SEPTEMBER 20, 2013 | 08:00 AM

The Business Value of BIM in North America

Multi Year Trend Analysis and User Ratings (2007 – 2012)

The Future Is Now: Alternative Project Delivery

AIA AAJ **NATIONAL CONFERENCE**

PORTLAND, OR | SEPTEMBER 18–21 **2013**

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Course Description

BIM usage has grown dramatically in the last five years. During the presentation we will highlight McGraw-Hill findings on the type and locations of the predominant users, what benefits they are receiving and what the impact will be on the industry going forward.

Learning Objectives

1. The program will help attendees establish a benchmark of BIM usage, and get a sense of where their organization falls amongst their peers.
2. The program will help attendees determine how BIM is being applied across different professions within the industry.
3. The program will help attendees recognize specific applications.
4. The program will help attendees anticipate usage as they work in different geographical areas.

Presenter:

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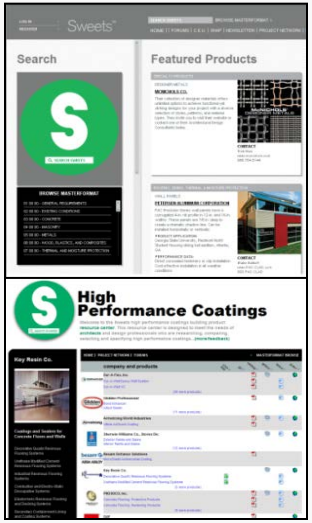
McGraw Hill Construction

- World's leading source of information about the construction industry (www.construction.com)

Engineering News-Record
(ENR)
Leading global construction industry magazine

Dodge
Leading source of data, forecast and analysis about global construction

Sweets
Leading source of information about building products



Architectural Record
Leading global architecture magazine

Agenda

Highlights of BIM Research

- Adoption, Implementation, Tipping Point
- Investments, ROI and Benefits
- Challenges

Impact and Emerging Trends

- Visualization, Analysis, Simulation
- Digital Fabrication
- Integrated Processes
- Lifecycle

SmartMarket Reports on Business Impact of Technology

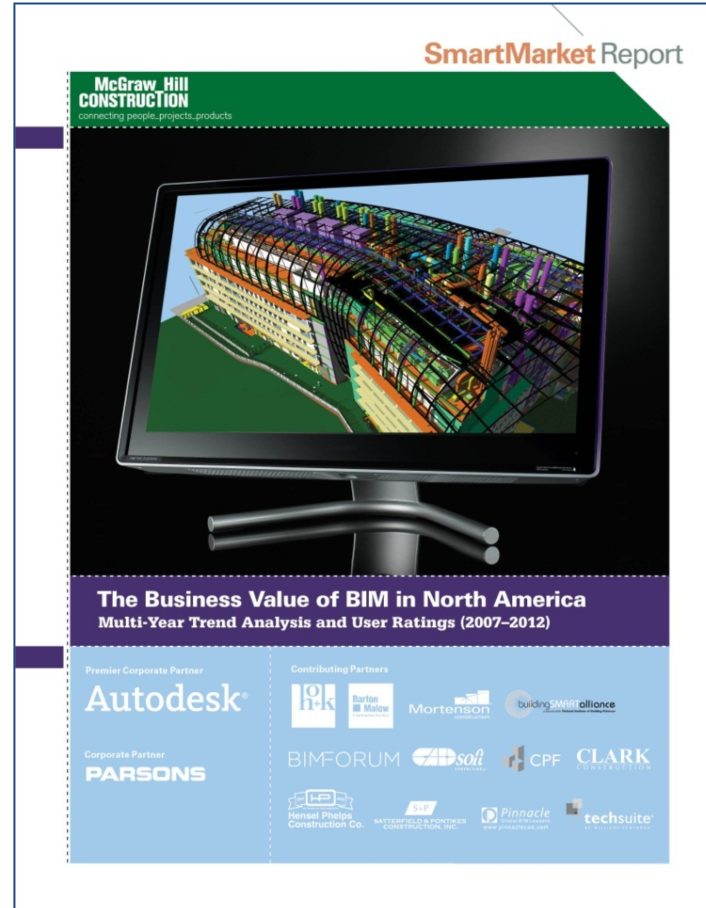
- 2007: Interoperability
- 2008: Building Information Modeling
- 2009: The Business Value of BIM
- 2009: BIM in China
- 2010: Green BIM
- 2010: BIM in Europe
- 2012: BIM for Infrastructure
- 2012: BIM in Korea

Free Download: construction.com/market_research

SmartMarket Report on BIM in North America

Newest BIM report:

- January 2013
- Multi-year BIM trends
  - 2007 to 2014 forecast
- New features:
  - BIM Engagement index
  - User Ratings for BIM processes and activities

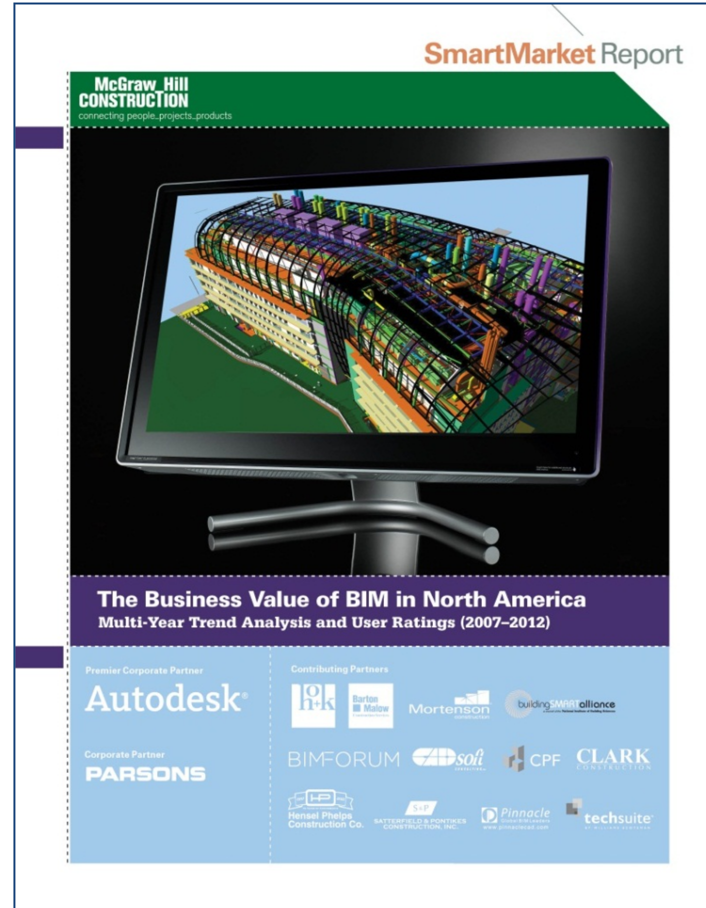


SmartMarket Report on BIM in North America

Sponsored by 14 industry leaders:

- Premier Partner: **Autodesk*******
- Corporate Partner: **Parsons**
- Contributing Partners:
  - **buildingSMART alliance******
  - **HOK*****
  - **Mortenson Construction****
  - **Barton Malow****
  - **BIMForum**
  - **CADSoft**
  - **Charles Pankow Foundation**
  - **Clark Construction**
  - **Hensel-Phelps**
  - **techsuite**
  - **Pinnacle Infotech**
  - **Satterfield & Pontikes**

* Have sponsored multiple MHC research reports



BIM Adoption, Implementation and Tipping Point

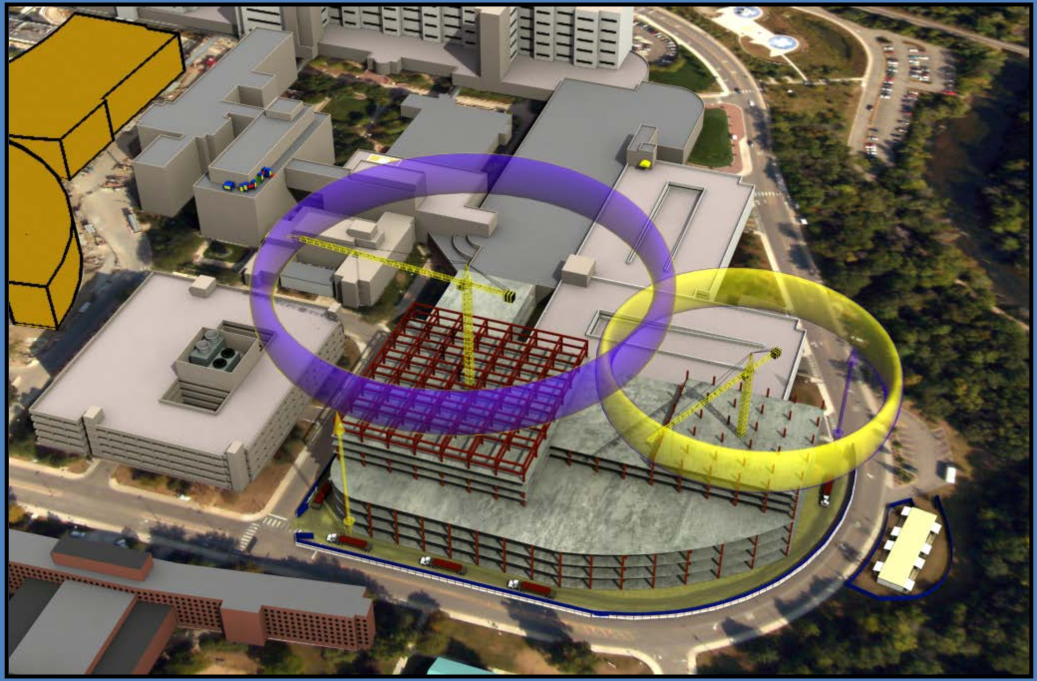


Image: Skanska

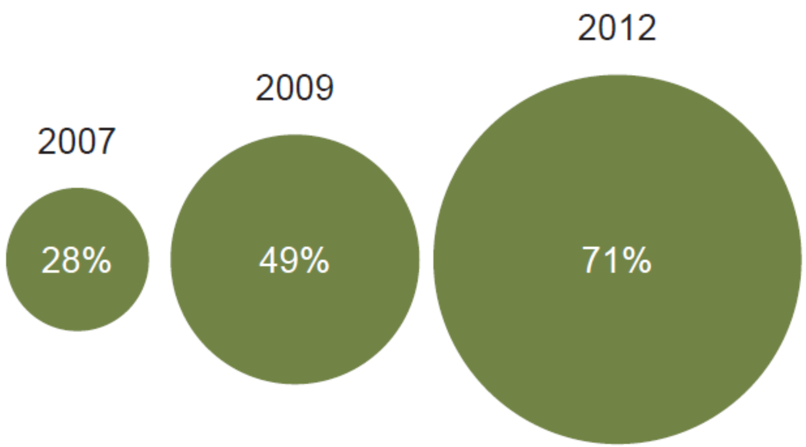
Definitions
of
BIM,
BIM Adoption
and
BIM User

For the purposes of this research:
"BIM" refers broadly to the creation and use of digital models and related collaborative processes between companies to leverage the value of the models.

- **"BIM"**
  - Consistent definition since 2007
  - Intended to differentiate from CAD
- "**BIM Adoption**"
  - Intentionally inclusive
  - Not just model authoring
  - Includes use of other's models or engagement with model-derived information
- "**BIM User**"
  - Currently engaged in some way with models or information derived from models on at least one project
  - Meant to indicate how many companies are engaging with BIM vs. relying solely on CAD

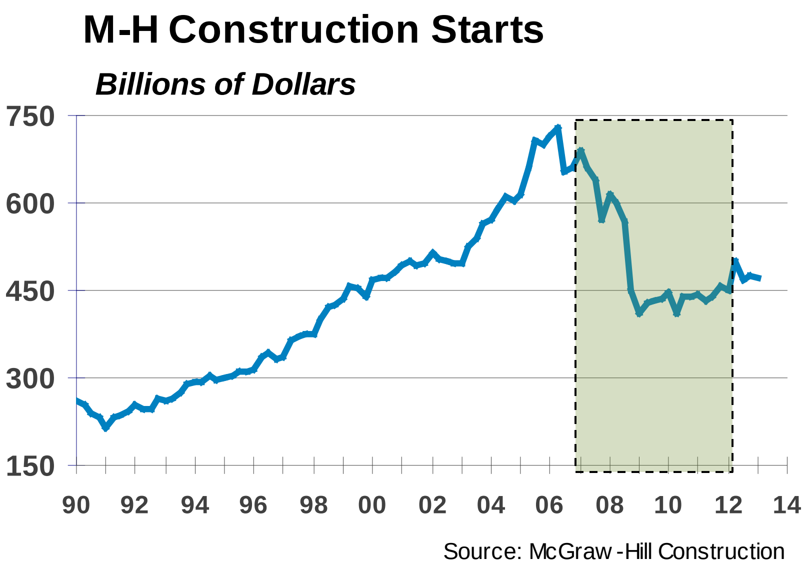
BIM Adoption: 2007, 2009 and 2012

- Overall Adoption of BIM has increased from 28% in 2007 to 71% in 2012
  - During a time of tremendous economic turmoil in AEC industry



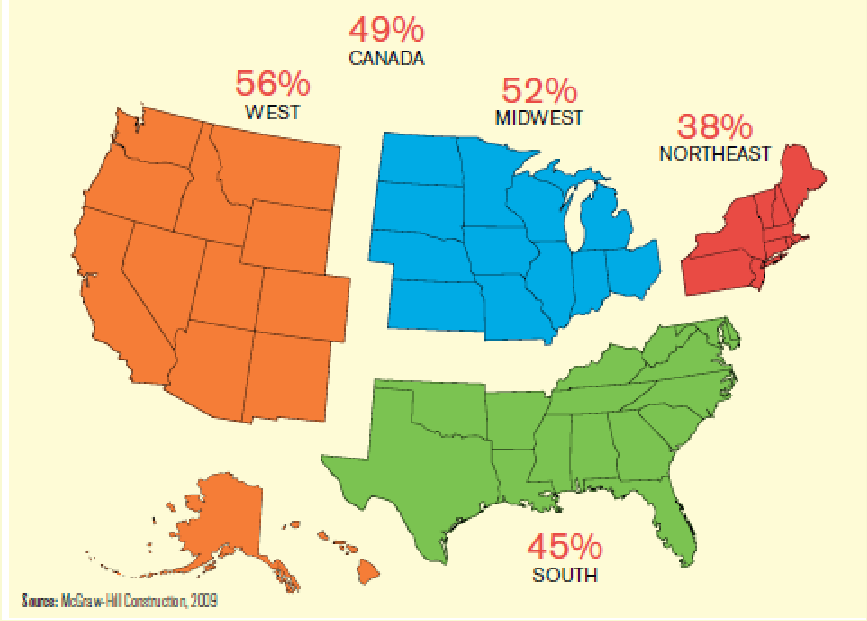
BIM Adoption in North America

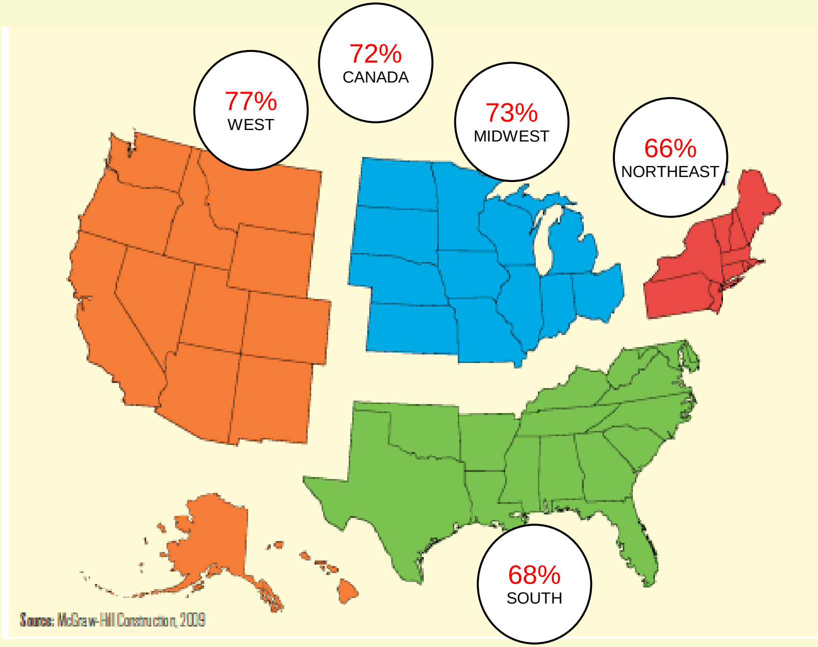
(Percentage of respondents that reported being currently involved with at least one BIM project)



Distribution of BIM Adoption by Region: 2009 and 2012

- 2009: Northeast lagged at 38%; West was leader at 56%; Total gap 18 %'ge points
- 2012: Northeast still lags but up by 28 points; Total gap now only 11 %'ge points



