SmartMarket Report





The Business Value of BIM in the Middle East

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The Business Value of BIM in the Middle East SmartMarket Report

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DODGE DATA & ANALYTICS

About Dodge Data & Analytics

Dodge Data & Analytics is North America's leading provider of analytics and software-based workflow integration solutions for the construction industry. Building product manufacturers, architects, engineers, contractors, and service providers leverage Dodge to identify and pursue unseen growth opportunities and execute on those opportunities for enhanced business performance. Whether it's on a local, regional or national level, Dodge makes the hidden obvious, empowering its clients to better understand their markets, uncover key relationships, size growth opportunities, and pursue those opportunities with success. The company's construction project information is the most comprehensive and verified in the industry. Dodge is leveraging its 100-year-old legacy of continuous innovation to help the industry meet the building challenges of the future.

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SmartMarket Report

Introduction

THE BUSINESS VALUE OF BIM IN THE MIDDLE EAST

he Middle East is home to some of the most innovative building projects in the world. Not only are these projects iconic, but they are also complex and demanding for the project teams, which are often based around the globe. In addition, the demand for tight schedules on projects in this region is particularly restrictive. These factors suggest that companies in the Middle East will benefit from wider use of building information modeling (BIM), and our latest study reveals that, while the use of BIM in the Middle East is still at an early stage, it is poised for dramatic growth.

The study included many architects and contractors who are currently using BIM, and right now, the percentage is almost evenly split between those using it on 30% or fewer of their projects (46%) and those using it on more than 30% of their projects (54%). However, **in just two years, over three quarters (79%) of current BIM users expect to be using it on more than 30% of their projects**.

This expectation for a higher level of BIM use is likely fueled by the benefits they gain on their projects from its use, including:

- Increased Efficiency Through Collaboration With Owners or Other Project Team Members (71%)
- Reduced Field Coordination Conflicts During Construction (70%)
- Reduced Errors and Omissions in Construction Documents (69%)

Over half are also reporting business benefits, including increasing their ability to market business to new clients (63%), enhancement of their organization's image as an industry leader (59%) and increasing their ability to offer new services (58%).

In fact, most respondents in the Middle East (80%) believe that they are experiencing a positive return on investment (ROI) from BIM implementation at their organization, with one quarter (25%) saying that they believe their ROI is 50% or higher.

Although many BIM experts in the region interviewed for this report state that current use of BIM does not always extend throughout the supply chain, this study shows that **BIM use by contractors is likely to be the area with the greatest potential growth in the region** because respondents report that having general or trade contractors with strong BIM skills increases project outcomes and quality, increases innovation and reduces overall project duration and cost.

Even the responses of the architects and contractors who are not currently using BIM suggest that it is poised for growth in the Middle East. All of them (100%) believe that BIM will be important to the industry in five years, and most believe it will be highly important. Most (85%) are at least interested in BIM or even actively evaluating the possibility of using it.

Encouragingly, some of the most important benefits that non-users say would influence them to adopt BIM, such as improved multidisciplinary coordination, reduced number of field coordination problems and improved communication between all parties, are already being reported by BIM users in that region.

While there are challenges (e.g., lack of trained BIM personnel, lack of client demand), all of these positive factors seem well positioned to drive a vigorous level of BIM adoption in this region in the near future.

We would like to thank our premier partner Autodesk for helping us to bring these important findings to the industry. In addition, we thank Pinnacle for their support, and we also thank all of our research partners for their efforts to engage the industry in the study.



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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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SmartMarket Report

THE BUSINESS VALUE OF BIM IN THE MIDDLE EAST

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China



Front Cover: Use of BIM allowed the client to visualize how the complex dome of the Abu Dhabi Louvre would be able to provide ventilation and lighting inside the building.

This page:

The efficiency of designing in BIM provided Stantec with the flexibility needed to handle scope changes during the design of the Mediclinic Parkview Hospital in Dubai.

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Executive Summary

BIM use expected to increase in the Middle East

While BIM is currently at an early stage of implementation in the Middle East, the study demonstrates that it is poised for significant growth. The majority (79%) of respondents currently using BIM expect to be at a high level of implementation in just two years, and 85% of current non-users are either interested in and/or are actively evaluating BIM. Strong project and business benefits reported by current BIM users will help drive the market, as will the perception of BIM's growing importance to firms seeking to stay competitive.

BIM Implementation in the Middle East

Design and construction professionals in the Middle East who are currently using BIM expect a significant increase in the percentage of their projects that will involve BIM over the next two years.

- The chart shows that, today, only about half of BIM users in the Middle East are engaging with it on more than 30% of their projects, but that within two years, well over three quarters (79%) say they will be operating at that level of BIM implementation.
- Among the project roles of BIM users, those who are primarily involved with construction activities (versus design) predict they will be the most active, with 83% of them forecasting that implementation level.

Plans to increase BIM implementation throughout the Middle East are robust, but there are some differences among specific regions.

- **30% or more of projects involve BIM**: 82% of Saudi BIM users forecast being at this level within two years.
- 60% or more of projects involve BIM: Users in the UAE, however, predict even more aggressive growth, with over half (51%) implementing BIM at this very advanced level.

Benefits of BIM

BIM users in the Middle East believe it generates powerful benefits, both on their projects and for their own businesses. The chart shows the percentage of current BIM users who report receiving each of these projectrelated benefits at either a high or very high level.

BIM users also report receiving several internal business benefits from BIM at a high or very high level.

- Marketing New Business to New Clients (63%)
- Overall Enhancement of Organization's Image as an Industry Leader (59%)
- Offering New Services (58%)
- Maintaining Repeat Business With Past Clients (46%)
- Increased Profits (44%)

Users' Forecast for Growth in Level of BIM Engagement (All Regions)

Dodge Data & Analytics, 2017

- Low BIM Engagement (30% or Fewer Projects Involve BIM)
- High BIM Engagement (Over 30% of Projects Involve BIM)



Top 5 Project-Related Benefits of BIM

(Percentage of BIM Users Reporting High Value) Dodge Data & Analytics, 2017

71%

70%

69%

64%

57%

Increased Efficiency Through Collaboration With Owners or Other Team Members

Reduced Field Coordination Conflicts During Construction Reduced Errors and Omissions in Construction Documents

struction Documents

Reduced Rework

Better Cost Control/Predictability

Factors That Would Increase BIM Benefits

The majority of users believe that more clearly defined BIM deliverables between parties, and more use of contracts to support BIM and collaboration, would contribute greatly to increasing their ability to generate benefits from BIM.

BIM Requirements Policies

Design teams that are working with BIM frequently encourage or require BIM capabilities from general contractors. As shown in the pie chart, this is true for almost 90% of firms in the Middle East.

Many general contractors who work with BIM in the Middle East also use BIM capability to qualify trade contractors.

- 17% require trade contractors to be experienced in BIM.
- 33% encourage BIM expertise, but do not require it.
- 50% say that BIM expertise does not affect their decisions about trade contractors.

Value of Contractors' BIM Capabilities

The BIM skills of both general contractors and trade contractors generate significant value on projects.

The chart at right shows the percentage of design professionals that rated general contractors' BIM capabilities as generating a high or very high level of each benefit shown, compared with the same ratings provided by general contractors about trade contractors.

Trade Contractor BIM Expertise Levels

General contractors in the Middle East report significant variation in the BIM skill level of trade contractors by region and by specialty.

- BIM-capable mechanical/sheet metal/plumbing contractors are cited as the most numerous among the trades throughout the Middle East.
- The UAE reports the least number of skilled trades among any of the regions studied.
- There are fewer concrete fabricators/contractors with BIM skills than any of the other trades studied, followed by civil/site/geotechnical.

Design Firms' BIM Requirement Policy for Contractors (All Regions)

Dodge Data & Analytics, 2017

- We Require Companies to be Experienced in BIM
- We Encourage BIM Expertise, But Do Not Require It
- BIM Expertise Does Not Affect Our Decisions



Positive Impacts From General and Trade Contractors' BIM Skills (Percentage Who Rate Value as High or Very High)

Dodge Data & Analytics, 2017

- Value of General Contractors' BIM Skill to Design Firms
- Value of Trade Contractors' BIM Skill to General Contractors



ROI for BIM

Since there is no accepted international standard for measuring return on investment (ROI) for BIM, users were asked to estimate their ROI based on a range from negative to break-even to several degrees of positive. The chart summarizes these responses in three broad categories.

- One quarter (25%) of BIM users believe they have an ROI exceeding 50%, which is an outstanding performance, and is a very positive sign for the continued growth of BIM in the Middle East.
- More contractors (29%) are in the top ROI group than are design professionals, who, by contrast, comprise the majority of the group reporting break-even or negative performance. This finding aligns with Dodge studies of BIM ROI around the world.
- There are significant regional variances with the Middle East, with 31% of users in Saudi Arabia reporting the highest ROI tier, compared with only 18% in the UAE. Twice as many users in the UAE are in the break-even or negative category (31%) than those in Saudi Arabia (16%).

Top BIM Investments

Successful BIM programs require investment, both to launch and to support growth. The chart shows the top seven types of BIM investments that are cited by users as high or very high priorities over the next two years.

- Although many people think of BIM as a technology initiative, the first and third investments both focus on collaborative processes, which underscores the importance of digital workflows to maximize the power of BIM. Contractors are particularly focused on the external processes, which makes sense because of their need to coordinate the work of so many parties.
- Training, hardware and software form the core of a BIM program, and users include all three in their two-year plans. Contractors show a particularly high commitment to training, which is typically an important aspect for all parts of their business.
- 3D libraries and software customization also score among top investments. These enhancements to a company's BIM program can greatly contribute to increased productivity.

Users' Reported ROI on BIM

Dodge Data & Analytics, 2017

- Very Positive (50% ROI or Higher)
- Positive (Up to 50% ROI)
- Break-even or Negative ROI



Top BIM Investments Planned by Users Over Next 2 Years (Percentage Who Plan High or Very High Levels of Investment)

Dodge Data & Analytics, 2017

Developing Internal Collaborative BIM Procedures



Non-User Attitudes About BIM

Design and construction professionals who are not currently involved with BIM characterized their interest level and attitude about BIM. The pie chart shows a simplified breakdown of the findings.

- The vast majority (85%) of non-users are either neutral or interested in BIM, which bodes well for a continued adoption pattern in the Middle East in the near future.
- Contractors comprise a larger share of the currently disinterested group than do designers, which corresponds with Dodge BIM research around the world showing that adoption is typically led by design professionals in its earlier stages. This is almost certain to level out in coming years, and in many cases contractors eventually surpass designers for both adoption and implementation.

Non-User Perspective on the Importance of BIM in Five Years

100% of non-users believe that BIM will be important to the industry in five years. And three quarters of them (75%) believe it will be of high or very high importance in that time. This is a very positive indicator that BIM adoption will continue at a robust pace.

Top Reason Non-Users Are Not Adopting BIM

Among 18 reasons surveyed, non-users cite a lack of demand from clients and/or other firms on projects as the top reason they are not involved with BIM. This should change as adoption and implementation rapidly expand and BIM requirements become more common.

Non-Users' Top Five Adoption Triggers

Certain benefits, if they could be validated as achievable through the use of BIM, would be very compelling to convince non-users to become involved with BIM. The table shows the top five out of 14 possible triggers included in the survey, and the percentage of non-users who rated them as having a high or very high impact on their decision.

Each of these is a documented benefit of BIM according to Dodge research studies around the world. Therefore, as BIM use matures in the Middle East, it should be possible to validate these benefits to non-users, and further accelerate BIM adoption throughout the region.

Non-Users' Attitudes About BIM

Dodge Data & Analytics, 2017

- We Are Interested or Are Actively Evaluating It
- We Are Not Currently Interested in Using It
- We Have Used It But Decided Not to Use It Anymore



Adoption Triggers

Dodge Data & Analytics, 2017

Top 5 Process or Outcome Improvements That, If Validated, Would be Most Influential to Convince Non-Users to Adopt BIM (All Regions) Improved Multidisciplinary Coordination 85% 1 Reduced Number of Field Coordination Problems 2 75% 3 **More Accurate Construction Documents** 75% Increased Ability to Use Lean Construction 4 70% Techniques Improved Communication Between All Parties 5 70% in the Design and Construction Process

Data: Introduction

or over a decade, Dodge Data & Analytics has been conducting research on the use and impact of building information modeling in the construction industry. The research has focused not only on the immediate project benefits derived from using the software, but also on its potential to improve construction processes by enabling better communication and collaboration across project teams.

