



# Building Information Modeling: A Platform For Global AEC Change

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[tiny.cc/businessofbim](https://tiny.cc/businessofbim)



Image courtesy of CCDI Group.

**Autodesk**<sup>®</sup>



# Mega-Trends

## Macro-Economic Change



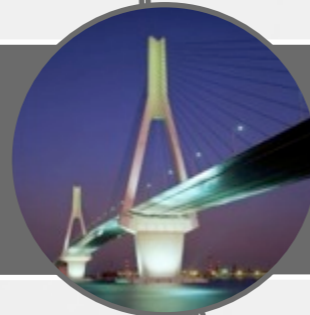
- Protracted Financial Uncertainty
- Increased Volatility in Materials
- Changing Economic Hegemony

## Shifting Demographics



- Aging Developed Economies / Youthful BRICs
- Rise in Urbanization & Middle-Class Wealth
- Maturation of the “New Millennial” Generation

## New Assets, New Models



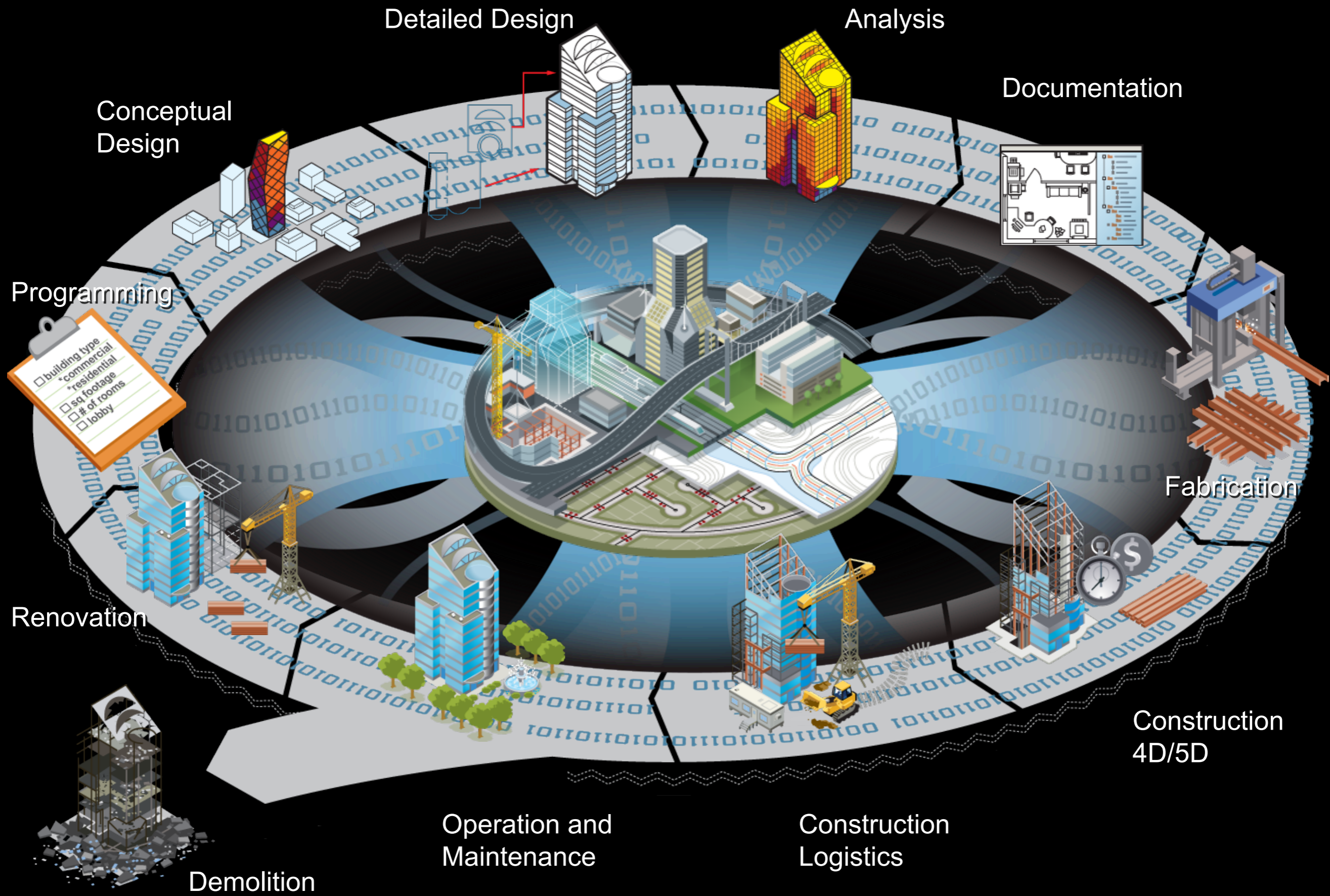
- Infrastructure: Expansion (1.0), Renewal (2.0)
- Pervasion of “Harmony with Nature”
- Market Liberalization

## Data Explosion

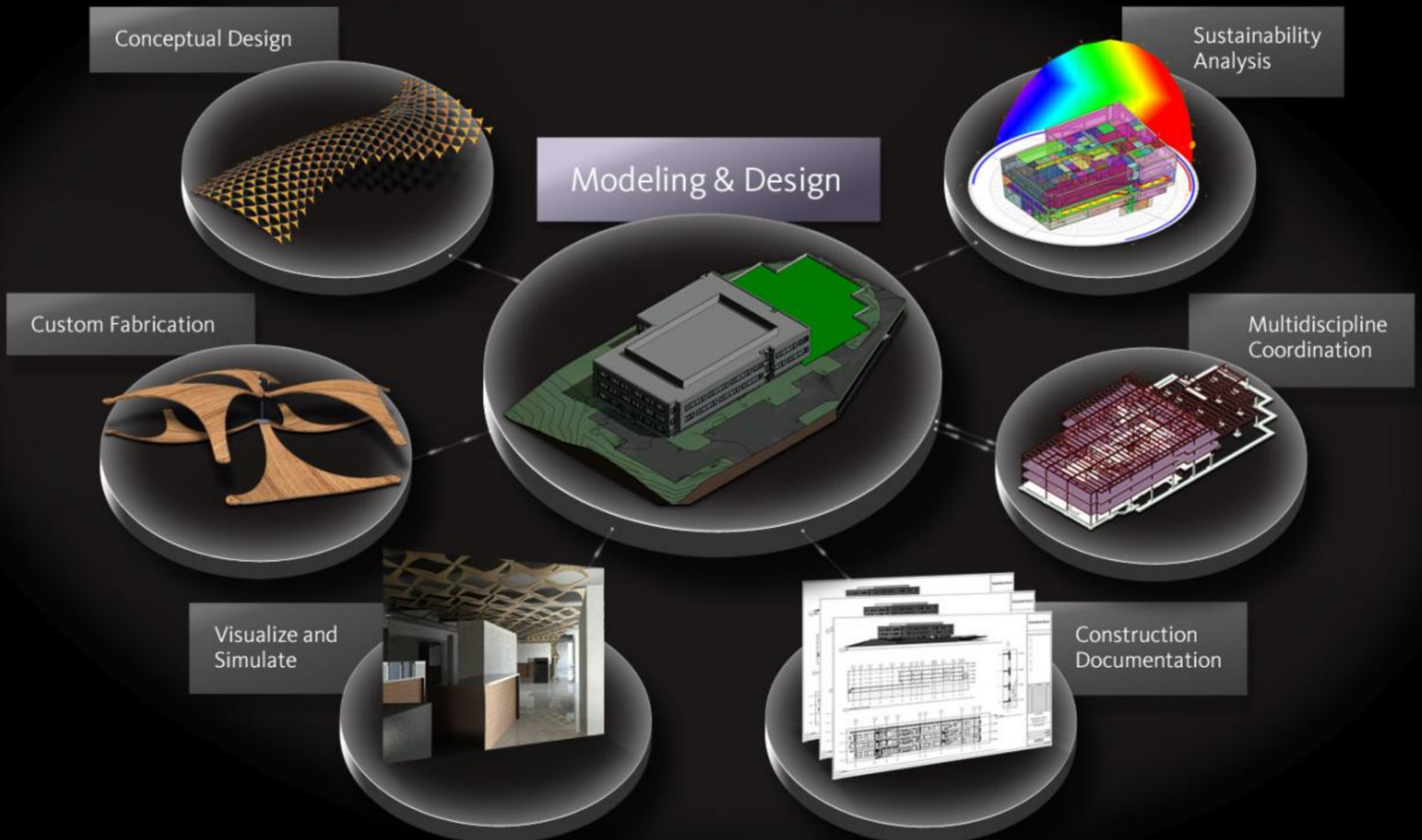


- Data Fusion
- Ubiquitous Communication
- Rise of Smart Systems



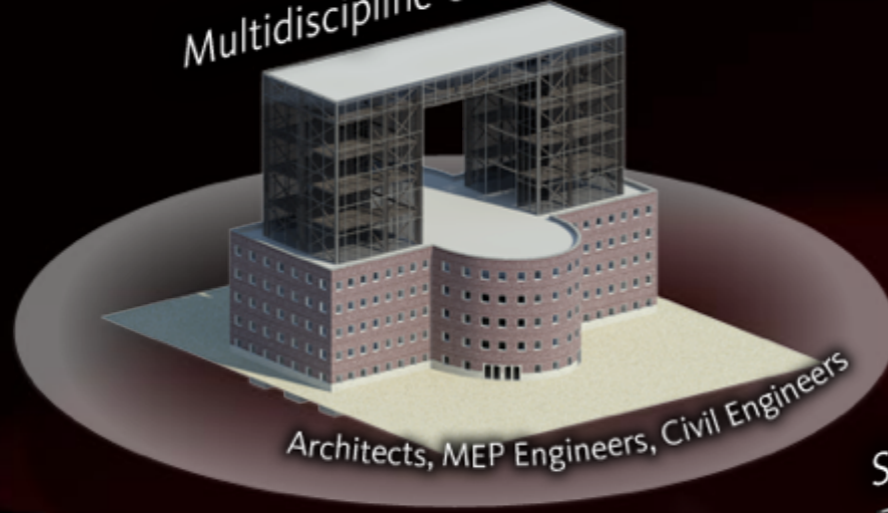


# Architecture



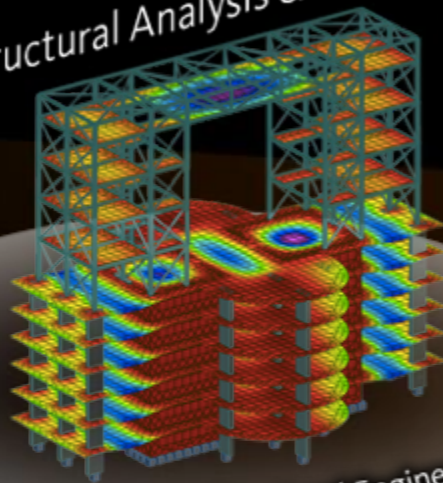
# Structural Engineering

Multidiscipline Coordination



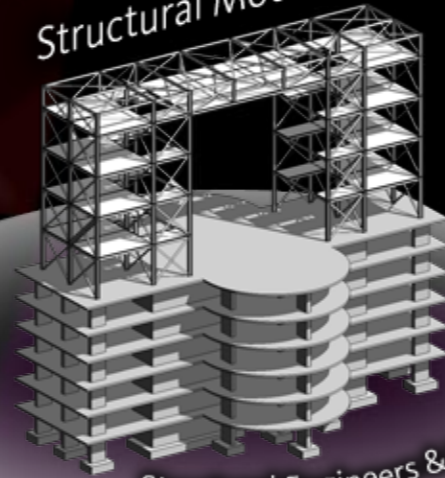
Architects, MEP Engineers, Civil Engineers

