BUILDING INNOVATION 2019
National Institute of BUILDING SCIENCES
CONFERENCE & EXPO

Standardize Virtual Design and Construction Performance Metrics and Key Performance Indicators

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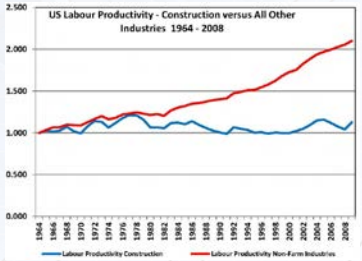
The Case for Standardized Metrics

- Reliable *platform* to share data
- Basis for objective *comparisons*
- Coordinated Evidence to *inform decisions*

Standardized & Scalable Sets of KPI: Call for Global Collaboration

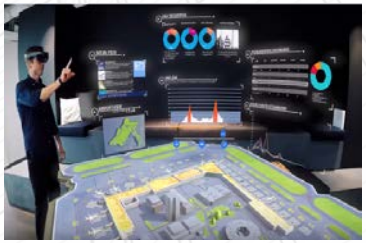
Economy → Country → City → Enterprise → Project → Facility & Infrastructure → Processes & Meetings → Part

Productivity Rate

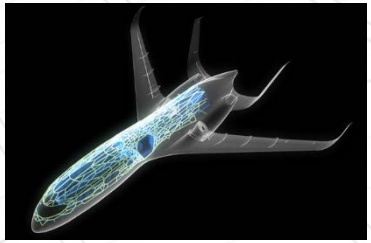


Societal Impact

User Engagement



Parts Optimization



Concept: Strategic Building Innovation . bimSCORE

Sources: Teicholz | ESRI | fracturereality.io | CNN

Takeaways

1. Focus on Meaningful Metrics; prioritize what can be done.
2. Link metrics to major organizational goals
3. Standardize metrics to support head-to-head comparisons
4. Develop a Holistic System of Comparable Metrics
5. Compile reliable evidence to support decisions
6. Select metrics to inform workflow management

Focus on Meaningful Metrics, Prioritize what can be done

Sources: masterclass.workplaceinsights.in| cdn2.iconfinder.com

What really matters?

- How many clashes can be found find,
  — or how smoothly the project comes together?
- How many items can be checked off RFI lists,
  — or how quickly we address the most critical issues?
- Keeping a regular meeting schedule,
  — or getting things done?

