



plante moran | Audit. Tax. Consulting.  
Wealth Management.

# Manage risk: data driven decisions for construction

Adapting to a new world



# Presenters



## Bob Tinglestad | Principal Construction Technology

I'm one of the firm's construction leaders with an emphasis on improving organizational performance through technology optimization and analytics. My expertise spans business intelligence needs analysis, data integration/management, and BI tool implementations. My passion is helping our clients through the journey of becoming a data-driven organization; enabling them in making confident decisions that solve problems, optimize productivity, seize opportunities, and manage risk.



# Learning objectives

- Understand how business analytics can improve your organization's decision making.
- Create a plan to update your business's technology and data structures to support more effective decisions around bidding, cash management, labor and project management.



# Data analytics: Lessons from the pandemic

1. The digital transformation is here.
2. Data enables better decision-making.
3. Data governance is critical.
4. Ensure privacy & security.
5. Focus presentation on users & action.
6. Don't be data historians.
7. Have a plan, but be agile.







# COVID-19 & construction: Work in progress

How many jobs am I winning? How are decreases in job size and increases in competition impacting our business model?

*How do we know what we think is happening, is really happening? How trustworthy is past experience?*

There's no consistency to how we measure project managers. 30/60/90% gain/fade would be great!

Everywhere I look, people have different versions of the same data. Which one do I believe?

Should we bid on this project? How much?

Are we tracking PPP spend appropriately?

What are COVID-19 case count trends near our job sites?

If that developer doesn't move forward, how can we best keep our skilled laborers?

Are subcontractor bids reasonable? What are the true indicators of an accurate bid?

I don't want to spend every weekend dumping bid, job cost, and scheduling data into Excel.

Will materials be on time? Can we stay on schedule?



# Creating a data-driven culture in construction

*Collaboration, Transparency & Alignment.*

*A few practical examples to support your  
visioning...*



# Example #1: Cash gap







# Example #2: Margin Analysis

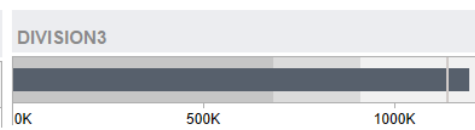
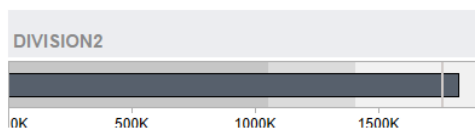
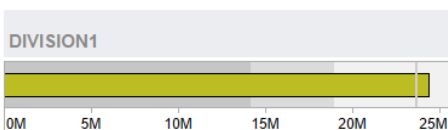
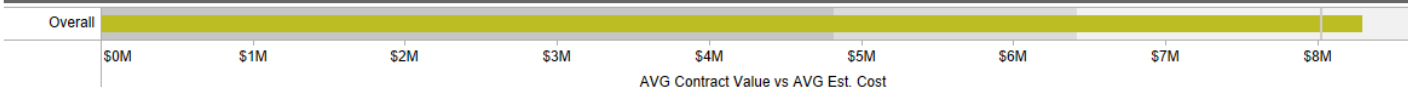


Gross Margin Analysis: 12/2017 to 12/2018  
YoY GM Increase | **YOY GM Decrease**

Click the bars to filter location

Contract Value	Gross Margin	Jobs	Change	<input checked="" type="radio"/> (All) <input type="radio"/> 2017 <input type="radio"/> 2018	Estimator (All) ▼	Project Manager (All) ▼
\$2,671M	\$86M	159	-6.84%			

## SAMPLE CONSTRUCTION Co



Gross Margin			Gross Margin			Gross Margin		
2017	2018	Change	2017	2018	Change	2017	2018	Change
37,871,536	34,150,426	-9.83%	2,853,020	2,907,720	1.92%	\$53,762	\$62,868	16.94%

Job Name	2017				2018			
	Contract Value	Estimated Cost	Gross Margin	GM %	Contract Value	Estimated Cost	Gross Margin	GM %
<b>Grand Total</b>	1,279,531,886	1,235,097,738	44,434,148	5.8%	1,391,744,331	1,350,348,316	41,396,015	6.0%
111 Diego Dr.	45,151,628	44,751,628	400,000	0.9%	46,709,054	48,806,326	-2,097,272	-4.5%
CC River	32,799,138	32,179,256	619,882	1.9%	33,186,530	33,325,356	-138,826	-0.4%
Park Library Parking Lot	237,203	237,203	0	0.0%	0	72,719	-72,719	0.0%
Cotton Wood Visitor Center Roof	143,000	143,000	0	0.0%	161,674	181,999	-20,325	-12.6%
Master Main Lobby	1,178,068	1,139,793	38,275	3.2%	1,173,171	1,184,984	-11,813	-1.0%
TR5 Veranda Reno	262,942	312,942	-50,000	-19.0%	227,256	238,669	-11,414	-5.0%
Succession Art Gallery	504,021	504,021	0	0.0%	532,524	533,622	-1,099	-0.2%
Widedot - Box T*R	1,691	1,495	196	11.6%	0	163	-163	
P90 USCG Carpet Install	2,547	2,316	232	9.1%	1,631	1,763	-132	-8.1%
Widedot - U3, Y65, Duo	4,893	4,355	538	11.0%	4,448	4,467	-20	-0.4%
Widedot Fill Holes	9,200	8,464	736	8.0%	4,980	4,998	-18	-0.4%
Widedot - Flooring	5,300	4,876	424	8.0%	4,941	4,958	-18	-0.4%
Widedot - Flooring part 2	5,300	4,876	424	8.0%	4,972	4,986	-14	-0.3%
Widedot - Basement Blowout	1,100	979	121	11.0%	1,047	1,050	-4	-0.3%
Welton Crop Redesign	1,125	1,077	48	4.3%	0	1	-1	





