



Operating System 2.0 Collaborating to Transform the Projects Industry



STEPHEN CABANO JULY 12, 2019





- Introduction
- Safety Moment
- TODAY: Current Industry Status
- TOMORROW: Desired Future State of the Industry
- RESULTS: Expected Impact
- Conclusions
- Q & A

Introduction: Stephen (Steve) Cabano

- Title: President, Pathfinder, LLC
- **Degrees:** BS Mechanical Engineering, **Villanova University**
- Years of Experience/Professional Field:



- 25+ years direct project management experience for owner and government clients in the Petroleum, Petrochemical, Chemical, Environmental, Power, Pharmaceutical, Food & Beverage, Mining, Industrial and Commercial industries.
- As Project Manager/team member in large project teams, has been responsible for costs, planning, scheduling, procurement, and similar project-related services.
- Professional affiliation memberships include:
 - Association for the Advancement of Cost Engineering International (AACEI[®]), Project Management Institute (PMI), American Institute Chemical Engineering (AIChE), American Society of Training and Development (ASTD), Society of Value Engineers (SAVE); board member and 2019 Chair of the Construction Industry Institute (CII), and Engineering and Construction Contracting (ECC) Association Board Member, (2006-2007 ECC Association Board Chair).

Safety Moment

2.

TODAY: Current Industry Status



Unfortunately, the C-Suite doesn't trust construction. Here's why:

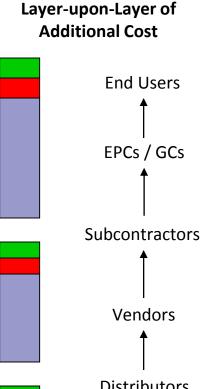
- 94.5% of projects do not meet one or more of their business objectives (CII)
- 70% of projects are not completed within 10% of budgeted cost and schedule (CII)
- 98% of megaprojects experience overruns that average 80% over budget and 20 months late (Bechtel)
- On the typical project, 40% of capital is "wasted" on transactions (NTNU/CII)
- Waste in Construction: 10% VA, 33% NVAR, 57% NVA (CII RT 191)

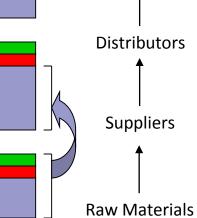


1963

Primary Sources of Transactional Waste

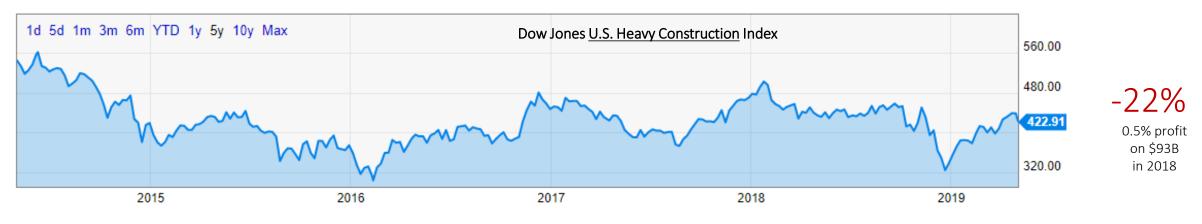
	Today	OS2
Trade Credit and Debt Finance Charges	25.9%	4.5%
Non-Value Added Field Operations	24.8%	2.2%
Missed Depreciation Charges and Excess Tax	10.3%	0.5%
Logistics Optimization and Expediting	9.7%	2.7%
Duplicative Insurance Coverage	7.5%	0.1%
Cost of Claims	7.1%	0.9%
Duplicative Contingencies and Management Reserves	6.4%	0.6%
PO / RFP / Bidding	5.2%	0.4%
Crime / Fraud / Counterfeiting	4.8%	0.6%
Surety / Bonding Expense	3.2%	1.0%
Interoperability	3.1%	0.3%
Rework	2.7%	0.3%
Foreign Exchange	2.3%	0.6%
TOTAL COST	41.4%	5.9%