Structural Analysis & Design



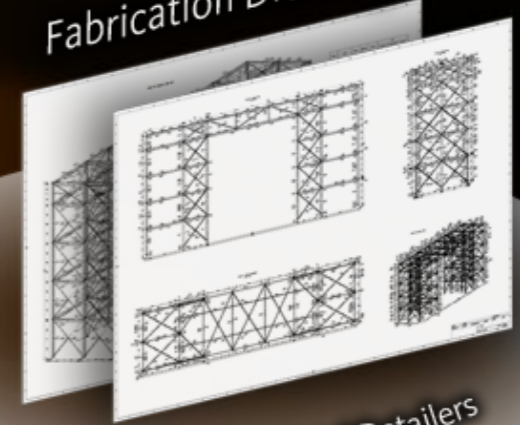
Structural Engineers

Structural Modeling



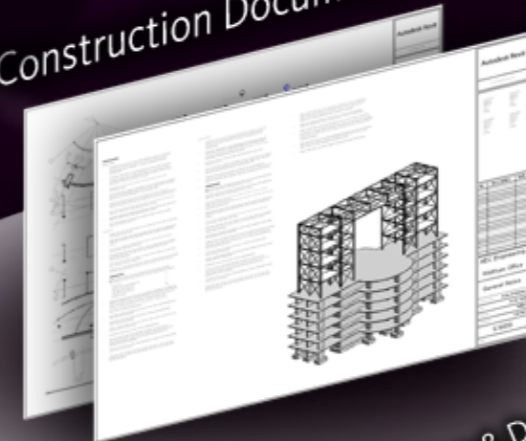
Structural Engineers & Drafters

Fabrication Drawings



Structural Detailers

Construction Documentation

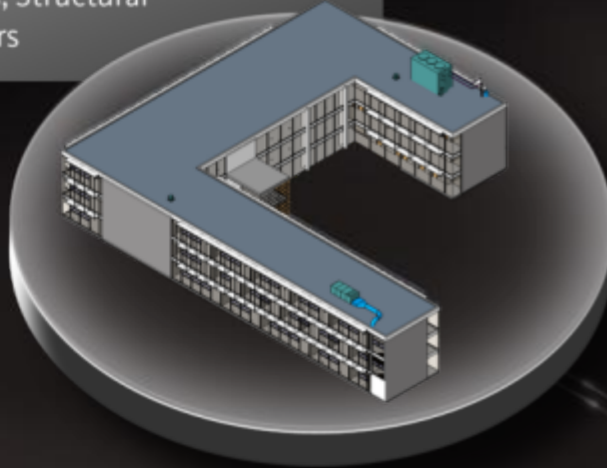


Structural Engineers & Drafters

# MEP Engineering

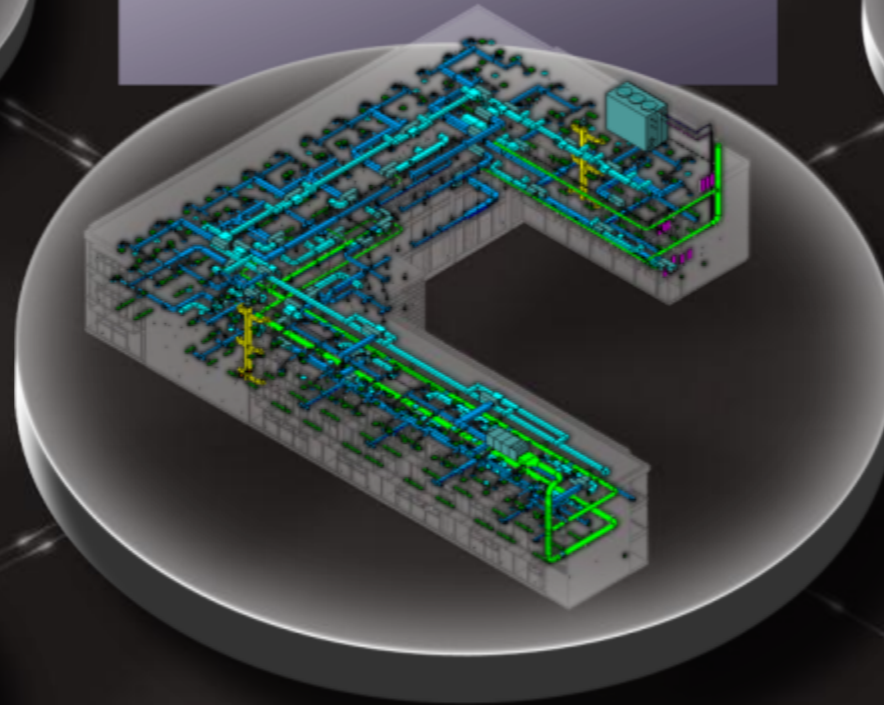
Multidiscipline Coordination

with Architects, Structural  
& Civil Engineers

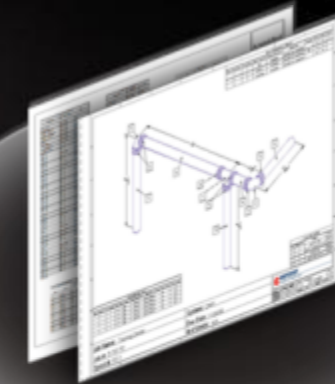


Modeling & Design

– MEP Engineers & Designers

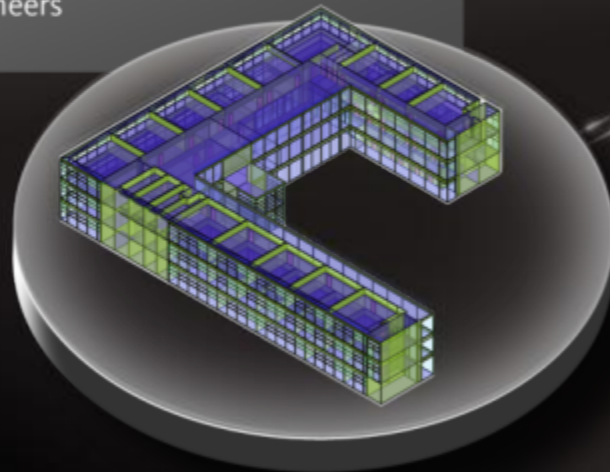


Fabrication  
Drawings  
– HVAC Contractors



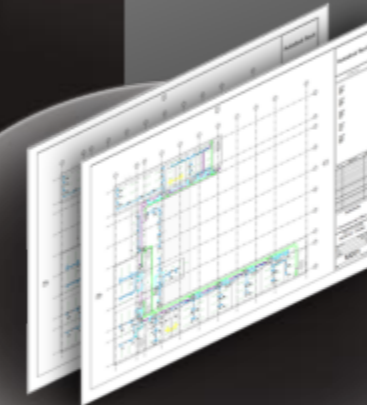
Sustainable Design &  
Building Performance Analysis