# Example #3: Backlog & scheduling

Labor Backlog						Material Backlog
Category	As Bid Backlog Days	Backlog Days Used	Days Remaining	Potential Days	Open Days	Choose a Job Number
Traffic Control	1643	661	982	1700	57	(All)
Grading	613	673	-60	750	137	Estimator Name
Mill Cleanup	1000	995	5	1500	500	(All)
Conditioning	105	100	5	110	5	Project Manager Name
Paving	889	449	440	900	11	(All)

Job Number	Job Description	Estimate Number	Estimator	Project Manager	Category	As Bid Backlog Days	Backlog Days Used	Days Remaining
316-56984	Bryant St	13654987	Noah Fant	Shaun Hanson	Conditioning	22	15	6.6
					Paving	94	83	10.6
					Grading	198	180	18
135-4465	16th Street Mall	13224976	Jack Johnson	Shaun Hanson	Conditioning	17	5	11.8
					Paving	73	43	29.8
					Grading	154	99	55



# Example #4: Equipment Cost Modeling

## EQUIPMENT COST MODEL EXAMPLE

**Shop Budget & Equipment Utilization**

Main Menu

	Target Hours	Expected Hours	Utilization	Required Shop Hours	Variable Equip Rate	Fixed Equip Rate	Fuel Cost	Parts & Service Costs	Shop Labor	Variable Shop Overhead	Projected Fixed Cost Recovery	Excess Capacity Cost	Total	
Grand Total	926,219	820,477	90%	26,038				\$11,289,648	\$4,626,807	\$520,769	\$1,001,826	\$10,731,873	\$1,936,058	\$32,107,086

**Excavators**

	Target Hours	Expected Hours	Utilization	Required Shop Hours	Variable Equip Rate	Fixed Equip Rate	Fuel Cost	Parts & Service Costs	Shop Labor	Variable Shop Overhead	Projected Fixed Cost Recovery	Excess Capacity Cost	Total
Cat 325/330	18,000	19,323	107%	461	\$ 9.05	\$ 9.92	\$542,976	\$112,548	\$9,223	\$33,155	\$191,603	(\$13,118)	\$896,383
Cat 345/350	10	10	100%	10									
Cat 365	4	4	100%	4									
Cat 375/385	6	6	100%	6									
Total	38	38	100%	38									

**Graders**

	Target Hours	Expected Hours	Utilization	Required Shop Hours	Variable Equip Rate	Fixed Equip Rate	Fuel Cost	Parts & Service Costs	Shop Labor	Variable Shop Overhead	Projected Fixed Cost Recovery	Excess Capacity Cost	Total
Cat 140	10	10	100%	10									
Cat 160	16	16	100%	16									
Cat 14	12	12	100%	12									
Total	38	38	100%	38									

**Dozers**

	Target Hours	Expected Hours	Utilization	Required Shop Hours	Variable Equip Rate	Fixed Equip Rate	Fuel Cost	Parts & Service Costs	Shop Labor	Variable Shop Overhead	Projected Fixed Cost Recovery	Excess Capacity Cost	Total
JD 850	30	30	100%	30									
Cat D8	12	12	100%	12									
Cat D8	14	14	100%	14									
Cat D9	4	4	100%	4									
Cat D10	2	2	100%	2									
Total	62	62	100%	62									

**Tractor-Boxblades**

	Target Hours	Expected Hours	Utilization	Required Shop Hours	Variable Equip Rate	Fixed Equip Rate	Fuel Cost	Parts & Service Costs	Shop Labor	Variable Shop Overhead	Projected Fixed Cost Recovery	Excess Capacity Cost	Total
Cat 416/420	7	7	100%	7									
Cat 570	7	7	100%	7									
Cat 580	7	7	100%	7									
Total	21	21	100%	21									

**Loader-Wheel**

	Target Hours	Expected Hours	Utilization	Required Shop Hours	Variable Equip Rate	Fixed Equip Rate	Fuel Cost	Parts & Service Costs	Shop Labor	Variable Shop Overhead	Projected Fixed Cost Recovery	Excess Capacity Cost	Total
Cat 140	10	10	100%	10									
Cat 160	16	16	100%	16									
Cat 14	12	12	100%	12									
Total	38	38	100%	38									

**Hourly Rate Summary**

Include Fuel? No

	Fuel	Parts & Service	Shop Labor	Fixed Equip Rate	Excess Capacity Cost	Shop Var Overhead	Fixed Equip Rate	Excess Capacity Cost
Cat 325/330	\$ 5.82	\$ 0.48	\$ 2.75	\$ 9.92	\$ (0.68)			

