final cost, which would put them in the best position to appreciate the positive impact of model-based processes.

# Impact on Outcomes

## HIGH-IMPACT OUTCOMES

Because the percentage of impact from BIM can be quite large on these labor-related outcomes, architects, engineers and contractors who reported at least some degree of impact were asked to identify the degree of that impact as being in one of these ranges: less than 25%, 25%–50% or more than 50%. The chart shows the combined percentage of all respondents who experience more than a 25% improvement.

### DIRECT IMPACT OF BIM ON LABOR

The explosive growth of model-driven prefabrication has been extensively documented in the BIM research reports from Dodge Data & Analytics' SmartMarket Report series. Now that many of the projects on which this practice has been deployed are complete, almost a third (31%) of the respondents reports seeing at least 25% **Less Site Labor Due to More Offsite Fabrication**. This trend can be expected to

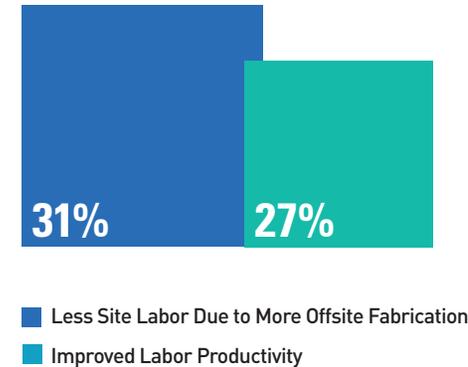
increase as further industrialization of the construction process gains traction.

Addressing the labor still deployed at the jobsite, over a quarter (27%) of those reporting some impact find they get at least 25% **Improved Labor Productivity** as a result of model-based processes. Among contractors, only 7% report no impact on productivity.

In an industry facing increasingly critical labor shortages, these positive impacts of BIM on labor confirm its benefit as a force-multiplying resource enhancement.

## High BIM Impact

*Percentage reporting that BIM has at least 25% positive impact on these project outcomes*



# Success Drivers

## CONTEXT-RELATED FACTORS

Many factors influence a team’s ability to improve project outcomes by deploying BIM. The five factors in this chart relate to resources and activities that, if they are in place early in a project, can provide a context for BIM success.

### FREQUENCY AND VALUE OF CONTEXT FACTORS

This chart combines two key indicators for five context-related success factors.

- The percentage of respondents who report high or very high frequency for each of these factors on their BIM projects.
- Among that high-frequency group, the percentage who put a high or very high value on having these factors in place on their BIM projects.

**BIM Planning** and **BIM Standards** are the highest rated context factors for both frequency and value. This combination of ratings indicates that, while not currently being implemented on every project, these factors are well positioned to become standard operating procedures for BIM projects.

The development of specific **BIM Objectives** for a team early in a project as an integral part of the BIM plan is only half as frequent as **BIM Planning** itself. Even though the frequency is low, its relatively high-value

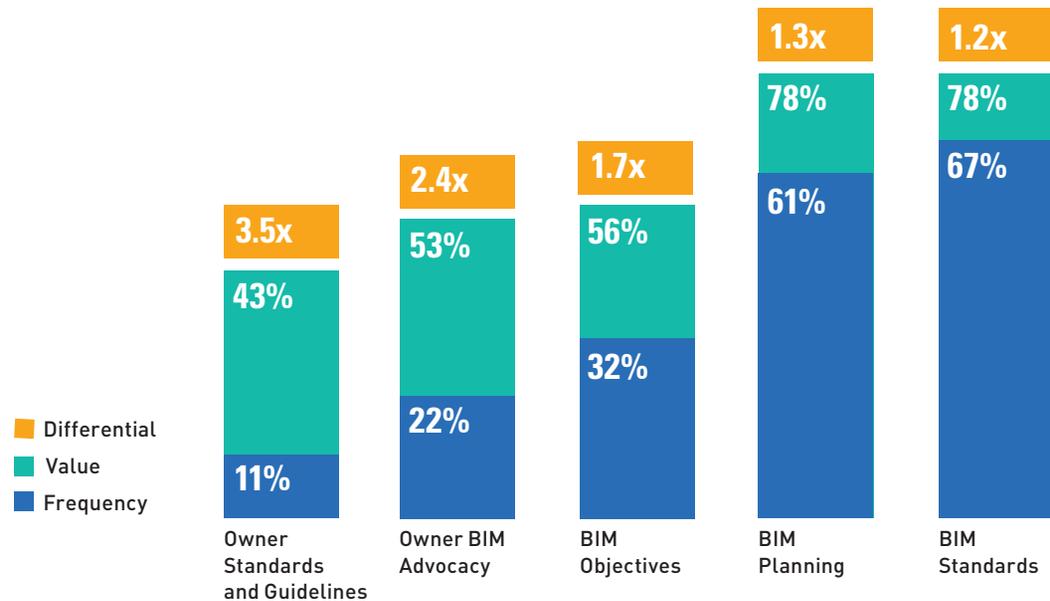
rating (56%) among those that do set objectives points to a practice that needs to be emphasized and incorporated in all BIM plans.