– MEP Engineers

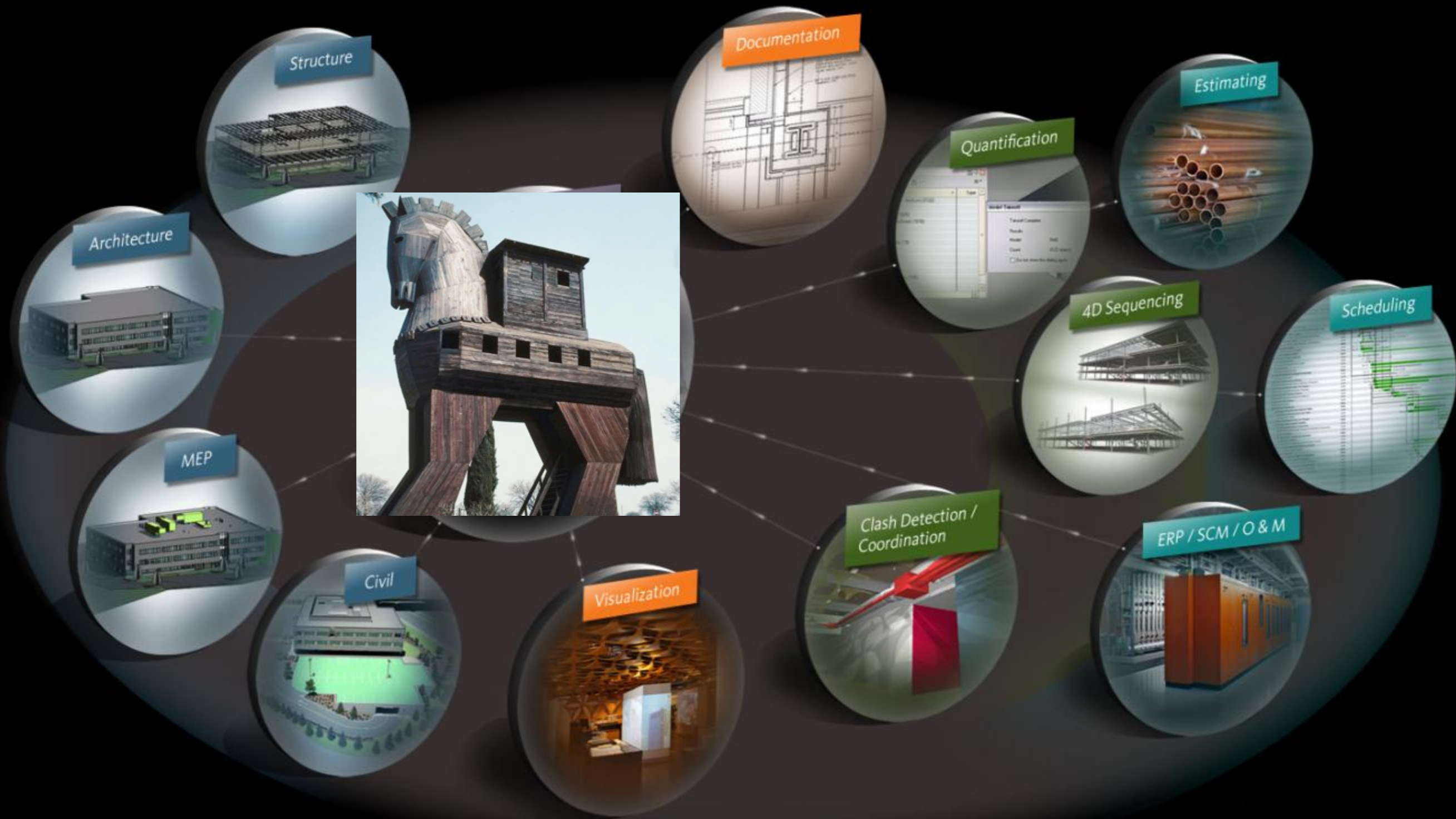


Construction  
Documentation

– MEP Designers & Drafters

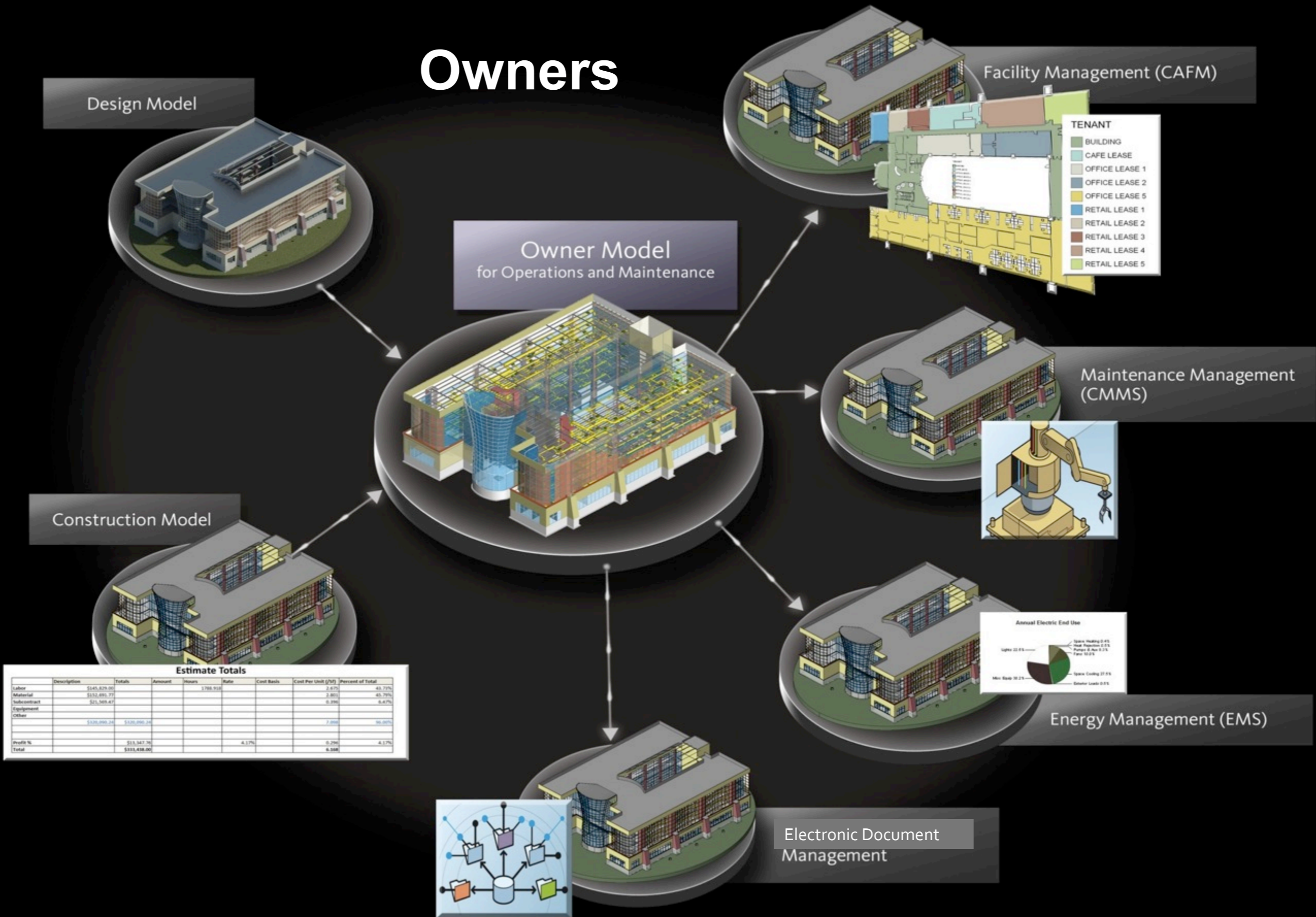


# Construction

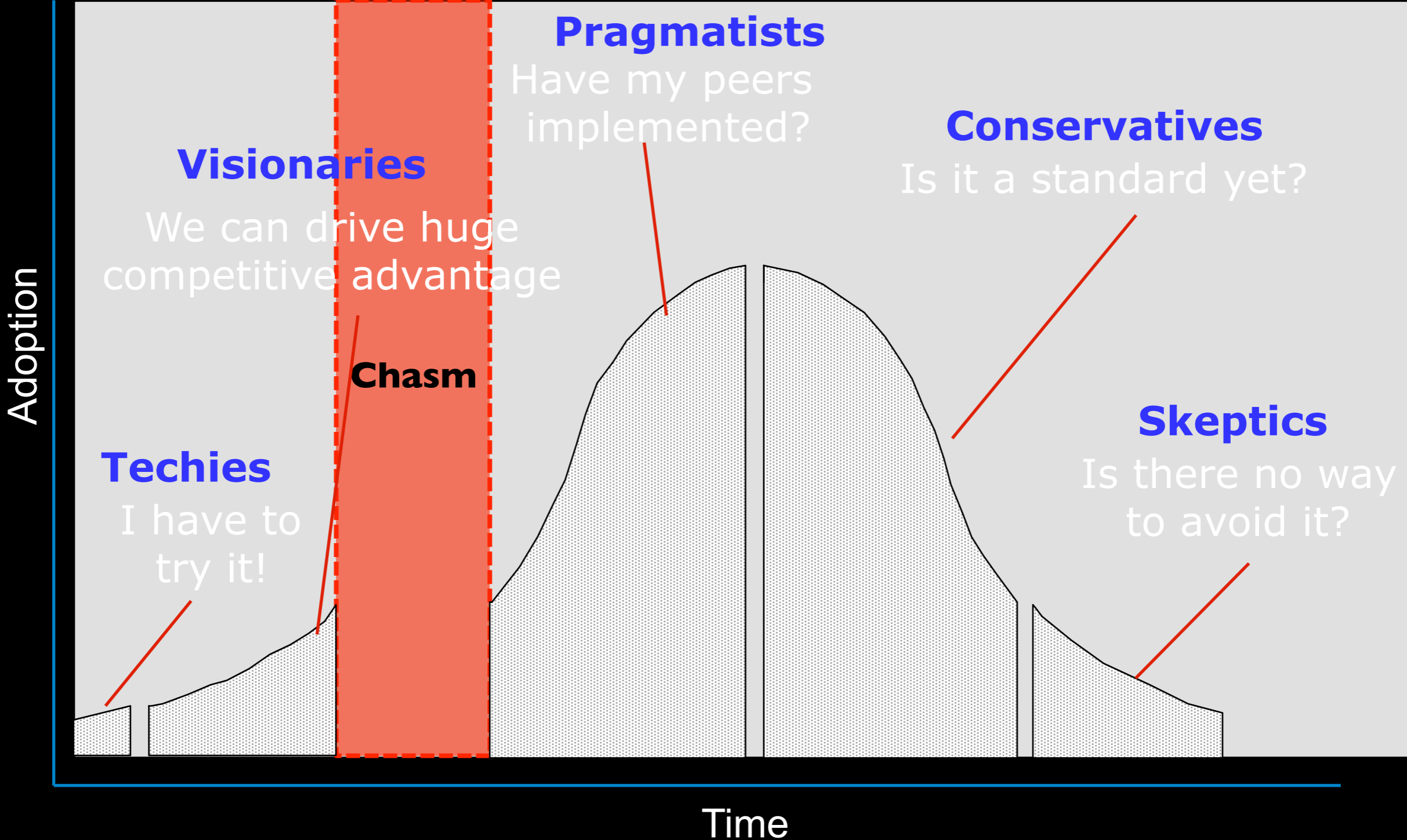




# Owners



# Crossing the Chasm (Geoffrey Moore)



# 3 Phases of BIM Engagement



**What is BIM?**

**Why should I invest?**

**Help me implement BIM.**

# BIM Adoption | worldwide

- UK – 2010 – major acceleration - National BIM Survey<sup>1</sup>
  - 31% of construction professionals are using BIM (vs 13% in 2010)
  - 78% say BIM is “Future of Project Innovation”
- BuildingSMART ME – 2010<sup>2</sup>
  - BIM penetration 25%
  - Recognition of BIM value connected to error reduction, improved quality control, improved productivity
  - Need to develop competency relative to Western Europe, US.
- Architosh BIM survey – 2010<sup>3</sup>
  - Over 60% report BIM adoption
- World Market Intelligence<sup>4</sup>
  - 40% contractors and project developers anticipate increased profitability due to BIM

<sup>1</sup> <http://www.thenbs.com/corporate/press/12-02-08.asp> and <http://www.scribd.com/doc/76221465/BIM-Research-Report-March-2011>

<sup>2</sup> <http://www.ameinfo.com/251742.htm>

<sup>3</sup> <http://architosh.com/2010/03/architosh-announces-2010-bim-survey-repor4 t/>

<sup>4</sup> <http://www.marketresearch.com/World-Market-Intelligence-v3764/Building-Information-Modeling-Global-Construction-6805143/>

# China

- Strong BIM awareness
- Growing adoption across major customers
- Gov't researching BIM & IPD
- China BIM Standards (CBIMS) phase 1 published
- BIM Services businesses by leading partners & DIs
- Lack of BIM-experienced workforce

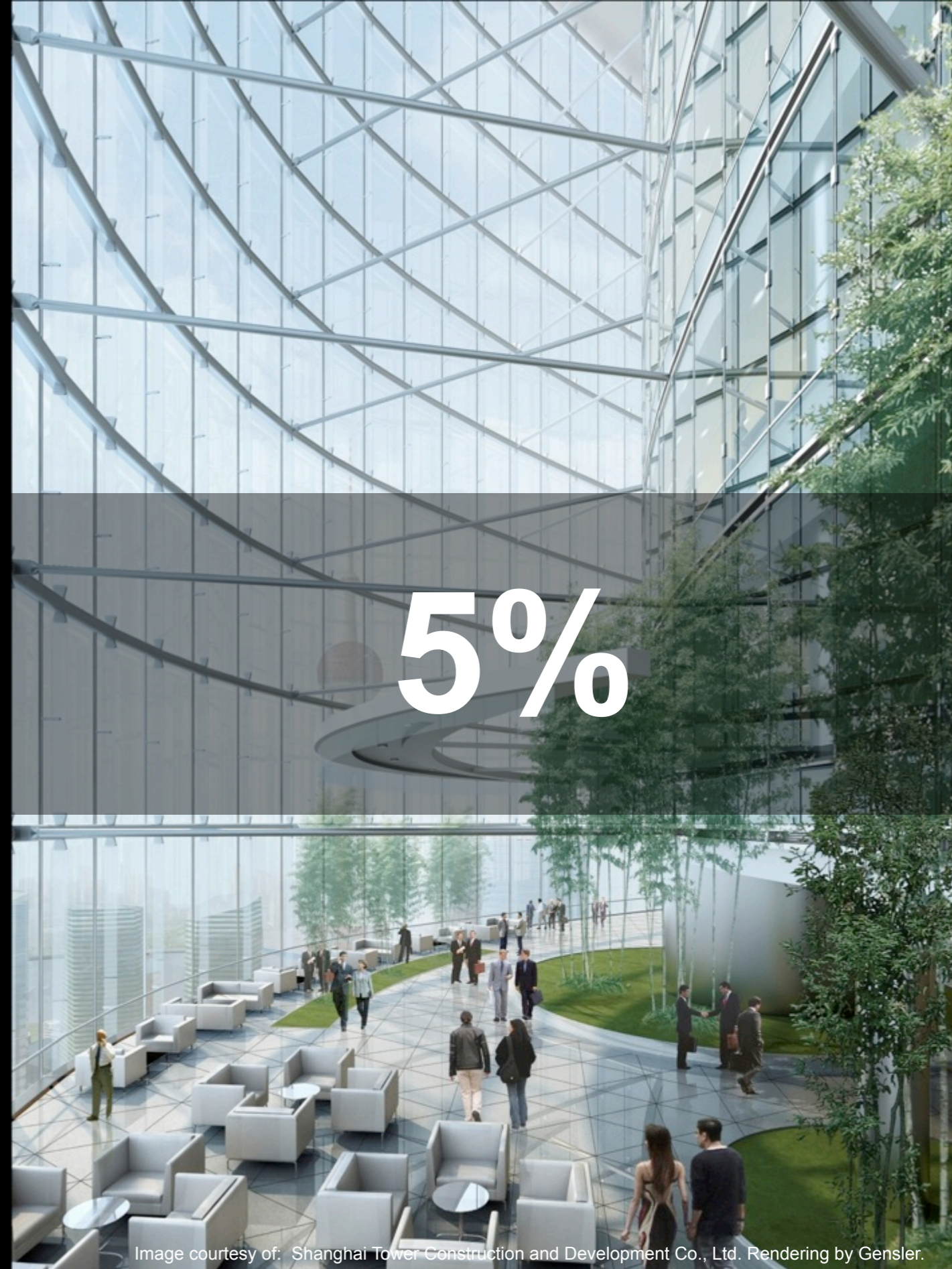


Image courtesy of: Shanghai Tower Construction and Development Co., Ltd. Rendering by Gensler.