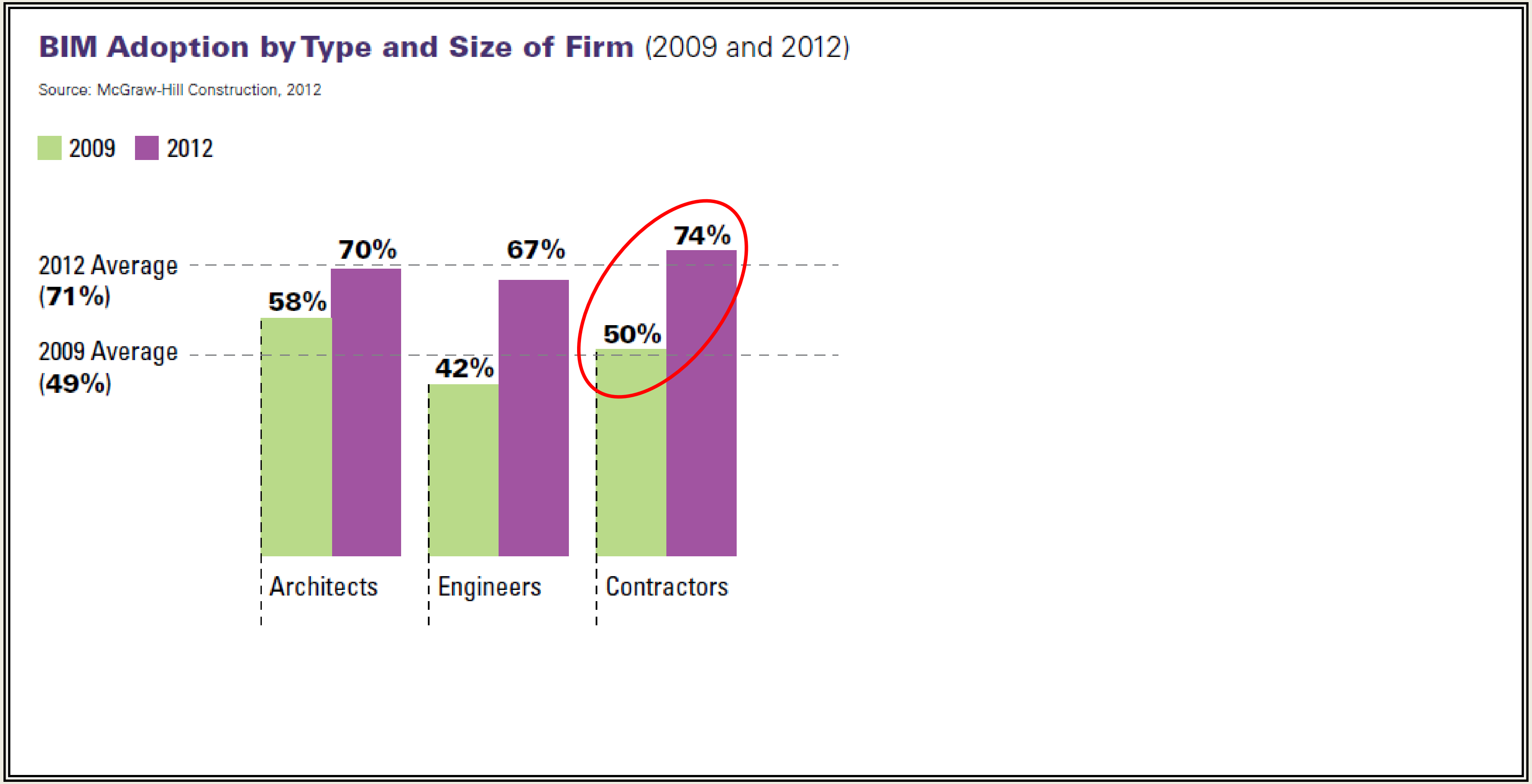


2009 North American Average:
49%

2012 North American Average:
71%

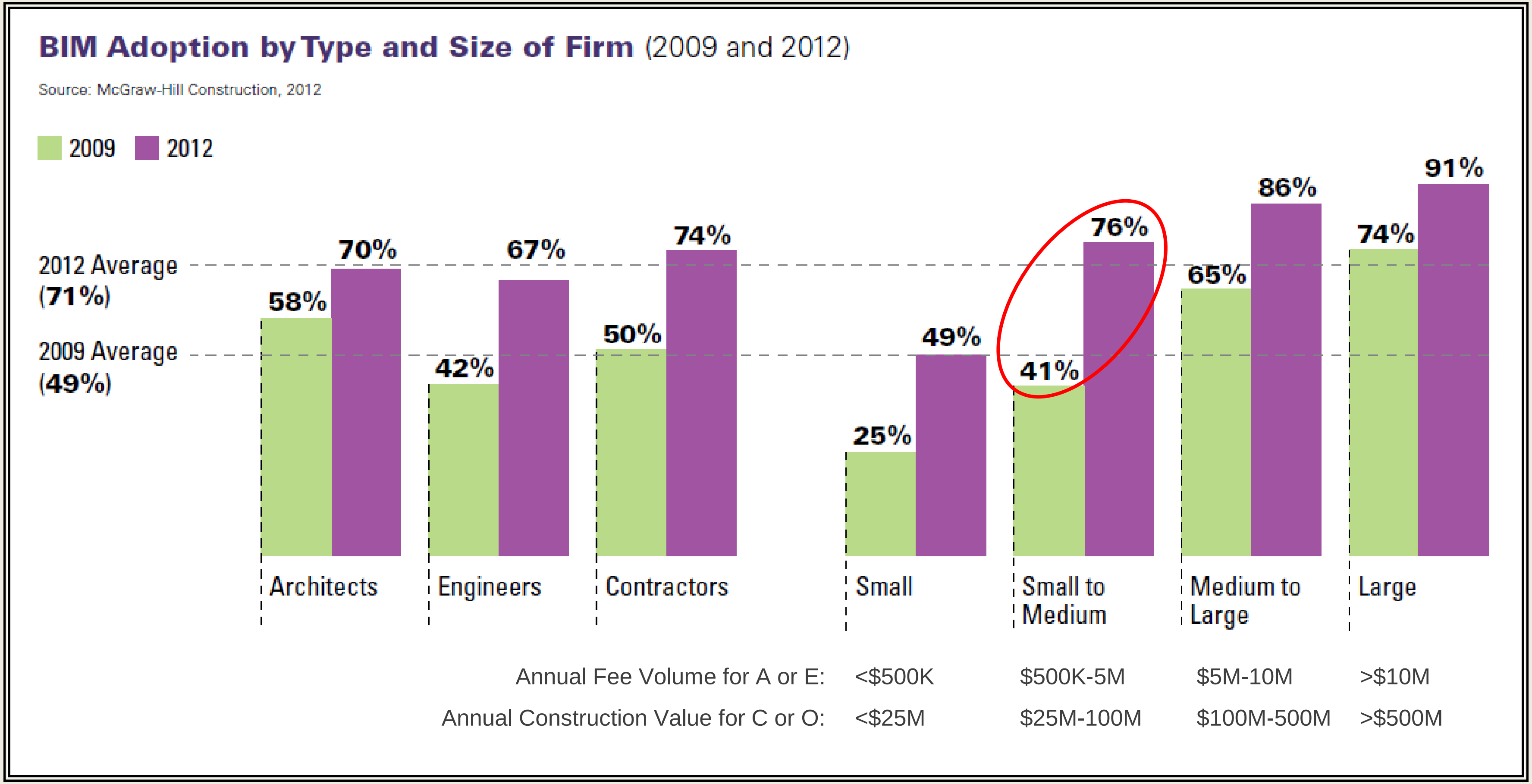
BIM Adoption by Company Type & Size: 2009 and 2012

- In 2009 Architects led adoption (56%)
- In 2012 Contractor adoption (74%) surpassed Architects (70%)



BIM Adoption by Company Type & Size: 2009 and 2012

- Larger firms have consistently led adoption
- Small-Medium category grew fastest since 2009; Small companies still trail leaders



BIM Implementation

"Implementation"

- **Percentage of a User's projects that involve BIM**
- **More meaningful metric than just Adoption**

Four Implementation Levels:	**Light** Users	**Medium** Users	**Heavy** Users	**Very Heavy** Users
Percent of Projects with BIM:	<15%	15 to 30%	30 to 60%	>60%

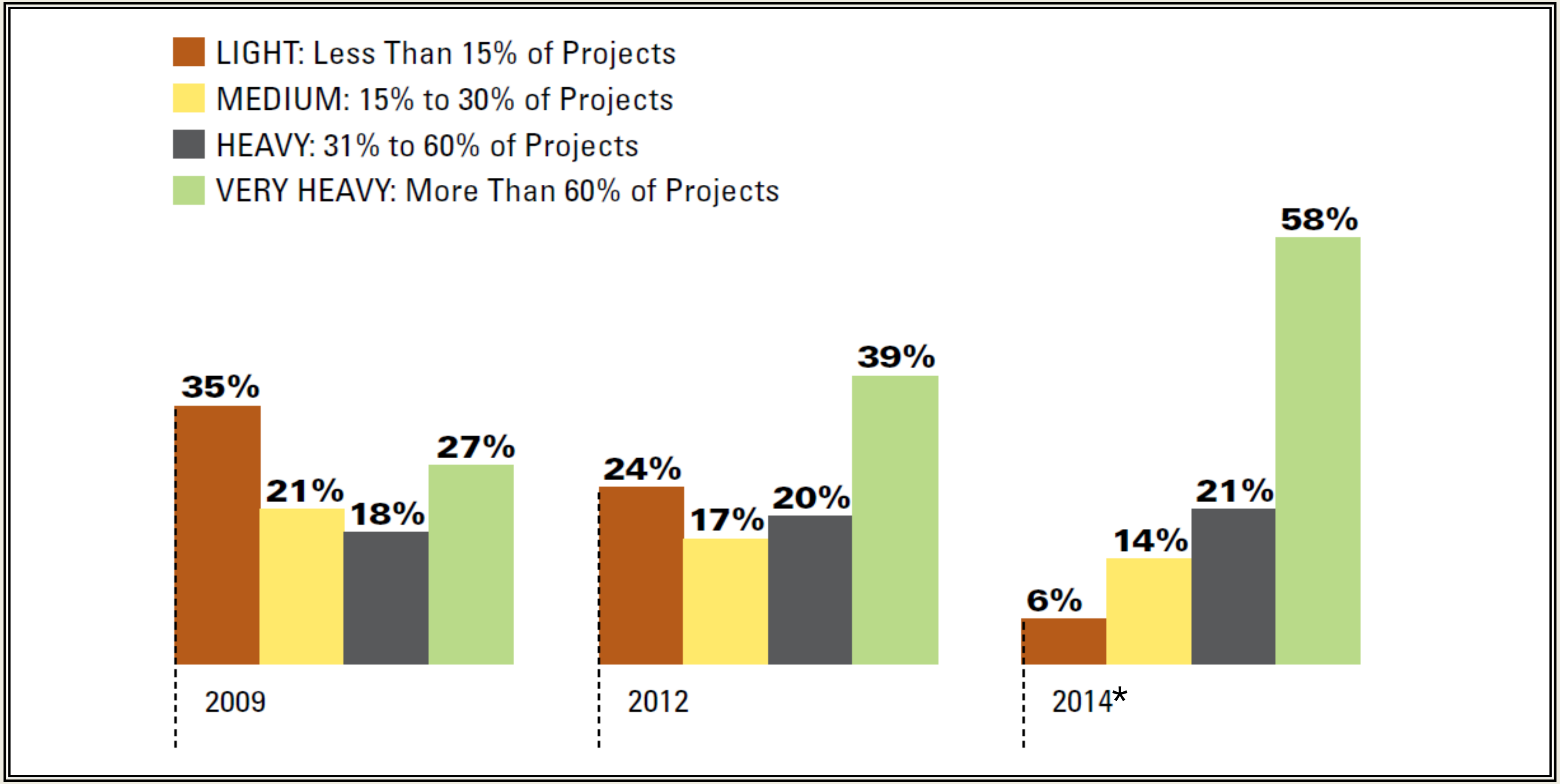
Levels signify commitment

- **Consider 'Very Heavy' Users (>60%) to be seriously committed to BIM**
- **Consider others to be still in development**

*User Forecast

BIM Implementation: 2009, 2012, 2014*

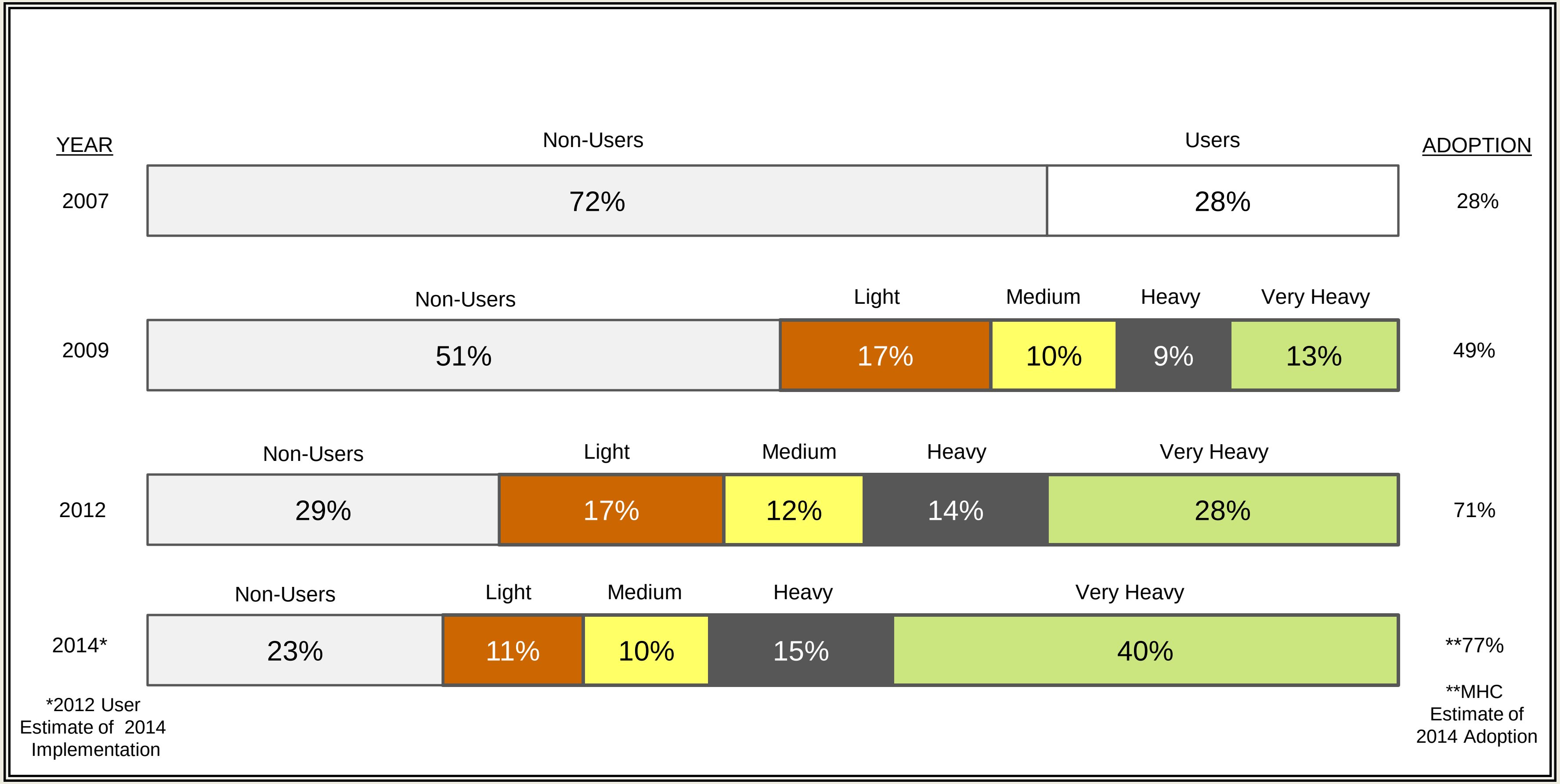
- BIM Users reported Implementation level in 2009 and 2012 research studies
- 2012 Users predicted their Implementation levels at end of 2014



*User Forecast

BIM Adoption and Implementation: 2007, 2009, 2012, 2014*

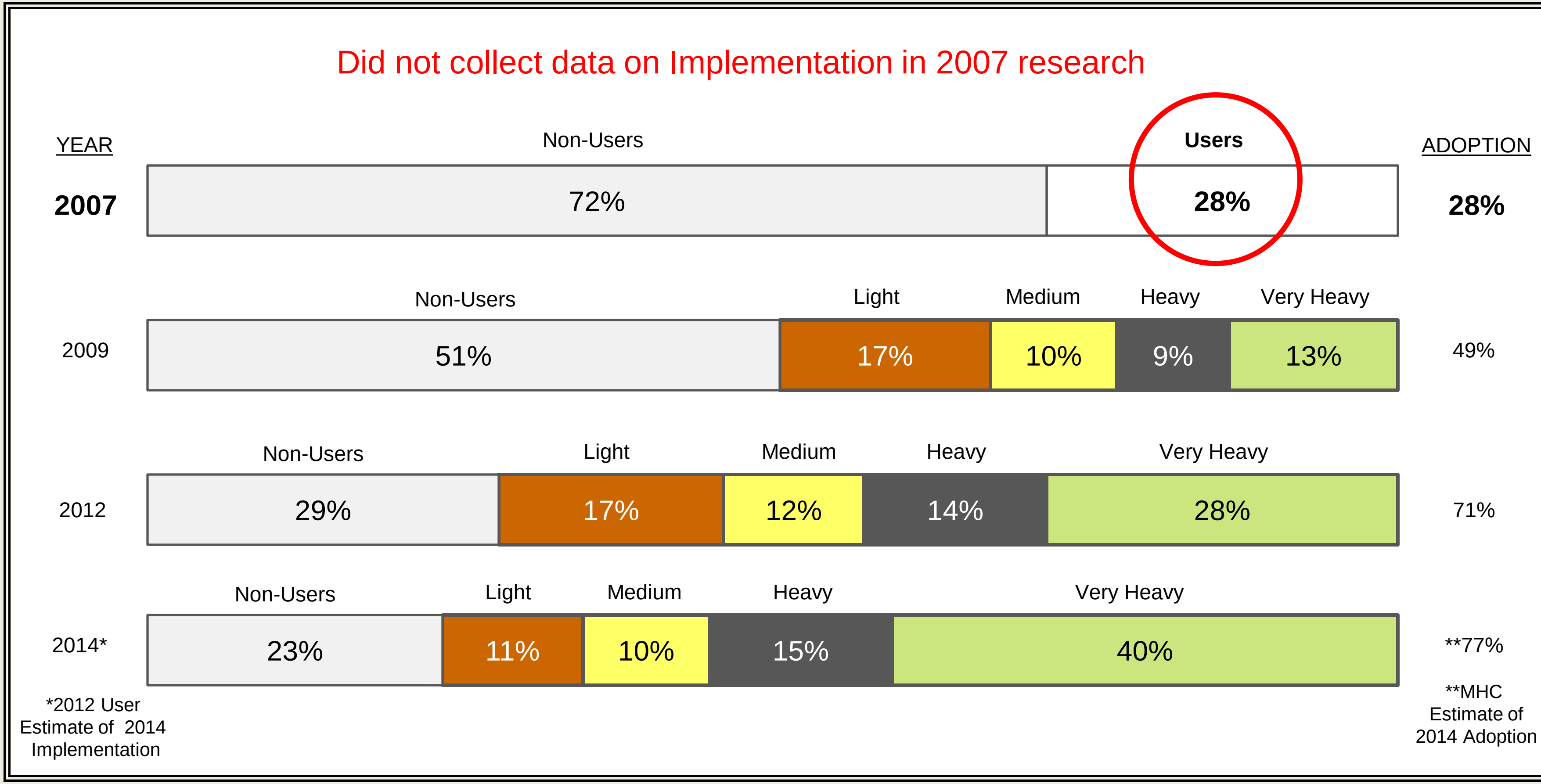
- Combine statistics for Adoption and Implementation for industry-wide picture