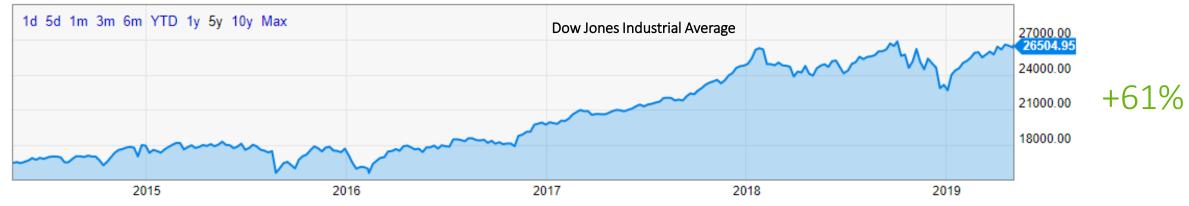




We Are Not Delivering Financially

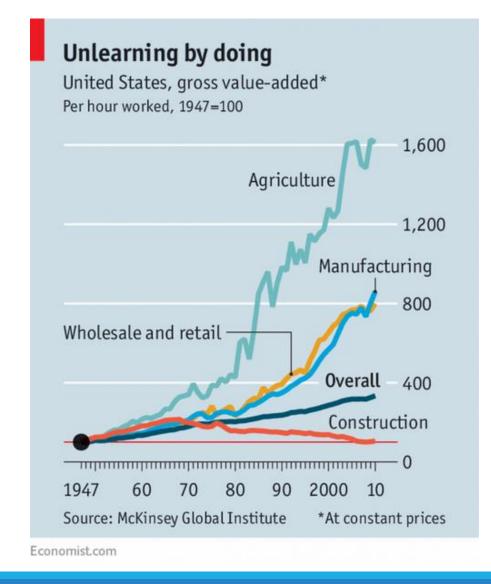
Dow Jones U.S. Heavy Construction Index (DJUSHV) vs. DJIA (May 2, 2014 – May 2, 2019):





Poor Productivity (Of Capital)

- Need to *improve capital efficiency*
- Not attracting enough investment
- Financially unhealthy (0.5% net profit)
- \$1.6T lost productivity each year, globally
- 5.7% increase in U.S. construction cost in 2018 (vs. 1.9% inflation)
- Breakthrough vs. continuous improvement
 - ✓ Improve 2.5% / year via Best Practices, but...
 - ✓ Industry declines 3% / year

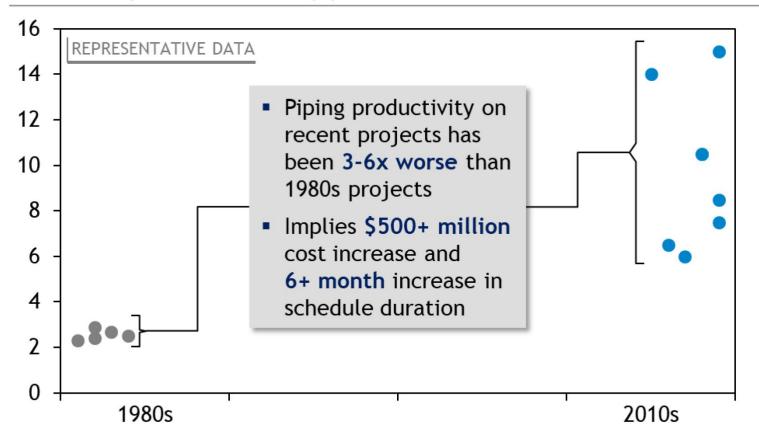


1980's Piping Productivity vs. Today

Piping productivity for major US Gulf Coast onshore investments¹

Work-hours per linear foot of pipe

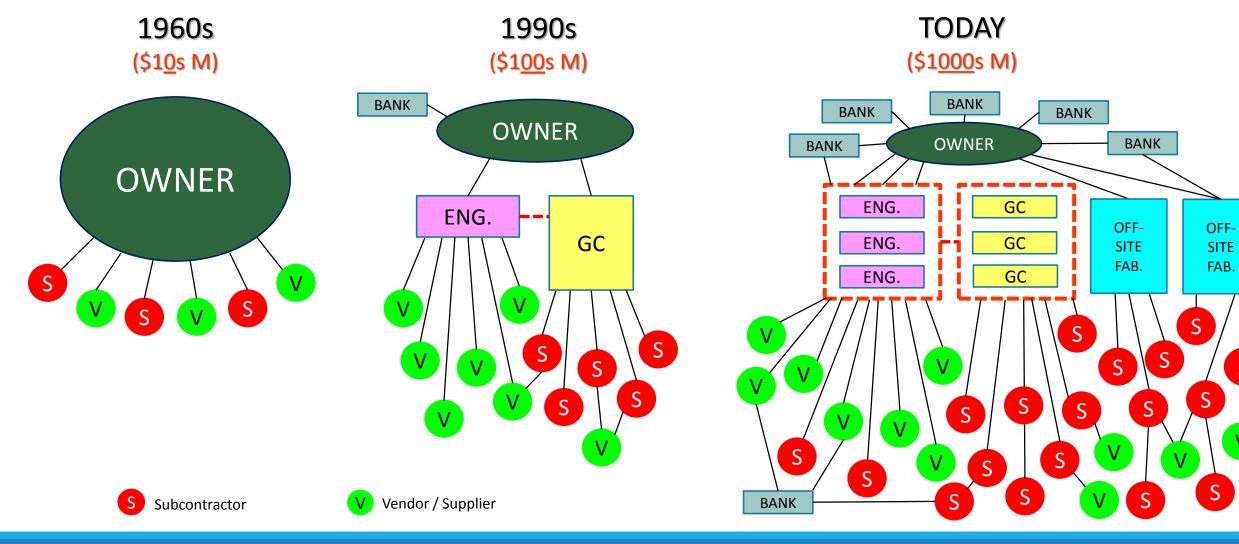
1980s • Recent



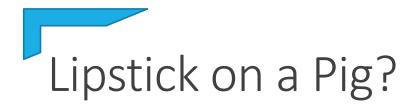
¹ Larger diameter, higher pressure and temperature projects (e.g., ethane crackers, LNG facilities, and similar)