# Japan

- BIM reached broader acceptance in 2009
- 80% are aware of BIM; 50% know what it is
- Architects leading demand for BIM
- Much slower adoption than any major market

<5%

# South & Central Europe

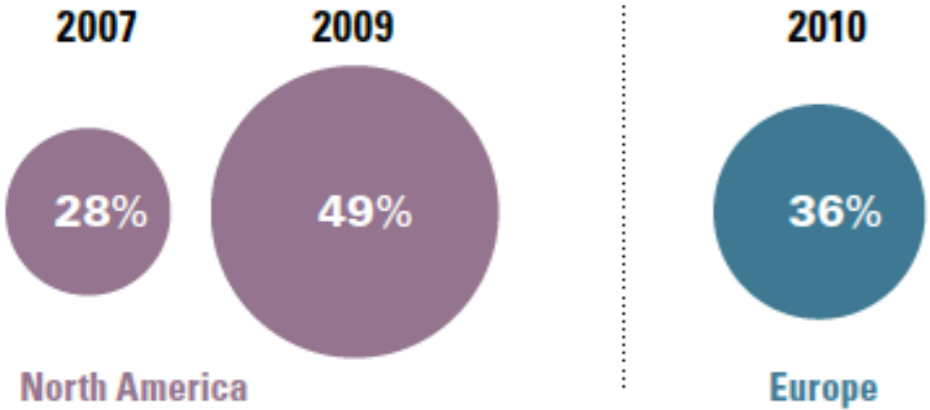
- 60% of market not using BIM
- 14% creating and analyzing models
- In 2 years, BIM will be used on most projects
- Lack of time to evaluate is largest obstacle



# 2010 Europe vs. North America

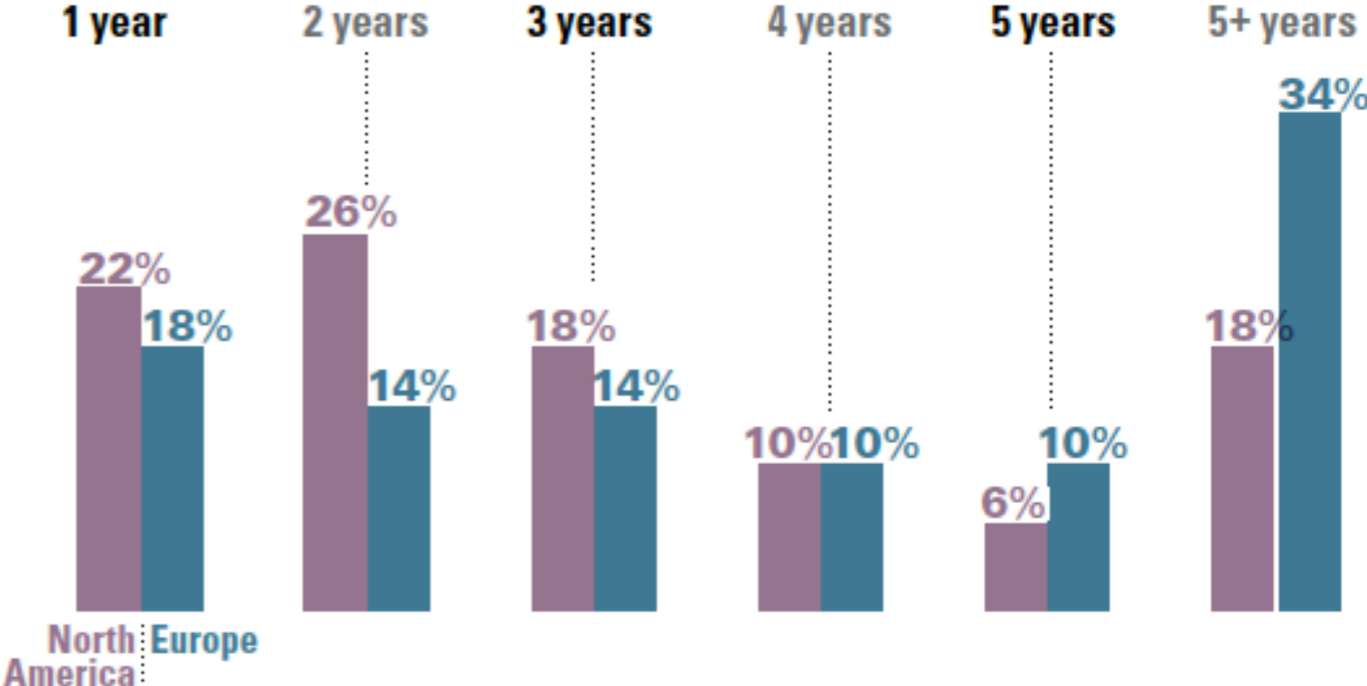
## BIM Adoption North America vs. Europe

Source: McGraw-Hill Construction, 2010.



## Years Using BIM

Source: McGraw-Hill Construction, 2010.

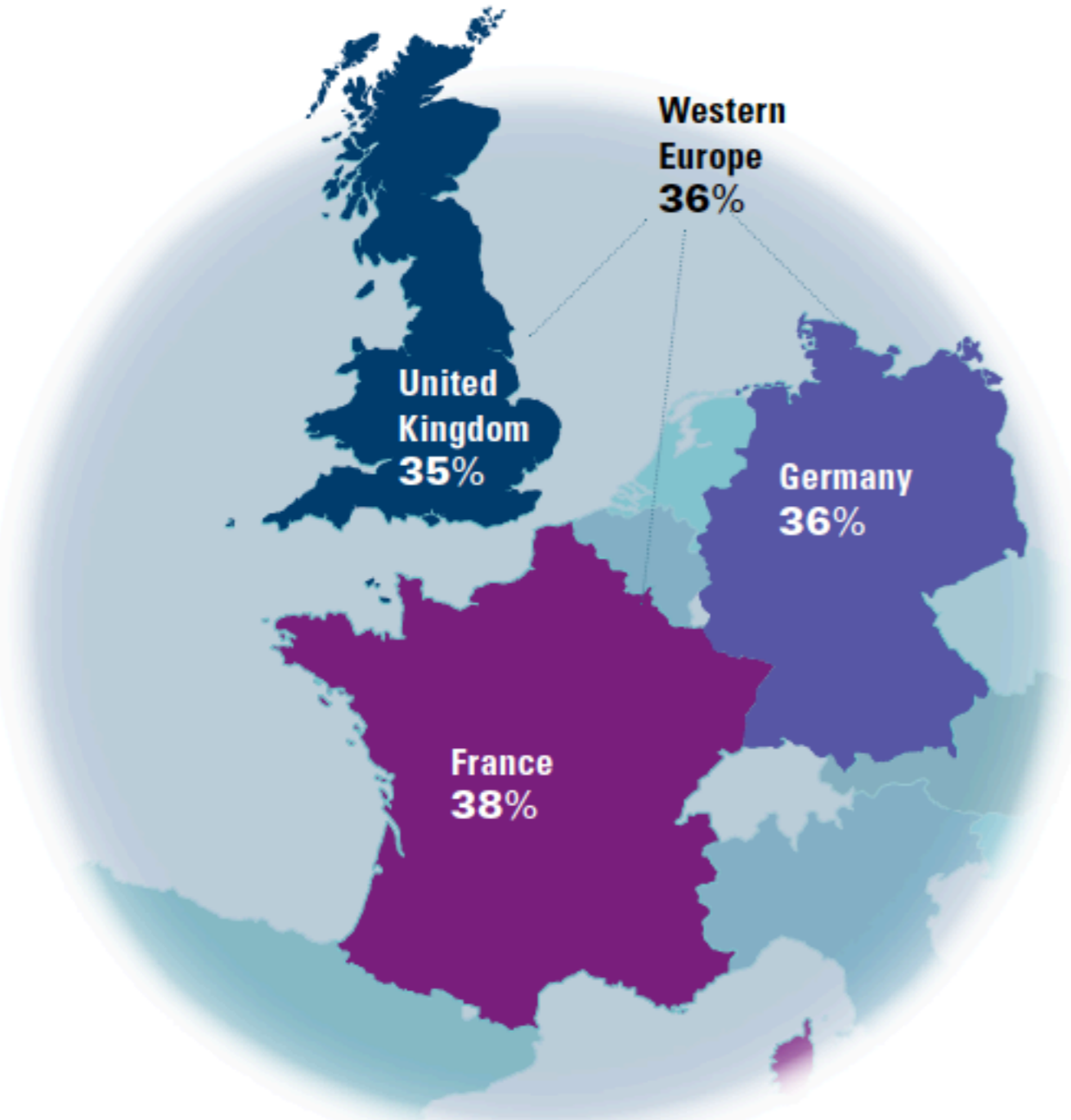




# 2010 Western Europe Adoption

## BIM Adoption Rate

Source: McGraw-Hill Construction, 2010.



## BIM Benefits Contributing the Most Value

Source: McGraw-Hill Construction, 2010.

Improved collective understanding of design intent



Improved overall project quality



Reduced conflicts during construction



Reduced changes during construction



Fast Client Approval Cycles



Better cost control/predictability



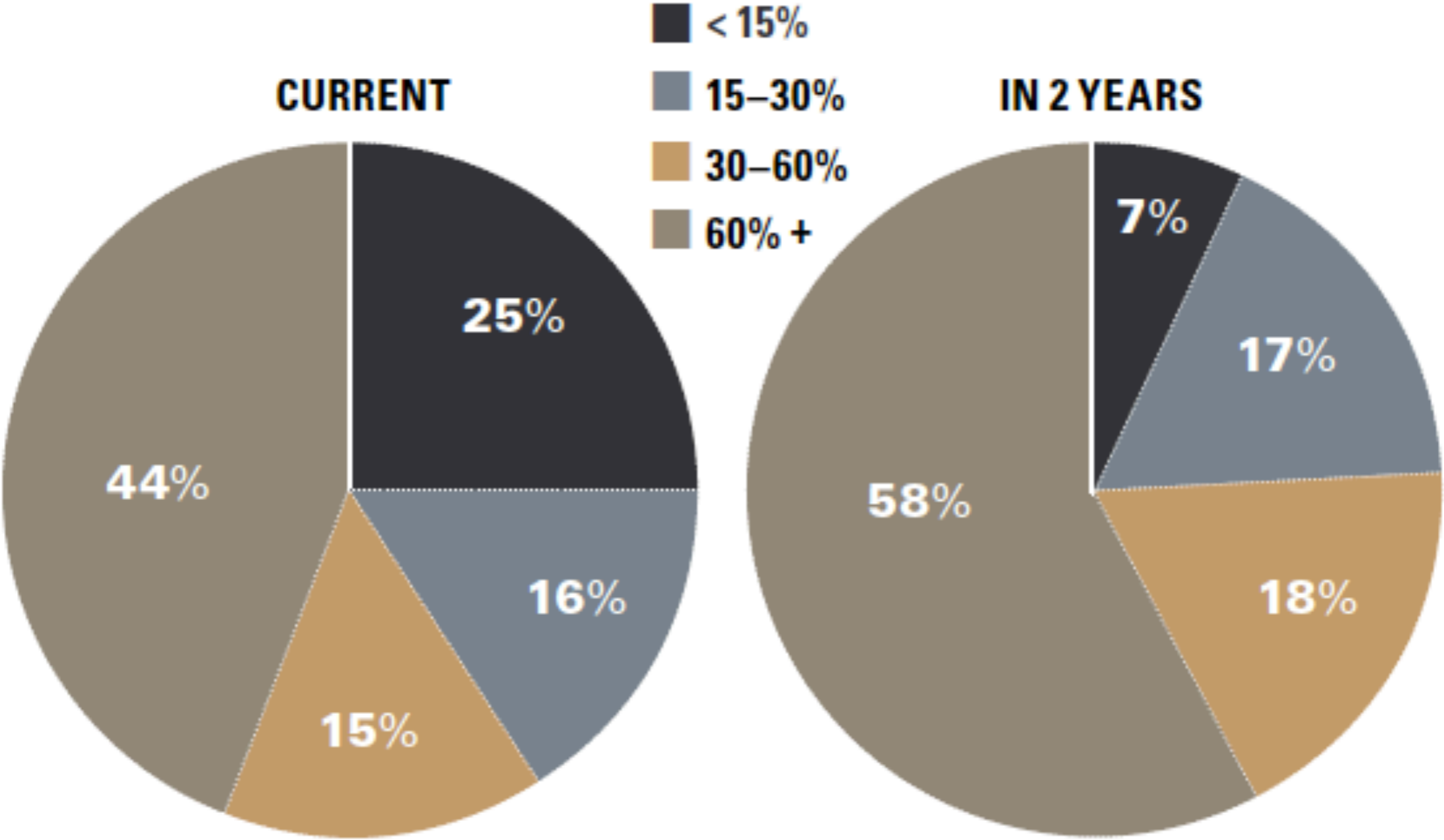
Reduced number of RFIs (Requests for Information)