BIM Adoption and Implementation: 2007, 2009, 2012, 2014*

*User Forecast

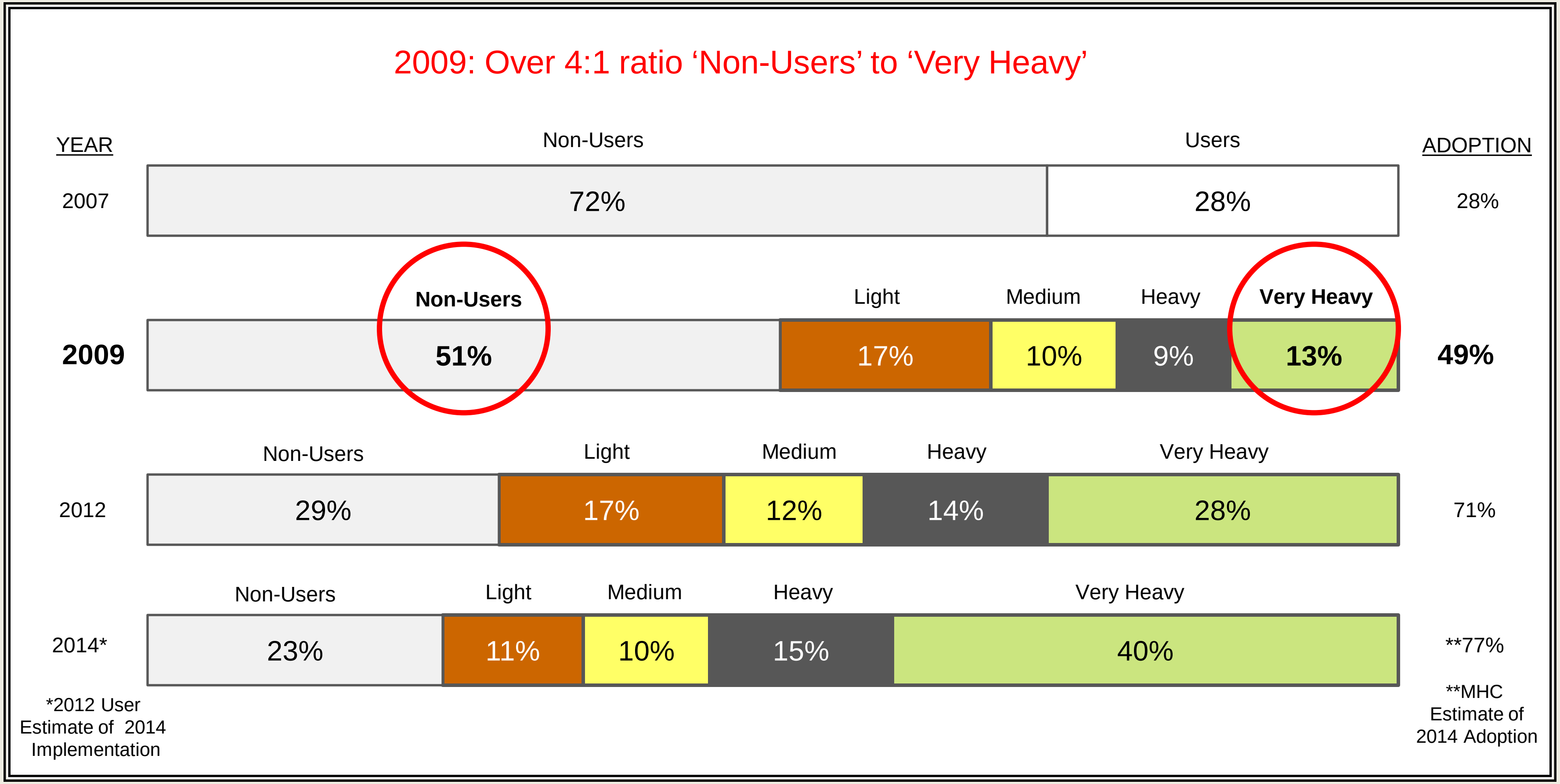
- **2007 Research:** Adoption-only



*User Forecast

BIM Adoption and Implementation: 2007, 2009, 2012, 2014*

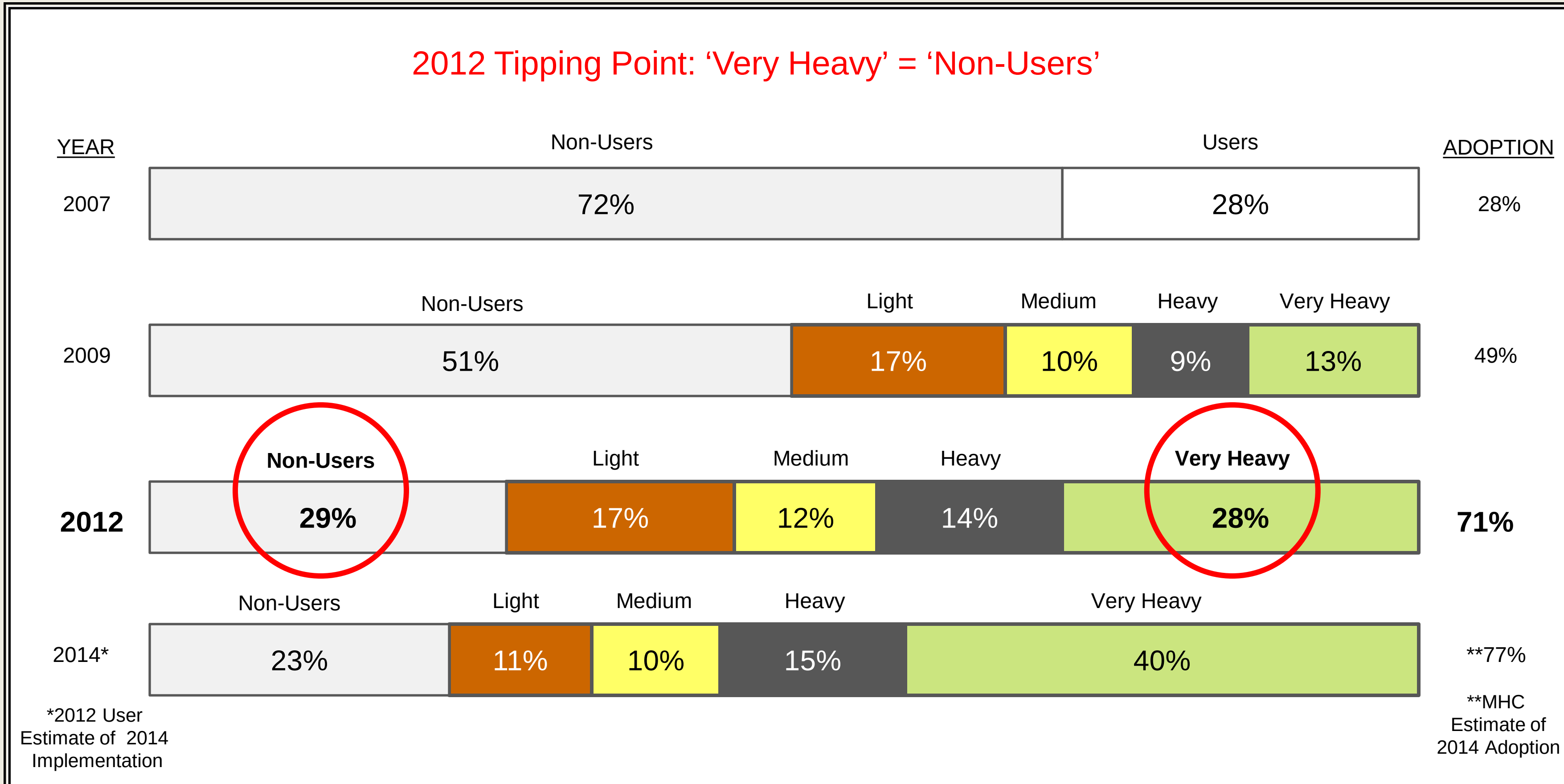
- **2009 Research**: 49% Adoption; but few at 'Very Heavy' Implementation level



BIM Adoption and Implementation: 2007, 2009, 2012, 2014*

*User Forecast

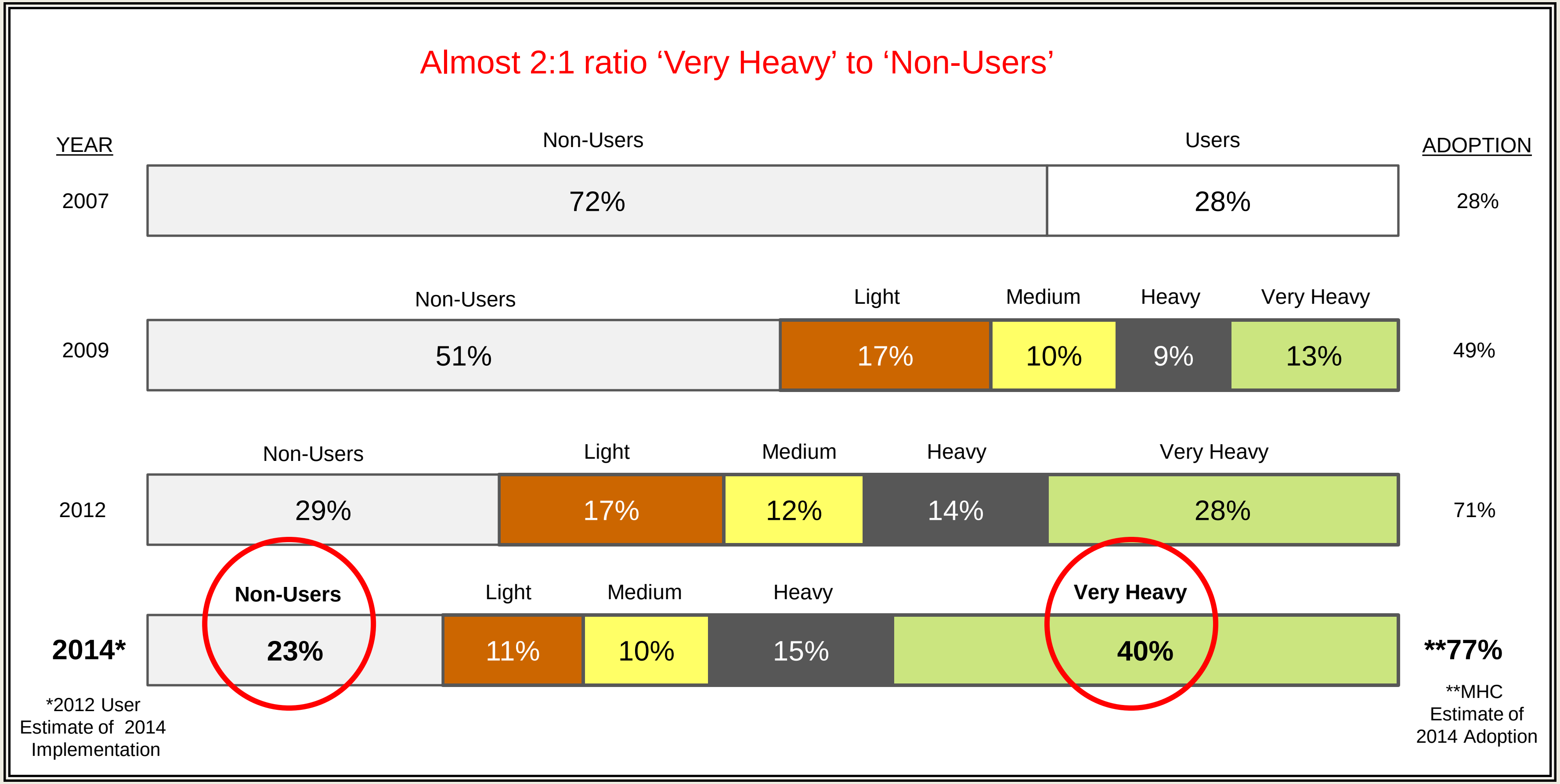
- **2012 Research**: 71% Adoption; 28% ‘Very Heavy’ and 29% ‘Non-Users’



BIM Adoption and Implementation: 2007, 2009, 2012, 2014*

*User Forecast

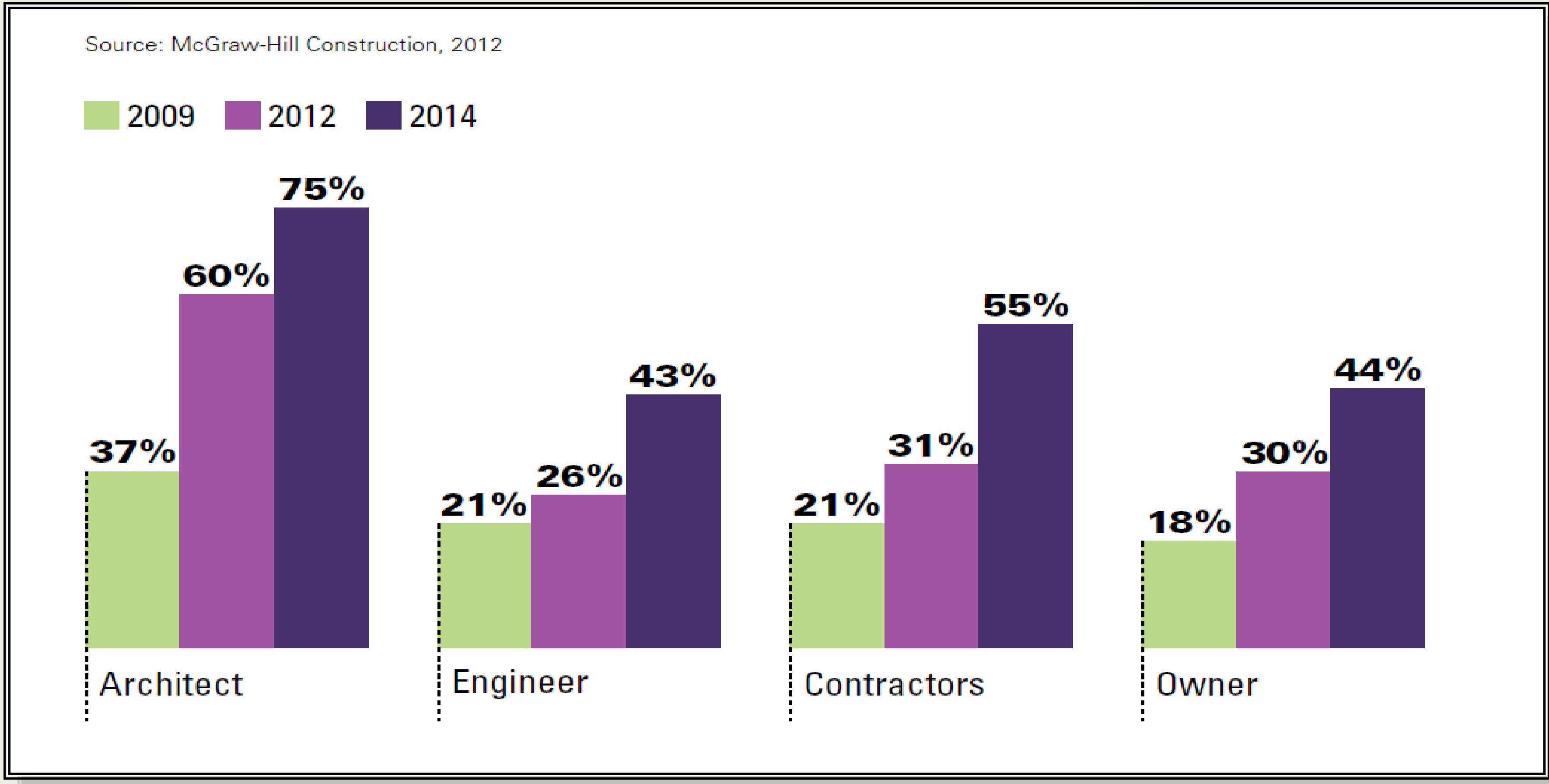
- **2014 Projection by Users**: Majority of Users will be at Very Heavy Implementation level
- As Adoption reaches a natural plateau, Implementation level will continue to increase