Link metrics
to major organizational goals

Sources: newdesignfile.com | shareicon.net | cdn3.iconfinder.com

Skanska Vision and Values

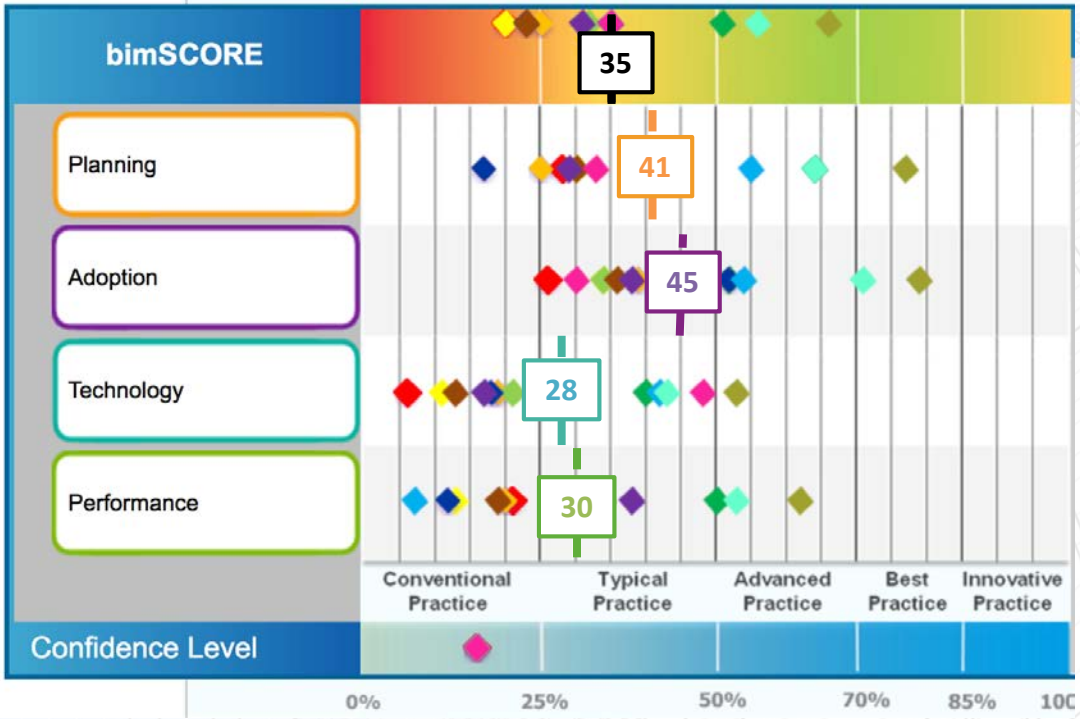
Metrics from Mortenson

Sources: https://www.usa.skanska.com/ | http://www.mortenson.com/vdc-report

Standardize Metrics
to support head-to-head comparison

Source: keydifferences.com

Firm BIM Maturity Comparisons



Project	Score	Set
Firm A	66	
Firm B	56	
Firm C	51	
Firm D	35	
Firm E	35	
Firm F	32	
Firm G	31	
Firm H	25	
Firm I	23	
Firm J	23	
Firm K	20	
Firm L	20	

Commitment Reliability

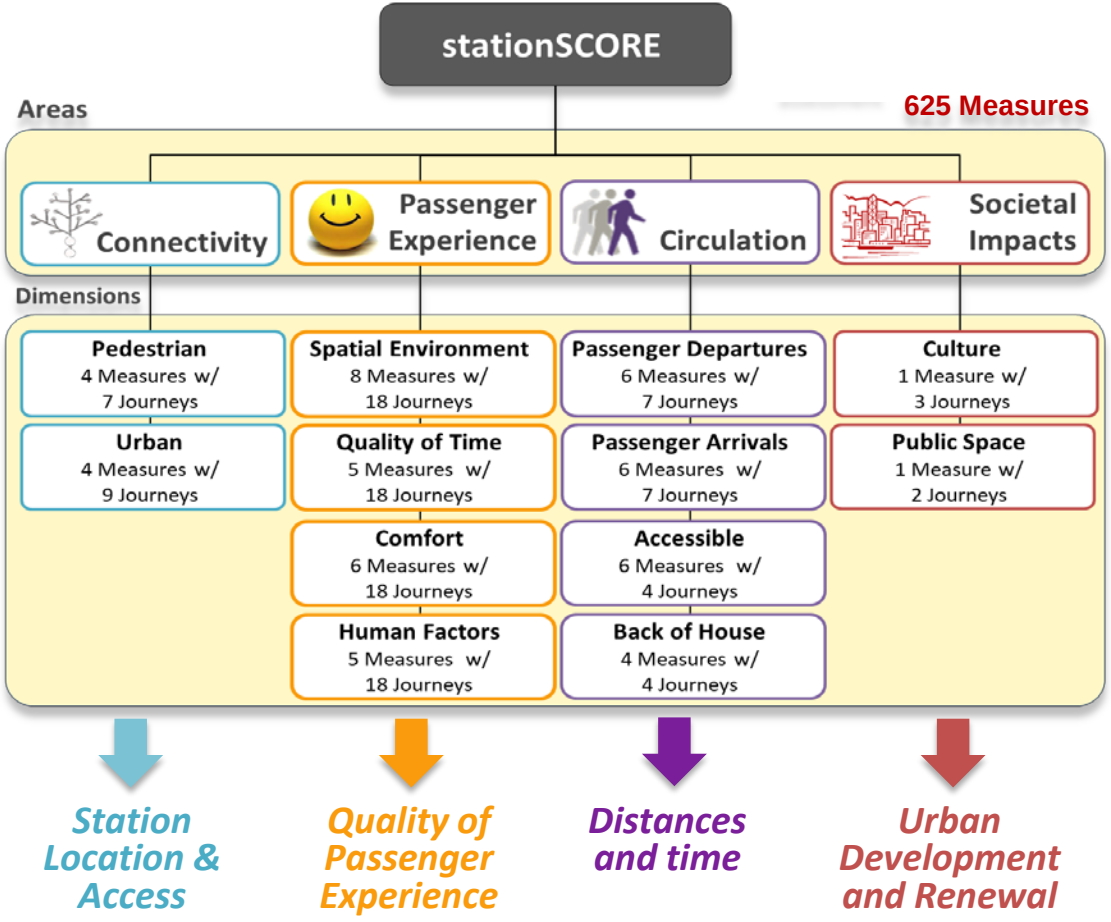
	AVERAGE LATENCYTYP A (Only Accounting Delayed Issues, Not Early Closing)	AVERAGE LATENCYTYP B (Accounting both Delayed Issues and Early Closing)	AVERAGE LATENCY TYP C (Accounting both Delayed Issues and Early Closing)	Average Postponement	Overall Commitment Reliability	Commitment Reliability Ranking
	A	B	C	D	A+B+C+D	
Design Architect	7.0	5.0	4.0	5.0	21.0	4
Civil Design	4.0	7.0	7.0	6.0	24.0	6
Kitchen Design	2.0	4.0	5.0	4.0	15.0	3
Executive Architect	3.0	2.0	1.0	1.0	7.0	1
MEP Design	6.0	8.0	6.0	3.0	23.0	5
Interior Design	1.0	1.0	2.0	7.0	11.0	2
Resort	5.0	3.0	8.0	8.0	24.0	6
Owner	8.0	6.0	9.0	9.0	32.0	9
Landscape Design	9.0	0.0	9.0	9.0	27.0	8