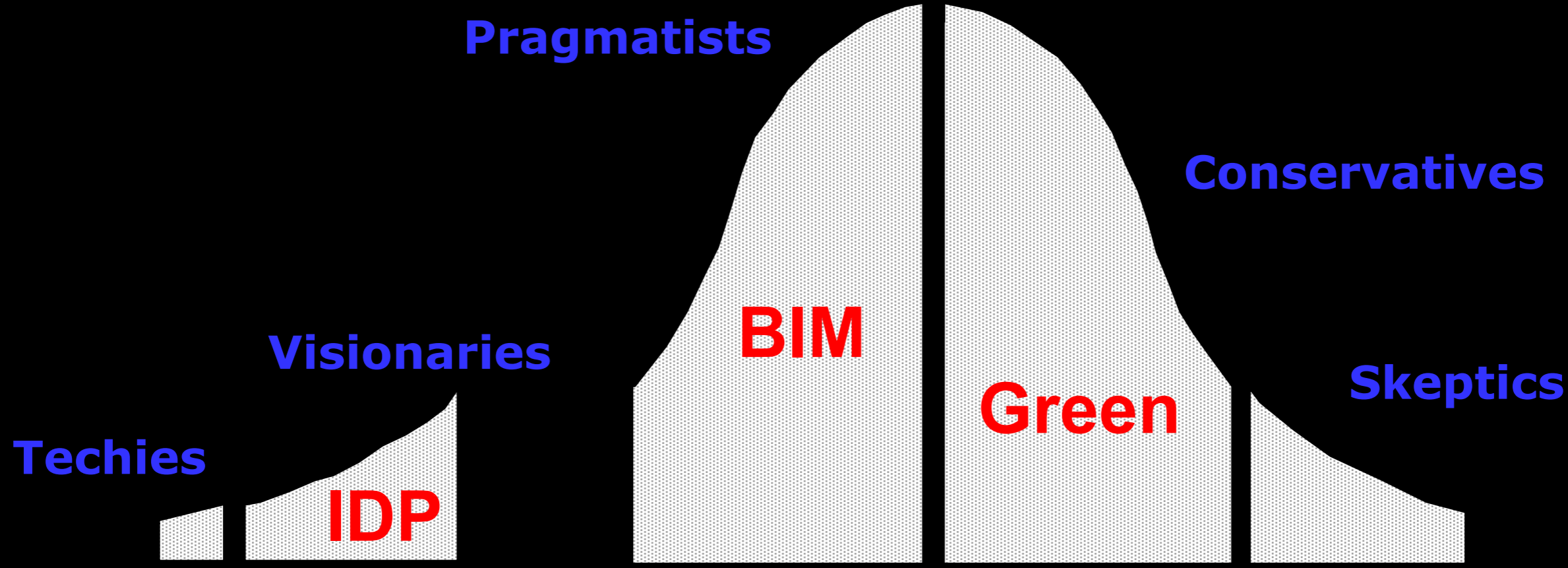
# 2010 Europe Adoption

## BIM Usage on Projects

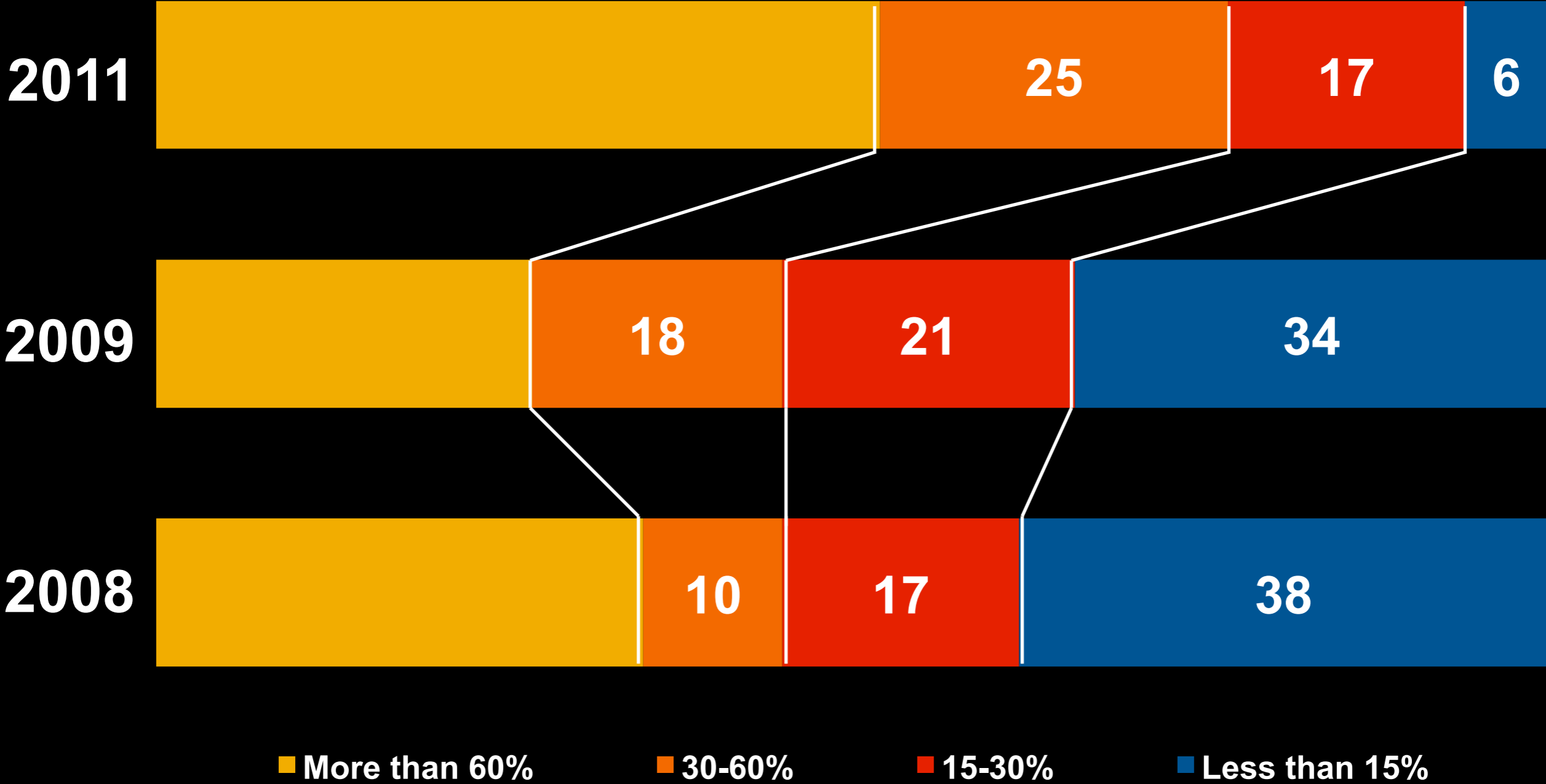
Source: McGraw-Hill Construction, 2010



# Innovation Adoption in the U.S.

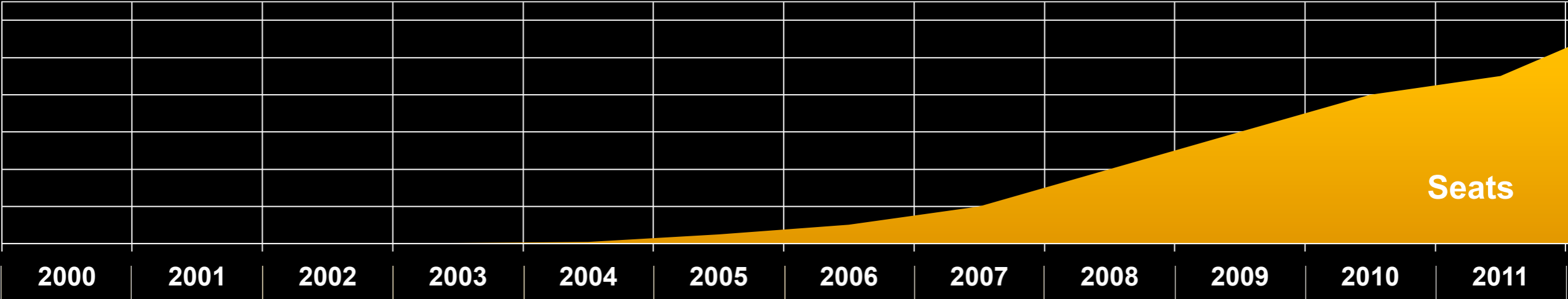


# Use of BIM for U.S. AEC Firms, 2008-2011



# U.S. BIM Adoption Timeline – Key Events

Cumulative Seat Adoption Curve



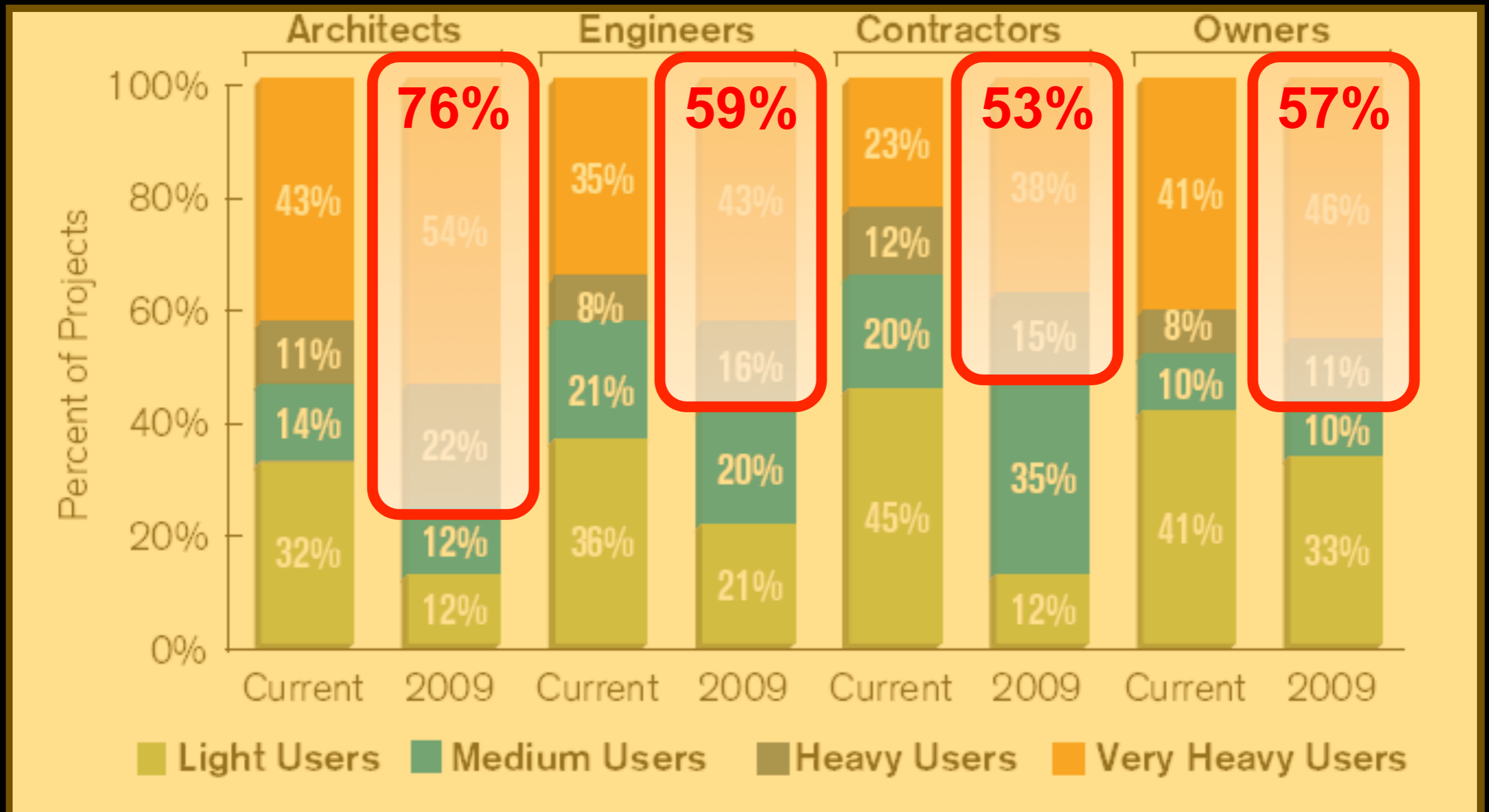
Industry Events

- 3/03 GSA BIM Standard
- 7/04 WSJ Freedom Tower article
- 8/04 CURT Paper
- 5/05 AIA Conv
- 09/07 AIA IPD Guide
- 10/08 AIA BIM Protocol
- 12/07 National BIM Standard