**Operating Costs - Excavators**

Main Menu

	Shop Hrs	Shop \$	Parts/Service	Interval	Cost / Hour	Shop Hrs	Shop \$	Parts/Service	Interval	Cost / Hour
Cat 325/330	18,000	\$112,548	\$112,548	18,000	\$6.25	18,000	\$112,548	\$112,548	18,000	\$6.25
Cat 345/350	10	\$10,000	\$10,000	10,000	\$1,000	10	\$10,000	\$10,000	10,000	\$1,000
Cat 365	4	\$4,000	\$4,000	4,000	\$1,000	4	\$4,000	\$4,000	4,000	\$1,000
Cat 375/385	6	\$6,000	\$6,000	6,000	\$1,000	6	\$6,000	\$6,000	6,000	\$1,000
Total	38	\$36,548	\$36,548	38,000	\$956.53	38	\$36,548	\$36,548	38,000	\$956.53

**Ownership Data**

Main Menu

	Replacement Cost	Salvage Value	Useful Life (Years)	Useful Life (Months)	Expected Hours / Machine	# of Units	Insurance Category	Target Hours / Unit	Base Ownership Rate	Salos Tax @ 10.25%	Property Tax @ 2.5%	Cost of Funds @ 6% over 4 years	Total Ownership Cost per Hour	
Cat 325/330	\$219,000	\$125,000	7	14,000	2,147	9	Off-road	2,000	6.71	6.69	0.31	0.22	1.99	9.93
Cat 345/350	\$358,000	\$20,000	7	14,000	1,667	5	Off-road	2,000	19.86	2.04	0.39	0.27	3.25	25.81
Cat 365	\$119,000	\$10,000	7	14,000	1,667	5	Off-road	2,000	19.86	2.04	0.39	0.43	5.14	40.83
Cat 375/385	\$119,000	\$10,000	7	14,000	1,667	5	Off-road	2,000	19.86	2.04	0.39	0.50	7.64	54.69

**Cost Factors**

Main Menu

	Off-road Fuel Cost	On-road Fuel Cost	Cost of Funds	Sales Tax Rate	Property Tax Rate	Insurance (annual premium)	Off-road - (% of equipment value)
	\$2.81	\$3.15	6.00%	10.25%	2.50%		0.25%

**Calculation of Remaining Shop Expenses**

	Total Department Budget	Less:	Excess Capacity Cost (per model)	Actual Equipment Depreciation	Maintenance Parts & Service (per model)	Fuel (per model)	Property Tax (per model)	Insurance (per model)	Mechanics Wages	Remaining Shop Overhead	Maintenance & Repair Labor Hours	Shop Base Wage Rate	Shop Overhead Rate	Total Shop Rate
	\$28,000,000		\$ 1,936,058	\$ 6,000,000	\$ 4,626,807	\$ 11,289,643	\$ 201,413	\$ 423,374	\$ 520,769	\$ 3,001,936	26,038	\$20	\$115	\$335

**Reconciliation to Shop Department Cost**

	Total Extended Cost (Cost Model)	Less costs in model but not charged to client	Subtract Capital Cost (Cost Model)	Subtract Cost of Funds (Cost Model)	Subtract Sales Tax (Cost Model)	Add costs charged to dept but not in model	Addback Actual Equipment Depreciation	Adjusted Equip Related Cost (Cost Model)	Total Department Budget	Variance
	\$32,107,086		\$ (7,789,774)	\$ (11,573,951)	\$ (798,247)		\$ 6,000,000	\$ 24,000,000	\$ 28,000,000	\$ 6,000,000

**Equipment Cost Model**

Main Menu

Set-up / Reporting

Cost Factors

Ownership Data

Shop Budget

Rate Summaries

Off-Road Operating Costs

Excavator

Grader

Dozer

Tractor-Boxblade

Loader-Wheel

Scraper

Compactors

Other Off-road

Trucking & Other Operating Costs

Trucks

Other Trucks

Haul Trailers

Other Trailers

Paving

Batch Plant

Bridge

Misc

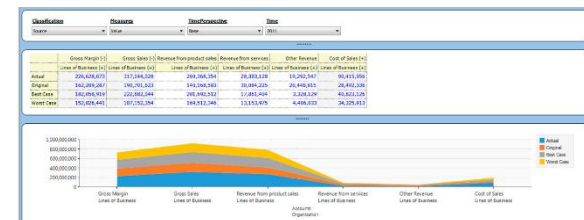
webinars.plantemoran.com



# Construction performance management

- Scenario / What-if modeling
  - Cash flow
  - Headcount Planning / PPP
  - CAPEX Planning
  - OPEX Budgeting
- Compare to industry benchmarks
- Planning and forecasting driven by leading indicators

Current Scenario	Entity	Module 10	Margin %	% Completion	Working	Module 10 Profit	Remaining Working, % Completion	Profit Total	Working	Industry	Market
12/31/2010	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2011	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2012	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2013	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2014	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2015	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2016	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2017	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2018	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2019	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2020	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2021	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2022	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2023	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2024	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2025	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2026	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2027	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2028	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2029	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2030	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2031	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2032	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2033	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2034	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2035	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2036	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2037	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2038	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2039	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2040	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2041	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2042	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2043	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2044	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2045	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2046	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2047	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2048	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2049	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539
12/31/2050	1,117,539	1,171,369	4.10%	10.00%	1,000,000	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539	1,117,539