*User Forecast

Very Heavy Implementers by Company-type: 2009 to 2014*

- Architectural BIM users lead Very Heavy implementation: Been using longest



Summary

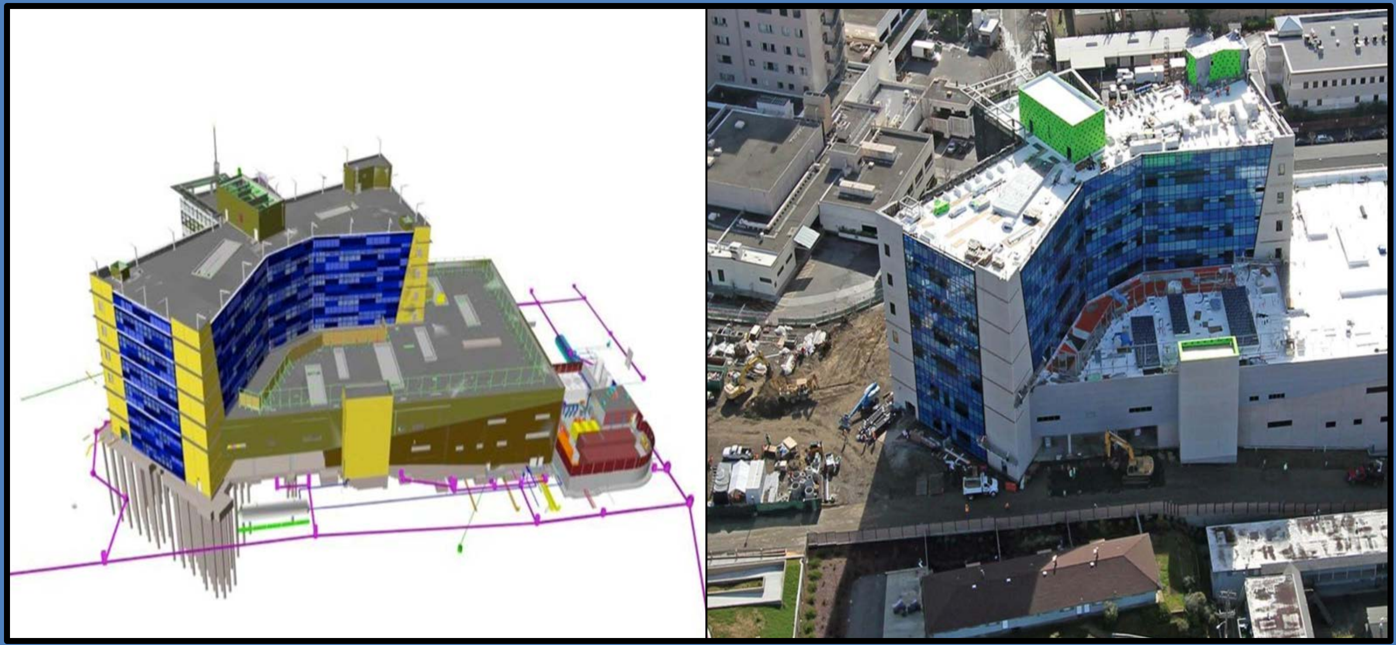
Adoption

- Up sharply in spite of economy
- Contractors surpassed Architects
- Forecast 77% Adoption 2014
- Small firms still <50% Adoption

Implementation

- Contractors advancing fastest
- Most Users ‘Very Heavy’ level by end of 2014

BIM Investments, ROI and Benefits

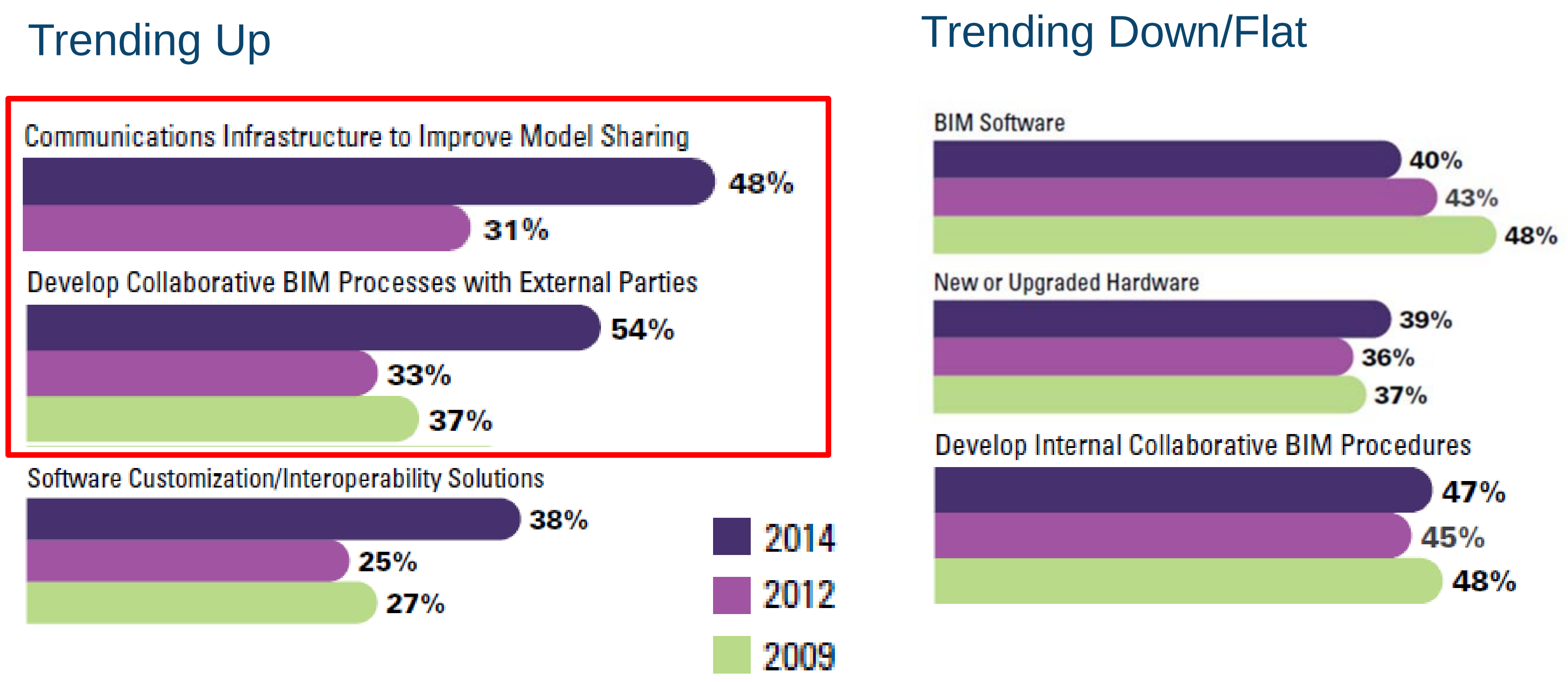


Images: DPR

*User Forecast

BIM Technology & Process Investments: 2009, 2012, 2014*

- Externally-facing Collaborative Infrastructure and Processes are fastest growing categories for 2014 investment



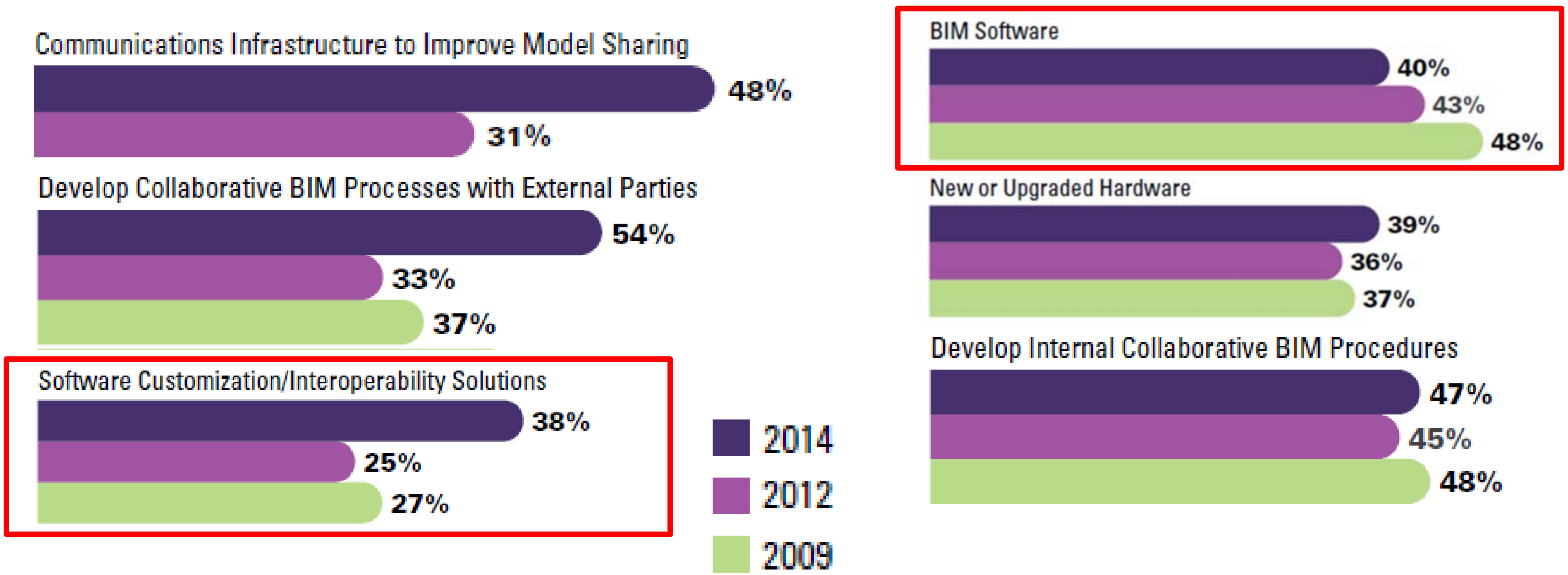
(Percentage of respondents that report making High or Very High level of investment in each category)

BIM Technology & Process Investments: 2009, 2012, 2014*

- Software investments steadily decreasing
- Software Customization/Interoperability Solutions will increase sharply

Trending Up

Trending Down/Flat



(Percentage of respondents that report making High or Very High level of investment in each category)

*User Forecast

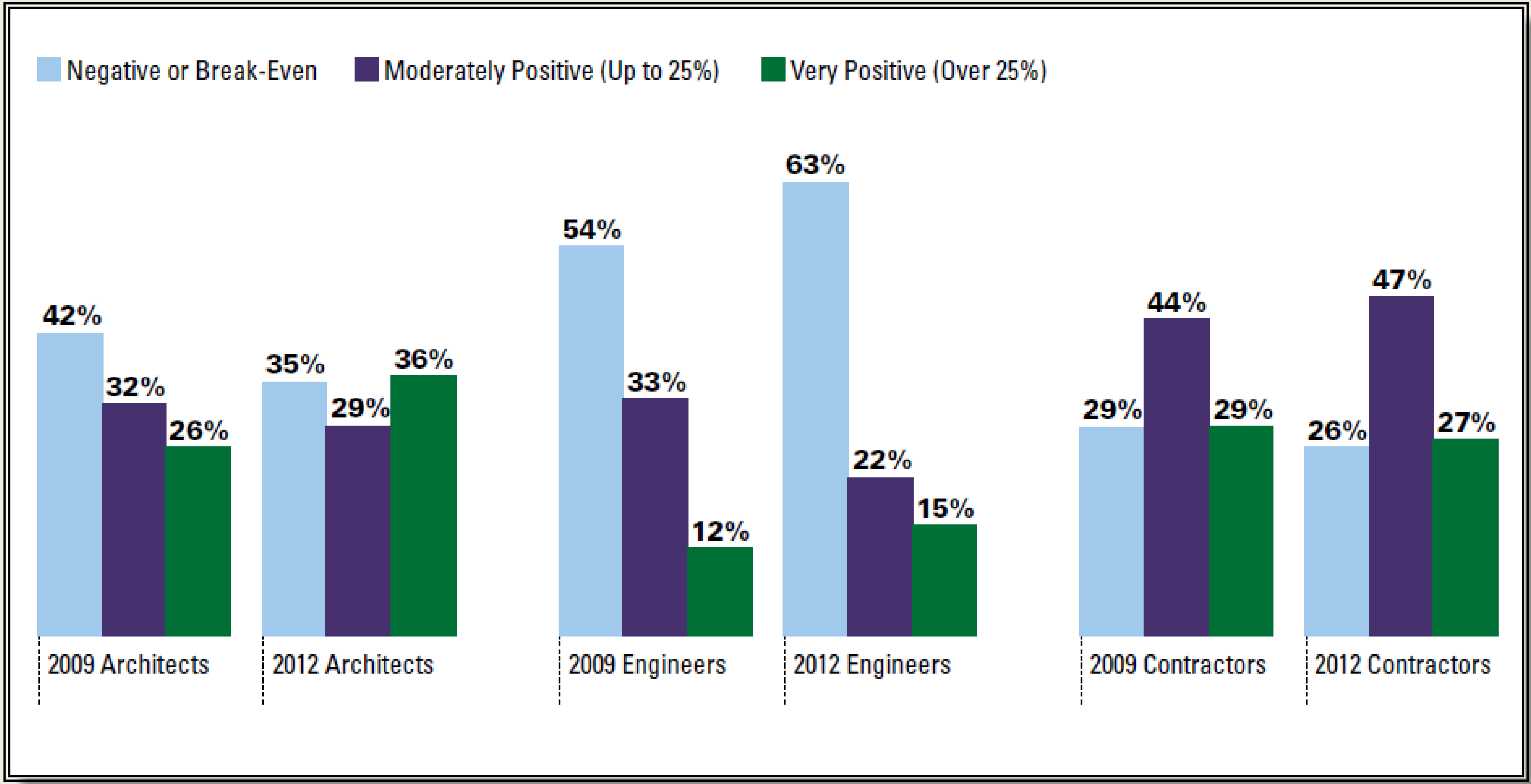
BIM Investments by Company-type: 2014*

- Planned BIM investments reflect stakeholder perspectives

Architects	Engineers	Contractors
1. Marketing Your BIM capability	1. Marketing Your BIM capability	1. Developing Collaborative Processes with External Parties
2. Communications Infrastructure to Improve Model Sharing	2. New or Upgraded Hardware	2. Marketing Your BIM Capability
3. Developing Collaborative Processes with External Parties	3. Developing Internal Collaborative BIM Procedures	3. BIM Training
4. Developing Internal Collaborative BIM Procedures	4. Developing Collaborative Processes with External Parties	4. Communications Infrastructure to Improve Model Sharing
5. BIM Software	5. Software Customization/ Interoperability Solutions	5. Developing Internal Collaborative BIM Procedures

Perceived ROI on BIM by Company-type: 2009, 2012

- Architects improved slightly
- Most mature users (65% positive)



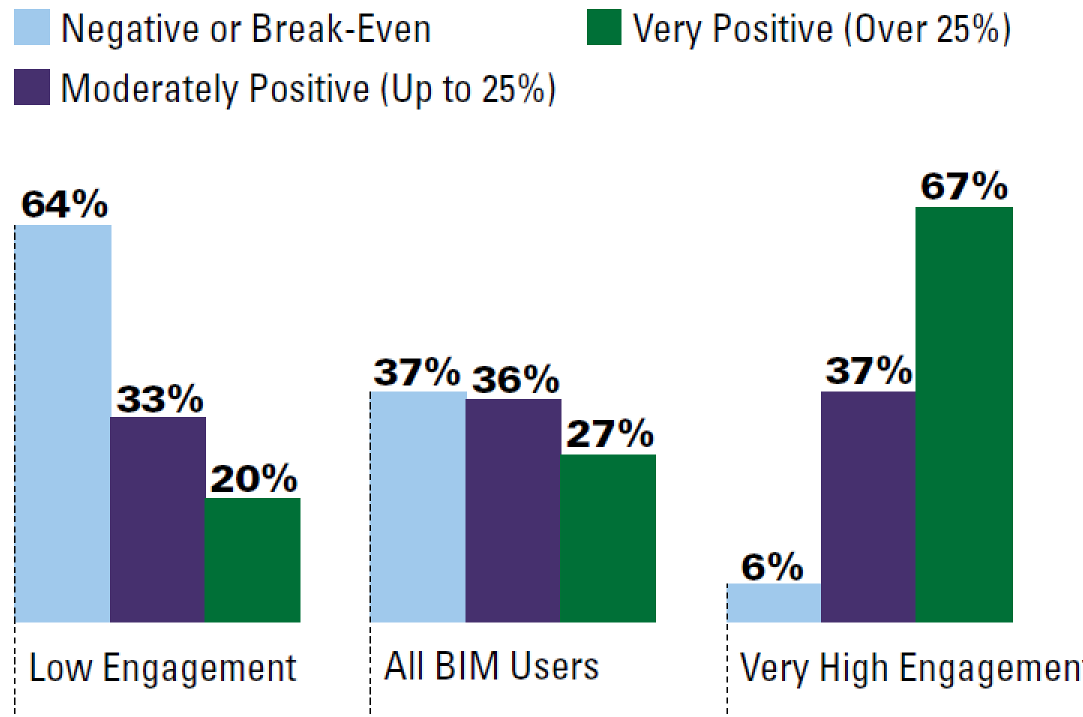
Perceived ROI on BIM by BIM Engagement level (E-level): 2012

- High-Engagement Users have best ROI (67% are Very Positive)
- Confirming evidence for benefit of commitment

Tiers of BIM Engagement (E-Level)	Percent of All Respondents in Each E-Level
Very High	13%
High	24%
Medium	32%
Low	31%