Product Events

- 3/00 ADT V 2001
- 4/02 Revit acquisition
- 6/02 Term "BIM"
- 6/06 Revit Structure release
- 3/06 Revit MEP release
- 2/08 GBS acquisition
- 07/08 Ecotect acquisition
- 10/10 Project Vasari

# Percent of Current & Future Projects Involving BIM



Source: McGraw Hill Construction October 2008 BIM Survey

<b><i>Relative Importance of internal benefit</i></b>	<b><i>NA</i></b>	<b><i>Low</i></b>	<b><i>Mod</i></b>	<b><i>High</i></b>
Marketing new business	2%	22%	27%	49%
Overall better construction project outcomes	2%	25%	25%	48%
Reduced errors and omissions in construction documents	4%	21%	28%	47%
Offering new services	2%	24%	27%	47%
Reducing rework	3%	25%	27%	45%
Maintaining repeat business with past clients	5%	31%	28%	36%
Improving knowledge about building in staff	6%	33%	30%	31%
Reducing cycle time for specific workflows	3%	34%	32%	31%
Reducing overall project duration	3%	41%	29%	27%
Reducing construction cost	6%	37%	32%	25%
Increasing profits	2%	46%	71%	21%
Recruiting, retaining staff	6%	43%	30%	21%
Fewer claims/ litigation	14%	40%	26%	20%

<b>Link between BIM Benefits and ROI</b>	<b>Low</b>	<b>High</b>
Better multi-party communication and understanding from 3D visualization	<b>5%</b>	<b>77%</b>
Improved process outcomes, such as fewer RFIs and field coordination problems	6%	<b>74%</b>
Improved productivity of personnel	7%	<b>73%</b>
Increased prefabrication	9%	<b>71%</b>
Positive impact on marketing	9%	<b>71%</b>
Reduced cycle time for project activities and delivery	9%	66%
Lower project cost	12%	57%
Improved jobsite safety	20%	50%
Positive impact on sustainability	21%	44%
Positive impact on recruiting / retaining staff	22%	43%
Faster plan approval and permits	26%	36%

RELATIVE IMPORTANCE of BIM Benefits to Improving ROI

None/Low High/Very High

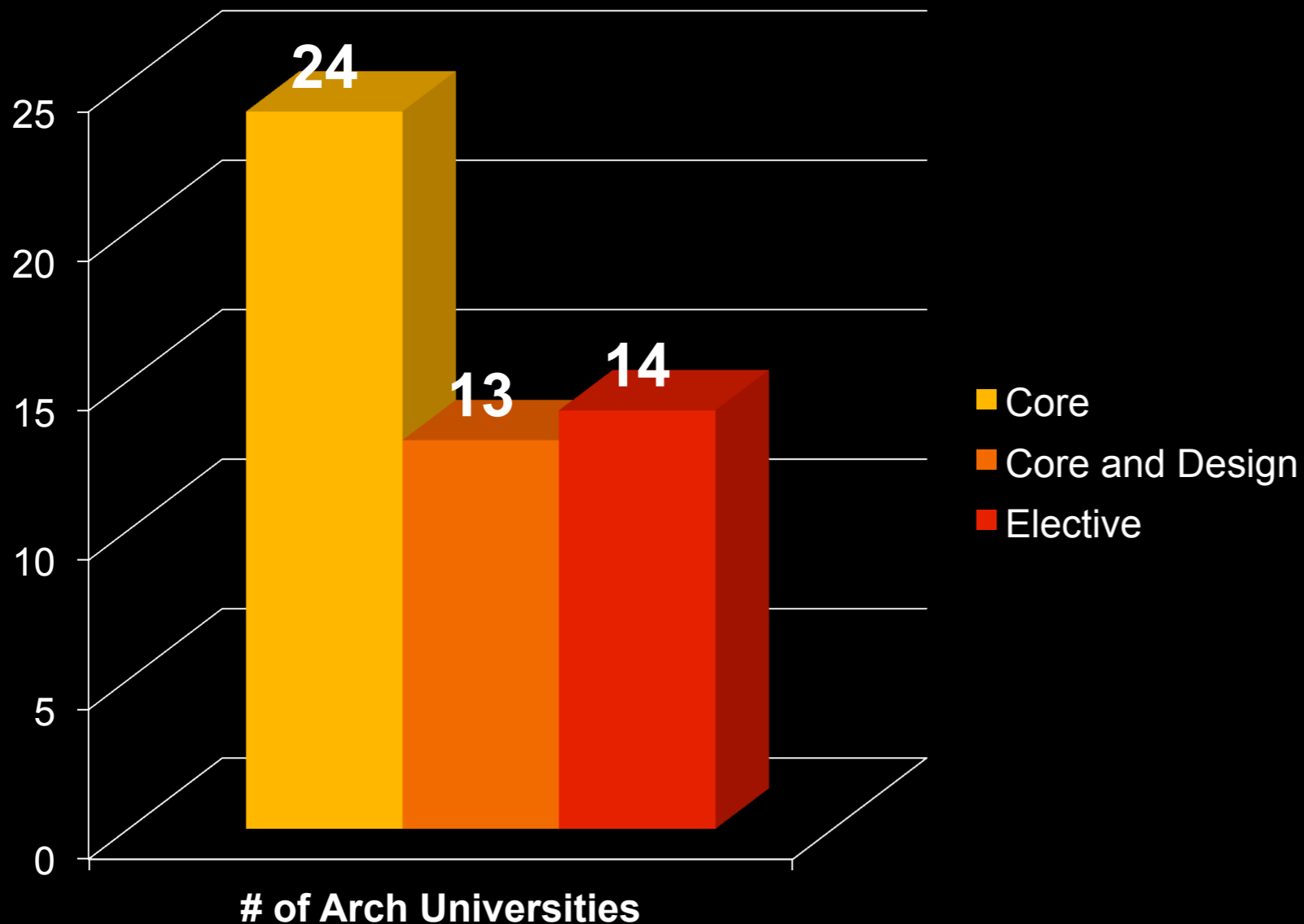
Young, Jones, Bernstein, Gudge (2009) "The Business Value of BIM: Getting Building Information Modeling to the Bottom Line", McGraw Hill Construction.



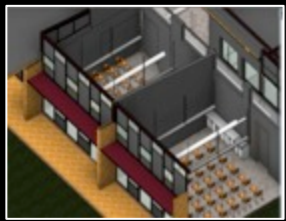
<b>Pre-design</b>	Spatial, functional investigation	<b>Conceptual Energy Analysis from early model proposals.</b>
	Considerations of site, context, site, zoning and codes	
<b>Schematic Design</b>	Initial proposal resolving issues of space requirements and form	<b>Use of Visualization for stakeholder engagement and approvals</b>
	Preliminary approach to massing and concept, materials and finishes	
<b>Design Development</b>	Detailed design, documents for client, regulatory approvals	<b>Integration of collaborator models from engineering disciplines.</b> <b>Enhanced understanding of design, informed decision-making.</b> <b>Improved coordination.</b>
	Focus on architectural systems (wall, floor, ceiling, envelope), structural, mechanical systems, electrical, lighting, fire protection, interior finishes, materials, site	
<b>Construction Documents, Detailing</b>	Site preparation, grading, demolition	<b>Clash identification, early resolution which reduces issues in the field.</b> <b>Opportunity for more accurate estimates from model data.</b>
	Specifications – systems, materials	
	Structural – components sizing, connections	
	System specifications	
<b>Construction Administration</b>	Coordination, review of details and materials	<b>Model increases understanding, reduces RFIs.</b> <b>Construction phasing, materials order and state of completion.</b>
	Respond to requests for information, change orders	
	Construction Sequencing	

# BIM Benchmark

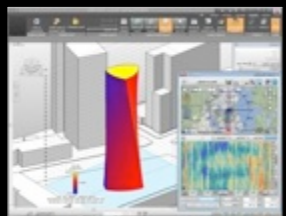
## Overview of Arch Universities and BIM



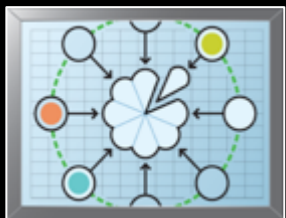
- BIM in theoretical courses along with hands-on applied design studios are optimal



**REPRESENTATION:** How is the project created, documented and transmitted?



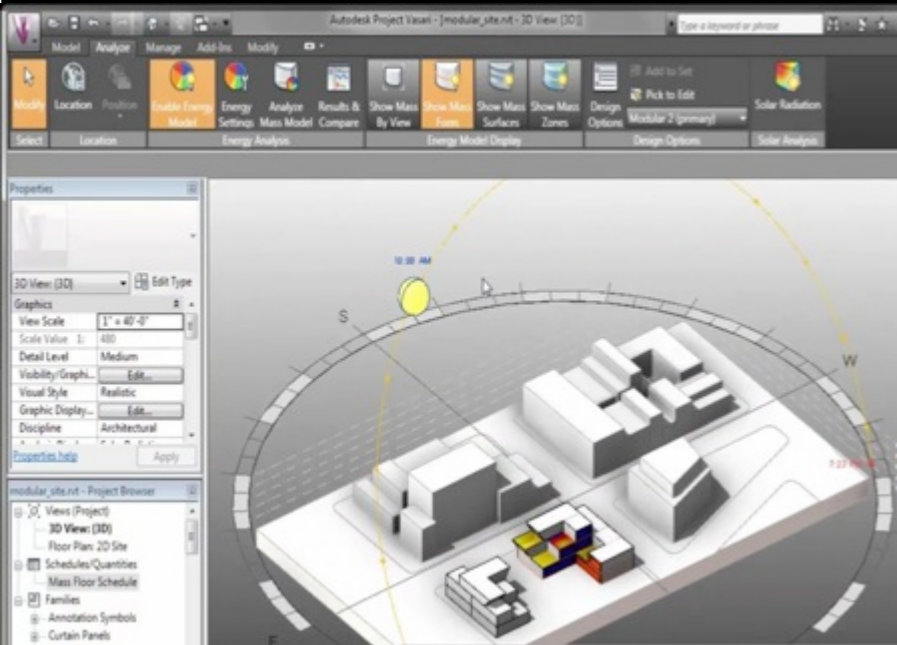
**ANALYSIS AND SIMULATION:** How is the project optimized for greatest effectiveness?