The scope of the research has expanded over the years from a focus on the U.S. construction market to a more international one, with reports looking at BIM adoption in over a dozen global markets. That breadth of coverage allows for this new study on the business value of BIM in the Middle East to not only provide a thorough examination of the responses of architects and contractors working in this region, but also offer a context for what they experience, compared with other global markets.

Study respondents are divided into two groups, those currently using BIM and those who are not. The majority of the data examines the experiences of BIM users. It reveals the project performance and process benefits they gain from using BIM, along with the internal business benefits that BIM offers their company. It also looks at their level of BIM implementation, the degree to which they see benefits from use of BIM by other project team members, the investments they plan to make to improve their use of BIM in the future and the return on investment they see from BIM use.

The findings are supported by the insights of several BIM experts, who agreed to participate in a series of in-depth interviews to share their insights about the use of BIM and its potential in the Middle East. Combined together, the quantitative study data and qualitative interviews present the portrait of a market poised for significant growth.

A similarly optimistic perspective on the use of BIM in the Middle East can be drawn from looking at the responses in the study by those who are not currently using BIM. Their positive attitude toward it suggests that BIM adoption is likely to continue to grow in this region.

Note About the Data

The data and analysis in this report are based on an online survey conducted with 138 architects and contractors in the Middle East from nine countries: Bahrain, Egypt, Jordan, Kuwait, Lebanon, Oman, Oatar, Saudi Arabia and United Arab Emirates (UAE).

Respondents were asked about their level of BIM use. Those using BIM to create models or to work with models created by others were classified as BIM users, and those not using BIM at all were classified as non-users. Those groups were asked different questions and thus analyzed separately. In total, there were 118 BIM users and 20 non-users who responded to the study.

The small sample of non-users, while not statistically significant, is useful to determine why some firms do not use BIM and what might lead such non-users to begin working with it.

BIM users were analyzed based on two variables: location and role.

- Location: There were sufficient responses from respondents based in Saudi Arabia and the UAE to look at how those countries compare to each other and to the rest of the responses throughout the region.
- Role: Users were divided into two groups, those primarily working on design and those primarily working on construction.

For more information on these variables, along with more information about the research conducted, see the Methodology on page 48.

Data: BIM Use

BIM Implementation Levels

A firm's BIM implementation level is the percentage of its projects that involve BIM. All respondents provided both a current level of BIM implementation and a forecast for what they believe their level will be two years from now, based on three tiers of implementation: light, medium and heavy.

The charts on this page show the total of these responses grouped in two ways:

- By Region: Saudi Arabia, UAE, and all others (combining Bahrain, Egypt, Jordan, Kuwait, Lebanon, Oman and Qatar)
- By Role: Respondents primarily involved with design at their firm and respondents primarily involved with construction at their firm

BIM Implementation by Region

As is typical in parts of the world where BIM is in a relatively early phase of adoption, light implementation is currently the most common level across the Middle East regions studied. However, the forecasts show dramatic reductions in light implementation and a corresponding robust prediction of growth in medium and heavy levels just two years from now.

There are a couple of interesting differences by country.

- Saudi Arabia currently has the fewest users at the heavy level of implementation (21%) and, although forecasting strong growth, is still projected to lag the other regions in heavy implementation in two years.
- The UAE and the All Others category currently have similar levels of heavy implementation and remain at near parity in their two-year forecasts, with half their users predicting heavy BIM implementation within that time frame.

For a global perspective, the international comparisons section of this report shows how the Middle East as a whole compares with China and Australia for high and very high levels of implementation (see page 44).

BIM Implementation by Role

The pie charts show the projected growth analyzed by role. Where the groups are currently at parity, more of the BIM users who are primarily involved in construction activities (83%) are forecasting higher levels of BIM implementation in two years than the design-oriented users (78%). This finding corresponds to a trend in most of Dodge's BIM research around the world that shows construction usage outpacing design.

Current and Forecasted BIM Implementation

Levels (By Region) Dodge Data & Analytics, 2017

- Light BIM Implementation (Less Than 30% of Projects Involve BIM)

Medium BIM Implementation (30%-60% of Projects Involve BIM) Heavy BIM Implementation (Over 60% of Projects Involve BIM)

46% 47% 45% 41% 38% 33% 21% 16% 15% Saudi Arabia UAE All Others (Current (Current (Current Implementation) Implementation) Implementation) 51% 50% 44% 38% 29% 24% 24% 21% 18% Saudi Arabia UAE All Others (Forecast 2 Years (Forecast 2 Years (Forecast 2 Years

From Now) From Now) From Now)

Medium/Heavy BIM Implementation (Over 30% of Projects Involve BIM) Light BIM Implementation (Less Than 30% of Projects Involve BIM)



Years of Experience Using BIM

Variation by Region

Because the use of BIM is relatively new in the Middle East, only a small percentage of users in any region have more than 10 years' experience. Aligning with the findings about relative levels of BIM implementation between regions (see page 9), Saudi Arabia (8%) has significantly fewer users with six to 10 years of experience than either the UAE (18%) or the average of the other countries in the Middle East included in the study (24%).

Variation by Role

Currently, far more of the design-related users have five or more years of experience (46%) than those whose activities primarily focus on construction (29%). This finding aligns with a consistent pattern in all other BIM research conducted by Dodge around the world, where BIM adoption and use begins in the design community and evolves over time to engage contractors.

This pattern typically also leads to more aggressive adoption and implementation eventually by contractors, who report enjoying immediate tangible benefits on their projects and rapidly seek to employ BIM more widely. This trend is foreshadowed for the Middle East in the finding on page 9 that more construction-related users are predicting a high level of BIM implementation two years from now than their design counterparts.

Years of Experience With BIM (By Region)

Dodge Data & Analytics, 2017

- 1-2 Years
- 3-5 Years
- 6-10 Years

More Than 10 Years



BIM Users With 5 or More Years of BIM Experience (By Role)

Dodge Data & Analytics, 2017



BIM Expertise Levels

Although there is no internationally accepted standard for BIM expertise, since 2009, Dodge has consistently asked users in its BIM research around the world to self-describe their skill level as basic, moderate, advanced or expert. Although subjective, these ratings tend to advance over time along with experience and implementation levels when Dodge revisits regions for follow-up studies, so they serve as a useful baseline for how a user community perceives itself.

Variation by Region

The top chart shows a pattern that generally aligns with the experience and implementation findings, with Saudi Arabia currently reporting the fewest (18%) users who self-describe as expert. A relatively large number of basic users, such as in UAE (18%), often indicates a surge in new adopters, which will typically evolve into higher levels of implementation for that region over time, as skills improve and usage gains traction.

Variation by Role

The pie charts show that the users who are primarily design-oriented currently have over twice as many at the expert level (24%) than their construction-oriented colleagues (11%). This follows the pattern that Dodge has observed in most of its BIM research, where design professionals lead the initial stages of adoption in a market and therefore show more advanced skill levels. The distribution of expertise levels typically becomes more balanced as adoption and implementation expand, and frequently, contractors eventually exceed designers in both categories.

Self-Described BIM Expertise Level (By Region)

Dodge Data & Analytics, 2017

- Expert
- Advanced
- Moderate Basic



BIM Expertise Level Among Design and Construction Users

Dodge Data & Analytics, 2017

- Expert Advanced
 - Moderate



Impact of BIM-Specifying Authorities and

Project Management Consultants

To address this issue, explored specifically for this report on the Middle East, BIM users were asked to what degree they agree or disagree with the following statement: "We are not able to implement BIM to the degree we would like to on projects because of BIM-specifying authorities and project management consultants."

While not a universally identified challenge, enough users report that it is challenging to warrant attention by those in the Middle East who desire to advance BIM adoption and implementation in the region.

Variation by Region

The findings shown in the chart are analyzed by region, and indicate a range of responses.

- UAE: BIM users in UAE seem most troubled by this issue, with over a third (38%) agreeing and the majority of those expressing strong agreement.
- Saudi Arabia: Saudi users report the least amount of agreement (24%), and the highest percentage who strongly disagree (12%). This may be due to more accommodating BIM-specifying authorities and project management consultants in that country, or it may be a function of their relatively lower levels of implementation, in which case this may increase in the future.
- All Others: No users in Bahrain, Egypt, Jordan, Kuwait, Lebanon, Oman or Qatar strongly agree, but this group has a similar overall percentage of agreement (38%) as those from the UAE. In addition, 38% report some level of disagreement with the statement, the highest among the three regions.

Variation by Role

Construction users are more uncertain about the impact of BIM-specifying authorities and project management consultants than designers.

- Design-oriented users are evenly split in thirds between agreement (34%), disagreement (33%) and those who are neutral or not sure (33%).
- Half of construction users (49%) are neutral or not sure, while 23% agree and 26% disagree.

Negative Impact of BIM-Specifying Authorities and Project Management Consultants (By Region)

Dodge Data & Analytics, 2017

Strongly	Disanroo
ouongry	Disugroo

- Disagree
- Neutral
- Agree
- Strongly Agree

Saudi Arabia

12	2% 24%	39%	2	4%
JA	E			0%——
10	<mark>)%</mark> 18%	35%	18%	20%
All Others				
	32%	24%	38%	
				0%

Data: Insights From BIM Experts

Insights From BIM Experts

On the use of BIM in the Middle East

Dodge Data & Analytics conducted a series of in-depth interviews with seven of the leaders advancing BIM in the Middle East, to gain their perspectives on the market for BIM and the factors influencing its adoption.

he Middle East is a unique market for BIM adoption. While still at a relatively early stage in BIM implementation compared with other markets around the world studied by Dodge Data & Analytics (see page 44), it is also a region that embraces unique, complex, challenging buildings while also being a highly competitive market in terms of cost.

To better understand the subtleties of vertical building construction in this region and how they influence the adoption and implementation of BIM, Dodge Data & Analytics interviewed seven leading BIM users in this region. All are enthusiastic proponents for BIM, and all see its adoption as inevitable, although the degree to which each has implemented BIM has varied from only doing conceptual designs in BIM to intensive BIM implementation across the project lifecycle and into building operations.

Despite this range of experience with BIM, there was wide agreement on the nature of the BIM market for vertical construction in the Middle East and what will encourage broader use of it in the future. For more information on the use of BIM in the Middle East in the infrastructure sector, see pages 42 to 43.

Market for BIM in the Middle East

WHAT MAKES THE MIDDLE EAST UNIQUE?

Nearly all of the BIM experts agree on

"If and when BIM is integrated, it will greatly help the market to achieve its fastpaced development requirements."

a few aspects of the Middle East that make it a unique market for BIM:

- High Volume of Work: Many find that the large number of projects in the Middle East supports a strong market for BIM use. According to Rajat Shankar of Stantec, the "sheer volume of work" attracts companies from outside the region, including those with greater BIM experience.
- Complexity and Scale of Projects: Nearly all the participants also believe that the large scale and complexity of many projects being built in this region also makes BIM highly relevant here. Biju Koottala, from BAM Higgs & Hill LLC, states that the use of BIM and 3D modeling technologies help with the creation of "very unique and complex ideas" for buildings.
- Fast Track Contracting Methods: Most also note that fast tracking projects is a common practice in the Middle East. Paul Watton from Khansahab believes that BIM offers a major improvement over existing approaches in this environment: "If and when BIM is integrated, it will greatly help the market to achieve its fast-paced development requirements." Pavithran K. Valappil, from a multinational construction

company, also finds that "tight program and frequent changes in design to accommodate the latest trends during the project process makes it more complex. Innovative technologies are inevitable to overcome such challenges."

Involvement of International Teams: The large, challenging projects also attract the interest of global design firms and construction companies. Marwan Abu Ebeid of Turner International Middle East believes that highprofile construction programs, such as preparing for the World Cup in Qatar and the Expo 2020 in the United Arab Emirates (UAE), are drawing global attention to the region. Roula Dahdaleh of **Consolidated Consulting Group** regards the international flavor of the construction industry as part of what distinguishes the Middle East market from other global markets, enhancing its need for BIM.