Tracking latency, average postponement, and overall commitment reliability

Source: SBI-bimSCORE

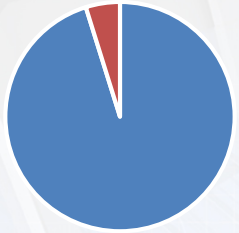
Overall Performance

London St. Pancras Int'l.
vs.
Beijing South Station

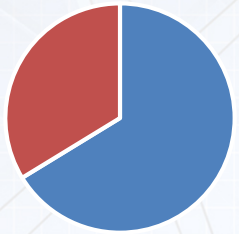


Operational Excellence: Enterprise Facility Lifecycle BIM Program

Oprimize Maintenance • Identify & Mitigate high-risk equipment investments



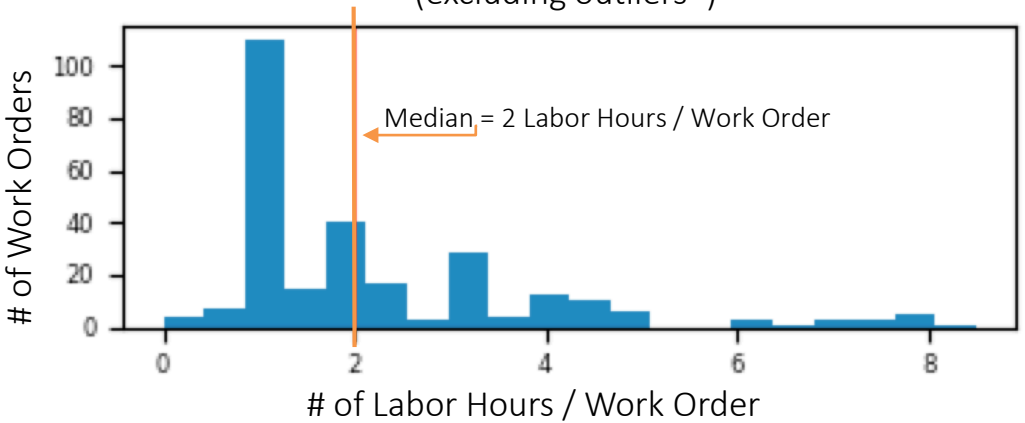
only **5%** of **work orders** are *un-scheduled*



yet **34%** of **labor hours** are *un-scheduled*

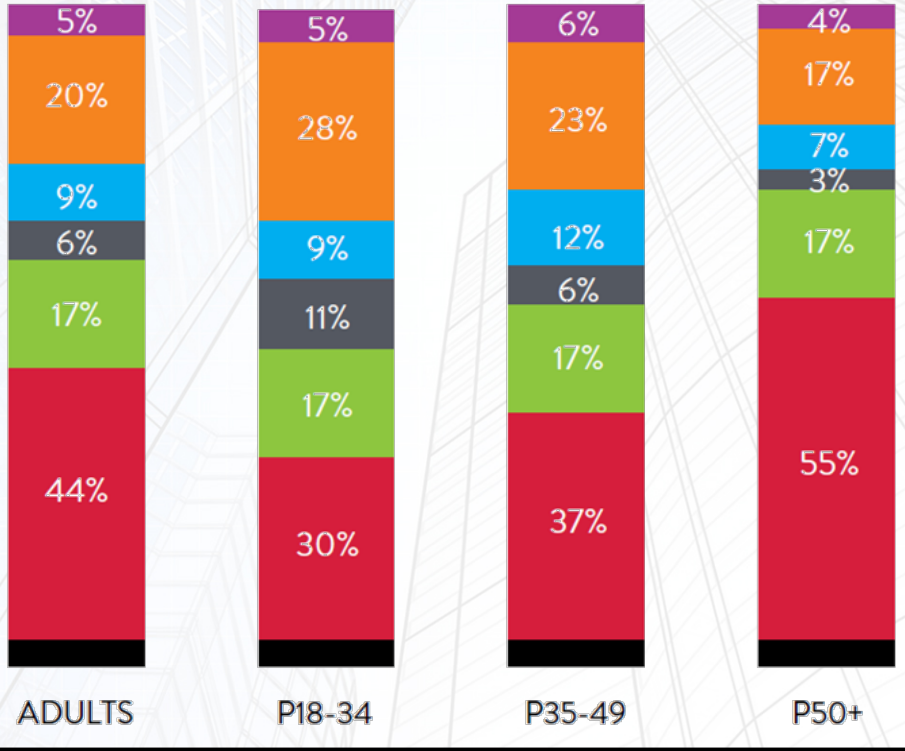
89% of *un-scheduled* labor hours are generated by 11% of assets ⇢ **high maintenance risk**