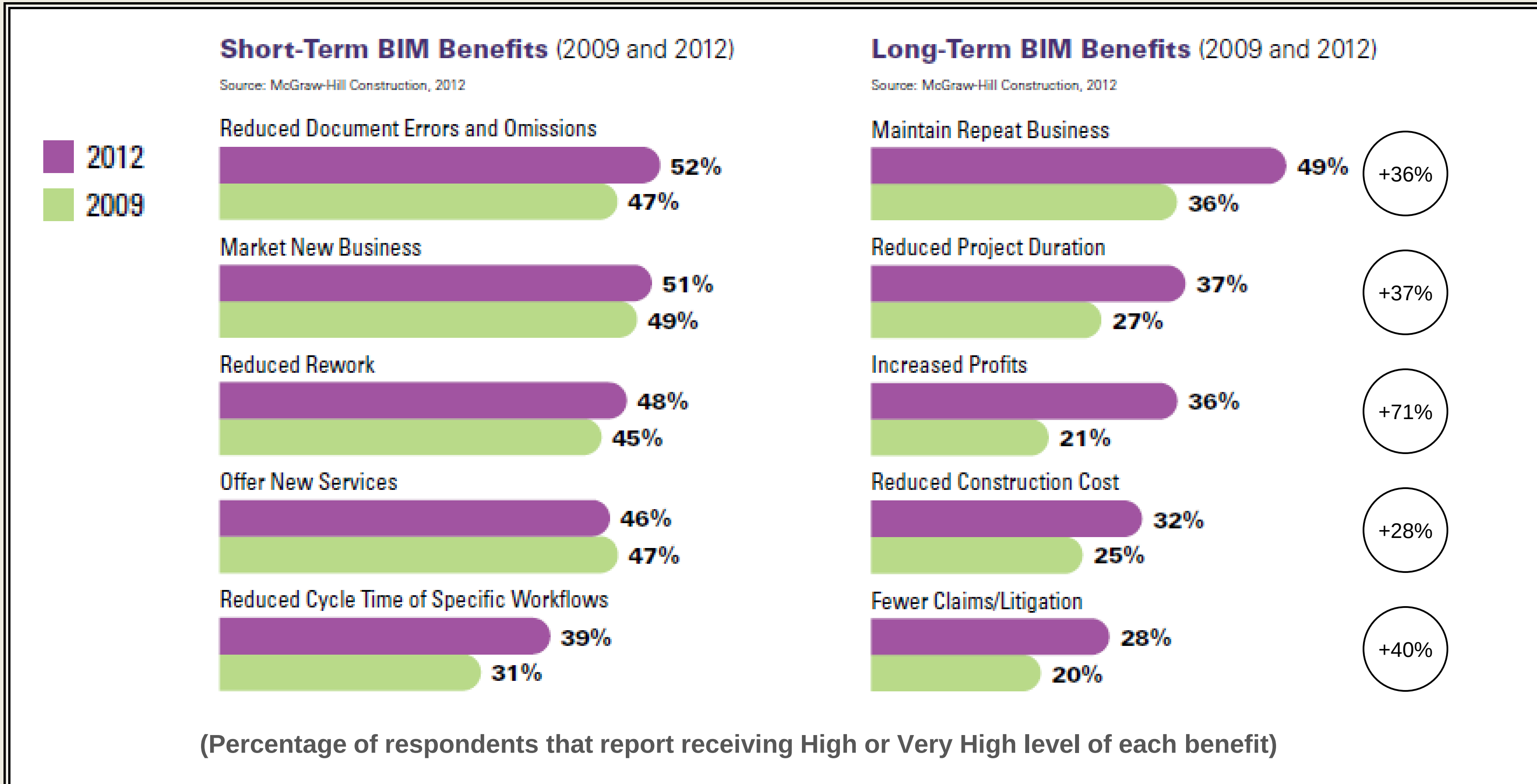
Very High BIM Engagement:
- >60% implementation
- Expert skill level
- > 5 years experience

Low BIM Engagement:
- <15% implementation
- Beginner/Moderate skill level
- 1-2 years experience



Benefits of BIM Use: 2009 and 2012

- Benefits which take longer to generate are now the fastest growing categories
- Confirming evidence for benefit of commitment



Benefits of BIM Use: 2012 Research

- Needs reflect perspective of each stakeholder

What factor will most increase your benefit of BIM?

- **Architects:**
  - More Owners asking for BIM
- **Engineers:**
  - Improved functionality of BIM software
- **Contractors and Owners:**
  - More clearly defined BIM deliverables between parties

Summary

Investments

- Externally-focused trending up
- Internally-focused flat or trending down

ROI

- Architects OK but flat
- Engineers suffering
- Contractors thriving

Benefits

- Long term benefits now fastest growing
- Users definitely getting Marketing/Bus Dev benefits

Challenges

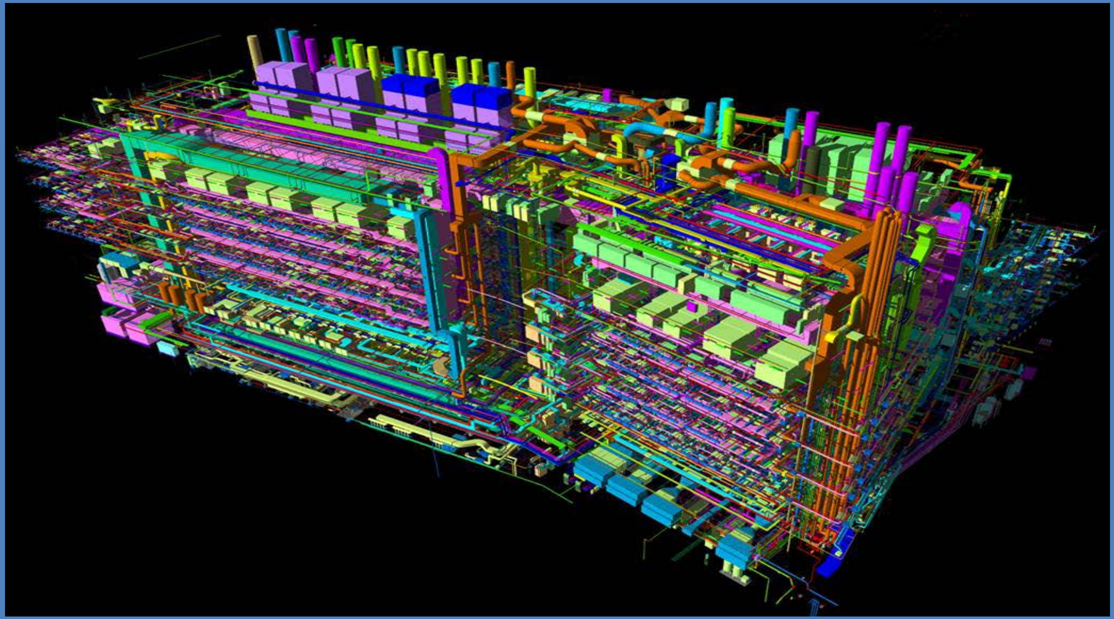


Image: HOK, PLP Architecture, AKT II, and Arup

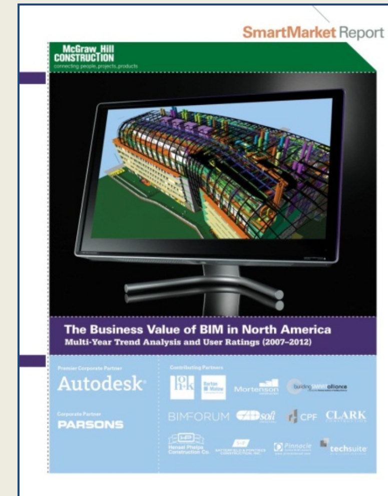
Challenges

- **BIM Functionality**
- **Benefit Parity**
- **Resistance**

BIM Functionality Challenges: Identified from 2012 User Ratings

- **User Ratings of Frequency, Value and Difficulty for 25 BIM Activities**
  - Users rated a list of BIM processes and activities that are appropriate to their project role
  - Gave three ratings to each on 1-10 scale:

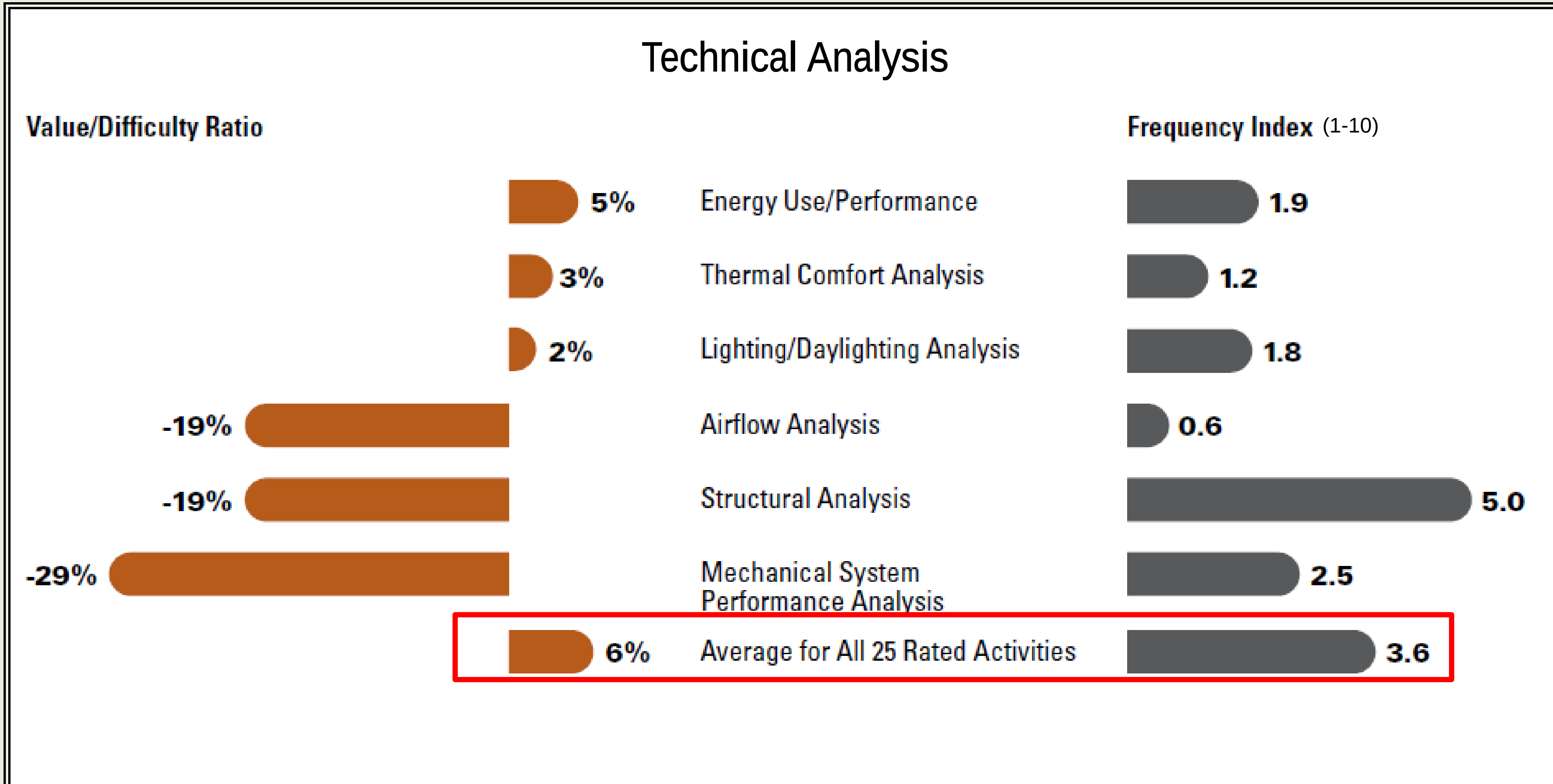
- **Frequency Index** represents how often BIM users engage in the activity or BIM is used for a process.
- **Value Index** represents the relative level of value that BIM users receive from the activity or the use of BIM for the process.
- **Difficulty Index** represents the relative degree of difficulty that BIM users face in achieving value from that activity or to use BIM for that process.



  - MHC calculated the Value/Difficulty Ratio = the "bang for the buck"
    - Positive Ratio is good; Negative Ratio is bad
    - Expect to see direct relationship of Value/Difficulty Ratio to Frequency

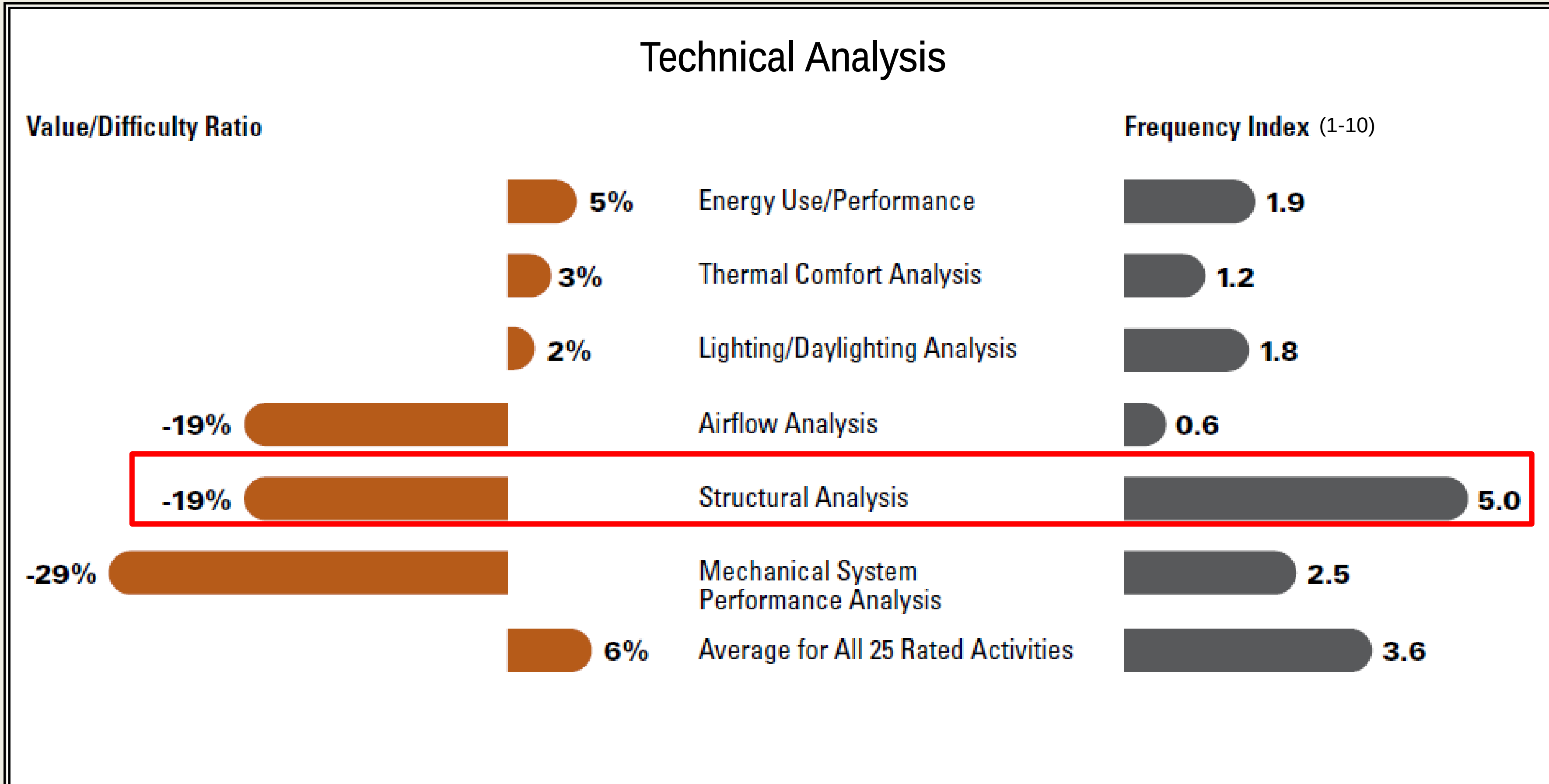
BIM Functionality Challenges: Technical Analysis

- **Technical Analysis** activities all rate lower than Average for Value/Difficulty
- Frequency Indexes are also generally below Average



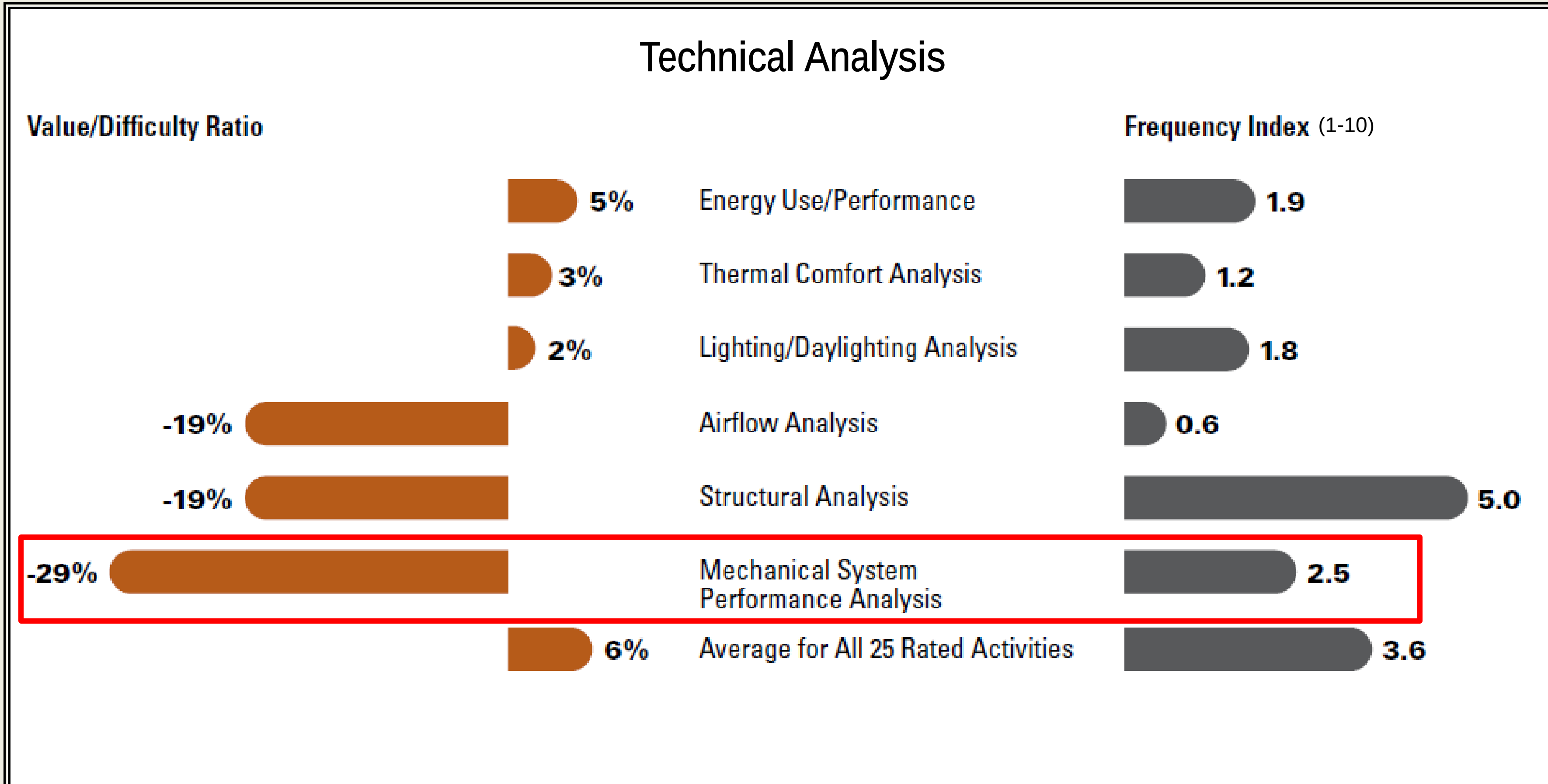
BIM Functionality Challenges: Technical Analysis