THE DUBAI MUNICIPALITY BIM MANDATE

All of the BIM experts who participated in the interviews agreed that the UAE leads the Middle East in use of BIM, largely due to the influence of the Dubai Municipality's BIM mandate. Currently, the mandate requires all buildings over



The image features a station from Systra's winning BIM design for a prototype for a 127 km Hyperloop line for passengers and freight, which would reduce the journey time between Dubai and the Fujairah emirate from 2.5 hours to under 10 minutes. The design of the prototype had to be completed in two days utilizing a collaborative BIM platform.

20 stories or larger than 200,000 square feet, specialized buildings such as hospitals and education buildings, government projects or any building requested by a foreign office to use BIM. Given the number of large, complex projects in Dubai and the number of projects led by multinational companies, the mandate applies to many projects.

Abu Ebeid thinks that a mandate

is a good beginning to increase the use of BIM because it provides a path for companies to learn about the benefits of using BIM and be willing to invest more broadly in its use.

While all participants regard the mandate as influential, a few do not believe that it goes far enough. Watton states that the requirements of the mandate are very easy to achieve and do not require

"Tight program and frequent changes in design to accommodate the latest trends during the project process makes it more complex. Innovative technologies are inevitable to overcome such challenges." implementation of BIM at a sufficient level to demonstrate its benefits effectively. Pavithran argues that for the mandate to be effective, the level of BIM use needs to be better defined and a monitoring program should be created to "ensure adoption and measure the level of adoption." He states, "Right now, there is no secure mechanism to ensure that the right BIM model with the right information is in place," and he regards the UK's Level 2 requirement in their mandate as a good model.

EMERGING COUNTRIES FOR BIM USE

Dahdaleh and Abu Ebeid believe

THE BUSINESS VALUE OF BIM IN THE MIDDLE EAST DATA

Jordan and Saudi Arabia have the greatest potential for wider BIM adoption in the future. Dahdaleh credits the big firms seeking to stay competitive and large consultants doing government work with driving increased use of BIM in her home country of Jordan.

Dahdaleh and Abu Ebeid agree that the size of the construction market in Saudi Arabia and the large scale of many projects in that region account for its potential as a strong BIM market in the future.

BIM USE ACROSS THE PROJECT TEAM

One area of growth identified by the experts interviewed is in BIM use across the project team. Many of them struggle to work with team members across the project lifecycle on a single model. Pavithran finds that, currently, "BIM is not implemented in a collaborative approach; rather each team tends to create their own models." Dahdaleh reports that in Jordan "very few contractors are using BIM," a fact that posed a challenge during a project she recently constructed that included a client mandate for all contractors to use the model, bring it to 5D and ultimately pass it on to the client for use during operations and maintenance. However, she does find that "in the Gulf, in the UAE, the contractors are a bit more advanced."

Mohammed al Sheik from Consolidated Contractors Company has seen the number of team members involved in using BIM on his projects increase over time. "We work with engineers, ... planning and procurement. Now we are starting to work with the foremen and site supervision, the direct manpower."

"We work with engineers, ... planning and procurement. Now we are starting to work with the foremen and site supervision, the direct manpower."

However, while he actively seeks out subcontractors who can implement BIM, he cannot yet require BIM use contractually, so he must adjust the contract based on the subcontractor's ability to use BIM.

For Watton, this issue has made it more difficult for his company to use BIM: "If Khansahab wants to do BIM, we have to ... develop a model for everyone else and then turn it back into 2D information so that people can build from it."

Factors Influencing BIM Adoption and Use in the Middle East

DRIVERS FOR GREATER BIM ADOPTION AND USE

While most of the BIM experts interviewed acknowledged the importance of the BIM mandate in Dubai in driving BIM use in the UAE, there was also general agreement that **the most important driver for greater BIM adoption will be client demand**, rather than government mandate. In addition, the importance of practitioner awareness and engagement was also made clear.

Therefore, the top drivers reported were those that would encourage practitioners and owners to consider using BIM.

 Industry Education to Build Awareness of BIM Benefits: Nearly all participants at some point in the interview referenced how the benefits of BIM need to be better understood across the industry to encourage adoption.

- Pavithran believes that the UK BIM Task Force is a good model for providing the industry with the education needed about benefits.
- AI Sheikh explains that he was able to draw support from their offices in Athens, Cairo and Ramallah to demonstrate the usefulness of BIM.
- Dahdaleh suggests that the software developers could be an educational resource.
- Rajat believes that BIM should be part of the curriculum at architecture and engineering colleges, and that the graduates would not only possess needed skills upon graduation, but that they could also serve as advocates for BIM in the marketplace.
- Watton argues that if the consultants understood BIM better and included it in their scope of work, that this would allow the clients to see that "they would get a project that is coordinated better, constructed better, [and] delivered on time or even early."
- Abu Ebeid recommends the creation of a formal BIM manager certificate program in order to avoid misconceptions about the capabilities of BIM created by people who claim that they are BIM managers but do not have the proper training.

"It is so difficult to get skilled technicians in this market that people are scrambling to get the right people."

Demonstrating the Benefits of BIM During the Construction Management Stage: The other major way to increase client demand for BIM is to demonstrate its usefulness beyond design and construction into the operational phase of the building.

- Dirk Van der Ploeg, from BAM Higgs & Hill LLC, thinks that client awareness of the benefit of using the model during this phase is growing, and that this will be critical to help drive BIM use.
- Pavithran reports that he would like to explore the implementation of BIM in the facility management phase for the benefit of the

industry, and he regards client education as a critical component of this because it will help them set up better requirements before the project begins.

OBSTACLES TO WIDER ADOPTION OF BIM

The top obstacles discussed by the BIM experts can be attributed to the early stage of implementation of BIM in the Middle East.

• Shortage of People With BIM Skills: Rajat describes the challenges faced by Stantec in trying to attract and retain people with sufficient skills. "It is so difficult to get skilled technicians in this market that people are scrambling to get the right people." He explains that he trains people but that the high level of demand for workers with BIM skills means that they often quickly find new positions for more money: "You try and build a team and then you realize you are left with half the people within two years." The cost of finding and keeping skilled technicians raises the cost of BIM implementation as a whole, and it forces Stantec to outsource to other countries. As a solution to this dilemma, he states, "If you build awareness [of the benefits of BIM], the whole market increases, the skill base increases and work comes back to the Middle East."

 Lack of Time and Budget to Conduct BIM Planning/Training: While BIM is well suited for fasttrack projects, it is also best served if sufficient time and resources are dedicated to BIM planning and training from the project outset, and

> BIM was essential to the design and construction of the complex dome of the Louvre Abu Dhabi. For more information on the use of BIM for this project, see page 36.



mage Courtesy of BuroHappold

"The first project was not time or cost effective. But now, the second, third, fourth, they are becoming much more cost effective."

a couple of participants find lack of time and budget to be an obstacle.

- Pavithran reports that after they win the bid, they are expected to start work onsite and "the contractor will not get enough time to do BIM modeling and coordination." He calls for changes in project contracting and delivery method to tackle this issue.
- Al Sheikh believes that creating proper training budgets at the onset of a project will help encourage wider BIM adoption because insufficient attention is paid to this issue now. Providing proper BIM planning and training from the beginning has yielded direct benefits: "I can minimize the budget before the project begins because once we have a model planned, we can extract the quantity requirements for all the buildings."

Initial Cost of Implementation:

Several participants emphasize that cost is a particularly prohibitive factor in the Middle East. While BIM may have a positive impact on costs ultimately, there may be reluctance to incur upfront costs on initial BIM projects. A few express concerns about high licensing fees, but most attribute initial costs to the lack of experience and the shortage of skilled workers.

 Dahdaleh's experience corresponds to the Dodge study findings that experience addresses the issue of cost: "The first project was not time or cost effective. But now, the second, third, fourth, they are becoming much more cost effective. It's the quality. You are sure that everything is in the right place."

Methodology

Dodge Data & Analytics conducted telephone interviews with seven people working in the Middle East on BIM.

- Marwan Abu Ebeid, Turner International, Middle East
- Roula Dahdaleh, Consolidated Consulting Group
- Biju Kouttala and Dirk Van der Ploeg, BAM Higgs & Hill LLC
- Pavithran K. Valappil, multinational company based in Dubai
- Rajat Shankar, Stantec International
- Paul Watton, Khansahab

Data: BIM Benefits

Experience of Overall Business Value From BIM

The BIM journey is a unique experience for every user, and each will view progress in a different way, depending on their objectives. As a benchmark, Dodge consistently asks users in its BIM research around the world to characterize their current status of achieving what they believe is the overall potential value of BIM to their organization.

The chart shows that the vast majority (94%) of current Middle East users are finding value in BIM. Among those:

- Only 9% of all users believe they have tapped its full potential, with UAE registering fewest (4%), and nearly twice as many designers (11%) reporting that belief than contractors do (6%).
- The majority (53%) believe that they are already getting strong value but there is more to be gained.

This overwhelmingly positive response is a good sign that BIM usage should continue to advance vigorously among its current users in the Middle East. More intensive levels of BIM implementation by current users may also influence non-users to adopt, since BIM use by competitors is typically a powerful incentive for non-users to adopt it. More information about the attitudes, objections and adoption triggers of design and construction professionals who are not currently using BIM is set forth in the Non-User section of this report (pages 38–41).

Experience of Overall Business Value From

BIM (All Regions) Dodge Data & Analytics, 2017

- We're Getting Everything Out of BIM That We Believe It Can Provide Us
- We're Getting a Lot of Value From BIM But Believe There Is More to be Gained
- We're Just Scratching the Surface of How Much Value BIM Can Provide Us
- We're Getting No Meaningful Value From BIM



Project Performance Benefits of BIM

The tangible contribution of BIM to improved project performance is a compelling aspect of its business value. Users were asked to rate that value on a one to five scale (none, low, medium, high or very high) for three critical metrics of project performance: improved safety, schedule acceleration and reduced construction cost.

Variation by Region

The chart shows the percentage of users who feel strongly (high or very high responses) that BIM is generating each benefit, shown divided by the regions studied in this research.

- Over half of users in both Saudi Arabia and the All Others regional category (Bahrain, Egypt, Jordan, Kuwait, Lebanon, Oman, Qatar) believe that BIM generates all three project performance benefits.
- UAE users are less enthusiastic, but 40% cite reduced construction cost.

While the lower ratings from UAE may truly indicate that fewer benefits are being experienced there, they may also reflect a lower overall need to address these performance metrics on their projects. Therefore, the relative positive impact is less than in the other regions.

For a global perspective, the International Comparisons section of this report shows how the total Middle East user group compares with China for high/ very high beneficial impact ratings (see page 45).

Variation by Role

A higher percentage of contractors (62%) report reduced construction cost than designers (43%), and while both are strong results, the higher percentage of contractors probably reflects their closer involvement with the details of construction cost.

Project Performance Benefits of BIM

(Percentage of BIM Users by Region Who Report High or Very High Degree of Benefit) Dodge Data & Analytics. 2017

- Saudi Arabia
- All Others

Improved Safety



Project Process Benefits of BIM

BIM can significantly reduce inefficiencies in many project processes. Users were asked to rate the beneficial impact of BIM on seven project processes. These findings demonstrate overall strong belief in the power of BIM to improve project processes.

Variation by Region

Some regional differences are evident in the responses.

- UAE: Similar to the project performance benefits findings, the users in the UAE are generally the least enthusiastic across all the project process benefits, although they outpace Saudi Arabia in two important measures: reduced field coordination conflicts during construction; and reduced errors and omissions in construction documents.
- Saudi Arabia: Saudi users lead the other regions and are most positive about the impact of BIM on reducing rework. That benefit is followed closely by Saudi users citing increased efficiency through collaboration with owners or other team members.
- All Others: Three benefits are selected by a high percentage of users from Bahrain, Egypt, Jordan, Kuwait, Lebanon, Oman and Qatar (79%).
 - Increased efficiency through collaboration with owners or other team members
 - Reduced field coordination conflicts during construction
 - Reduced errors and omissions in construction documents

The three lowest-rated benefits (better cost control/ predictability, less time documenting and more time designing, and faster client approval cycles) still garner top scores from about half of all users, so BIM also provides significant value in these important areas.