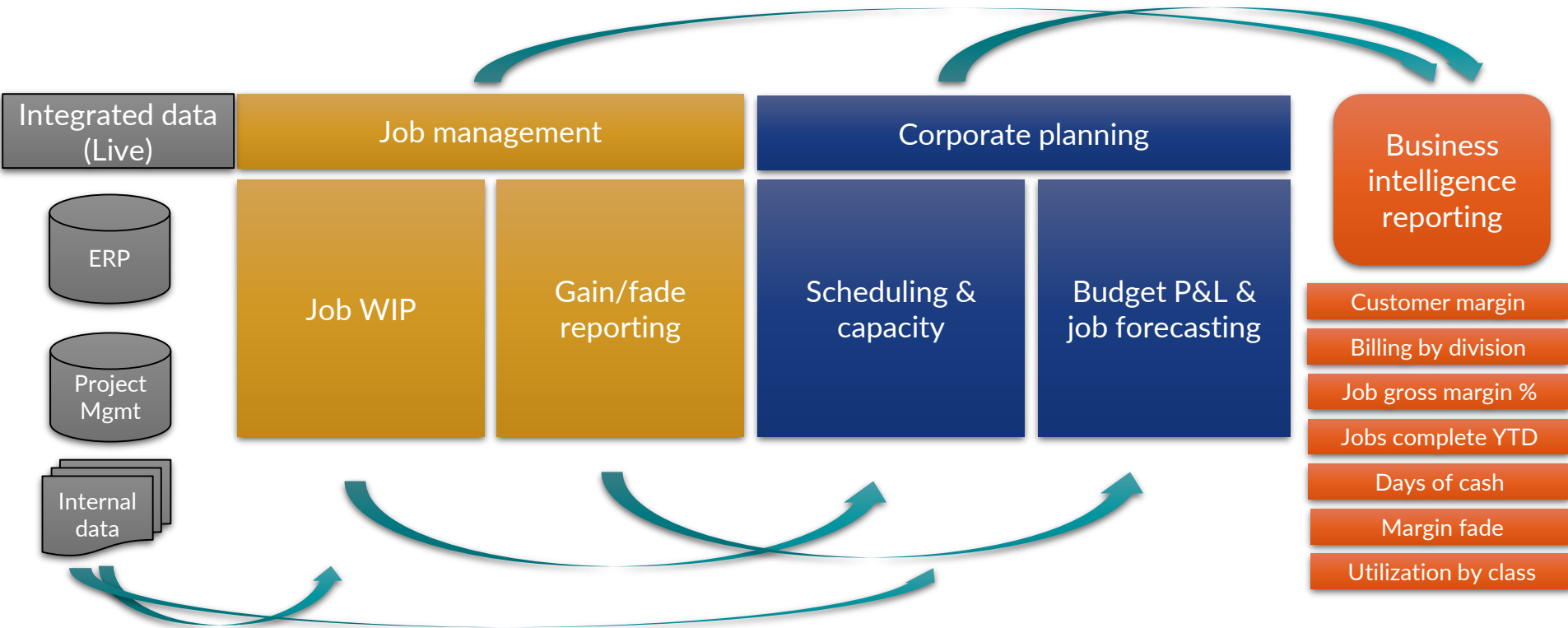


*"In preparing for battle, I have always found that plans are useless, but planning is indispensable."*

*– General Dwight D. Eisenhower*



# Construction performance management







# Learning objectives

- Understand how business analytics can improve your organization's decision making.
- **Create a plan to update your business's technology and data structures to support more effective decisions around bidding, cash management, labor and project management.**



# Construction industry data challenges



- Multiple data systems
- Redundant, manual and paper-based reporting
- Lack of single source of truth for data
- Unclear responsibilities for and ownership of data
- Data & analytics skill & communication gaps



# Applications for construction

- Primary systems
  - Estimating & bidding
  - Accounting systems
  - Project management systems
  - Project scheduling
  - Fleet management
- Additional systems
  - Invitation to bid
  - Contact management/CRM
  - Prequalification
  - Telematics
  - Safety/EHS
  - Human Resources
  - Payroll
  - Plant ticketing
  - Etc.









# The real-world problem of data issues

Customer name	Number of orders	Total paid
Chris Froome	11	11,000
Mark Cavendish	7	7,000
Bradley M Wiggins	6	6,000
M.S. Cavendish	6	6,000
Bradley Marc Wiggins	5	5,000
BM Wiggins	4	4,000
Taylor Hamilton	3	3,000
Tyler Hamilton	2	2,000
Brad Wiggins	2	2,000
Bradley Wiggins	2	2,000
Tylor Hamilton	1	1,000
B.M. Wiggins	1	1,000