The two owner-related factors, **Owner BIM Advocacy** and **Owner Standards and Guidelines** for BIM are lagging in reported frequency while both, particularly

advocacy (53%), earn strong value ratings. This points to the need to educate owners more fully on BIM benefits to generate their advocacy, and encouraging owners to employ standards to ensure that they consistently enjoy those benefits.

## Frequency and Value: Context

Percentage rating high or very high frequency and value for these factors/activities being in place at the start of a project and the differential factor, indicating unmet market demand



# Success Drivers

## PROCESS-RELATED FACTORS

The five elements in this chart are BIM-related factors and activities during the project process that can drive better outcomes.

### FREQUENCY AND VALUE OF PROCESS FACTORS

Similar to the chart for context-related factors on page 8, this chart combines two key indicators for five process-related success factors.

- The percentage of respondents who report high or very high frequency for each of these factors on their BIM projects.
- Among that high-frequency group, the percentage who place a high or very high value on having these factors occur on their BIM projects.

**BIM-Integrated Project Meetings** is the factor that rates the highest score for value (78%) among respondents who report experiencing any of these factors frequently. Similar to **BIM Planning** and **BIM Standards** among the context-related factors, the use of models to improve project meetings seems to be an increasingly important practice.

Having **Platform Compatibility** among the members of a project team is the most frequently used factor and is also considered very valuable. This probably

reflects the work of many technology companies to accommodate an increasing level of interoperability in their tools, which is certainly appreciated by users.

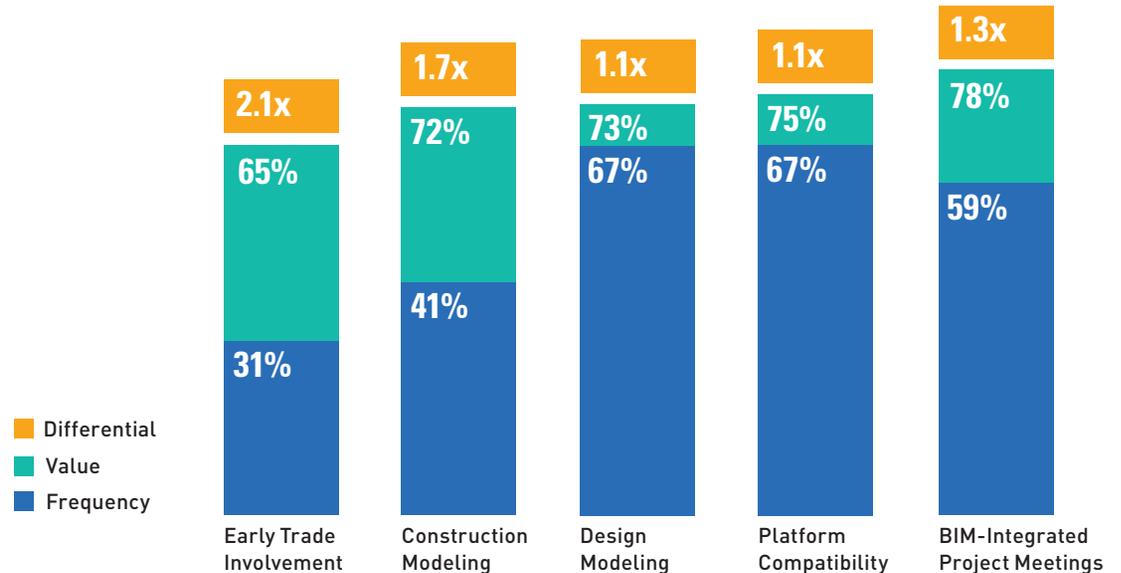
Both **Design Modeling** and **Construction Modeling** are highly valued, but the latter is distinctly lagging in frequency. This suggests a strong market demand for more modeling by contractors and a related need for

specialized tools, content, standards and processes to optimize the use of modeling.