The International Comparisons section of this report provides a global perspective of how the total Middle East user group compares to China (see page 45).

Variation by Role

Similar percentages of design and construction-related users scored each benefit as having a high or very high impact with a few exceptions.

- Far more contractors (83%) cite increased efficiency through collaboration with owners or other team members than designers (66%), perhaps reflecting their role coordinating the work of many parties.
- Related to that, 60% of contractors give top scores to faster client approval cycles, versus only 49% of design-related BIM users.

Project Process Benefits of BIM (Percentage of BIM Users by Region Who Report High or Very High Degree of Benefit) Dodge Data & Analytics, 2017

Saudi Δrahia

Saudi	Aſ	abi
UAE		

All Others

Increased Efficiency Through Collaboration With Owners or Other Team Members



More contractors (79%) are enthusiastic about reduced field coordination conflicts than designers (66%), which probably reflects their closer day-to-day involvement with that issue.

Internal Business Benefits of BIM

In addition to providing a number of valuable benefits to project processes and performance, BIM users report numerous ways in which BIM contributes to the internal business success of their organizations. Users rated the beneficial impact of BIM on seven aspects of their internal business. Although not as high-scoring as the project process benefits, these findings still demonstrate the power of BIM to improve users' businesses.

Variation by Region

Though generally consistent across the Middle East, in some cases, the findings highlight interesting differences.

- Marketing new business to new clients is the overall top-ranked internal benefit, but especially so in the All Others regional category (Bahrain, Egypt, Jordan, Kuwait, Lebanon, Oman, Qatar). This could be because of the relatively higher BIM implementation and experience levels of the respondents from these countries, compared with those from Saudi Arabia and the UAE, thereby enabling more experienced practitioners to use beneficial outcomes from a higher number of completed BIM projects as a competitive advantage in pursuing new work.
- This finding is echoed in the relatively high percentage (59%) of those in the All Others category who see a positive impact from BIM on maintaining repeat business with past clients, compared with Saudi Arabia (44%) and UAE (38%).
- Over half (58%) of Saudi users report increased profits because of BIM. The other regions average only 38%.
- More in the UAE report that their BIM capability generates improved recruiting and retention of staff than in other regions. As BIM use grows in the Middle East, finding and retaining skilled staff is a major challenge, so firms that learn how to use their BIM capability to attract talent will benefit. See pages 16 and 31 for more on the challenge of retaining skilled staff.

For a global perspective, the International Comparisons section of this report shows how the Middle East BIM users compares with those in China for high/very high beneficial impact ratings (see page 45).

Variation by Role

Unlike project process benefits, where designers and contractors' responses were closely aligned, the gap between their perspectives on internal business benefits is dramatic. **Overall, 61% of contractors report a high impact across all seven internal benefits, compared with** Internal Business Benefits of BIM (Percentage of BIM Users by Region Who Report High or Very High Degree of Benefit)

Dodge Data & Analytics, 2017



All Others

Marketing New Business to New Clients



only 44% of designers.

In fact, four of the top five greatest differences between the experience of benefits by designers and contractors are in the category of internal business benefits (see page 22).

DATA

Top Differences Between Roles for BIM Benefits

Analyzing responses for all 17 beneficial impacts of BIM studied in this research, the chart shows the top five that feature the greatest disparity between the percentages of construction-related BIM users versus design-oriented users who report them having a high/ very high positive impact.

Four of the five are in the category of internal business benefits (offering new services, increased profits, fewer claims/litigation, improved recruiting and retention of staff). This can be interpreted to mean that design practitioners are struggling to find the same level of internal business value from BIM that construction team members are enjoying. This finding in the Middle East corresponds to similar Dodge BIM research around the world: emphasizing the tangible, repeatable, scalable benefits of BIM for contractors, but, at the same time, highlighting the fact that the industry also needs to focus on benefits that translate to business success for design professionals.

Benefits of BIM With the Greatest Difference Between Value Ratings by Design and

Construction Users (Percentage of All BIM Users Who Report High or Very High Degree of Benefit) Dodge Data & Analytics, 2017

Construction BIM Users





Increasing BIM Benefits

Top Industry Resources That Would Increase BIM Benefits for Users

BIM users were shown a list of industry resources that could increase their benefits from BIM and asked to select the top three that they believe would be most impactful. The top chart on page 23 shows all those that were selected by at least 30% of all users.

- More BIM training and support, and more owners asking for BIM both captured majorities within users' top three selections. The percentages for both of these are consistent across the region, but between roles, far more contractors (60%) cite a need for BIM training and support than do designers (46%). This may reflect the apparent surge in usage by contractors (see page 9).
- The need for more external firms with BIM skills is ranked in the top three by far more Saudi users (51%) than those in the other regions (37%). This aligns with

that region's relatively low implementation level (see page 9), which creates a need for more firms that can participate collaboratively in BIM projects.

- More quantified metrics and data demonstrating the business value of BIM is cited as a top need by significantly more UAE users (58%) than those in Saudi Arabia (36%). Since the UAE has higher current and forecasted BIM implementation levels than Saudi Arabia (see page 9), this could be interpreted as a need by those users to validate their planned expansion.
- More internal staff with BIM skills is the top need (56%) cited by users from the All Others category (Bahrain, Egypt, Jordan, Kuwait, Lebanon, Oman and Qatar) and far outpaces those who rank this as a top need in the UAE (42%). With both the highest current and most aggressive forecasted implementation levels (see page 9), it makes sense that users from this group of countries identify internal BIM skills as a major issue.

BIM Benefits Increasing BIM Benefits CONTINUED

More readily available outsourced modeling services to augment your staff is also ranked as a top three need by about a third of users in both the All Others regional category (35%) and Saudi Arabia (31%). BIM users frequently rely on third-party modeling resources to augment internal staff. The projected growth of BIM use in the Middle East combined with an identified demand for internal talent should lead to an increase in outsourcing activity throughout the region.

Top Technical and Process Factors That Would Increase BIM Benefits for Users

BIM users were shown a list of technical and process factors that could increase their benefits from BIM and asked to select the top three that they believe would be most impactful. The chart shows the factors that were selected by at least 30% of all users.

- More clearly defined BIM deliverables between parties, which is the top choice across all users in all regions, is particularly strongly cited by the contractors (66%). This makes sense because of a contractor's typical role of coordinating documentation and information between many parties on BIM projects. In this capacity, the need for clarity on BIM deliverables is critical.
- Saudi users (62%) are well above the others (37%) in their demand for more use of contracts to support BIM collaboration. Similarly, contractors (66%) outpace designers (52%). These findings align with the need for more clearly defined BIM deliverables, with both enabling collaborative digital workflows that allow project teams to leverage BIM to its greatest advantage.
- More contractors than designers identify both improved functionality of BIM software (51% to 37%, respectively) and more product manufacturer content for BIM (46% to 37%, respectively) as top factors that would improve their BIM benefits. Saudi users are the least concerned about these two factors, perhaps because these issues have not become sufficiently challenging due to their relatively low implementation levels.
- A higher percentage of designers (40%) choose more integration of BIM data with mobile devices/ applications among their top three most impactful factors than do contractors (31%). This is likely to change as more contractors become involved in fieldrelated BIM activities.

Top Resources That Would Contribute Most to Increasing BIM Benefits for Users (Percentage in All Regions Rating Each Factor as High or Very High Impact) Dodge Data & Analytics, 2017

More BIM Training and Support



Top Technical and Process Factors That Would Contribute Most to Increasing BIM Benefits for Users (Percentage in All Regions

Rating Each Factor as High or Very High Impact) Dodge Data & Analytics, 2017

More Clearly Defined BIM Deliverables Between Parties

More Use of Contracts to Support BIM and Collaboration

56%

47%

46%

61%

Improved Functionality of BIM Software

Improved Interoperability Between Software Applications

More Product Manufacturer

Content for BIM

40%

More Integration of BIM Data With Mobile Devices/Applications

37%

Improved Flexibility and Collaboration With BIM

Mediclinic Parkview Hospital

DUBAI, UAE



hen it was announced in early 2015, the Mediclinic Parkview Hospital project in Dubai was planned as a fast-track project. After the owner, Mediclinic Middle East, decided to include some future expansion plans into the main scope, schedule became even more critical. Through use of BIM, the design team was able to make the necessary adjustments needed to expand the project quickly, with limited impact to the overall schedule.

Adjusted Scope With Minimal Schedule Impact

Rajat Shanker, principal at multidisciplinary firm Stantec and senior project manager for the Mediclinic hospital project, says the original schedule called for Stantec to take the project from concept to construction documentation in 32 weeks. However, early in the design, the client explored the idea of including a future expansion, which meant expanding the building's size by about 60% while preserving the design schedule. Rajat says that the efficiency of designing in BIM allowed the team to make the needed changes quickly. Ultimately, Stantec was able to accommodate the changes with only four weeks added to the design schedule—a 12.5% increase in schedule for a 60% increase in project scope.

"That's the value of BIM," he says. "It made it easy for us to present the concept to the client and confidently say we can make the changes in four weeks."

When completed in late 2018, the 613,306-sq-ft building, which sits on a 2.33 acre site, will include 188 beds, 397,414-sq-ft of clinical space spanning 10 floors, two levels of below-ground parking and a 58,372-sq-ft MEP plant.

Improved Ability to Work With Stakeholders

Rajat says that the project contract did not require BIM. However Stantec chose to use it because of its value in bringing increased efficiencies of design coordination across all design disciplines, that eventually saved time and money on the project's design delivery stages. Another big advantage in using BIM was in creating repetitive rooms and components in the building. Rajat says the building has 12 typical room designs, including in-patient rooms, outpatient exam-consultation rooms, treatment rooms, and utility and linen rooms. This strategy proved particularly useful when the client decided to increase the project's main scope by adding a future expansion.

"We got approvals from the client and the stakeholders on the typical rooms, which covered about 80% of the area of the building," he says. "That's the beauty of a BIM model with typical rooms—you can create these components that are repeated across the whole project."

Design approvals were required by four stakeholders, including the client's CEO, COO, engineering director and chief medical officer.

"We had some debates, but those debates were supported by the BIM models," he says. "We were able to show them [spaces], move things around and show how concepts would work or not work."

Rajat says Stantec was able to create renderings and virtual reality views of the typical spaces to help stakeholders visualize those areas during the approval process.



Mediclinic Parkview Hospital

DUBAI, UAE

BIM and the Project Team

Stantec's in-house engineering capabilities also streamlined the use of BIM during the design process. Stantec's design responsibilities include architecture, structural engineering, mechanical engineering, electrical engineering, plumbing works and interior design. Although Stantec can seamlessly work in BIM internally, he says outside specialist consultants work in 2D CAD.

"We extract DWG files for them," says Parshav Kansara, Stantec's BIM manager on the project. "They give us DWG files back, and we import them back into the model. So there is coordination, but not the way we want it to be [fully in 3D BIM]."

In light of the successful use of BIM during design, Mediclinic Middle East chose to mandate use of BIM by the contractor on the project, AI Shafar General Contracting (ASGC). "The client saw the benefit," Rajat says. "As we did the specifications for the project, the client said, 'let's get a contractor who can do BIM.' They saw the benefit of coordination, creating shop drawings from BIM and the clash detection [capabilities]."

In order to realize shop drawings from BIM models, the owner mandated LOD 400 on the project. However, Rajat says that the contractor's BIM execution plan also defined the potential for LOD 500 on the project.

Due to liability concerns, Rajat highlights that there will always be a legal separation of the design and construction models. However, the two parties are collaborating as closely as possible, he says.

Stantec provided its design

stage models to help the contractor build its construction models. He says Stantec's structural model was particularly helpful for the contractor's BIM efforts. ASGC was able to prepare structural shop drawings much faster, which allowed them to commence work onsite earlier, and the project's construction is currently a month ahead of schedule. The contractor shares its model with Stantec every two weeks for review and approval. "We're working with the contractor as a team to make sure the BIM model is correct," he says. "It's a very collaborative approach. We said, 'OK, whatever helps the project; we will do everything possible."