HISTOGRAM of Labor Hours for *Un-scheduled* Work Orders (excluding outliers*)



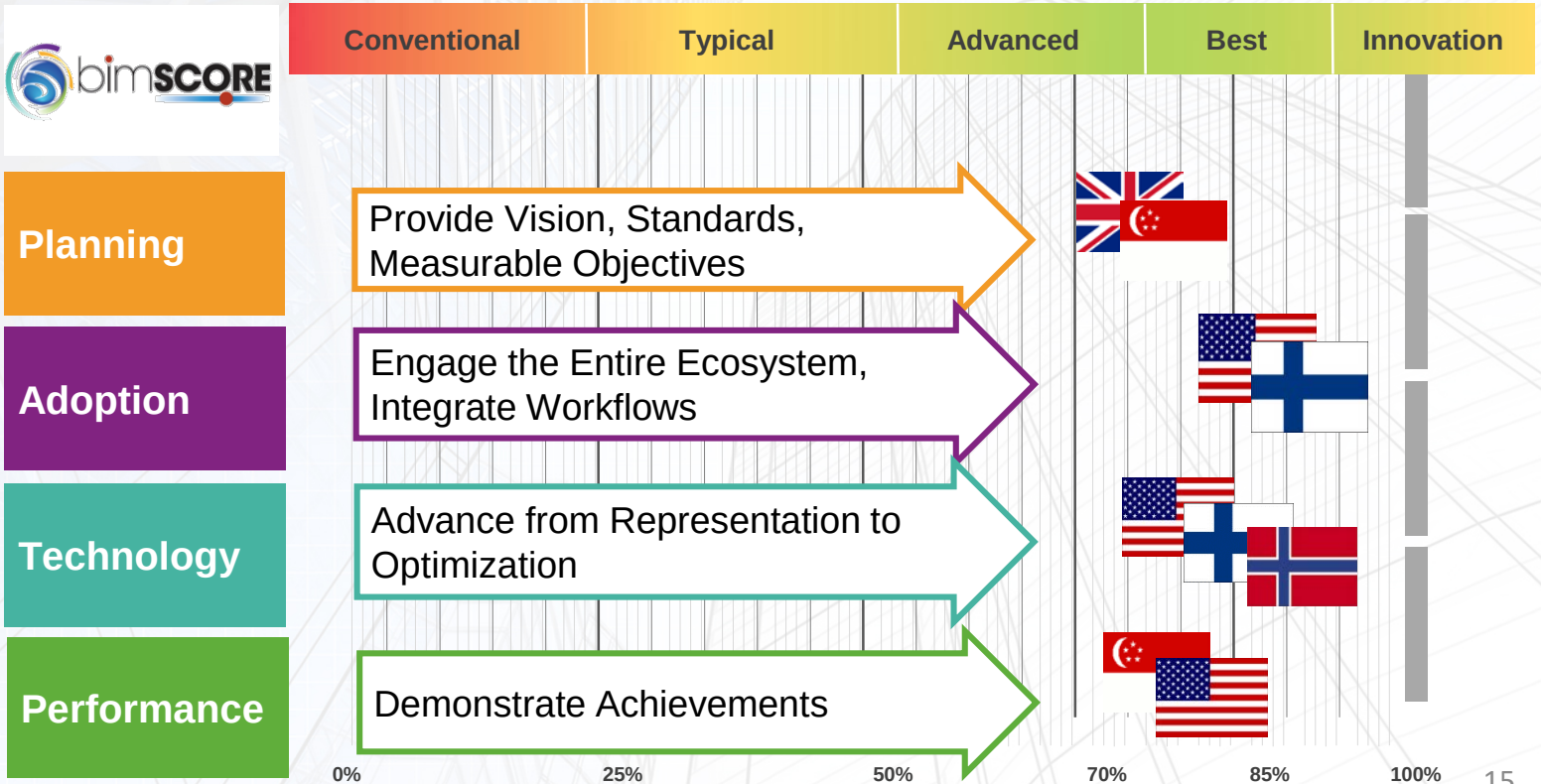
*some outliers require 100 to 2,484 Labor Hours / Work Order