- **Structural Analysis** shows high Frequency vs. low Value/Difficulty Ratio



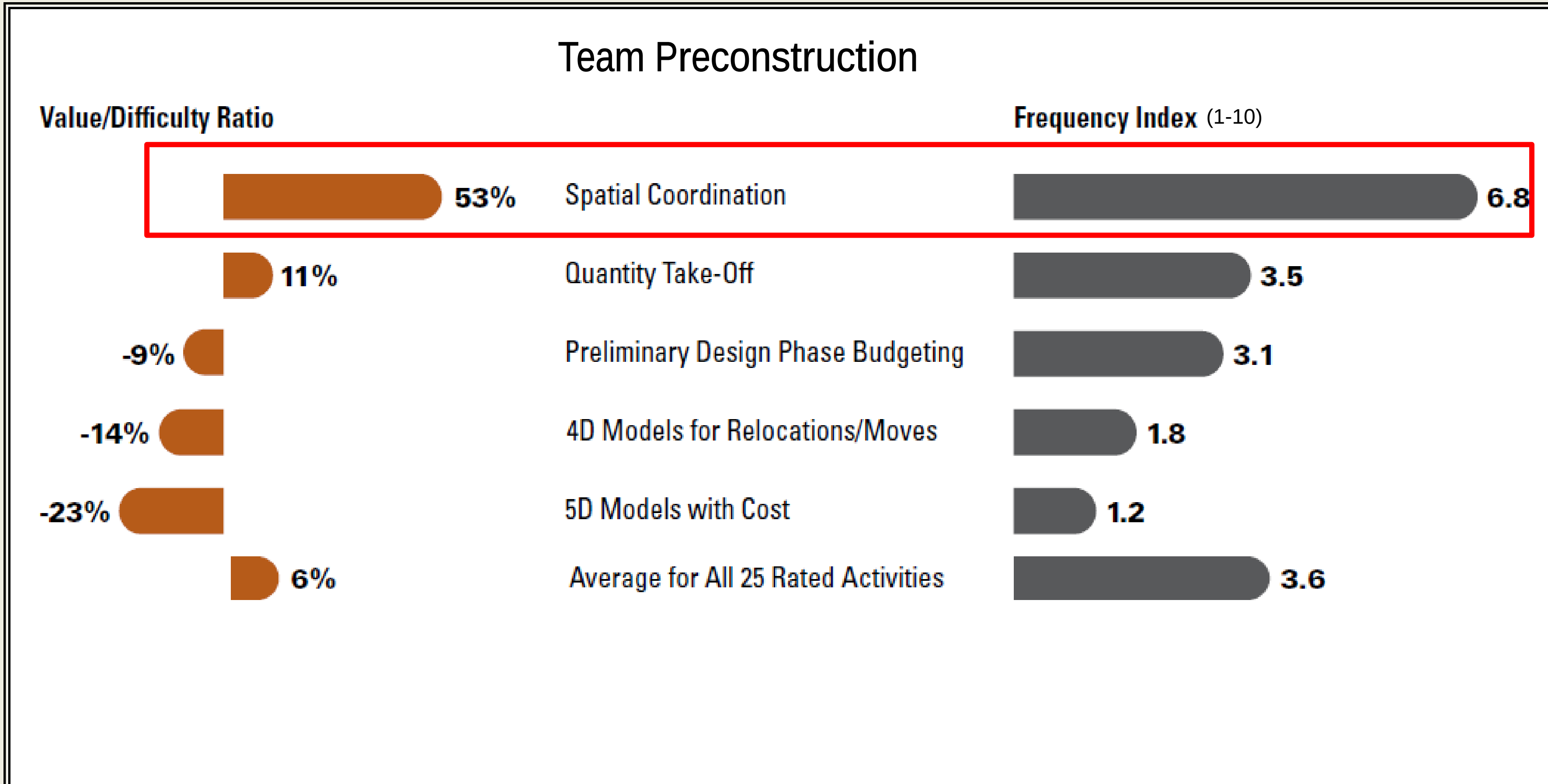
BIM Functionality Challenges: Technical Analysis

- **Mechanical Performance Analysis** very challenging



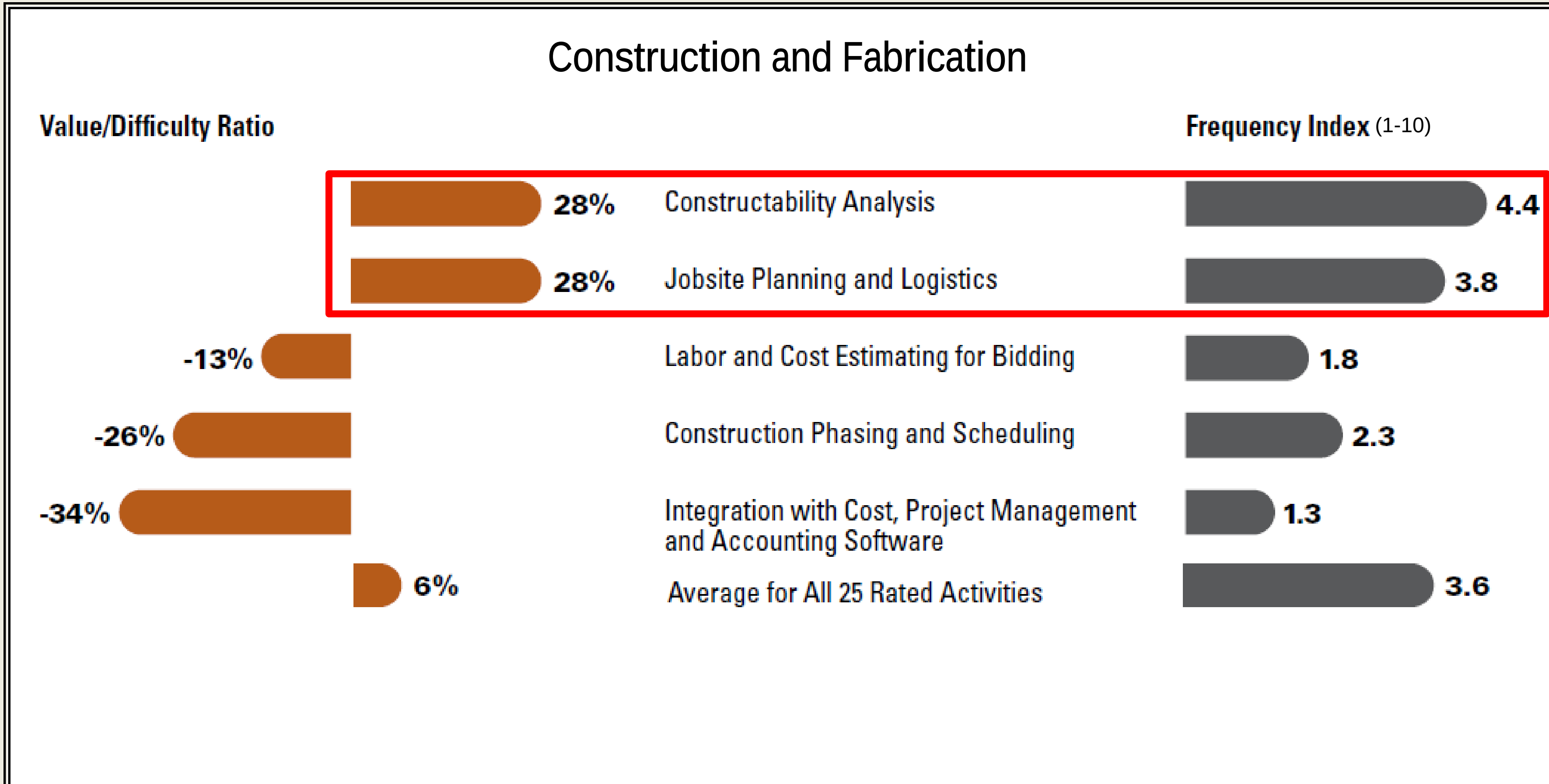
BIM Functionality Challenges: Team Preconstruction

- **Spatial Coordination** is the highest rated activity among all 25



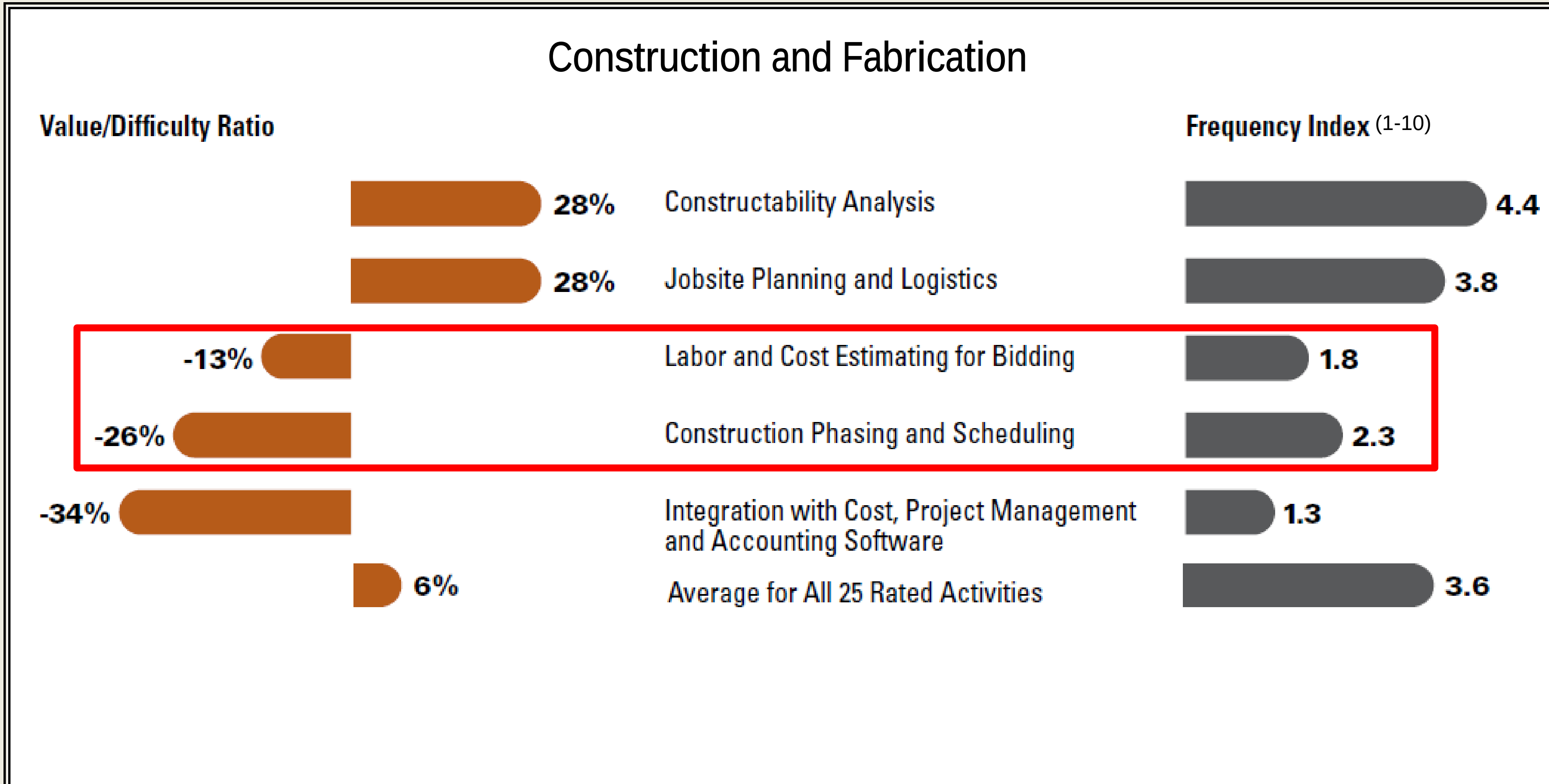
BIM Functionality Challenges: Construction and Fabrication

- **Constructability Analysis** and **Jobsite Planning** both score well



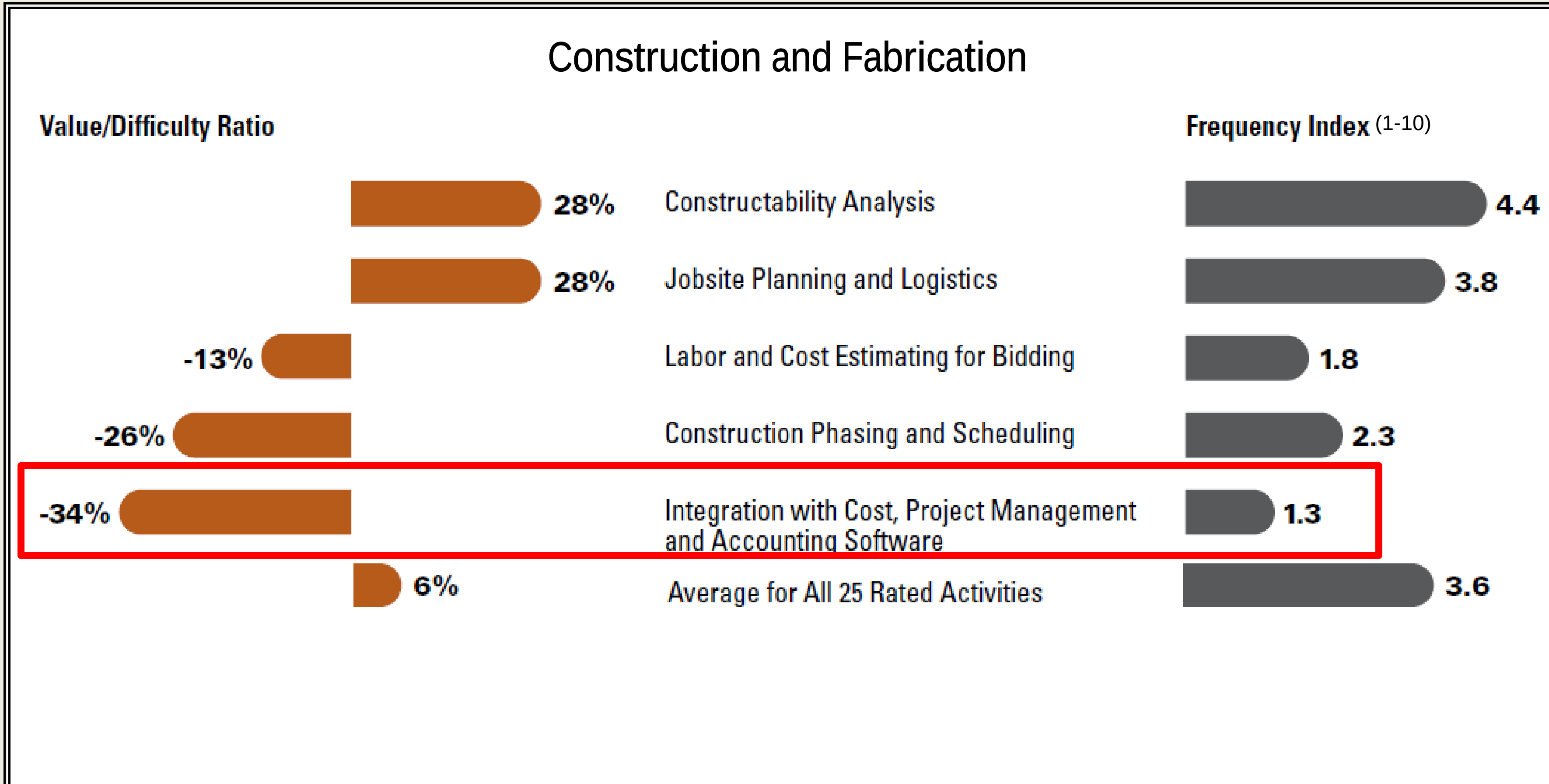
BIM Functionality Challenges: Construction and Fabrication

- **Estimating** and **Construction Scheduling** both still emerging



BIM Functionality Challenges: Construction and Fabrication

- **Integration with legacy management software** lowest rated of all 25 activities