Using BIM, Stantec was able to produce sufficient drawings for contractor bidding within two months of the initial concept phase. A two-stage procurement approach was then used, which allowed the contractor to start site enabling works in January 2017 before the full building construction documentation was completed in March 2017.

BIM Skills in the Middle East Market

In building the construction model, Rajat says that the contractor sees limited use of BIM among its local subcontractors and is taking on those tasks in house. "They have a BIM studio of 25 to 30 people," he says.

Rajat notes that finding qualified BIM professionals is a significant challenge in the Middle East. He says the local Stantec office has dedicated time for BIM training for staff members. "Senior technicians can jump up to the next level very quickly, but for a [less-experienced] technician to get up to a middle level [of BIM proficiency] is a steep curve."

To help fill gaps in its BIM needs, Rajat says Stantec sometimes outsources, but then prefers to bring outsourced BIM technicians into its office to work directly with the design team.

Using BIM for cost estimating is also a challenge in the Middle East, Rajat says. "Cost consultants are picking up on BIM, but [adoption] will take a long time for them," he adds.

With the project in the early stages of construction, enhanced ways to use BIM are still under consideration with the client team, including use of an LOD 500 model for facility management needs and virtual reality mock-ups.

Project Facts and Figures

Name Mediclinic Parkview Hospital Project

Location Dubai, UAE

Client Mediclinic Middle East

Architect Stantec International, Inc.

Contractor Al Shafar General Contracting

Site Area 2.33 acres

Built Area

613,306-sq-ft (clinical space, basement parking and MEP plant)

Groundbreaking January 2017

Completion Late 2018

Data: BIM Teams

Importance of BIM for Team Formation

A significant number of BIM users say that having access to more external firms with BIM skills would increase their ability to generate benefits from BIM (see page 23). As BIM usage and maturity grows in a region, BIM skills typically become an increasingly important qualification requirement for team formation.

BIM Requirements

Users from design firms were asked to characterize their BIM requirements policies related to the contractors they select for their projects.

- Overall, only 13% of users from design firms claim that BIM expertise does not affect their contractor selection decisions. Interestingly, in spite of the relatively advanced level of BIM implementation reported by respondents from the AII Others regional category, which includes Bahrain, Egypt, Jordan, Kuwait, Lebanon, Oman, Qatar, (see page 9), nearly one third (31%) of users in these countries state that BIM expertise does not affect their contractor selections, compared with just 5% in UAE and 0% in Saudi Arabia.
- About half (48%) of designers in the Middle East report that they require contractors to have BIM capabilities. This is a positive sign of maturing BIM processes. In alignment with their high implementation level, the All Others category tops the UAE and Saudi Arabia with 54% stating they require BIM.

Design Firms' BIM Requirement Policy for Contractors

Dodge Data & Analytics, 2017

We Require Companies to be Experienced in BIM

We frequire companies to be experienced in bit

We Encourage BIM Expertise, but Do Not Require It

BIM Expertise Does Not Affect Our Decisions



Value of GC BIM Skills

Value of General Contractors' BIM Experience

BIM users from design firms were asked to rate, on a one to five scale (none, low, medium, high, very high), their receipt of five benefits generated from a general contractor's BIM skills. **On average, 45% of these users cite receiving high or very high levels across all five benefits**.

The chart highlights variations between the three regions for each of the benefits.

- Almost two thirds (63%) of all users from design firms strongly agree that having contractors with BIM skills improves project outcomes/quality.
- Users in the All Others regional category (Bahrain, Egypt, Jordan, Kuwait, Lebanon, Oman, Qatar) are most enthusiastic about the value of contractors' BIM skills. This finding corresponds with their relatively high level of BIM implementation (see page 9) and their leadership among regions in requiring BIM capabilities from contractors (see page 26).
- Conversely, the relatively low ratings from Saudi users may reflect their relatively lower level of BIM implementation. These value ratings should advance as BIM implementation expands in that region.

Degree of Benefit Received by Design Firms Because of General Contractors' BIM Skills (Percentage Reporting High or Very High Value for

Each Benefit)
Dodge Data & Analytics, 2017

Bouge Data & Analytics, 2

Saudi Arabia

All Others

Improves Project Outcomes/Quality



Importance of BIM for Trade Contractor Selection

General Contractors' BIM Requirements for Trade Contractors

General contractors and construction managers were asked to characterize their BIM requirements policy for trade contractor selection on their projects.

Almost three quarters (71%) of general contractors in UAE require BIM experience from trade contractors, which is more than twice as many as in the other Middle East regions studied. In addition, none of the firms in that country report that BIM has no impact on their decisions.

Based on Dodge BIM research around the world, this trend can be expected to increase throughout the Middle East as BIM usage matures and contractors more fully appreciate the value of trade contractors skilled in BIM.

For a global perspective, the International Comparisons section in this report shows how general contractors in the Middle East compare with 10 other regions for trade contractor BIM requirements (see page 44).

General Contractors' BIM Requirement Policy for Trade Contractors

Dodge Data & Analytics, 2017

We Require Companies to be Experienced in BIM

We Encourage BIM Expertise, but Do Not Require It

BIM Expertise Does Not Affect Our Decisions



Value of Trade BIM Skills

Value of Trade Contractors' BIM Capabilities

General contractors and construction managers were asked to rate their receipt of five benefits generated from trade contractors' BIM skills, on a one to five scale (none, low, medium, high, very high). Similar to designers' views of the value of general contractors' BIM skills, 44% of contractors receive high or very high value from trade contractor BIM skills across all five benefits.

- All respondents in the All Others regional category (Bahrain, Egypt, Jordan, Kuwait, Lebanon, Oman, Qatar) cite top beneficial impact on quality, innovation and schedule. This passionate level of enthusiasm aligns with the high level of BIM implementation by respondents from those countries (see page 9).
- Similar to the ratings from designers, the relatively low ratings from Saudi general contractors may reflect their relatively lower level of BIM implementation. These value ratings should also advance as BIM implementation expands in that region.
- The relatively low score for cost reduction is typical for a region in the early stages of BIM implementation. Final cost is affected by so many elements on a project that linking reduction directly to BIM is often slower to be perceived as valid than other benefits, but should advance with BIM maturity.

Degree of Benefit Received by General Contractors Because of Trade Contractors' BIM Skills (Percentage Reporting High or Very High Value for Each Benefit)

Dodge Data & Analytics, 2017

- Saudi Arabia
- All Others

Improves Project Outcomes/Quality



Trade Contractor Proficiency in BIM

As BIM use expands, trade contractors' contributions to activities such as spatial coordination, fabricationlevel modeling and model-driven prefabrication become increasingly important. To assess the capability of trade contractors in the Middle East, general contractors were asked to identify the trades where at least half of the firms they deal with have an acceptable level of BIM skill. The chart shows the percentages across all regions.

The majority (78%) of general contractors perceive that mechanical contractors have an acceptable level of BIM skills, which far outpaces their perception of BIM proficiency among the other five trades studied. This aligns with findings in every other geography studied by Dodge, driven primarily by the powerful advantages that virtual coordination and prefabrication offer mechanical contractors.

For a global perspective, the International Comparisons section of this report shows more detail about how general contractors' perception of the BIM proficiency of trade contractors in the Middle East compares with 10 other regions around the world (see page 46).

Trade Contractors With an Acceptable Level of BIM Expertise Among at Least Half of the Firms (According to General Contractors by Region)

Dodge Data & Analytics, 2017

- Saudi Arabia
- UAE All Others

Mechanical/Sheet Metal/Plumbing



Education Now!

Across the Middle East, the availability of BIM-qualified professionals is falling well short of the growing need for them, making expanded design and delivery of BIM education a crucial component of facilitating BIM uptake in the region.

he primary factors driving the need for BIM skills include the continuing recovery of the construction sector, regulatory agencies' expanding requirements for BIM-based submissions, clients' growing awareness of and demand for the lifecycle advantages of BIM and the increasing adoption of BIM by international collaborators on project teams. To many in the industry, however, BIM is still understood as little more than a 3D substitute for 2D CAD.

A Concerted Effort

Fundamental to an effective education program is the distinction between technology and process, according to Pavithran K. Valappil, a director of BIM and design for a Dubai-based multinational. "Although BIM is now known to the entire industry," says Pavithran, "people still can't distinguish between the technology of creating a 3D model and the process of proper information management for the ultimate end use."

In a study of obstacles to the implementation of BIM in Dubai,¹ Pavithran recommends the municipality form a task group which would assist with BIM adoption in the region and oversee the development of a comprehensive BIM training program for multiple stakeholders. The proposed program would comprise four levels tailored to the diverse needs of four categories of BIM users. For senior managers and government officers, the course content would focus on macro-level aspects like procurement and contractual issues. For model managers and construction trade supervisors, a BIM process certification course would include the macro-level information and additional content focused on standards and basic technology. For modellers and CAD teams, a BIM technology certification course would focus on standards, tools and technology. And for design practitioners and students, universities would be encouraged to deliver BIM courses covering all of the content described above.

Leading the Charge

Only a few colleges and universities in the region currently offer BIM training. In the departments in which courses are offered, they are generally optional, and their emphasis lies primarily on the technology of 3D modelling, rather than the process of lifecycle information management. An exception is the Department of Architecture at the American University in Dubai, where BIM is a core required subject in the architecture and interior design curricula. AUD architecture graduates are achieving BIM certification at a rate of about 70%, and finding themselves in high demand in an industry hungry for their skill set.

When the department initially proposed its BIM courses in 2009, they were intended to be optional, according Alex Albani, a professor of architecture at AUD. "We were all amazed when [the UAE Ministry of Higher Education and Scientific Research] reviewed our program for accreditation, and recommended that they be core required courses," he says.

The Department's mandatory introductory course has received a commendation of distinction on the National Architecture Accrediting Board's most recent visit. An intermediate/advanced course is mandatory for architecture students. Beginning in fall 2017, the department will introduce BIM MEP (mechanical/electrical/plumbing) and BIM Structural. And, far from limiting instruction to the technology of modelling, says Albani, "lifecycle is a key word when I teach this subject."

Currently, Albani is the only instructor in his department able to teach these courses, but momentum is building. Albani is delivering workshops to other faculty, the university's engineering department is in the process of developing BIM course offerings, and "even the oldschool guys are slowly coming on board," he says. "When we get to the point where everybody is speaking the same language, and using the same form of practice, things will settle down-but the process has been taking a long time." In the meantime, the need for BIM-qualified professionals continues to grow.

1. Pavithran (2016), "Dubai Municipality Directive for BIM Implementation: Investigating Barriers and Workflows for Implementation of BIM by the Construction Industry," Middlesex University.

Data: BIM Investments

BIM Investments

Ongoing investments are required in order to optimize the potential benefits of BIM. Users were asked to identify the degree to which they plan to make each of seven types of BIM investments over the next two years. The chart shows the percentage who plan to invest in each at high or very high levels.

BIM Basics

Software, hardware and training are the basic elements of a BIM program. On average, 50% of all users report that they are highly committed to making these investments over the next two years.

- Variation by Region: UAE users (56%) are above the average and Saudi users (44%) are below. This finding aligns with the more aggressive two-year BIM implementation plan predicted by users in the UAE versus Saudi Arabia (see page 9).
- Variation by Role: Construction-oriented users are more committed to training (60%) than design-oriented users (49%). This follows a general trend found in all of Dodge's research that construction companies are more committed to investing in training than design firms.

BIM Processes

As BIM use matures in a region, practitioners increasingly realize that great value can be derived from collaborative model-based processes, both within their organization and externally, to engage other project team members most effectively in productive digital workflows.

- Across all regions, internal process investment plans (61%) outweigh external (53%). This is a typical pattern in Dodge BIM research around the world for regions in the early stages of BIM adoption. Companies initially focus on internal standards and procedures before turning to improving how they work with third parties.
- Construction-oriented users (57%) are more committed to investing in external processes than are designers (51%). This makes sense because they are often involved with a larger number of companies during a project.

BIM Enhancements

As users mature, they typically begin to develop content and tools that will enhance their BIM program. Over half of users (55%) report that they plan significant investments in BIM content libraries, especially those in the All Others category (Bahrain, Egypt, Jordan, Kuwait, Lebanon, Oman, Qatar), and nearly half (44%) will invest in custom software solutions.