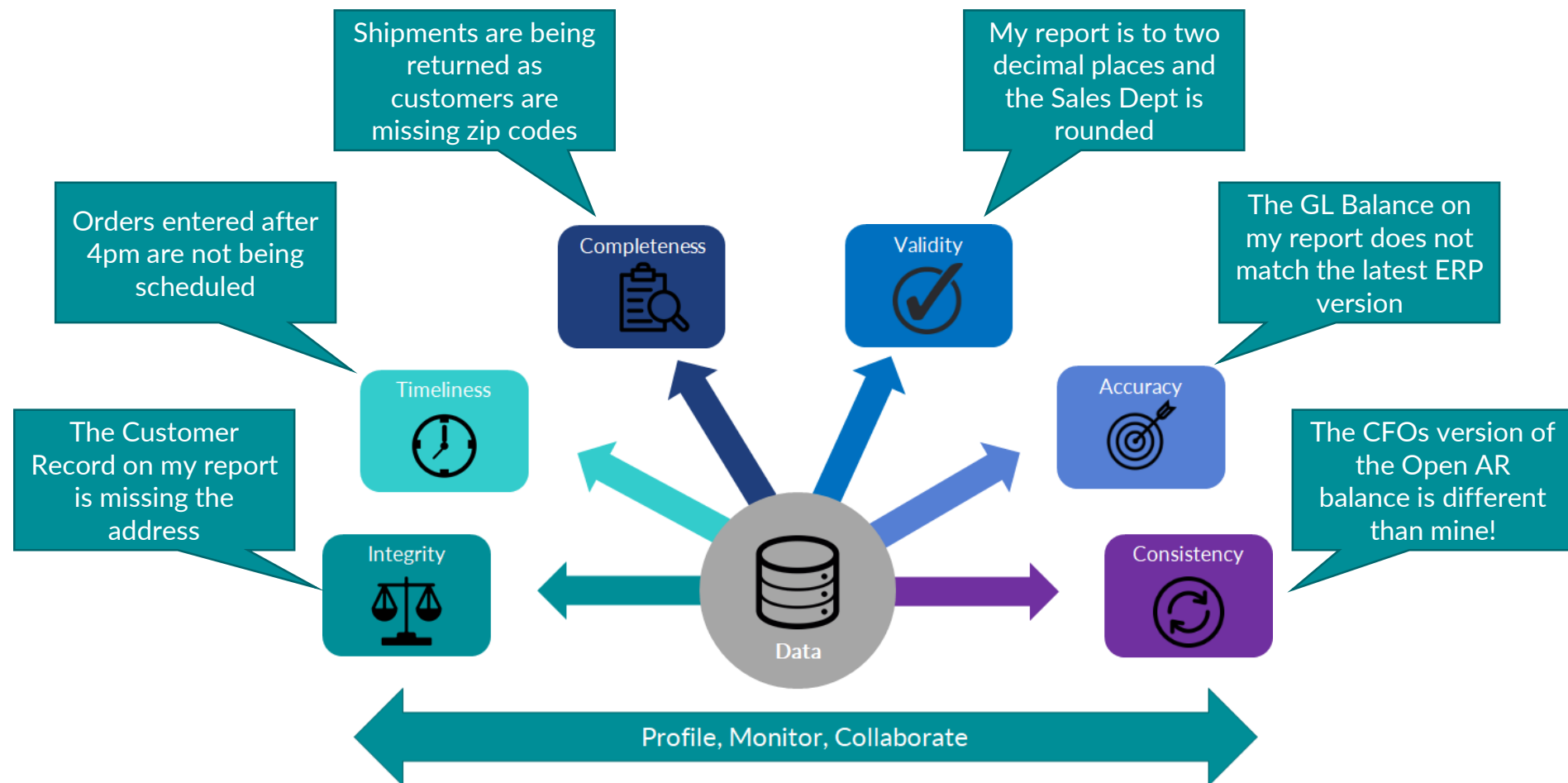


Customer name	Number of orders	Total paid
Bradley Wiggins	20	20,000
Mark Cavendish	13	13,000
Chris Froome	11	11,000
Tyler Hamilton	6	6,000