**COLLABORATION:** How does the project team work together?



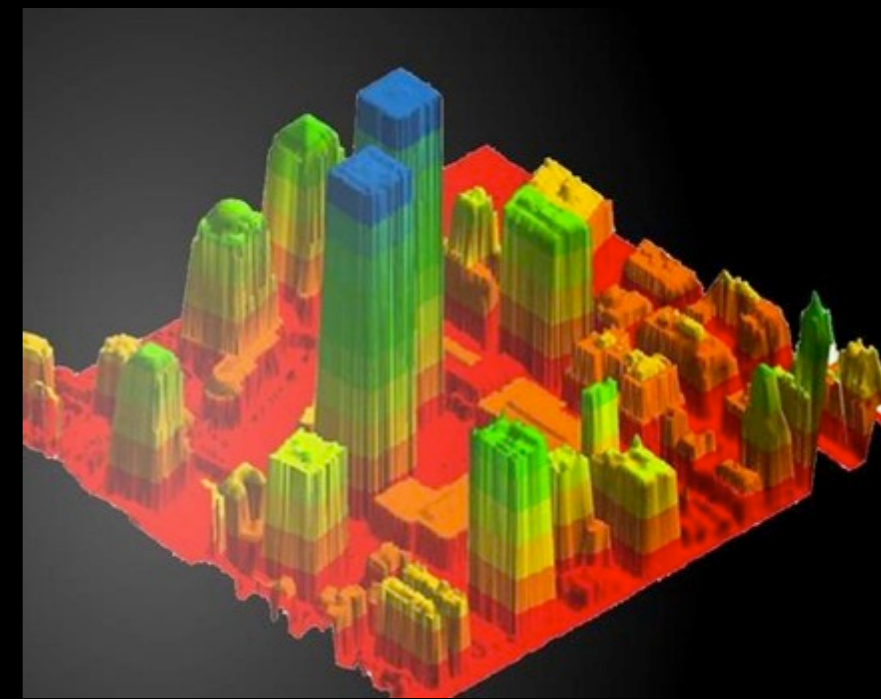
**REALIZATION:** How is design information transformed into a constructed project?



**Modeling**



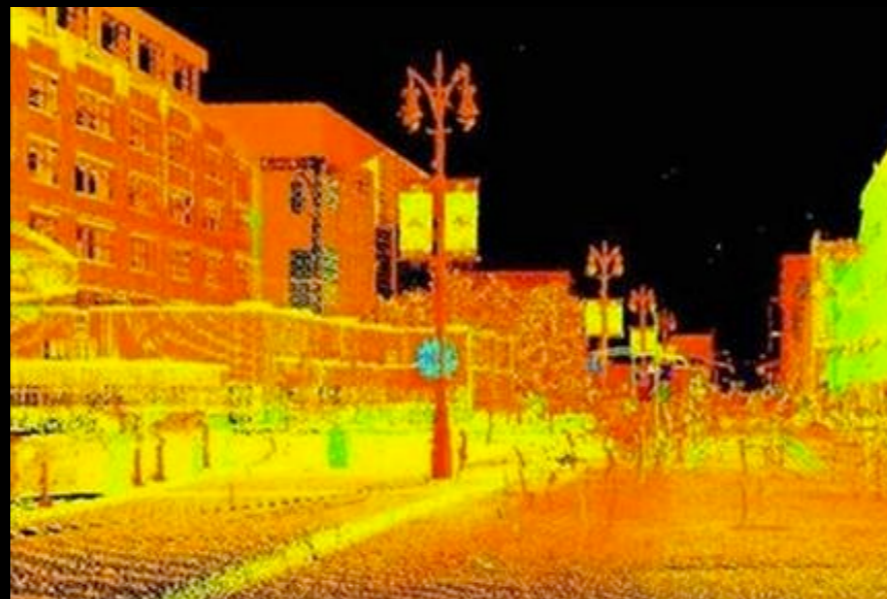
**Cloud**



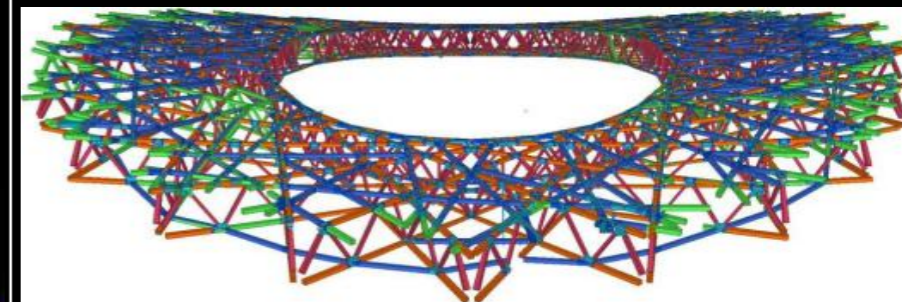
**Simulation**



**Collaboration**



**Analog → Digital**



**Digital → Analog**

# Collaborative Project Delivery (IPD)



Involve all team members in design meetings, including contractors.



Institute building information modeling.



Facilitate collaboration



Set up contract mechanisms that enable open collaboration.



Minimize paper-based processes, and collaborate digitally.



Check for and manage interferences between trades, digitally.



Create a culture of trust and sharing.



Communicate design ideas using 3D visualization to keep everyone aligned.

# Always Sustainable



Green Globes



**DGNB**  
Deutsche Gesellschaft für nachhaltiges Bauen e.V.

breeam



**CASBEE™**



THE CHINA SUSTAINABLE ENERGY PROGRAM  
*Toward a Sustainable Energy Future for the People's Republic of China*