Planned Investments (Percentage of BIM Users Planning High/Very High Levels of Investment in the Next 2 Years)

Dodge Data & Analytics, 2017

Saudi Arabia
UAE

All Others

BIM BASICS

BIM Training 44% 62% 50% New/Upgraded Hardware 51% 51% 47% **BIM Software** 38% 56% **50%**

BIM PROCESSES

Developing Internal Collaborative BIM Procedures



Developing Collaborative BIM Processes With External Parties

> 46% 53% 59%

BIM ENHANCEMENTS

Developing Custom 3D Libraries



SmartMarket Report

Data: BIM ROI

Perceived ROI on BIM

Although there is no widely accepted method for calculating a company's return on investment (ROI) for their BIM program, most users have a perception of the degree to which they are receiving value for the time, money and effort expended. In its BIM studies around the world, Dodge asks users to estimate their ROI from among a selection of categories.

The charts show the responses from BIM users in the Middle East, broken out by region and by role.

- 8% or fewer of the users in any region believe they currently have a negative ROI. Among roles, only 3% of the construction-related users believe they are in that position. This matches global findings from Dodge research that generally show contractors tend to report higher ROI.
- Saudi Arabia has the most users (31%) with very high ROI (over 50%). This is interesting because users in this region report the lowest level of BIM implementation (see page 9) and lagged other regions somewhat in planned investments (see page 32).
- Construction users (29%) also outpaced designers (20%) in the top ROI category. This finding corresponds with other Dodge BIM research globally.

For a global perspective, the International Comparisons section of this report shows how the Middle East compares with China and Australia for the percentage of users who perceive a positive ROI (see page 47).

Perceived ROI on BIM (By Region)

Dodge Data & Analytics, 2017

- Very High (Over 50%)
- High (25% to 50%)
- Moderate (Up to 25%)
- Break-Even
- Negative



Perceived ROI on BIM (By Role)



Formal Measurement of BIM ROI

Frequency of Formal BIM ROI Measurement

The frequency with which users formally measure their ROI from BIM covers a wide range. The top chart shows the percentage of projects on which users currently measure BIM ROI, broken out by region.

- Almost twice as many Saudi users (33%) measure ROI very frequently (on more than half of their projects) than those in the other regions (18% each). This may correspond to the higher ROI reported by these users (see page 33).
- Almost a third (31%) of construction-oriented BIM users are measuring ROI very frequently versus only 19% of designers. Again, this greater frequency of measurement may relate directly to their higher reported levels of ROI.

History of BIM ROI Measurement

The second chart shows the percentage of users who report they have been measuring BIM ROI for more than two years. In addition to measuring BIM ROI more frequently, Saudi users have also been doing it longer.

Percentage of Projects on Which Users Formally Measure the ROI of BIM (By Region)

Dodge Data & Analytics, 2017

- More Than 50%
- 25% to 50%
- Less Than 25%
- None



Percentage of Users Who Have Been Formally Measuring the ROI of BIM for More Than 2 Years (By Region)

Dodge Data & Analytics, 2017



SmartMarket Report

Top Benefits That Contribute to Increasing BIM ROI

It is natural for companies to want to continually improve their ROI for BIM. Users were asked to identify which internal and project-related BIM benefits, if received, would contribute most significantly to increasing their ROI.

Top Internal Business Benefits That Would Contribute to Improving ROI

From a list of eight internal business benefits of BIM, users selected the top three that would be most impactful on increasing their ROI. The chart shows the five top-scoring internal business benefits across all regions.

- Improved productivity tops the list overall (average of 58%), but just 44% of Saudi users selected it for their top three, versus 68% of their peers in the All Others category (Bahrain, Egypt, Jordan, Kuwait, Lebanon, Oman, Qatar). This 24 percentage point spread is unusual in a first place selection, which generally garners more unanimity.
- Offering new services ranks second, but it also generated regional differences, with 59% of Saudis selecting it versus only 42% from the UAE.
- Design and construction-related users were remarkably aligned on all five top selections.

Not ranking among the top five were positive impacts on sustainability, repeat business and recruiting/ retaining talent.

Top Project Benefits That Would Contribute to Improving ROI

Users also selected the top three benefits that would be most impactful on increasing their BIM ROI from a list of nine project benefits. The chart shows the five top-scoring internal business benefits across all regions.

- Two field-related improvements are tied for the top spot, highlighting their direct contribution to improved productivity (named as the top internal benefit).
 Among the two, the reduced rework benefit also has a surprising degree of differences between regions, with only 42% of UAE users selecting it, versus 62% in the All Others regional category.
- Improved efficiency through multiparty collaboration scores third, but also has a 24 percentage point regional variance. This time, UAE users were most enthusiastic (56%), while their colleagues in Saudi Arabia are almost indifferent (26%).

Top Five Internal Business Benefits of BIM That Would Most Contribute To Improving Users' ROI (Percentage of Users That Included Each Benefit in Their Top 3 Most Important)

Dodge Data & Analytics, 2017

Improved Productivity of Personnel



Top Five Project Benefits of BIM That Would Most Contribute to Improving Users' ROI

(Percentage of Users Who Included Each Benefit in Their Top 3 Most Important) Dodge Data & Analytics, 2017

Reduced Rework



Not ranking among the top five are reduced errors and omissions, offsite prefabrication, reduced construction cost or improved safety.

BIM for Smarter Design and Construction

of Complex Projects

The burgeoning construction market in the Middle East includes many iconic buildings, with challenging and complex geometries. Using BIM for design and construction of these buildings supports analytics that help merge grand architectural gestures with practical building performance.

ecent projects in the Middle East include buildings that are cultural icons. BuroHappold Engineering is a consultant on two such projects: the Louvre Abu Dhabi in the UAE and the Museum of the Future.

Alain Waha, the global lead for **BIM and Digital Transformation** at BuroHappold, explains that the main benefit of using BIM from the concept stage forward on both projects is that BIM "fundamentally changes the conversation that the project team might have" from focusing on the immediate challenges faced in each discipline to "exploring compromises to produce a better outcome for the client." The use of information-rich modeling at the concept stage provides the opportunity to analyze the impact of decisions made throughout the design process for better outcomes.

Waha mentions a recent university project in Kuwait as an example of how this analysis can inform decisions. They were trying to achieve three distinct sustainable outcomes on this project that require different, at times conflicting, strategies: extensive daylighting, reducing heat gain and establishing views. He explains how their analytic tools allow them to quickly see the impact of various shading and facade choices. This analysis allows them to select the solution that best responds to all three desired outcomes.

The two museum projects, though, were particularly challenging



Interior construction of the dome for Louvre Abu Dhabi (see cover for dome exterior)

due to their complex nature, and Waha describes the ways in which BIM helped to provide solutions to the challenges they presented.

Louvre Abu Dhabi

Construction is well underway on the Louvre Abu Dhabi, a building that is largely submerged, with a prominent dome rising out of the water. Waha describes it as "a simple building with a complex dome on top." He explains that most of the building has "a pretty normal geometry ... immersed but straightforward." The challenge lies in the dome, which is uniquely complex and a grand architectural statement.

DESIGN

The complexity of the dome is driven by the vision of architect Jean Nouvel, which Waha describes as introducing "Islamic style architecture and using that to allow for lighting and natural ventilation ... [through] a mechanism with moving, repeating patterns that create the shading, and let air and natural ventilation work." This is accomplished through the use of 7,850 unique elements in its design.

For a building this complex, Waha explains that the client needed to understand how it will function in order to have faith that it can deliver the desired ventilation and lighting effects. He argues that a sketch cannot explain to the client how the dome will work structurally or convey how the complexity can be managed by the project team. He affirms, "You have to simulate [the architect's vision] in a digital domain" in order to put the client inside of it and demonstrate how it is going to

Courtesy of BuroHappold

deliver the ventilation and how the lighting will work."

For Waha, and for BuroHappold as a whole, "the ability to computationally link the analysis to the BIM" was influential on their work moving forward. What was a major process advancement for them four years ago has become standard practice on their projects globally. To demonstrate this, Waha discusses the World Cup soccer stadiums that they are currently designing: "We are applying this connected computational thinking to those stadiums. If the architect changes the slope of the roof, we recalculate the loads, the acoustics in the stadium, the member-sizing, and we represent within a few seconds what the stadium might look like and how it might perform from a visual and an acoustic point of view."

CONSTRUCTION

BIM was also essential to the construction of the Louvre by helping to support supply chain monitoring. A case study written by the company that provided the supply chain solution¹ explains that, at first, the general contractor for the steel structure, Waagner-Biro, tried to track the fabrication and installation of the 7,850 individual components through a spreadsheet, but inconsistencies and inaccuracies plagued this approach and required additional coordination time via phone and email.

The solution was the use of an app tied to a database that allowed for easier tracking of the fabrication and installation of the pieces that make up the dome. Lukas Olbric, managing director at Sablono, explains that their BIM-based workflow allowed "field workers, who were distributed all over the site and within different production facilities, [to] use mobile devices to report progress on [the individual components of the dome]." Each component was flagged with a unique barcode that workers along the entire process scanned when working with that component, and the resulting database allowed the contractor to track the progress of the dome construction with great precision.

Museum of the Future

The Museum of the Future in Dubai is a sculptural building that is a cross between a torus and an ellipsoid, a drawn-out oval with a hole in the center. The surface of the building is covered with Arabic writing, which also serves to let light into the building. Construction is expected to begin in 2017.

Waha explains that the model helped the client to understand how such an unusual building can be built, including the installation of mechanical systems into such an unusual shape. It also allowed them to demonstrate to the client that the building can serve their needs and avoid large amounts of unusable space. From the start, the project involved a detailed BIM implementation plan that addresses the design and construction stages, and is also designed to allow the owner to continue utilizing the data in the model during building operation.

In order to deal with the design challenges created by the complex shape, a collaborative process for the multinational design team, which extended from the Middle East to New York to Mumbai, had to be created. As Waha explains, "We needed to present a unified information model to all those teams and make it work across all those geographies, and we wanted [the team to work from] live models." They needed a solution to deal with the latency they were experiencing due to the wide geographical disparity of the team and developed a practical, process-based approach to deal with the issue.

"It is about thinking about the model as a real building," says Waha. People were only allowed to work in areas that other people were not working on, the same as on a jobsite. "Thinking about it in those terms and using the physical geometry of the model helps," he states.

They also advanced their use of big data analytic thinking on this project. "You start dashboarding your models and the data, and you begin to understand who is working on what and sharing through the cloud some of the families and BIM objects that you want everyone to use."

In all, both projects have helped BuroHappold to create a feedback loop that informs the design conversations and engages the entire team. Waha explains, "It used to be that the structure was a derivative of the form, the mechanical was a derivative of what the form and structure looked like, and the construction was a derivative of the design. We are trying to break that and say, 'If you are going to build it this way, the form could respond' and all this is informed by the computational and BIM approach to the design process. We are reshaping the conversation, so that everyone sitting around the table is now contributing, and therefore, we get a better outcome."

1. "Feasibility of consumer mobile devices in project delivery management for real-time progress updates case study" Lukas Olbrich, Sablono GmbH, Goswin Rothenthal, Waagner Biro Stahlbau AG, January 2016.

Data: Non-Users

Non-Users' Attitudes Toward BIM

As part of its BIM studies around the world, Dodge frequently surveys design and construction professionals who have not yet begun working with BIM to determine their perspectives about the current market usage and future industry importance of BIM, their objections to using it and the top triggers that would encourage them to adopt it. Given the number of non-user respondents in the study (see page 8), these findings are presented as trending data rather than statistically significant findings.

Current Non-User Attitudes About BIM

The pie chart shows the percentages of non-users who say they hold each of five perspectives on BIM.

- Over half (55%) of non-users have a positive attitude about BIM, and some are actively evaluating it.
- Only 15% have either used BIM and rejected it (all of these respondents are designers from the UAE), or say they are not interested in it (all of these respondents are contractors from Saudi Arabia).

For a global perspective, the International Comparisons section of this report shows how the Middle East compares with China for non-users' attitudes about BIM (see page 47).

Non-User Perspectives on the Future Importance of BIM

In addition to their current viewpoint, non-users were asked how important they believe BIM will be to the industry in the next five years on a scale of one to five (none, low, medium, high, very high). The chart shows the percentage who believe its future importance to be high or very high.