# Dimensions of Data Quality



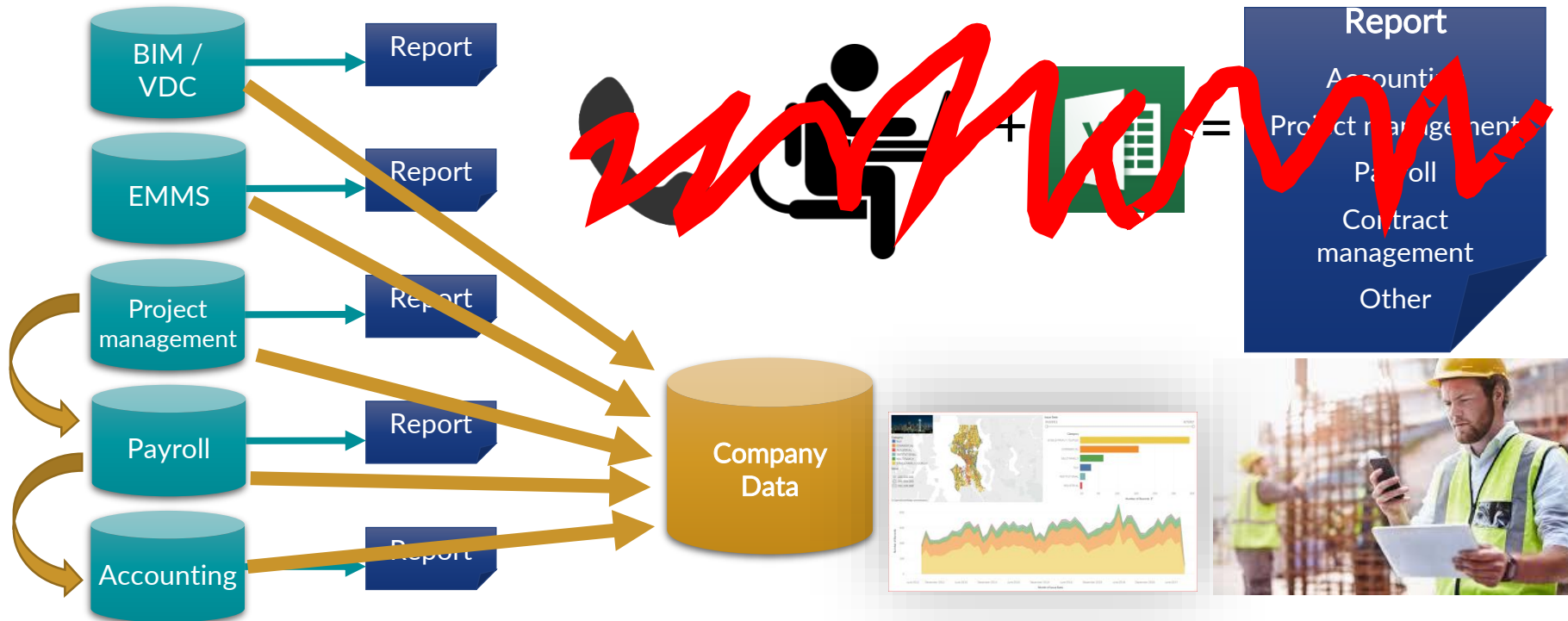


# Before it all comes together





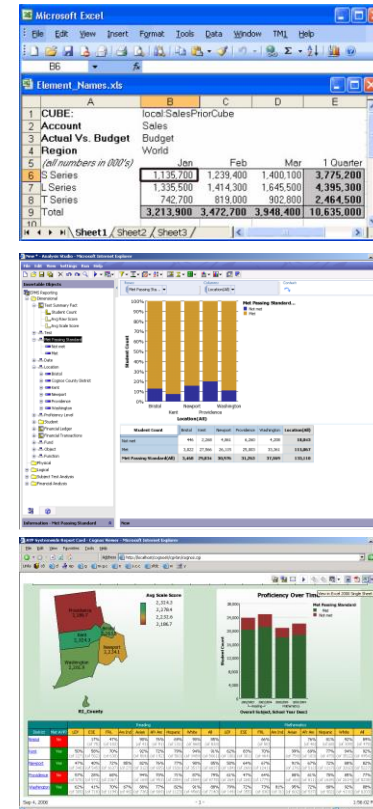
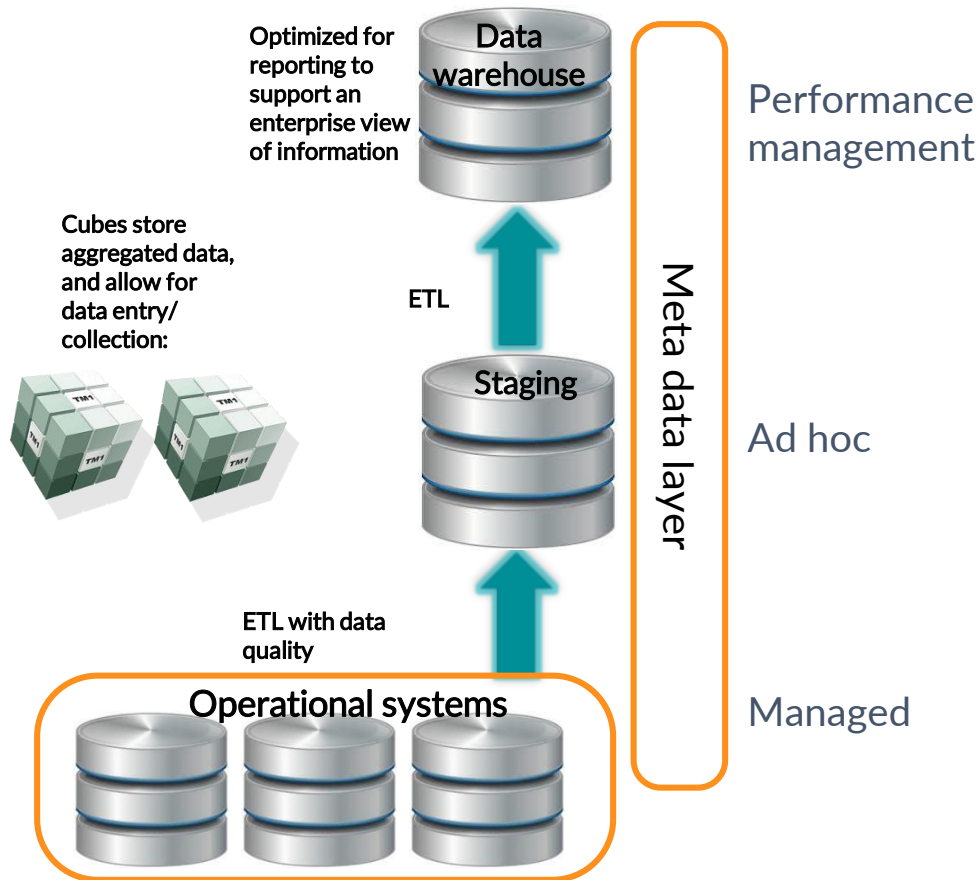
# After business analytics solution is implemented