The data suggest that **Early Trade Involvement** is the biggest unmet opportunity. Less than a third report seeing it frequently, but nearly two thirds of that group rate it as highly valuable because increasing its frequency is likely to generate improved outcomes.

### Frequency and Value: Process

Percentage rating high or very high frequency and value for these factors/activities during projects and the differential factor, indicating unmet market demand



# Success Drivers

## MOST COMPANY TYPE VARIANCE ON VALUE

Focusing just on the scores for value, the chart shows the three drivers with the greatest amount of difference between the rating by a specific company-type and the average rating by all respondents.

### ENGINEERS LEAST SUPPORTIVE OF EARLY TRADE INVOLVEMENT, MOST IN FAVOR OF BIM-INTEGRATED PROJECT MEETINGS

Engineers (structural and civil for this study) ascribe far less value to **Early Trade Involvement** than do architects and contractors. This may indicate that integrated engineering and construction is still emerging in these sectors. Simultaneously, engineers show the strongest support for **BIM-Integrated Project Meetings**. These findings suggest that, though resistant to early involvement by trades in the design, engineers are amenable to leveraging models with the core project team.

### CONTRACTORS LEAST, ARCHITECTS MOST CONCERNED ABOUT PLATFORM COMPATIBILITY

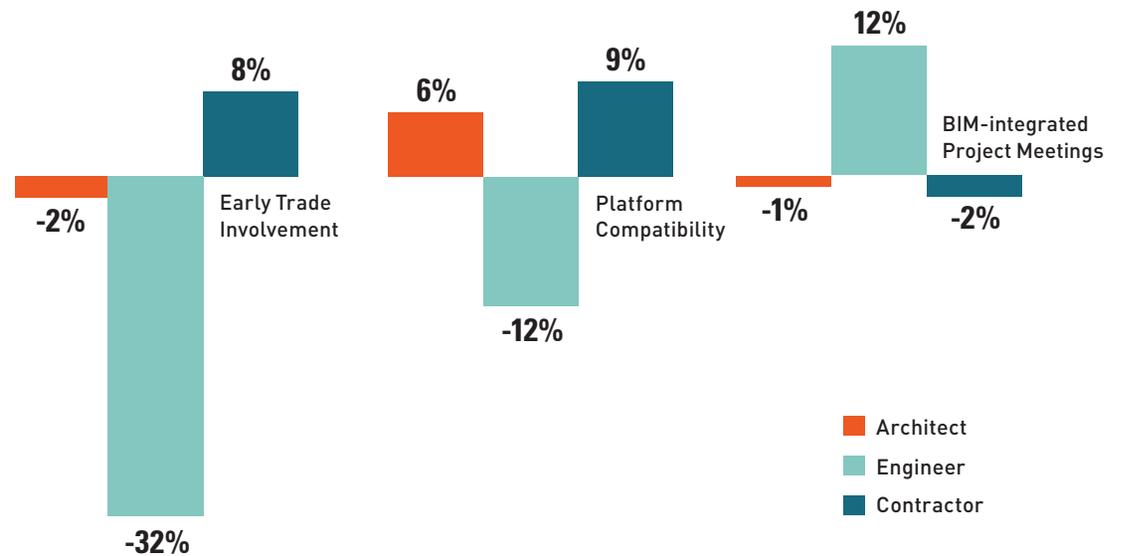
This finding makes sense because architects regularly engage with multiple consultants and others in creating design models and are therefore challenged more by interoperability issues than contractors, who are often able to take advantage

of tools that can work seamlessly with multiple model formats (e.g., for spatial coordination). This may change as design and construction processes

become increasingly integrated, and contractors will gain a greater appreciation for the value of improved compatibility between technology platforms.

## Variance From Average for Value

*Greatest percentage variations of high/very high responses by company type from the average rating for value of BIM success drivers*



# Obstacles to Success

## OBSTACLES TO BIM SUCCESS

The success experienced by BIM users can be undermined when BIM is not embraced by the entire project team, when it is not used in a collaborative manner or when the most important success factors discussed on pages 8 and 9 are absent. The chart shows a combination of the frequency and the negative impact for six factors that each has the potential to be a significant obstacle to BIM success.