- The unanimous rating by non-users in the All Others category (Bahrain, Egypt, Jordan, Kuwait, Lebanon, Oman, Qatar) corresponds with the aggressive BIM implementation forecast reported by current users there (see page 9). Together these findings suggest a dynamic overall growth of BIM usage in the Middle East.
- When these non-user predictions are analyzed by roles, designers (77%) and contractors (71%) are closely aligned.

Non-Users' Attitudes Toward BIM

Dodge Data & Analytics, 2017

- We Have Not Used It But Are Actively Evaluating It
- We Believe It Will be Valuable for Us But Have Not Begun Evaluating It
- We Are Open to Exploring Its Potential Value for Us
- We Have No Interest in Using It
- We Have Used It But Decided Not to Use It Any More



Non-Users Who Expect BIM to Be of High/ Very High Importance in the Next 5 Years

Dodge Data & Analytics, 2017



Most Important Reasons for Not Adopting BIM

Non-users rated the impact of 18 possible reasons why they are not yet involved with BIM on a scale of one to five (none, low, medium, high, very high). The chart shows the top 10 objections that were identified as having high or very high impact.

- The lack of demand for BIM by clients and/or other firms on projects tops the list, and is consistently the main obstacle cited by non-users in all Dodge BIM research.
 - In the Middle East, there is a strong regional difference in those who consider this highly impactful, with 86% citing this challenge in Saudi Arabia, compared with only 40% in UAE.
 - A similar gap exists between designers (77%) who are often waiting for owners to generate BIM demand—and contractors (44%)—who are more frequently being encouraged (or required) by design firms that are already using BIM. (See page 26 for more information about GC BIM requirement policies.)

Problems related to training, software and hardware rank second, third and fourth.

- These core elements in a company's BIM program are identified by many current BIM users as top priority investments over the coming years (see page 32), which will further widen the gap between users and non-users.
- This situation should also provide opportunities for outsourcing firms to provide modeling services, thus avoiding the need for non-users to invest up front.
- Interestingly, twice as many design firms rated these as top objections than did contractors.
- Strategic issues about internal understanding of BIM, and how project roles, processes and ownership of information would be affected rank fifth, sixth, seventh and ninth.
 - The rankings by design-oriented non-users are generally close to those by contractors, with the understandable exception that more design firms are concerned about model ownership issues (46% versus 29%).
 - Among regions, non-users in the UAE express the least overall concern with these strategic issues.
 - This group of strategic objections presents an excellent opportunity for industry organizations to help their members understand BIM, learn about best practices and become comfortable getting involved.

Non-Users' Top 10 Most Important Reasons for Not Adopting BIM Yet (Percentage Rating of High or Very High Impact)

Dodge Data & Analytics, 2017



General perception issues (cost required, seems less efficient for smaller projects) round out the top 10.

The other eight objections are much less influential, with 30% or fewer non-users rating their impact as high or very high. Those include: BIM functionality does not suit their practice; current contracts do not support BIM; insufficient objective documentation of BIM's benefits; insufficient BIM content available; current methods are better; BIM software is hard to use; poor interoperability with CAD; and concerns about liability.

Non-Users' Perceptions of Competitors' and Clients' Use of BIM

In addition to owner, architect or general contractor BIM requirements, competitive pressure can be an influencing factor in driving non-users to become involved with BIM. The charts show the degree to which non-users believe their competitors are using BIM and their clients are working with other project teams that are using BIM.

The vast majority (80%) of non-users believe there is some level of BIM activity going on in their markets. This is a more common perception by contractors (86%) than designers (77%), but it does not vary significantly across regions. This widely held belief is an encouraging indicator that competitive pressure may have a powerful influence on driving non-users to engage with BIM.

Non-Users' Perceived Use of BIM by Others

Dodge Data & Analytics, 2017

Non-Users' Perceived Use of BIM by Their Competitors

- High Use by Competitors (Over 30% of Projects)
- Use by Competitors (Less Than 30% of Projects)

No Use by Competitors



Non-Users' Perceived Use of BIM by Their Clients When Working With Other Project Teams

High Use by Clients (Over 30% of Projects)
 Use by Clients (Less Than 30% of Projects)
 No Use by Clients



BIM Benefits That Would Convince Non-Users to

Consider Adopting BIM

Non-users were shown a list of BIM benefits and asked how much influence each benefit would have on encouraging them to become involved with BIM, if each could be demonstrated to be valid. The charts show these benefits in two categories and indicate the percentage of non-users who say that a benefit would have a high or very high influence on encouraging them to consider adopting BIM.

Most Influential Process-Related Benefits

The first category of benefits addresses improvements that BIM generates in the process of designing and building a project.

The top three benefits relate to improving multiparty workflows and communication, which Dodge research consistently reveals to be major benefits reported by BIM users around the world. Therefore, these benefits should be able to be effectively demonstrated to non-users in the Middle East.

Across all six of the process benefits, there is general parity in the level of potential influence reported by both design and construction non-users, but regionally there is notably stronger support for them in the All Others regional category, which includes respondents from Bahrain, Egypt, Jordan, Kuwait, Lebanon, Oman and Qatar.

Most Influential Outcome-Related Benefits

The second category of benefits that would trigger non-users to adopt BIM addresses measurable improvements to project outcomes.

As a category, these outcome improvements were cited as potential influencing factors by more construction-oriented non-users (average of 69%) than by those who are primarily involved in design activities (average of 47%), which makes sense because contractors are typically held directly accountable for outcome-related issues. Regionally, more non-users in both Saudi Arabia and the All Others category tend to cite these outcome benefits as highly influential than those in the UAE.

Process Improvements That Would Be Most Influential to Convince Non-Users to Adopt BIM (Percentage in All Regions Rating Each Improvement

as High or Very High Influence) Dodge Data & Analytics, 2017

Improved Multidisciplinary Coordination



Project Outcome Improvements That Would Be Most Influential to Convince Non-Users to Adopt BIM (Percentage in All Regions Rating Each Improvement as High or Very High Influence)

Dodge Data & Analytics, 2017

More Accurate Construction Documents



Interview: Thought Leader



Christopher Tebb, BEng (Hons) MSc CEng MICE, Digital Delivery Lead, Middle East Unit, Mott MacDonald

Christopher is a Chartered Civil Engineer with 10 years' experience in the AEC industry across built environment and transportation projects. His current position is leading the Mott MacDonald Middle East's digital implementation process and providing advisory services to clients on leveraging the value of BIM.

What makes the Middle East a unique market for BIM?

TEBB: What makes it unique is that it is a melting pot. Particularly here in Dubai, there is a culture that embraces innovation, but at the same time they are also looking for innovation and guidance from outside the region that can be applied. This is why this market is different, as we are not adhering to a single set of guidelines for BIM; the region embraces BIM good practice from multiple global sources. It is a very agile market and what makes it a challenge is having to navigate all of this, because there is no single set of rules for most engineering projects. Different people will adopt different standards; for example I have even seen local documents bring a mix of global standards together to meet the local needs and requirements.

What is the value that BIM brings to a market like this?

TEBB: I suppose it's twofold. The first is that this region has the opportunity to learn from developed cities such as London, New York, Singapore, where you have a significant amount of aging infrastructure. As new infrastructure is constructed here, BIM can add value because it means we can get it right the first time and not have to worry about the changing demands of the next 50 or 100 years since the assets are designed, constructed and operated with the future requirements in mind. BIM enables setting out the asset requirements at the start, and that is what we are starting to see here in the Middle East; the realization that the times of boom before the global financial crisis are over, and owner operators across the region now plan accordingly. Money cannot be spent on new projects continuously, and the need to consider effective spend in order to deliver in line with goals and visions is now the norm.

Where do you see the greatest potential for wider BIM adoption by sector?

TEBB: My view on this is that everything has potential; in my role, I now cover multiple sectors, as such I am introducing the same practices into every sector, so that there's no one sector that is underdeveloped. Certainly, in the built environment sector, there is going to be a significant amount of benefit. The same goes for the transportation sector and the growing water sector; the water sector stands to benefit the most as it is starting to build largescale pumping stations and sewage treatment plants and infrastructure. With the constraints that you have in the Middle East, particularly with geography and future demand, the adoption of BIM on these projects is going to provide real benefits.

What do you think are the most important factors that would encourage wider BIM adoption in the Middle East?

TEBB: A clear and concise idea of what BIM is and what BIM means to the Middle East is needed. What is evident at the moment is that there is a considerable amount of 3D modeling and the inherent uses that come from it, but we are not seeing as much of the transference into the owner operator organizations. Dubai, the UAE and most of the Middle East is a very labor-driven market when it comes to construction. If you are going to adopt new technologies and techniques and processes, then you have to demonstrate value in doing so.... It is a very competitive market with a variety of different local, international firms competing. It is necessary to have a clear and concise way of adopting BIM so that everyone is on a level playing field, in such a way that when a client is getting a cost from competing companies, that the same service is offered to him, and there are no complications in comparing cost.

How can that be achieved?

TEBB: It has to be led by the government/semi-government/ developer organizations, i.e., those that own and operate or own and develop assets. Owner/operators should start communicating to their supply chain what outcomes they are trying to achieve in their projects, and set up their own standards of information requirements. This will enable success in generating the most value out of the use of BIM because it is the OPEX (operational expenditure) stage of the project that will get the most benefit. It is not quite as simple as a single entity mandating BIM in Dubai because of other considerations, but I think owner/operator organizations are in a position to lead on this by setting out what they require from their supply chain and how this information should be exchanged. This will limit the variety of processes currently being used.

What do you think are the biggest obstacles to increasing the use of BIM?

TEBB: As this is still an emerging way of working, it is going to take time and investment to see the benefits materialize. Individually, companies should see this is the way that they need to work to stay competitive; but simultaneously, it needs to be considered an investment by all parties. Whether it be the companies, themselves or whether it be clients accepting that costs may go up slightly in the short term to provide long-term benefits.

Another obstacle is one that I have already mentioned, in that the region is sponge for good practice and as such the lexicon, the language, the communication needs to be there, so that everybody understands that they are talking about the same thing. We see a lot of examples of discussions between us and collaborative partners, where we are using the same language but we are understanding different things, which has led to confusion. We may need a group that can help be the custodians of BIM across the region, to help everyone work to the same playbook and ensure consistency.

In your personal experience, what are the most productive ways that BIM has been used on your company's projects? **TEBB:** The transition from 2D to 3D cannot be ignored. I know we do not like to talk about it when we talk about BIM because 3D modeling has become synonymous with the term BIM; however, the fact is that models can be utilized as visual aids effectively. You actually see what is being designed and will be constructed in a way that the human mind can comprehend, as opposed to trying to interpret a drawing. That is definitely number one for productivity.

I also think as well, from my own personal experience and background, an important benefit is putting an emphasis on the better management of information. We refer to BIM as better information management. We are trying to move away from the term building information modeling as BIM applies to all sectors. We also want to avoid the term modeling, because again, it is more than just the modeling of an asset; it is the entire enabling process. The adoption of a common data environment process internally has meant that we are making sure that every discipline team is coordinating with each other more effectively and that the right information is easily accessible.

What are you not doing now that you'd like to be doing in the future?

TEBB: The next jump will be to generative design and machine learning. We want to start utilizing programming to help with design optioneering, removing the time constraints of manually simulating multiple permutations of designs to find the optimal solution. This will also enable us to deal with reactive changes that may be requested as we can utilise automated processes to do so. We are trying to establish a level of mass standardization in the application of BIM, yet at the same time, we are trying to retain mass customization so that changes can be made to suit our client's outcomes. Hence, why I think the future for this process is generative design and machine learning.

Data: International Comparisons

International Comparisons

The charts on the following pages provide some comparisons between the Middle East and other regions studied by Dodge.

Users at a High Level of BIM Implementation

The chart shows the percentages of design and construction-oriented users who report using BIM on at least 30% of their projects.

- BIM use typically begins in the design community and is followed by contractor adoption. BIM has been in use for a longer time in Australia than China or the Middle East, which explains the higher percentage of designers there.
- But significantly more construction-oriented users in the Middle East report being highly involved with BIM than was found in either China or Australia. This is a good indicator that BIM use is maturing in the region.