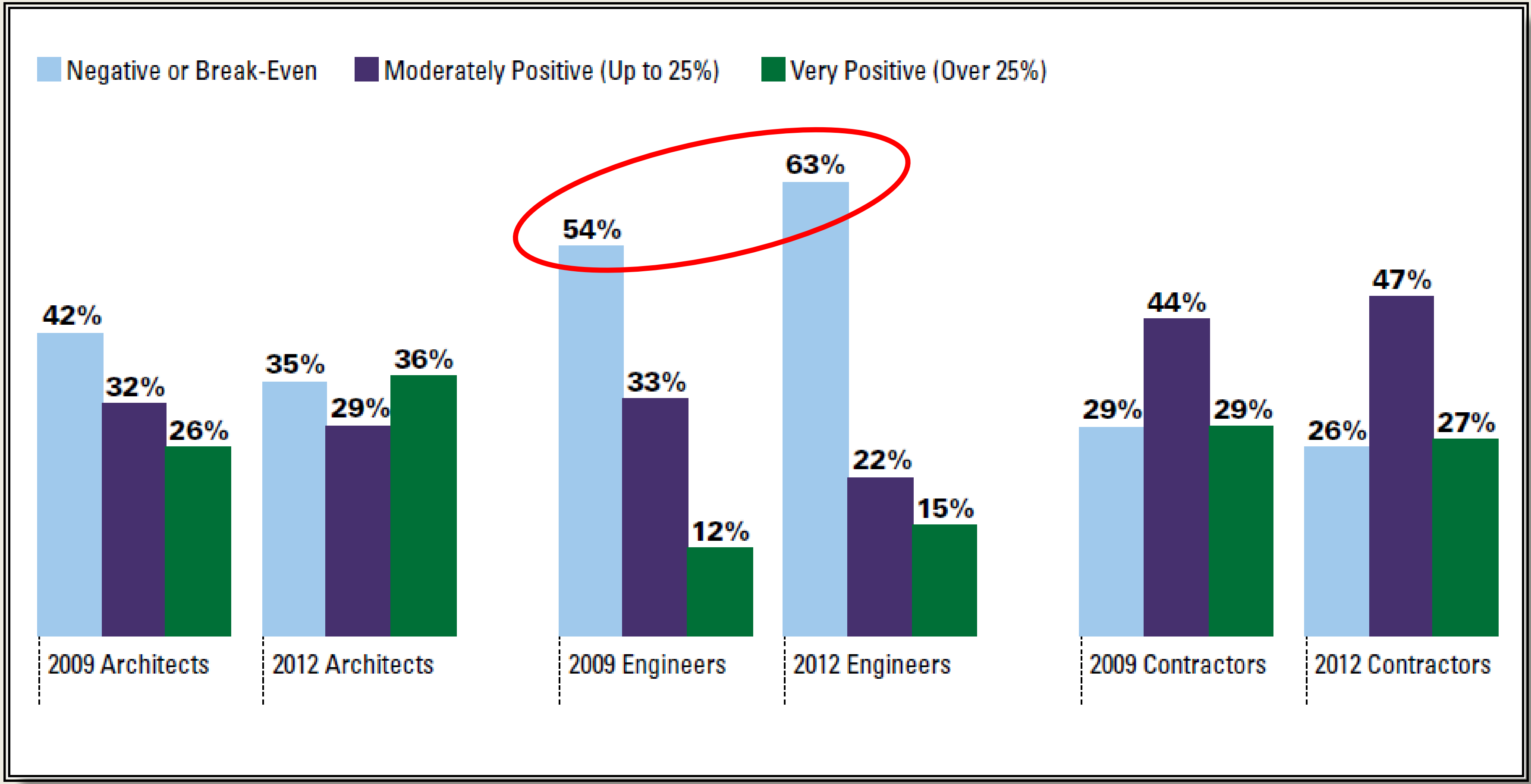


Challenges

- BIM Functionality
- Benefit Parity
- Resistance

Perceived ROI on BIM by Company-type: 2009, 2012

- Engineers consistently worst ROI;
- Worsened from 2009 to 2012 (only 37% positive)



Benefit Parity for Engineers

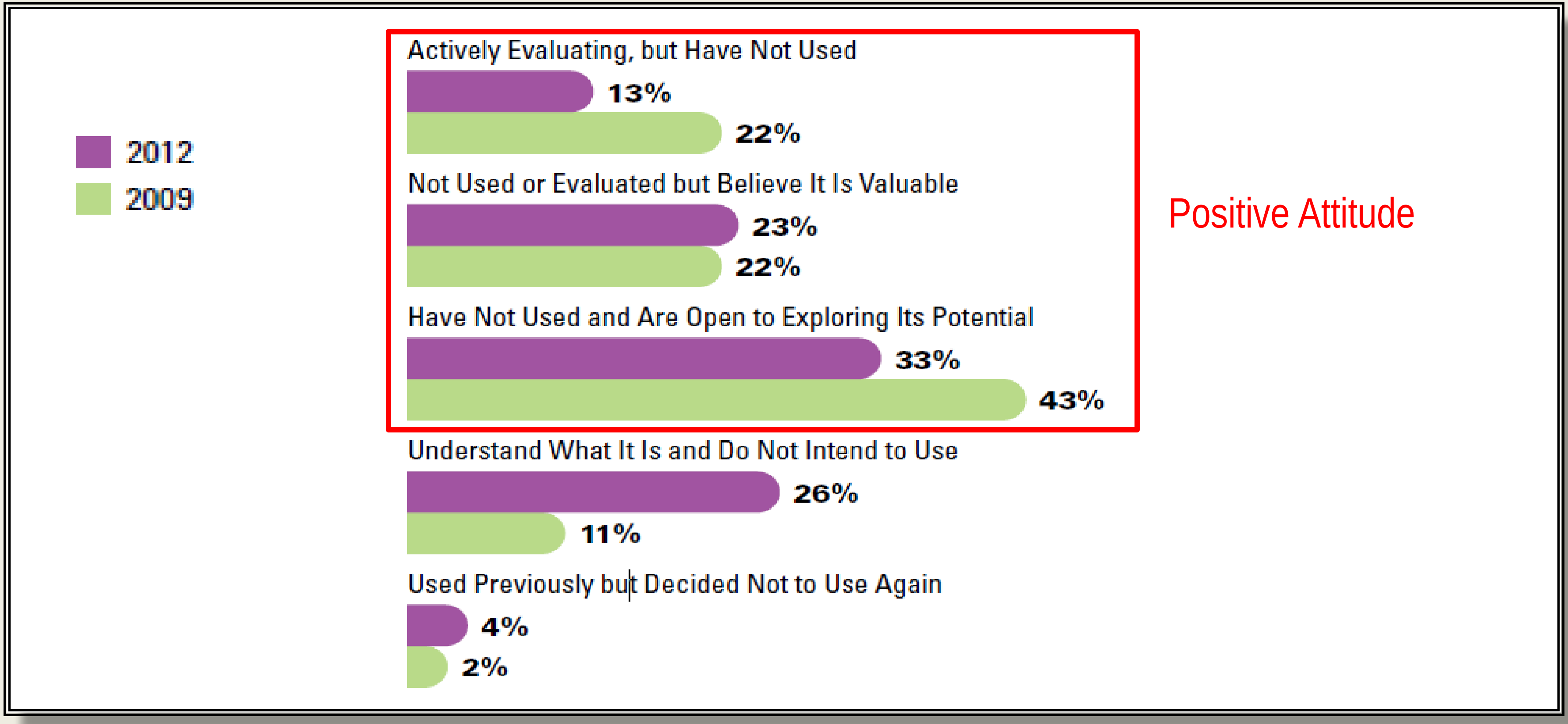
- **Challenges**
  - Multiple platforms to support multiple clients
  - Less mature functionality
  - Content
  - Increasing responsibility for coordination with no more fee
- **Market response:**
  - Trade contractors increasingly modeling

Challenges

- **BIM Functionality**
- **Benefit Parity**
- **Resistance**

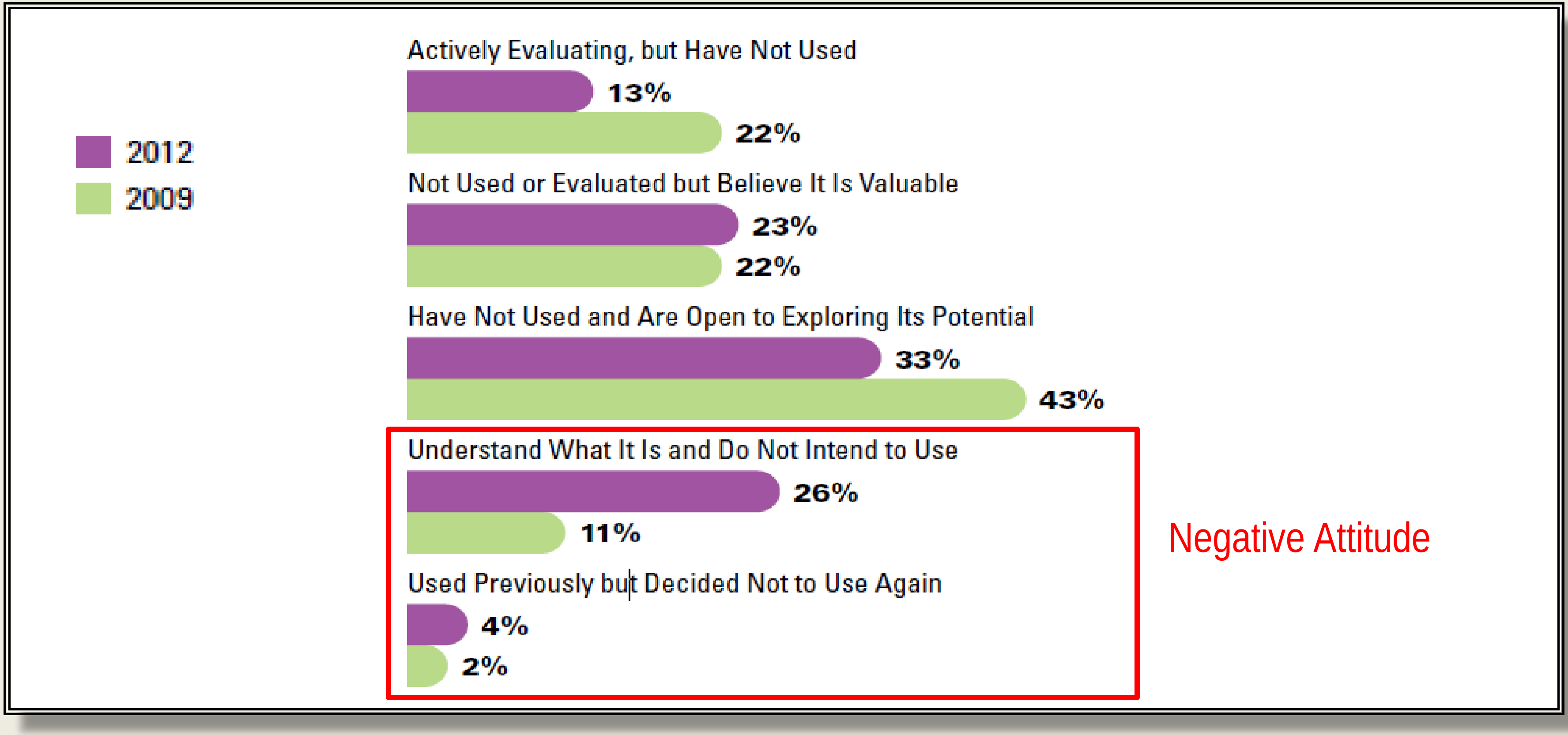
Non-User's Attitude Towards BIM: 2009 to 2012*

- Non-users are fewer, but are becoming more entrenched in their attitude towards BIM
  - – Number with positive attitude is decreasing



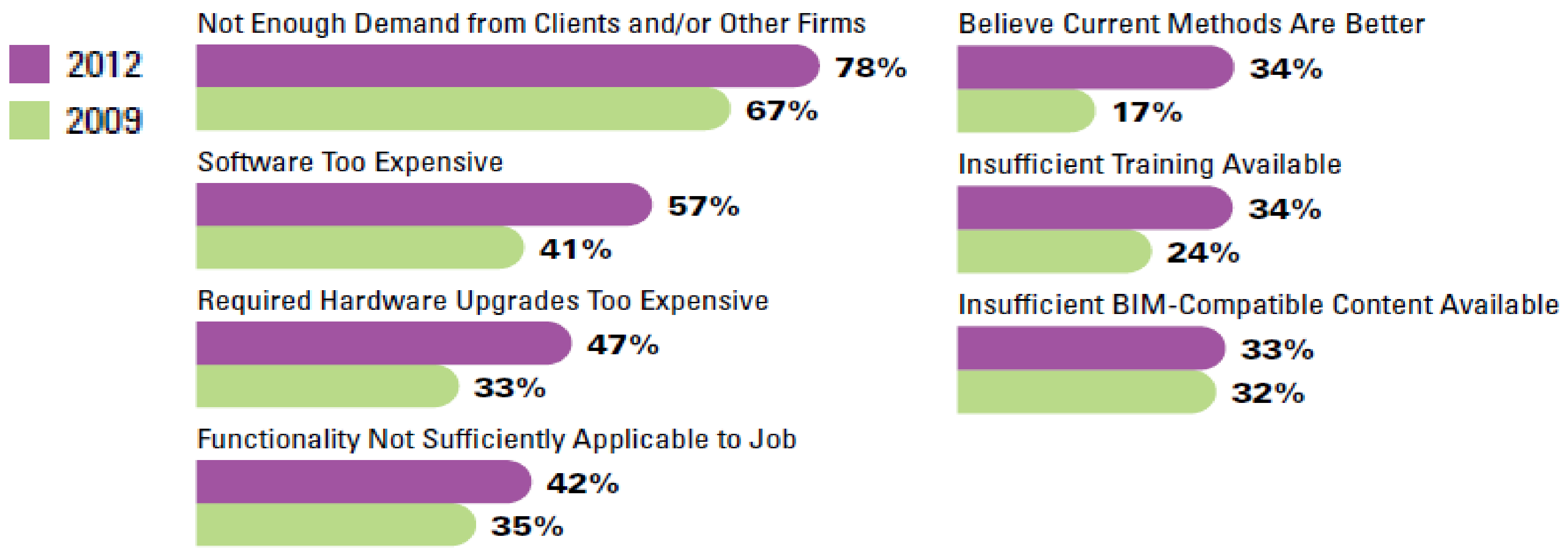
Non-User's Attitude Towards BIM: 2009 to 2012*

- Non-users are fewer, but are becoming more entrenched in their attitude towards BIM
  - – Number with negative attitude is increasing



Non-Users' Reasons for Not Adopting BIM: 2009 to 2012*

- Top reasons increased from 2009 to 2012
- Consistent #1 reason is lack of demand



(Percentage of respondents that report High or Very High level for each reason)

Summary

BIM Functionality

- Average User Ratings show slightly positive (3.6) “bang for the buck” ratio
- Low rating with relatively high Frequency indicates particularly important focus for vendors (e.g. structural analysis)

Benefit Parity

- Engineers not enjoying same BIM benefit level
- Calling out for better BIM functionality

Non-User Resistance

- Non-user resistance hardening
- Natural process of maturing technology
- MHC estimate: stabilize at 10-15% of industry

Impact and Emerging Trends

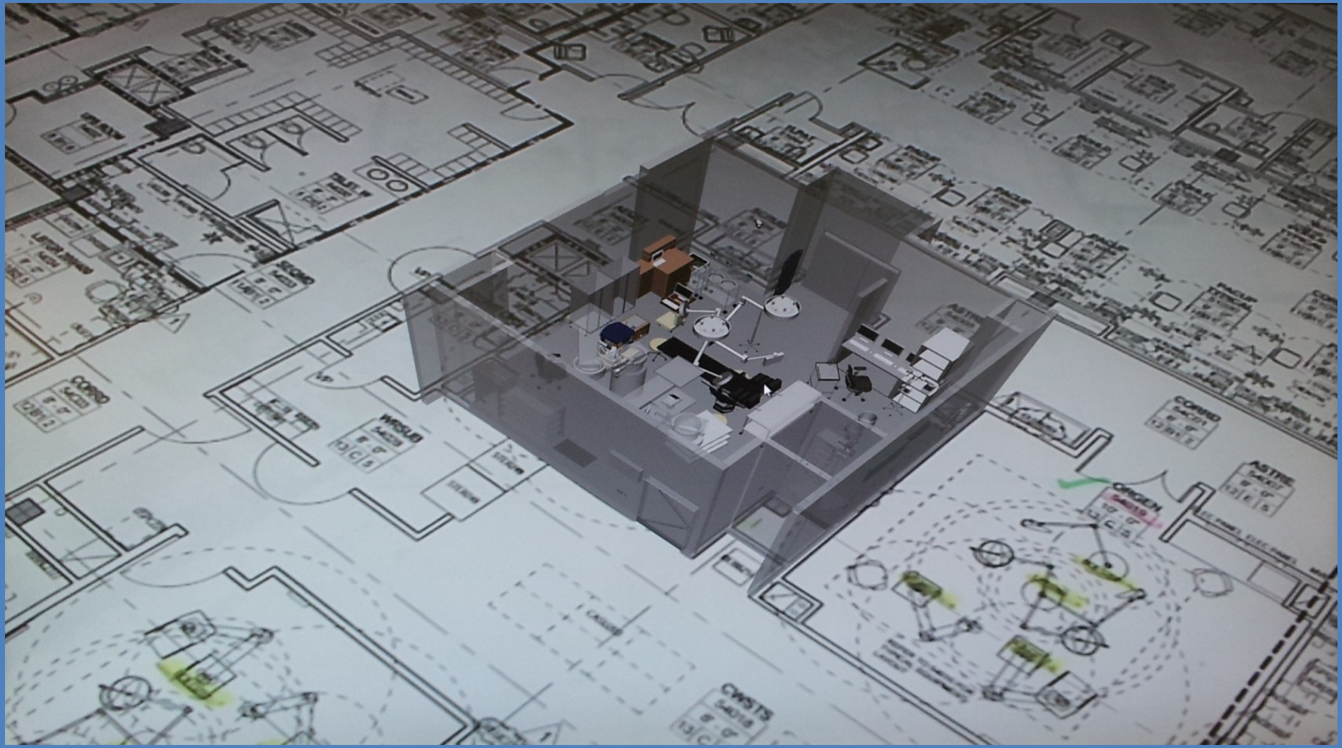


Image: DPR

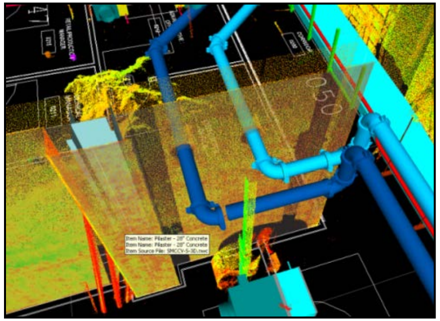
Incremental waves of BIM Adoption and Implementation