### SOCIAL FACTORS UNDERMINE SUCCESS

**Low Level of Team Interest/Support** for BIM and **Low Level of Collaboration** among team members are the most dangerous obstacles to BIM success. While there is, fortunately, a low frequency reported for the former, the relatively high frequency for the latter is troubling. These social factors cannot be addressed by implementing BIM standards or plans. They require more effective vetting during the team formation process.

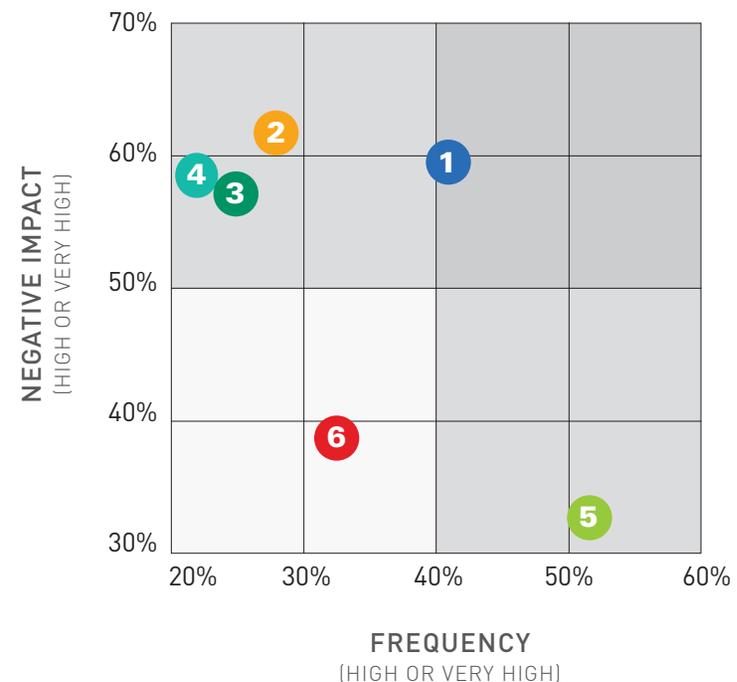
### LACK OF BIM SUCCESS DRIVERS HAS NEGATIVE IMPACT

The high scores for **BIM Planning** and **Platform Compatibility** as valuable BIM success factors are amplified here through the high negative impact ratings for their absence. Fortunately, both show low frequency.

The high frequency yet relatively low negative impact of **Lack of Owner BIM Advocacy** indicates that teams have become used to being able to achieve BIM success without it. Although as the previous success factor data indicates, it is beneficial when you have it.

## Obstacles

Combined frequency and negative impact of factors that impede BIM success on projects



- 1 Low Level of Collaboration
- 4 Platform Challenges
- 2 Low Level of Team Interest/Support
- 5 Lack of Owner BIM Advocacy
- 3 No BIM Planning
- 6 BIM Not Leveraged for Project Meetings

# Top BIM Success Factors

## MOST IMPACT ON BIM SUCCESS

The chart shows the four factors that have the greatest net impact on BIM success, calculated by combining the negative impact rating of their absence (obstacles) and the positive value rating of their occurrence (drivers).

### TOP MUST-HAVES TO ENABLE BIM SUCCESS

**BIM Planning** and **Platform Compatibility** rise to the top of the net impact rating with high positive values given for their occurrence and strong negative impact ratings for their absence. Close behind those leading factors, **BIM-Integrated Project Meetings** score equally strongly for value, but are somewhat less harmful in their absence. Clearly, if a team wants to focus on a few major factors to create an environment that is conducive for BIM success, these three are generally within their control to implement and should generate appreciably positive outcomes.

### TEAMS COPE WITH LACK OF OWNER BIM ADVOCACY

The findings for **Owner BIM Advocacy** suggest that, while it is valuable when it is in effect on a project, it is not a critical factor when it is absent. Its relatively low negative impact in spite of its very low frequency of occurrence suggest that project teams are able to achieve BIM success without it. Obviously, the frequency of owner involvement will improve as owners become increasingly engaged with BIM, develop standards and guidelines and incorporate model-based processes as standard practice in their project delivery programs.

## Most Impactful Factors

Success factors with greatest net combined impact of added value from occurrence and negative impact from absence on BIM projects