Develop a Holistic System of Comparable Metrics



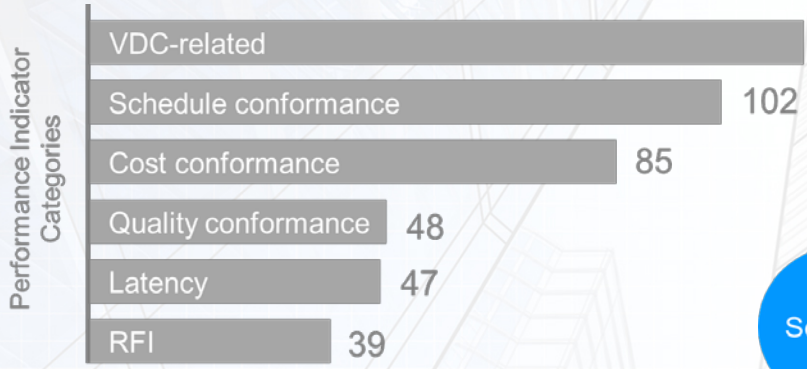
Source: linkresearchtools.com

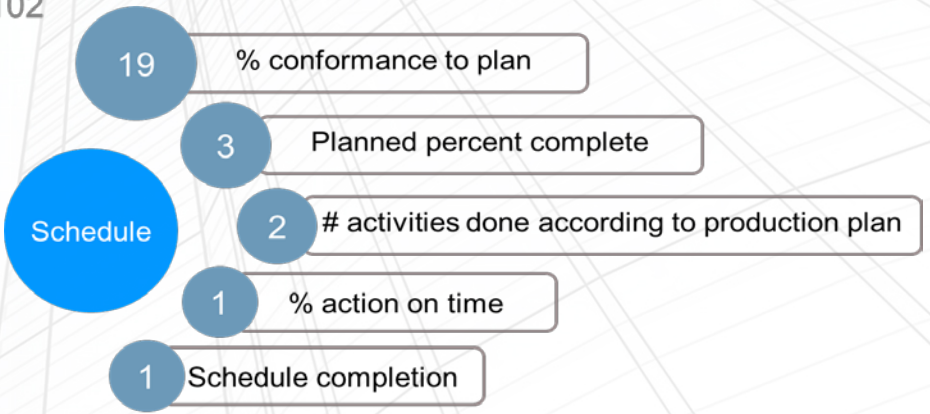
Global Benchmarking



161 projects from the CIFE Certificate Program

- **811** total performance indicators
- **535** unique performance indicators





Categories	Indicators	Metrics	Inputs
Client Objectives	Satisfaction	Client Satisfaction	[20] Estimate the client's satisfaction with selected performance objectives (E.g. Sustainability, Building quality etc.)
Project Objectives	Satisfaction	Project Performance Satisfaction	[14] Estimate the satisfaction for different aspects of project performance (E.g. Design clarity, Meeting effectiveness etc.)
	Design Performance	Design Alternatives	[15] # of major design alternatives considered for the project
		Design Robustness	[18] Cost of remediation / renovations performed after the completion of construction to remedy deficiencies in DESIGN
	Construction Performance	Schedule Variance	[16] % of construction tasks completed early or on-time relative to the baseline/planned construction schedule
		Cost Change	[17.1] % of construction cost change caused by Discretionary (intentional) changes
			[17.2] % of construction cost change caused by Non-Discretionary (unplanned) changes
	Operation Performance	Operation Reliability/Construction Quality	[19] Total % of operation/maintenance issues reported in the first five (5) years of operation
ICE	Decision Management	Decision Durability	[11.1] % of construction costs resulting from changed decisions
			[11.2] List typical root causes of changed decisions
			[12] % of re-visited decisions
	Stakeholder Engagement	Response Management	[13] Average response time for an action item
BIM	Level of Development (LoD)	Model Element LoD Compliance by Discipline	[6] % of BIM objects that meet targeted LoD requirements BY DISCIPLINE
		Model Element LoD Compliance by Model Use	[7] % of BIM objects that meet targeted LoD requirements by MODEL USE
	Data Compliance	Model Element DATA Compliance by model use	[8] % of BIM objects that meet targeted attribute DATA requirements by MODEL USE
PPM	Commitment Reliability	Commitment Reliability	[9] % of design and construction issues and/or decisions that are resolved on or before their original commitment date
			[10] Average latency (# of days late) of design and construction issues and/or decisions relative to their commitment date