- **Design-driven**
  - **Visualization, Simulation, Analysis**
- **Construction- driven**
  - **Spatial coordination**
  - **Construction modeling**
  - **Construction planning**
  - **Prefabrication:** Single Trade, Multi-trade
  - **Digital Fabrication:** Major elements, Whole buildings
  - **Technology at the Site**
- **Owner-driven**
  - **Integrating model data with O&M**
  - **Real time monitoring of operations via the model**

Impact and Emerging Trends

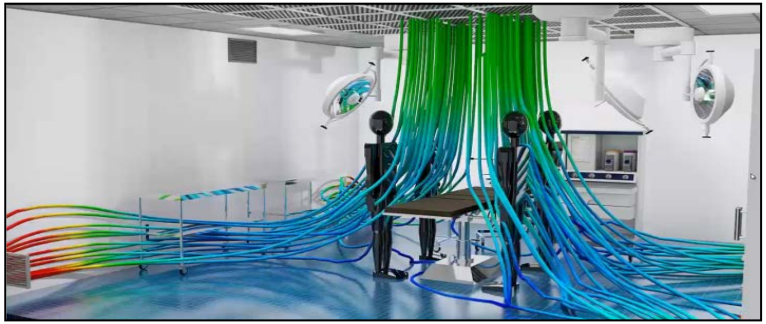
- Increasingly sophisticated and practical uses of model data for Visualization/Analysis

Laser Scanning



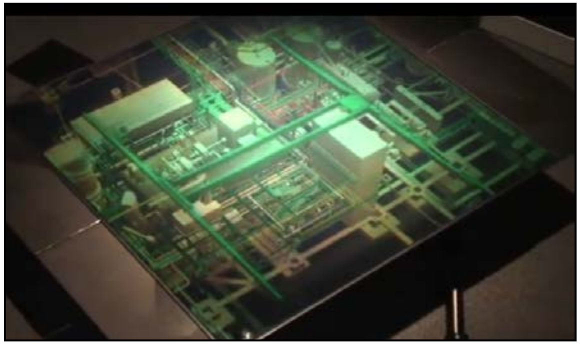
Augmented Reality

System Performance Simulation

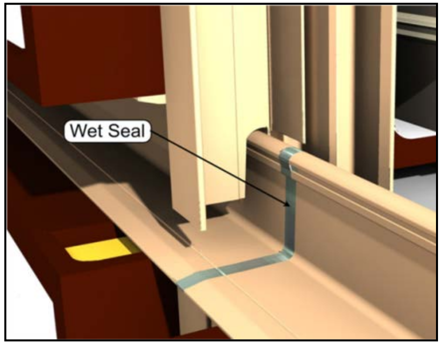


Subsurface Civil Modeling

Holographic Prints



Constructability Evaluation

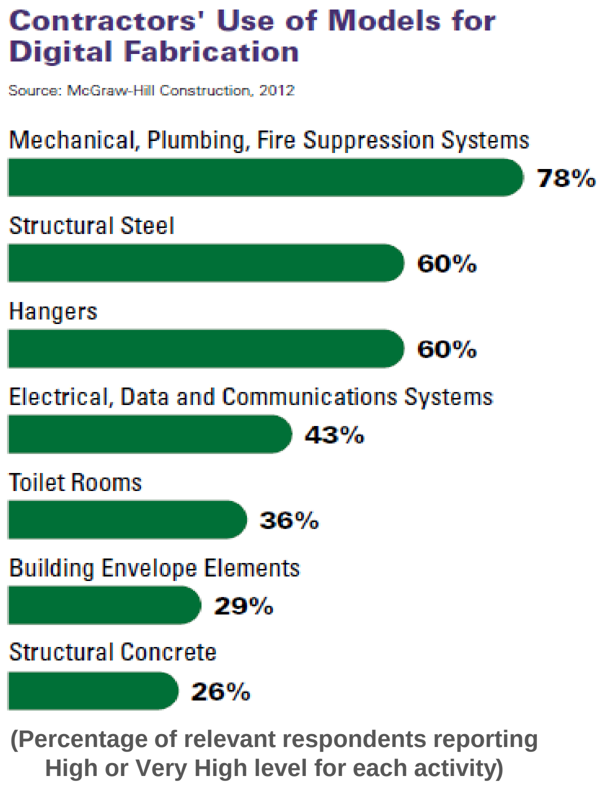


Incremental waves of BIM Adoption and Implementation

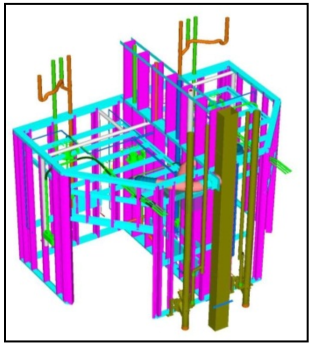
- **Design-driven**
  - **Visualization, Simulation, Analysis**
- **Construction- driven**
  - **Spatial coordination**
  - **Construction modeling**
  - **Construction planning**
  - **Prefabrication:** Single Trade, Multi-trade
  - **Digital Fabrication:** Major elements, Whole buildings
  - **Technology at the Site**
- **Owner-driven**
  - **Integrating model data with O&M**
  - **Real time monitoring of operations via the model**

Impact and Emerging Trends

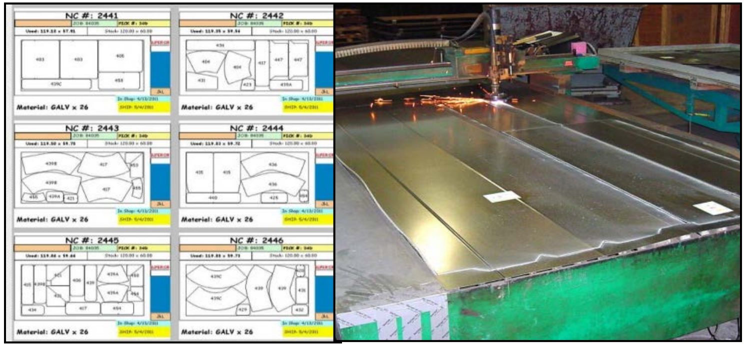
- Increasing use of model data for digital fabrication workflows



Toilet Rooms



Mechanical Ducts



Mechanical Piping, Sleeves and Hangers

Impact and Emerging Trends

- 60’ x 60’ chiller plant prefabricated, then assembled onsite in 3 weeks vs. 3 months

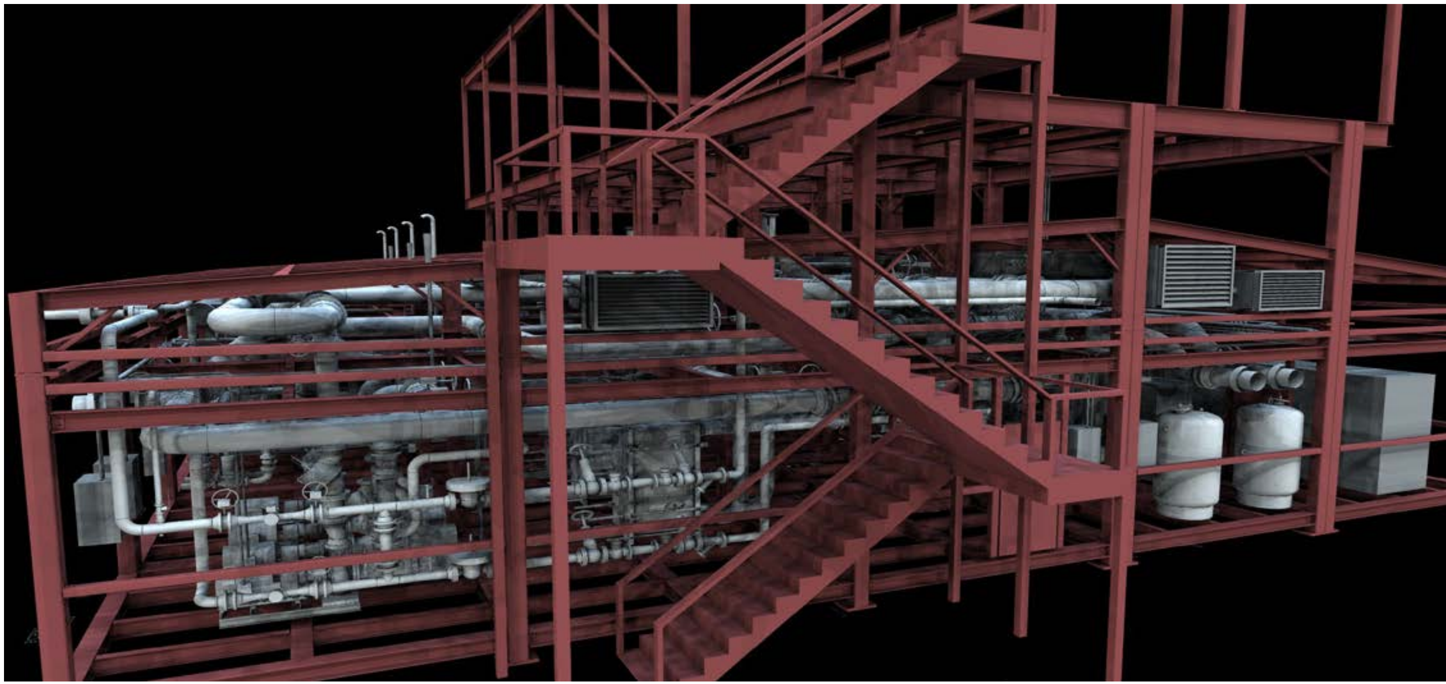
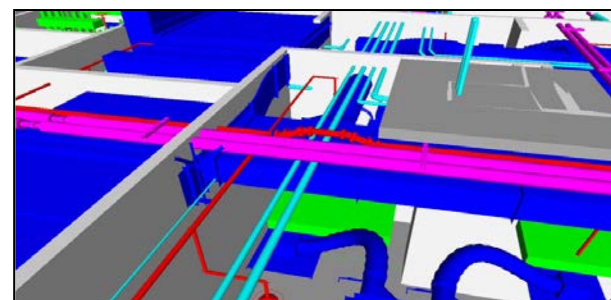


Image: The Hill Group

Impact and Emerging Trends

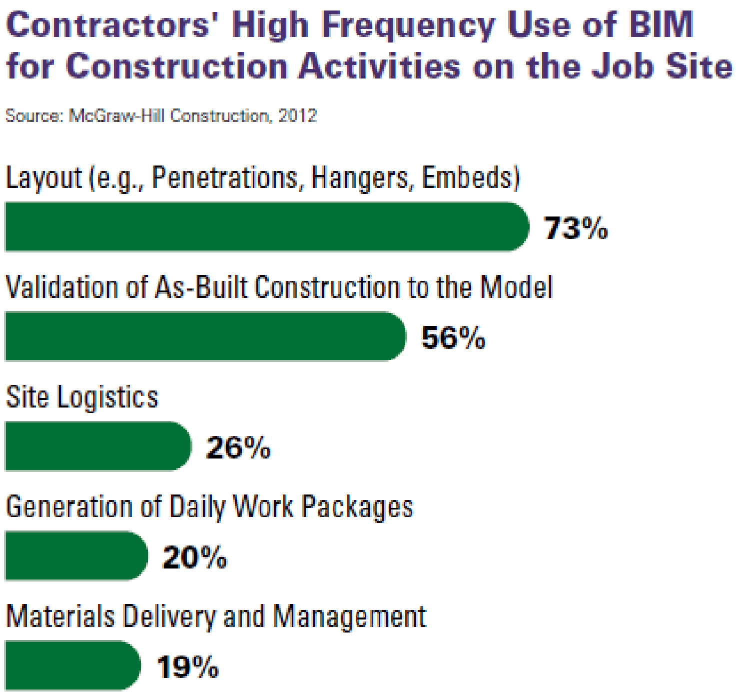
- Coordinated model with multiple Specialty Contractors
  - Framing Contactor trusts sufficiently to prefabricate openings in full-height partitions

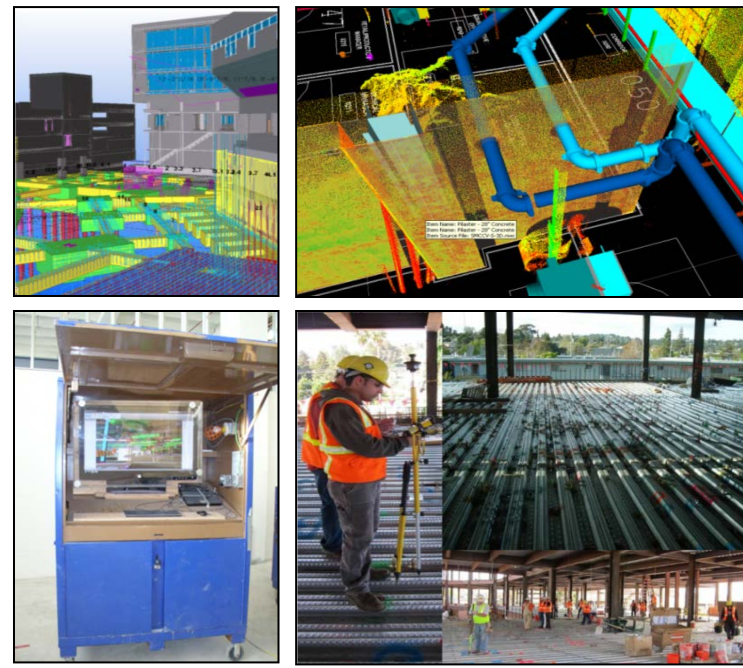


Images: Turner, University Mechanical

Impact and Emerging Trends

- BIM in the Field





Images: Aditazz

Incremental waves of BIM Adoption and Implementation

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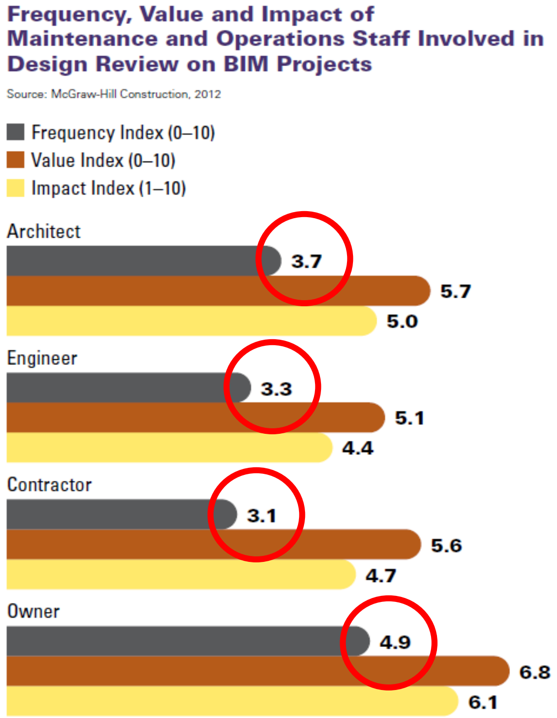
Impact and Emerging Trends

- Integration of Operations and Maintenance staff in BIM process
  - Everyone thinks FM involvement in BIM process is valuable…

Impact and Emerging Trends

- Integration of Operations and Maintenance staff in BIM process
  - But hardly anybody's doing it … yet



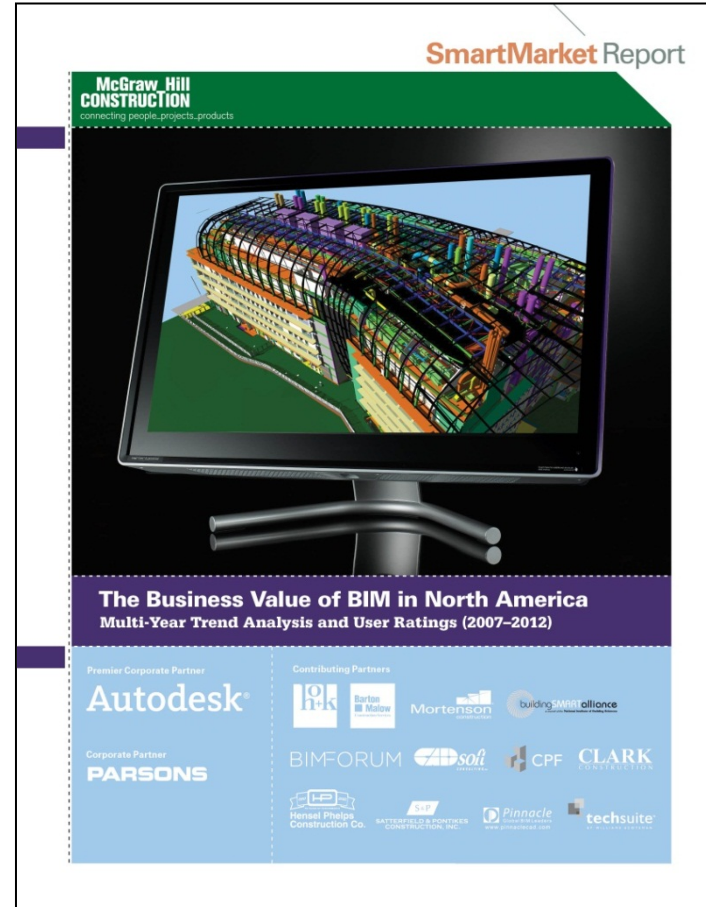
Impact of Increasingly Integrated Digital Workflows

- **Responsibilities…**
  - Shift from “Who always did it” to “Who ought to do it”
- **Timing of Information/Documentation…**
  - Shift from “As late as possible to serve my needs” to “As early as needed to serve the whole project team”
- **Visibility…**
  - Shift from “Silos of information in each company” to “Transparency between companies”

SmartMarket Report on BIM in North America

Newest BIM report:

- January 2013
- Multi-year BIM trends
  - 2007 to 2014 forecast
- New features:
  - BIM Engagement index
  - User Ratings for BIM processes and activities



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The Business Value of BIM in North America

Multi Year Trend Analysis and User Ratings (2007 – 2012)