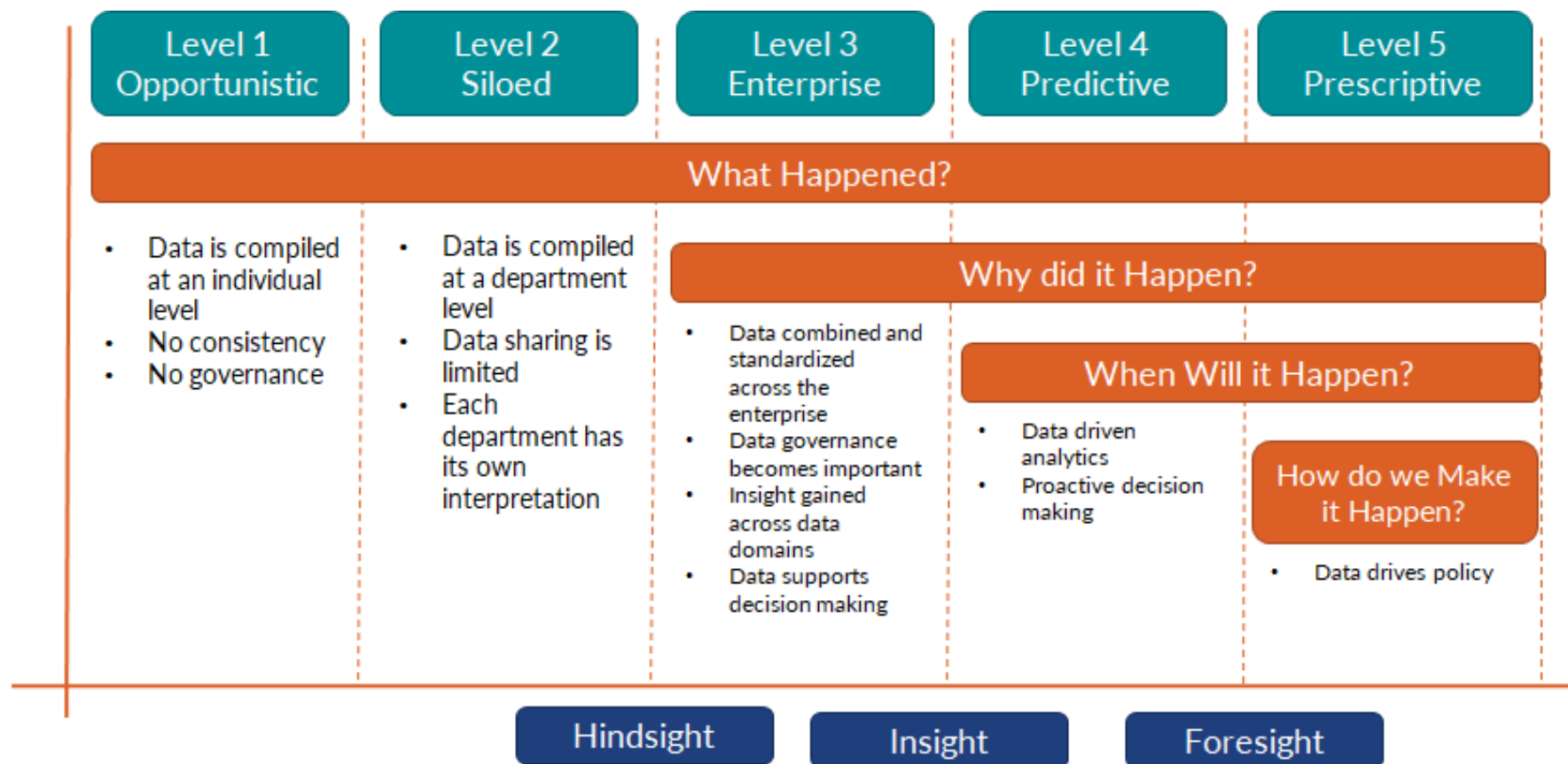


# Reference business analytics architecture





# Analytics stages of maturity



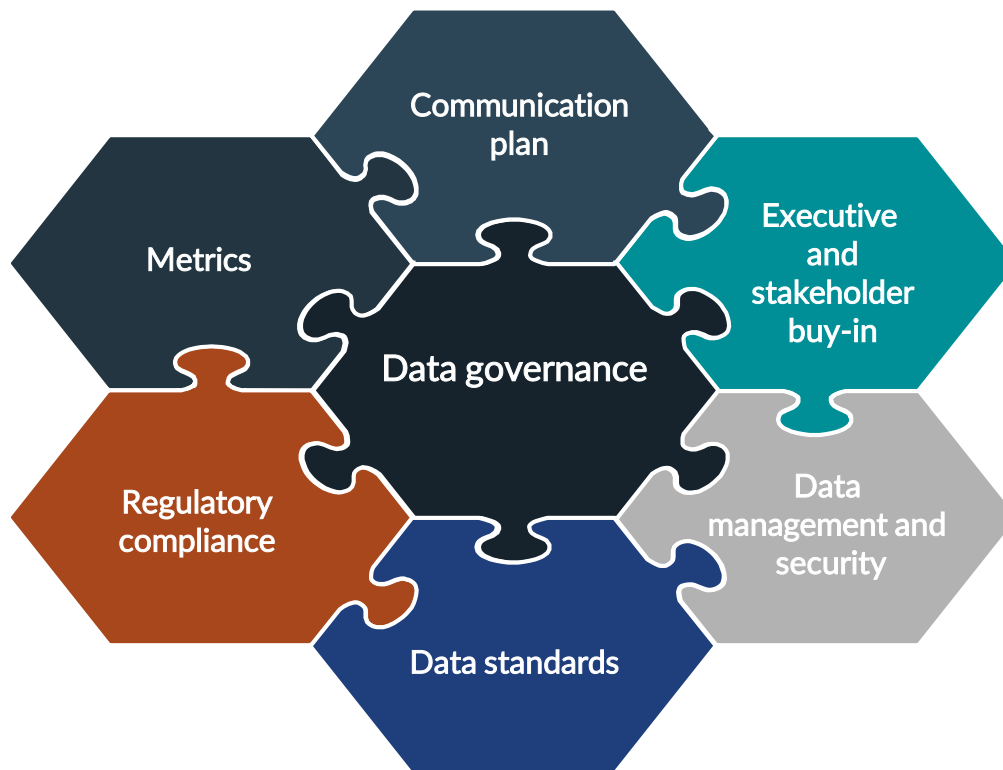


# The jigsaw of data governance

Best practice components are **variable** for each **organization**; some translate into higher success rates than others.

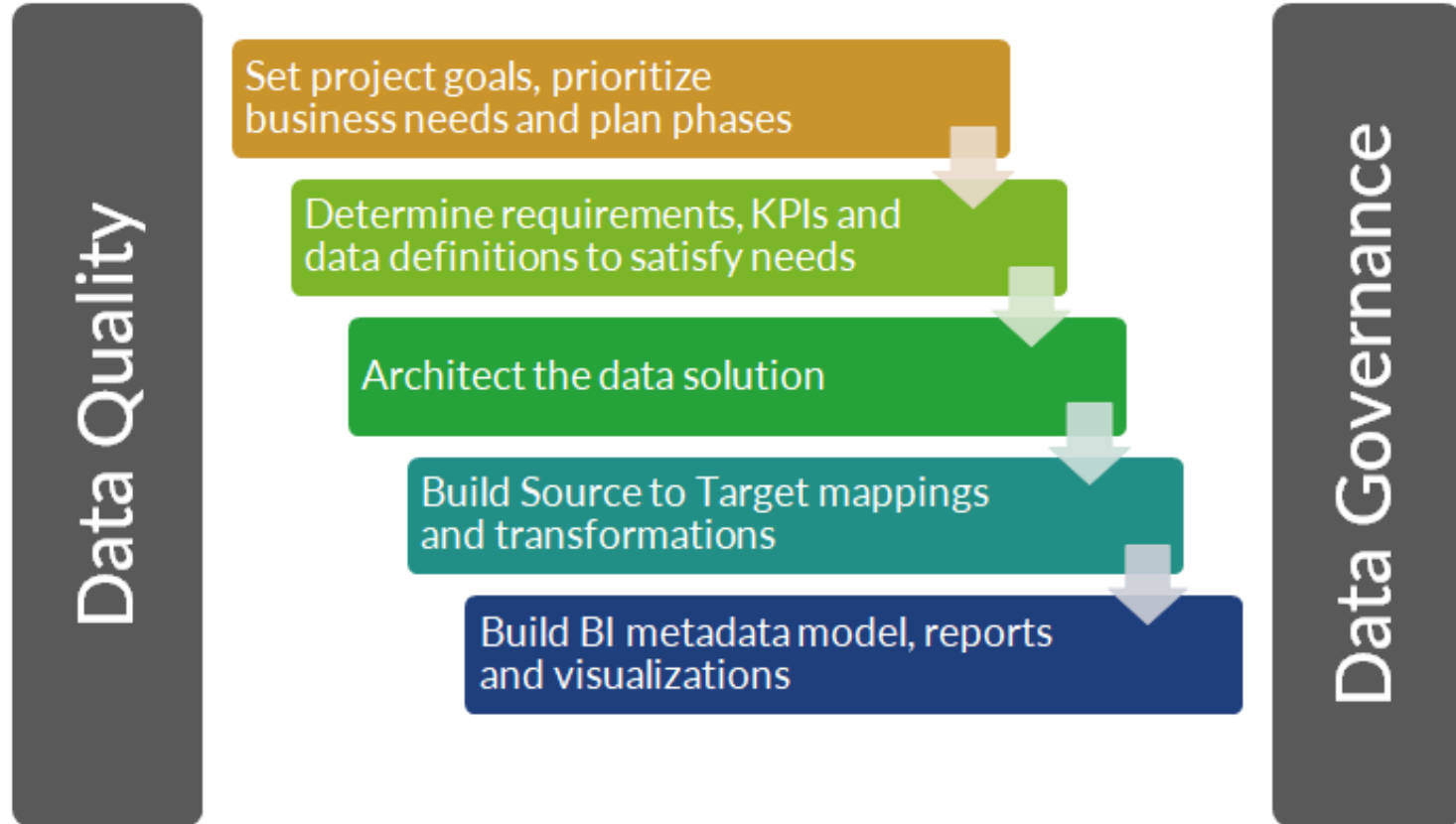
Start with a manageable set of data. **Look at the size of the organization, the number of data sets to be governed, and required data security compliance**

**Establish which best practices will generate the highest results** for your organization's data governance initiative and implement them first.





# Analytics program methodology







# End user adoption

Solve a business need

Understandability

Performance

Accuracy

Executive sponsorship





# Q&A



# Thank you for attending!

Business Analytics for Data Driven Decisions (CFMA)

Supercharge your industry peer group to drive innovation

Growing into business analytics

How construction companies can use business analytics to boost margins

Case study: Large construction company upgrades critical ERP software