600+ Metrics >> 10 Key Performance Indicators >> 5 Categories

ICE (Integrated Concurrent Engineering):

Decision Durability

- On average, **31% decisions** are revisited

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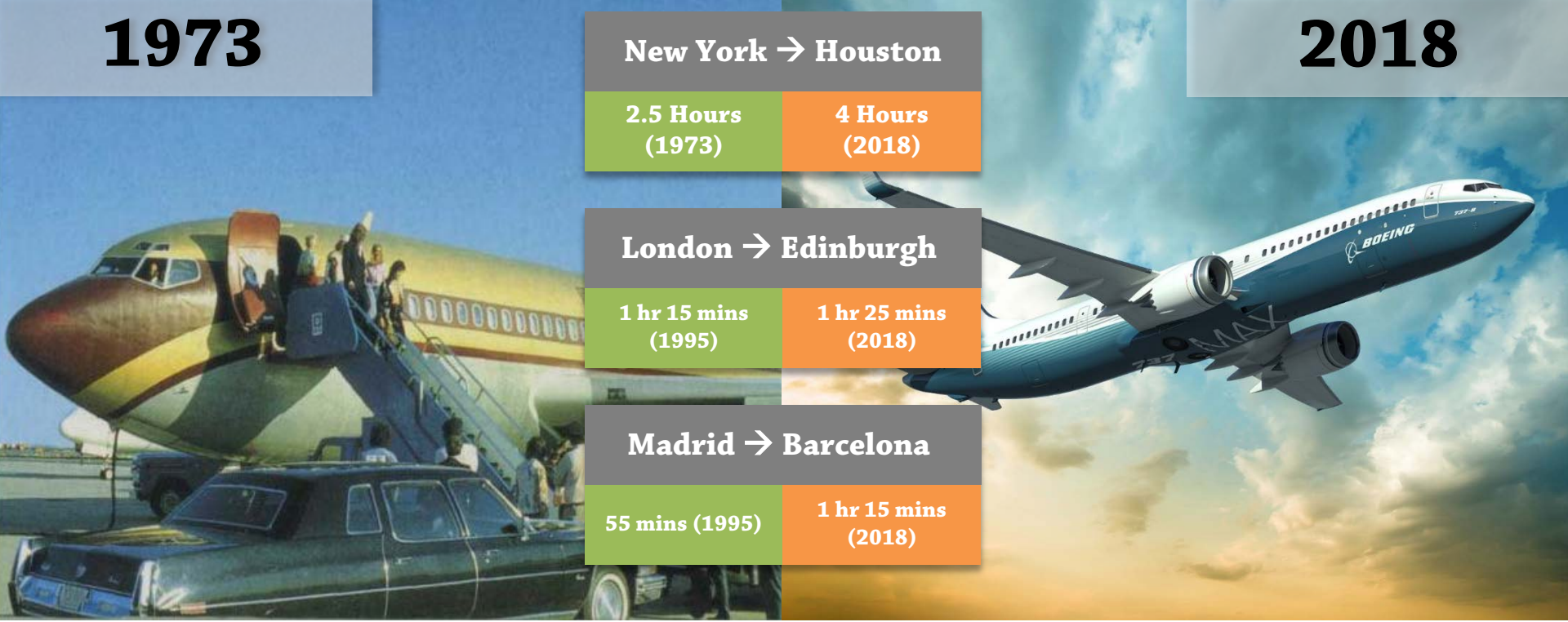
600+ Metrics >> 10 Key Performance Indicators >> 5 Categories