BIM Requirement Policies by General Contractors

As the chart shows, more general contractors in the Middle East (48%) report that they require trade contractors to have BIM skills than in any of the other regions studied by Dodge. This is another good indicator that BIM use is maturing in the region.

Users at a High Level of Engagement

(Companies in the Middle East, China and Australia That Say 30% or More of Their Projects Involve BIM)

Louge Uata & Malaytics, 2017 China Data: The Business Value of BIM in China, SmartMarket Report, Dodge Data & Analytics, 2015 Australia Data: The Business Value of BIM in Australia and New Zealand, SmartMarket Report, Dodge Data & Analytics, 2014

Design Construction



General Contractors' BIM Requirement Policies for Trade Contractors

(Middle East Compared With 10 Global Regions)

Dodge Data & Analytics, 2017; China Data: The Business Value of BIM in China, SmartMarket Report, Dodge Data & Analytics, 2015 Other Country Data: The Business Value of BIM for Construction in Major Markets, SmartMarket Report, Dodge Data & Analytics, 2013



International Comparisons

BIM Benefits Compared With China

The Middle East and China are similar in that both are dynamically growing regions with large amounts of construction activity, and both are in relatively early stages of their BIM maturity. As such, it is meaningful to compare what value BIM is generating for users on projects in both regions.

The charts show the percentage of users reporting high or very high levels of these six process-related benefits and three outcome-related benefits in each region. Although these regions are on opposite sides of the world and are vastly different in many ways, there is remarkable parity in the overall responses.

- The comparison shows somewhat higher percentages in the Middle East than in China for all the benefits, except faster approval cycles, which may be a function of external process challenges that BIM cannot effectively improve.
- The most highly cited benefit in China (69%) is reduced errors and omissions in construction documents, and the same percentage of Middle East users agree. This is a critical upstream benefit that can have a positive effect throughout the rest of a project. It commonly reduces coordination problems and rework, and thereby enables better cost control/predictability, each of which also rate well in both regions.
- The largest differential in responses occurs with users citing increased efficiency through collaboration with owners or other team members. This could well be due more to cultural differences than true variations in the value of BIM.
- The three benefits related to improved project outcomes (safety, project duration and final construction cost) score lowest among users in both regions, underscoring the difficulty, especially in early years of BIM implementation, of being able to sufficiently correlate BIM use directly to these downstream metrics. As implementation expands and users complete more BIM projects, these ratings can reasonably be expected to improve in both regions.

Project Process Benefits of BIM (BIM Users in the Middle East and China Reporting High Degree of Benefit)

Dodge Data & Analytics, 2017 China Data: The Business Value of BIM in China, SmartMarket Report, Dodge Data & Analytics, 2015

📕 Middle East 📃 China

Increased Efficiency Through Collaboration With Owners or Other Team Members

71% 54% **Reduced Field Coordination Conflicts During Construction** 70% 57% **Reduced Errors and Omissions in Construction Documents** 69% 69% Reduced Rework 64% 55% Better Cost Control/Predictability 57% 46% Faster Client Approval Cycles 52% 63%

Project Outcome Benefits of BIM (BIM Users in the Middle East and China Reporting High Degree of Benefit)

Dodge Data & Analytics, 2017 China Data: The Business Value of BIM in China, SmartMarket Report, Dodge Data & Analytics, 2015





International Comparisons **International Comparisons** CONTINUED

Acceptable Levels of Trade Contractor BIM Skill

As BIM use matures, general contractors increasingly rely on the BIM skills of trade contractors for spatial coordination, fabrication modeling and prefabrication. Finding an adequate supply of BIM-capable trade contractors is a frequent challenge in all markets in which Dodge has conducted BIM research.

In this and other Dodge studies, general contractors were asked to identify in which trades they find acceptable levels of BIM skills in at least half of the firms they work with. The chart shows how the Middle East compares with China, Australia and a combined total of eight other regions (Brazil, Canada, France, Germany, Japan, South Korea, UK and USA).

- Mechanical contractors are consistently reported through all Dodge research as the most likely to be BIM-capable practitioners. A significantly higher percentage of general contractors working in the Middle East cite this finding than in any other region studied.
- The Middle East also appears to boast an aboveaverage number of curtain wall fabricators/installers with BIM skills. This may be helped by the high proportion of glass-clad structures in the region.
- In contrast, there appears to be a shortfall in the number of BIM-capable steel fabricators/erectors, which are typically the second-highest trade reported for BIM skill in Dodge research studies. This points to a need for BIM penetration in that specialty and an opportunity for skilled practitioners to enter or expand in the region.
- The Middle East appears to be about at parity with all the other regions for the number of electrical, civil and concrete trades with acceptable BIM capabilities.

Trade Contractors With An Acceptable Level of BIM Expertise (According to General Contractors in the Middle East, China, Australia and 8 Other Global Regions)

Dodge Data & Analytics, 2017 China Data: The Business Value of BIM in China, SmartMarket Report, Dodge Data & Analytics, 2015 Australia Data: The Business Value of BIM in Australia and New Zealand, SmartMarket Report, Dodge Data & Analytics, 2014 Other Country Data: The Business Value of BIM for Construction in Major Markets, SmartMarket Report, Dodge Data & Analytics, 2013

Middle East China Australia 8 Other Global Regions*

* 8 Other Global Regions: Average of Brazil, Canada, France, Germany, Japan, South Korea, UK and USA

Mechanical/Sheet Metal/Plumbing



International Comparisons

Positive ROI

Because there is no internationally accepted standard for calculating ROI (return on investment) for BIM, Dodge asked BIM users to select a range they feel best represents the level of return on their investments. The chart shows the percentage of users in the Middle East who selected a positive range (i.e., anything other than negative or break-even), compared with users in China and Australia, also divided between designer and contractor users.

- It typically takes time for BIM users to amortize their initial investments and feel they are making a positive return. So the length of time BIM has been in use in a given region usually directly affects the responses. As such, it is not surprising that Australia leads.
- The Middle East, however, has a markedly higher positive response than China, although both regions are in relatively early stages of BIM maturity. This is a positive sign for users in the Middle East, and seeing a positive return is being achieved by almost two thirds of current users may help to encourage non-users to adopt BIM.

Non-User Attitudes

Dodge asks those who are not currently using BIM to select the statement that best represents their attitude about BIM. Comparing the findings from the Middle East and China is meaningful because of their relatively similar stages of BIM maturity, where bringing in new users is critical to maintaining implementation momentum. The chart compares non-user responses in China and the Middle East.

- There is near parity between the groups that are not interested in BIM and those that are essentially neutral, saying they are open but not taking a position on its value.
- Where the regions diverge markedly is among those who feel BIM is valuable. In China the vast majority (8:1 ratio) report that they are actively evaluating BIM. In the Middle East, however, the opposite is true. Most non-users who say they believe it is valuable have not begun evaluating it. Although there are pockets of high activity, such as the UAE, this finding is a less encouraging sign for robust growth of BIM in the Middle East.

BIM Users Reporting a Positive ROI for BIM

(Middle East Compared With China and Australia)

Dodge Data & Analytics, 2017 China Data: The Business Value of BIM in China, SmartMarket Report, Dodge Data & Analytics, 2015 Australia Data: The Business Value of BIM in Australia and New Zealand, SmartMarket Report, Dodge Data & Analytics, 2014



Non-Users Attitudes About BIM (Middle East Compared With China)

Dodge Data & Analytics, 2017 China Data: The Business Value of BIM in China. SmartMarket Report, Dodge Data & Analytics, 2015



*Note: Results do not include Non-Users who have used BIM but decided not to use it anymore.

Methodology:

Building Information Modeling in the Middle East Research

THE BUSINESS VALUE OF BIM IN THE MIDDLE EAST

Dodge Data & Analytics conducted the 2016 Building Information Modeling in the Middle East survey to examine the use of BIM by design and construction firms.

The research included firms in the following countries: Bahrain, Egypt, Jordan, Kuwait, Lebanon, Oman Qatar, Saudi Arabia and United Arab Emirates (UAE). The research in this report was conducted through an online survey of construction and architecture firms between August 19 and November 24, 2016. The survey was open to all design and construction firms regardless of BIM use.

Definition of BIM Use in the Survey

In the survey, respondents were told that BIM refers broadly to the creation and use of digital models and related collaborative processes between companies to leverage the value of the models.

- Respondents who indicated that they are either authoring models, using models or doing both were noted as BIM users.
- Respondents who noted they were not engaged with BIM at all were noted as non-users of BIM.

Each group answered different questions about BIM and its use in the Middle East.

Survey Participants

The survey had 138 complete responses. The respondents' firms had to be involved in design (architecture, engineering, design consultant or planning firm), or construction (multidisciplinary firms [A/E, A/E/C, design build], general or trade contractors or construction management) to participate. Firms had to be involved with building architecture or interiors, infrastructure or industrial projects.

CLASSIFICATION OF BIM USERS AND NON-USERS

Of the respondents, 118 were classified as BIM users and 20 as non-users of BIM. The small sample of non-users, while not statistically significant, was included to get an idea of why some firms do not use BIM and what might lead such nonusers to begin working with it.

MARGIN OF ERROR

The use of a sample to represent a true population is based on the firm foundation of statistics. The sampling size and technique used in this study conform to accepted industry research standards expected to produce results with a high degree of confidence and low margin of error. The total sample size (138) used in this sample benchmarks at a 95% confidence interval with a margin of error (MOE) of 8.34% for the entire sample and a 9% MOE for BIM users.

Variables Used in the Analysis

ROLE

In the analysis in the report, all respondents were divided into two groups, based on whether they were primarily involved with design or construction.

- 96 respondents involved primarily with design
- 42 respondents involved primarily with construction

LOCATION

Respondents were divided into three groups for analysis based on the location of the office in which they primarily work.

- 47 are in offices in Saudi Arabia
- 50 are in offices in the UAE
- 41 are in offices in the other seven countries in the region (Bahrain, Egypt, Jordan, Kuwait, Lebanon, Oman and Qatar)

This analysis allows for comparison of activity in Saudi Arabia and the UAE against overall regional trends.

Comparisons With Other Regions

The final data section of the report includes comparisons of the overall findings from the Middle East with data from previous BIM studies conducted by Dodge Data & Analytics:

- Business Value of BIM for Construction in Major Global Markets SmartMarket Report (2014), which includes data on BIM use by contractors in 10 countries (Australia, Brazil, Canada, France, Germany, Japan, Korea, New Zealand, United Kingdom, United States)
- Business Value of BIM in Australia and New Zealand SmartMarket Report (2014)
- Business Value of BIM in China SmartMarket Report (2015)

SmartMarket Report

Resources

Organizations that can help you get smarter about the use of BIM in general, and in the Middle East in particular.



Dodge Data & Analytics

Main Website: construction.com Dodge: construction.com/dodge Research & Analytics: construction.com/dodge/ dodge-market-research.asp Sweets: sweets.com SmartMarket Reports: analyticsstore.construction.com

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www.autodesk.com/bim

Contributing Partner

Pinnacle Infotech: www.pinnaclecad.com

Research Partners

AIA Middle East: www.aiamiddleeast.org bnc: www.bncnetwork.net/home the BIM Hub: https://thebimhub.com/ CG/LA Infrastructure: www.cg-la.com Sanveo: www.sanveo.com

Other Resources:

Abu Dhabi Quality and Conformity Council: https://qcc.abudhabi.ae/en/Pages/default.aspx#Quick_links_TAB3 BIMForum: http://bimforum.org/ bimSCORE: www.sbi.international BIM Task Group (UK): www.bimtaskgroup.org BSI Middle East and Africa: www.bsigroup.com/en-AE buildingSMART International: http://buildingsmart.org/ Construction IT Alliance (CitA): www.cita.ie Emirates BIM User Group: Bit.ly/Emirates_BIM_User_Group Horizon 2020 Smart Cities: https://ec.europa.eu/digital-single-market/en/about-smart-cities Middle East BIM Summit: http://mebimsummit.com/ NBS National BIM Library: www.nationalbimlibrary.com Qatar BIM User Day: www.bimuserday.com RICS (Royal Institute of Charted Surveyors): www.rics.org

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