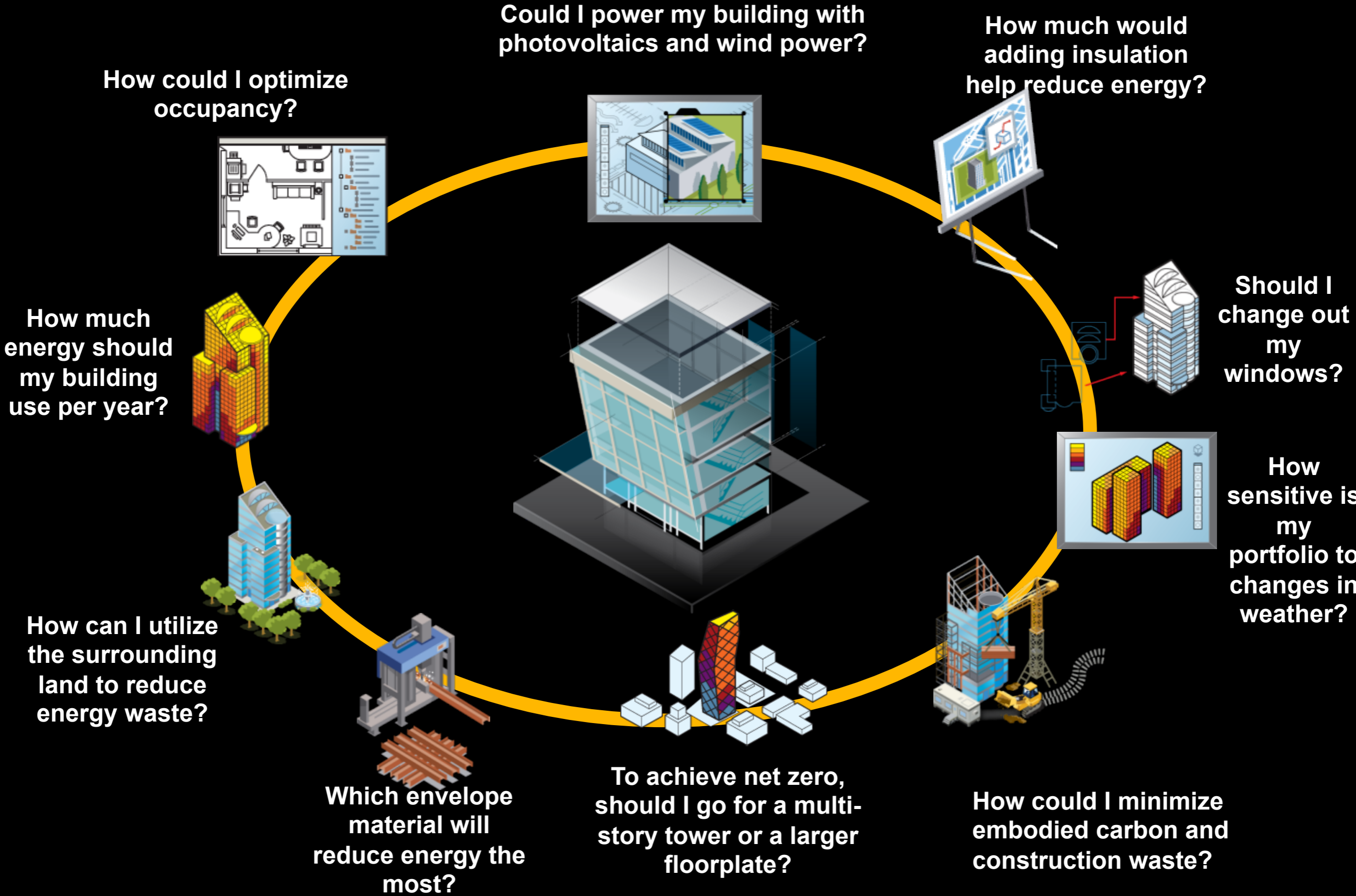


**ASHRAE**  
Advancing HVAC&R to serve humanity  
and promote a sustainable world

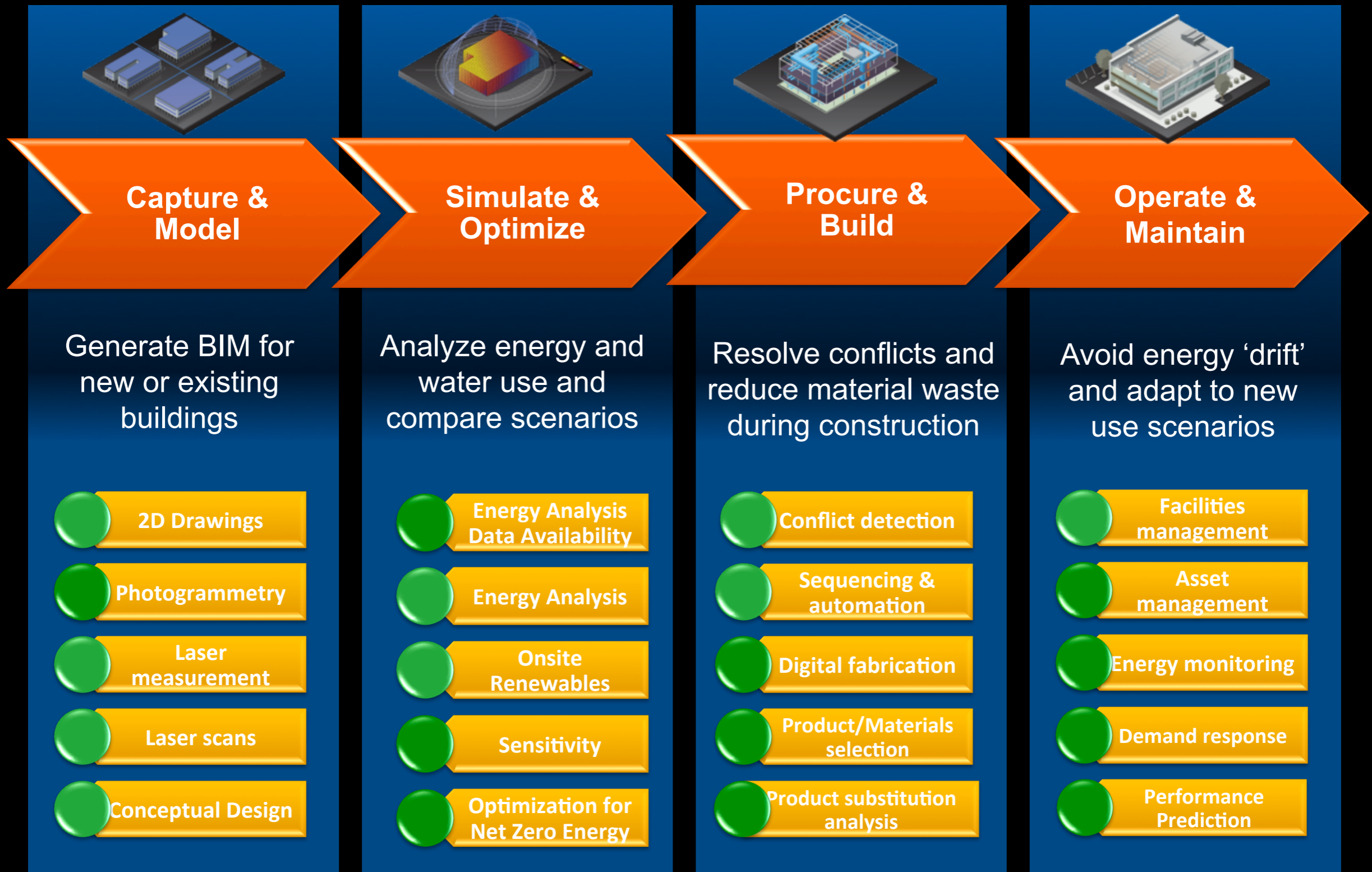


**WORLD GREEN BUILDING COUNCIL**

# Example: Early Sustainable Design Decisions

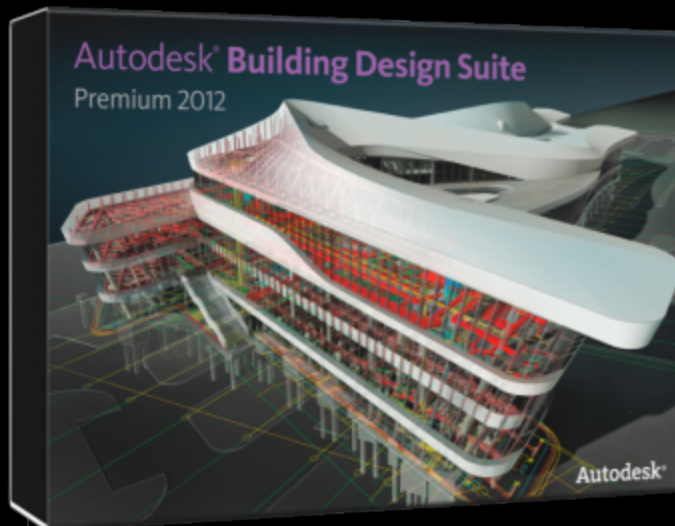


# Sustainable Buildings Lifecycle, Technology, Maturity





# Sustainable Building Solutions



## **Autodesk® Revit® Architecture**

Sun path simulation and cloud-based conceptual energy analysis\*

## **Autodesk® Revit® MEP**

Integrated heating and cooling load calculations and conceptual energy analysis\* as a foundation for engineering-driven calculations

## **Autodesk® Revit® Structure**

Analyze design alternatives and optimize the structure to minimize material use and waste

## **Autodesk® 3ds Max® Design**

Natural and artificial daylighting simulation

**Autodesk® Navisworks® Products** Model aggregation and project simulation help identify wasteful conflicts and errors

## **Autodesk® ImageModeler™ 2009**

Helps capture existing conditions for rapid energy modeling of existing buildings.

## **Autodesk® Green Building Studio**

Cloud based whole building energy analysis

## **Autodesk® Project Vasari**

Building performance analysis in a conceptual modeling tool

## **Autodesk® Ecotect® Analysis**

Interactive, visual tools to study the impact of solar radiation, shading, and daylighting

## **Autodesk® SEEK**

Search for building product materials by environmental attributes such as insulation value and recycled content

\*Web-based analysis is available to Autodesk Subscription customers of Autodesk® Revit® Architecture and Autodesk® Revit® MEP software during the term of their Subscription.

# Business Value of BIM

**Macro-Economic  
change**



**Shifting  
demographics**



**New Assets,  
new Models**



**Data explosion**



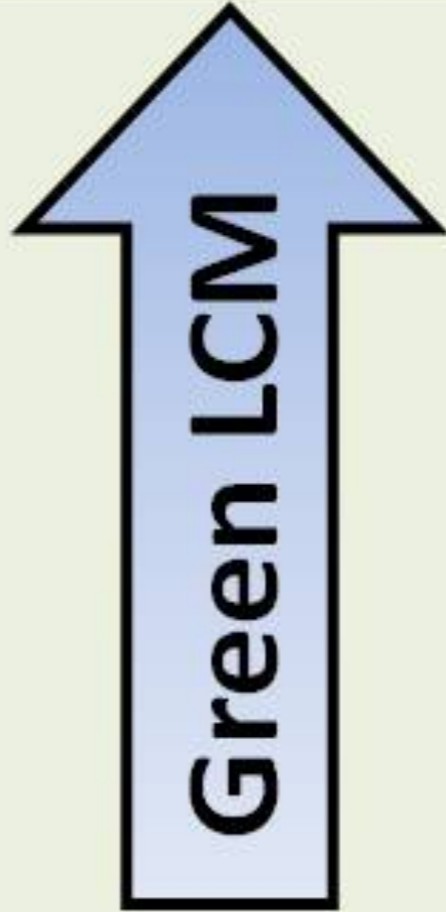
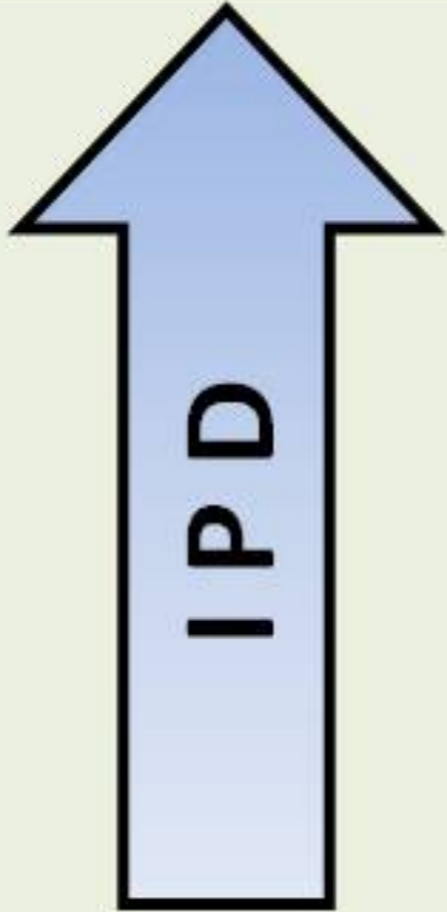
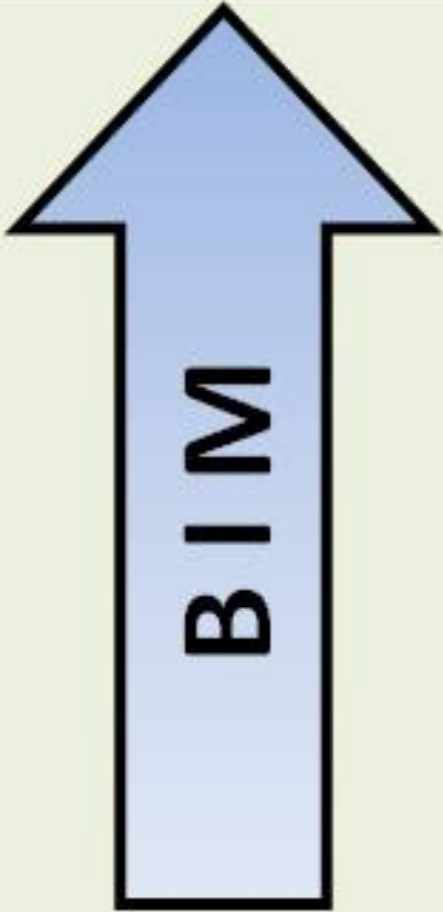
**Improved  
decision-making**



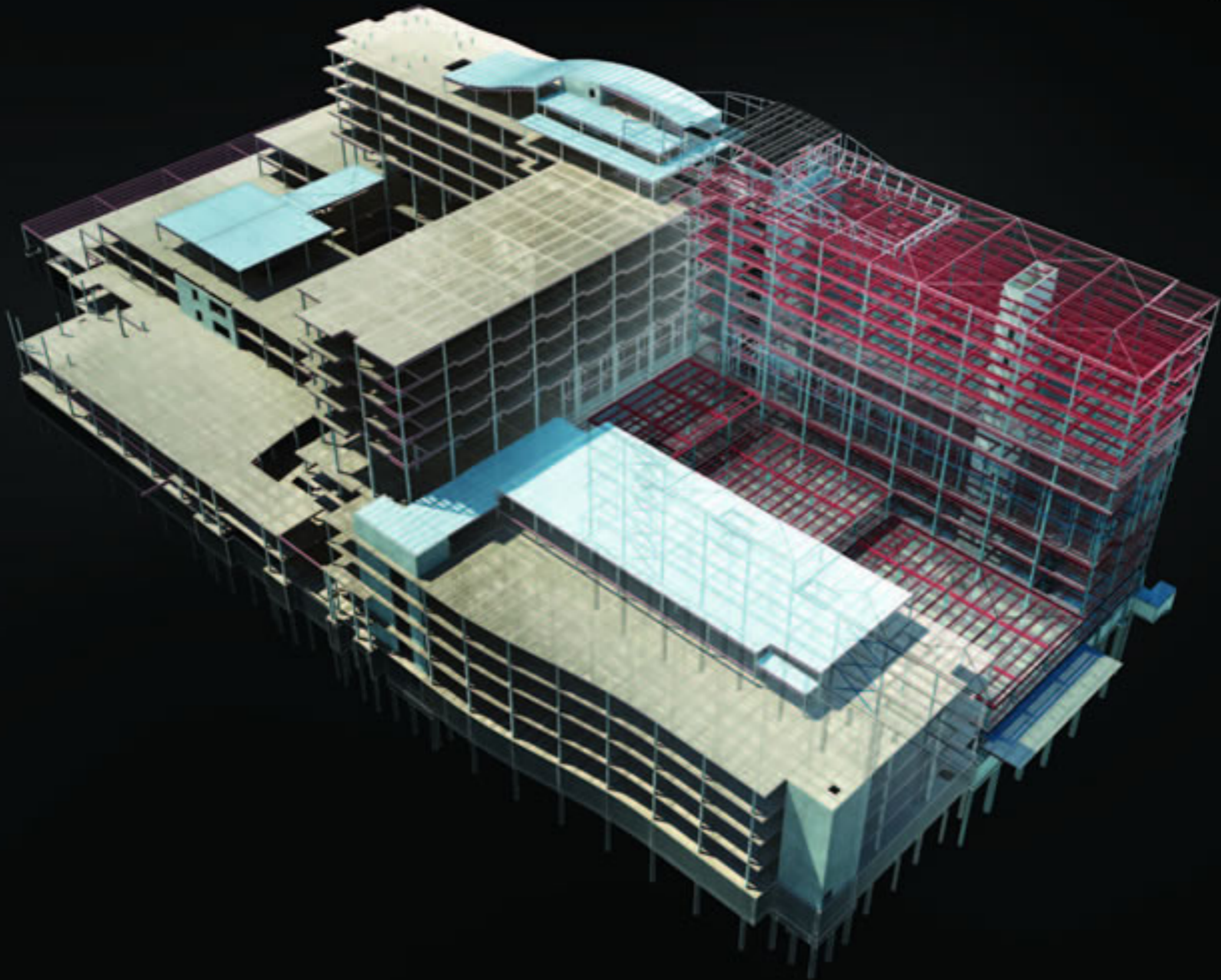
**Conflict reduction**



**Faster delivery**



**Pieces (Product)**



**Autodesk®**