Compile reliable evidence to support decisions

Source: conceptdraw.com

Evidence - Comparable performance metrics correlated to decisions

Advice - Inform decisions to achieve desired outcomes



jetBlue

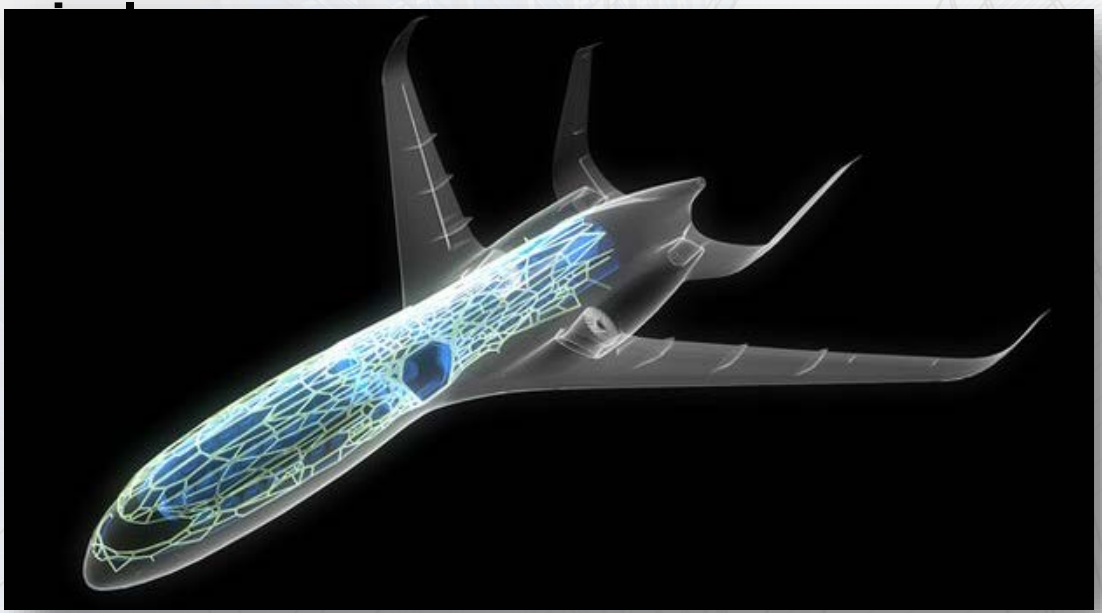
*Adds an average of **two minutes** to each flight since 2008*

$ 1,360,000 saving

Sources: http://www.feelnumb.com/ | https://www.cnbc.com | https://www.skyscanner.com.tw

Aerospace: A380 & Boeing 747-8: 6,000,000 Parts

Lightweight Carbon fibre composites for



- Can reduce the weight of an aircraft by up to **20%**
- Each kg cut means a saving of **roughly $1m in costs** over the lifetime of an aircraft

Source: https://www.bbc.co.uk/news/business-25833264

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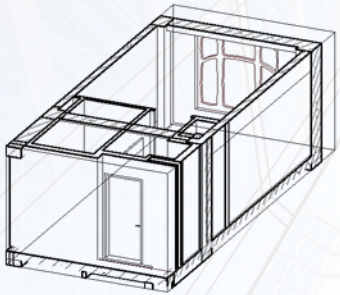
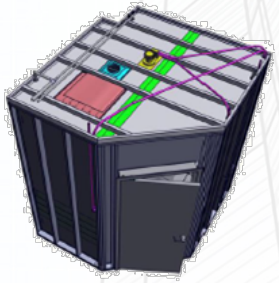
Typical Hotel Guestroom	Hospital Bathroom	Prefabricated Hospital Bathroom
# of Parts	# of Parts	# of Parts
8,350 – 12,650	4,000	60





For 440 Bathrooms:

98.5% Reduction

from 1,700,000 to 25,000

CIFE

Select metrics
to inform workflow management

Source: wp-content

Controllable Factors

Publish Goals and Provide meaningful management information

Adopt and Integrate technology to achieve goals

80% Commitment Reliability

Uncontrollable Factors

Economic Downswings

Skilled Labor Availability

Client Decision-making

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Control Metrics Leading / Process / Action Indicators

- 3D Visualization 100% for Critical Areas
- 90% BIM Coordination in every working session
- 80% Commitment Reliability

Outcome Metrics Lagging / Product / Result Indicators

- Project meets Quality Expectations
- Minimized Field Coordination Defects
- Project on Budget & on Time

Fragmented	Interim Progress	Integrated
Quantity Take Off Time		
1 day / floor	1 hour / floor	15 min/ floor
BIM Authoring Turnaround Time		
2 months	2 weeks	2 days
Managing Priorities		
Listing 100+ unfiltered clashes	Focusing on 10 design issues	Optimizing design alternatives

Invest in Meetings

# of Attendees	=	10 – 20 professionals
Rate	=	$80 - 150/hr
Duration	=	1 - 3 hours
Frequency	=	12 - 50 meetings / yr
Cost	=	**$9000 - $450,000 / yr**
10% waste	=	**$900 - $45,000 / yr**

Compare the outcomes…

Traditional Practice

50 person hours / issue

Per Issue
= $7,500

Advanced Practice

29 person hours / issue

Per Issue
= $4,370

Traditional Practice

3 Weeks

Baseline

Advanced Practice

4 days

Time Reduction
≥ 81 %

Source: bimSCORE

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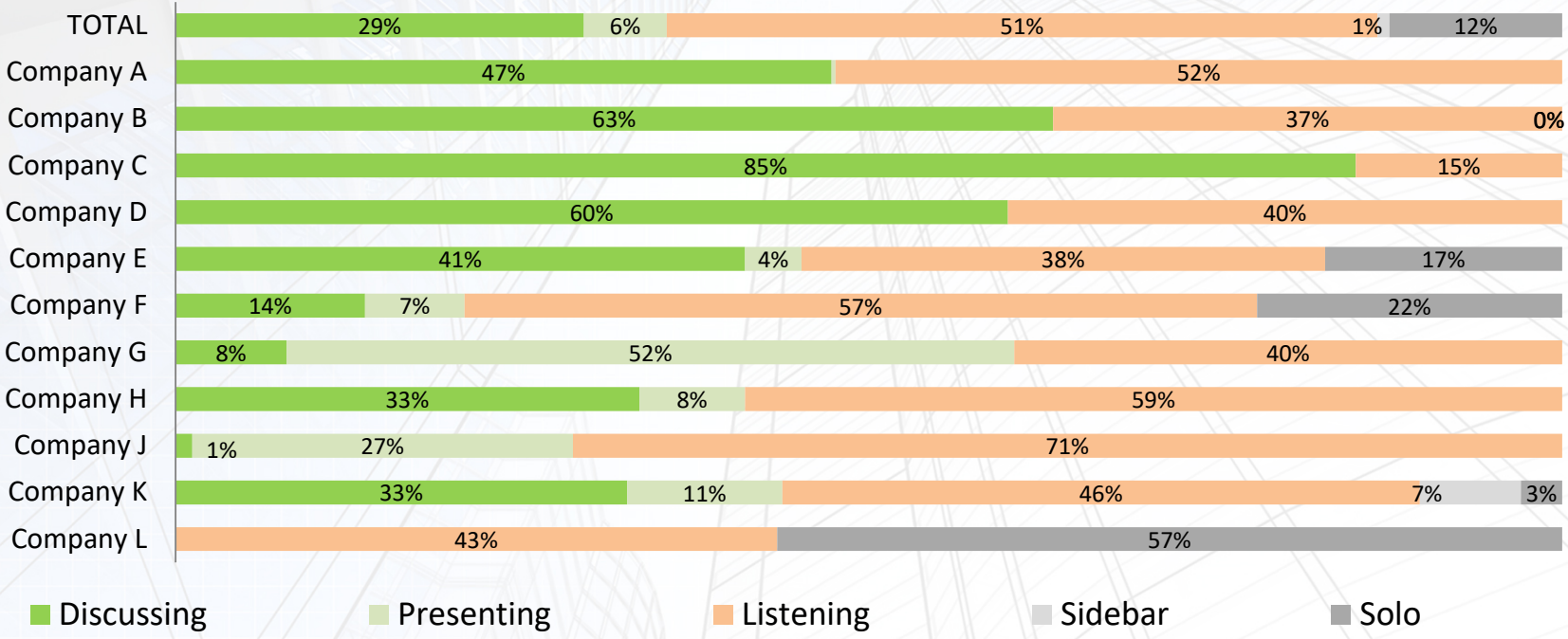
Collaboration Effectiveness



Source: bimSCORE

Meetings

" CEOs Are Always in Meetings "

On average, executives report investing an average of 23 hours / week in meetings in which 34% of the time is wasted

From "How CEOs Manage Time?" by Michael E. Porter and Nitin Nohria, Harvard Business Review

"Most employees attend 62 meetings / month"

There are more than 3 billion meetings per year. Executive on average spend 40-50% of their working hours in meetings.

From "How CEOs Manage Time?" by Michael E. Porter and Nitin Nohria, Harvard Business Review

Resolutions & Commitments

Decision Management & Meeting Facilitation

teamingSCORE

Contact Us

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