Source: 2019 CapExperts LLC

Trends: Increasing Fragmentation and Complexity



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- Today's BEST PRACTICES and technology POINT SOLUTIONS are good, but they aren't delivering step-change improvement
- Why? Because they are being applied to an inherently broken business model
- We need a NEW BUSINESS MODEL that allows our best efforts to thrive:
 - ✓ Advanced Work Packaging (AWP)
 - Early (agile) planning
 - Alignment and team building
 - Modularization and off-site fabrication
 - Zero accident techniques

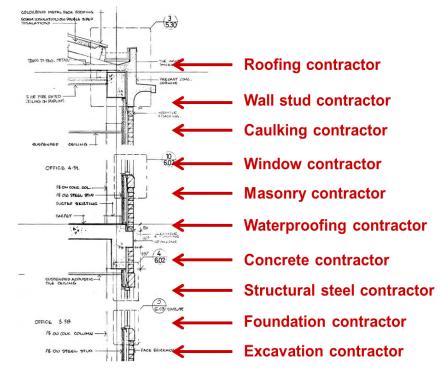
Best Practices are the best of what we know today, but they won't necessarily make you successful tomorrow. The world is moving fast. By definition, Best Practices are yesterday's news.

...and more...

We Need a New Business Model

- Today, most owners and contractors have opposing business goals
 - Individual profit is more important than achieving the owner's business objectives (Zero Sum Game)
 - Need to implement new ROI-based compensation models
- Contracts are a major root cause of the problem
 - ✓ Poor alignment between owners' Business, Supply Chain and Project groups
 - Unfair allocation of risk throughout the supply chain
 - Typical procurement is "3 bids and a cloud of dust"
- Most of today's contractors struggle with:
 - Tighter margins, higher risk and no money to invest internally
 - Legacy systems and sunk cost (e.g. ERPs, homemade solutions)
 - Plethora of emerging point solutions (VHS vs. Betamax)
 - Increasing project sizes, fragmentation and complexity
- Lack of Trust We need more Collaboration & Transparency

"Buildings Leak at the Intersection of Contracts"



Overused, Yet Nonetheless TRUE

Insanity: doing the same thing over and over again and expecting different results. -Albert Einstein



Construction is one of the largest industries (\$10T) that has yet to be disrupted.



TOMORROW: Desired Future State of the Industry



"How can the project better enhance business value?"

"Can we make projects a preferred investment choice for the C-suite?"

"Can we eliminate significant transactional waste through better contracting and collaboration?"

"Can we procure materials and services based on ROI/ROCE instead of just initial cost?"

"Can we leverage advanced computing power to improve project outcomes?"

"Can we better take advantage of global trade and tax regulations?"

"Can leasing provide a better option for funding capital projects?"

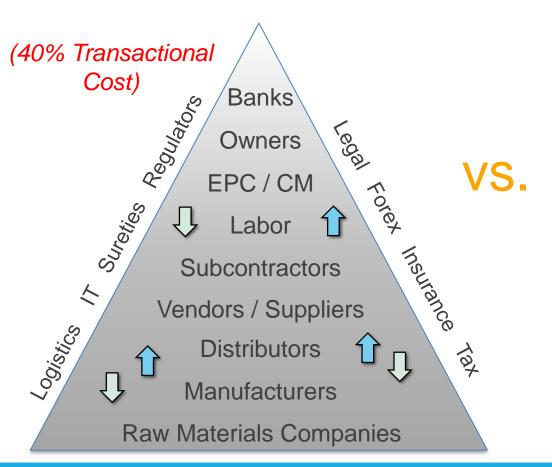
"Can we improve the overall financial health of the industry?"

Research & Development Thrust Areas

	Research & Development	Contract Simplification	Finance & Accounting	Commercial Platform	Resource Acquisition	Investment Strategy
1	Leasing Model		✓		<	✓
2	Equity Participation in Asset Development / Owner Models	1	1	1		✓
3	Depreciation / Tax Advantages and New Accounting Methods	✓	1			<
4	Cloud-Enabled Thin Platform	✓		1	✓	
5	Optimal Partner Selection	✓		✓	✓	
6	Risk, Insurance, Surety, Bonding	✓	✓		✓	
7	Supply Chain Rationalization	✓	✓	 ✓ 	✓	✓
8	New Credit Facilities		✓	✓		✓
9	Agile Planning & Generative Design	✓		✓	✓	
10	Business Support for Practice and Technology Deployment	4	1	1	4	



TODAY'S "OS1" BUSINESS MODEL



OS2

Capital Markets (Owners, Private Equity, Bonds, MLP's, Syndicates)



(Open Source, Cloud-Enabled Thin Platform)

Commercial Finance Integrator (IT)

Tax

MS 20 Slow of the solution of

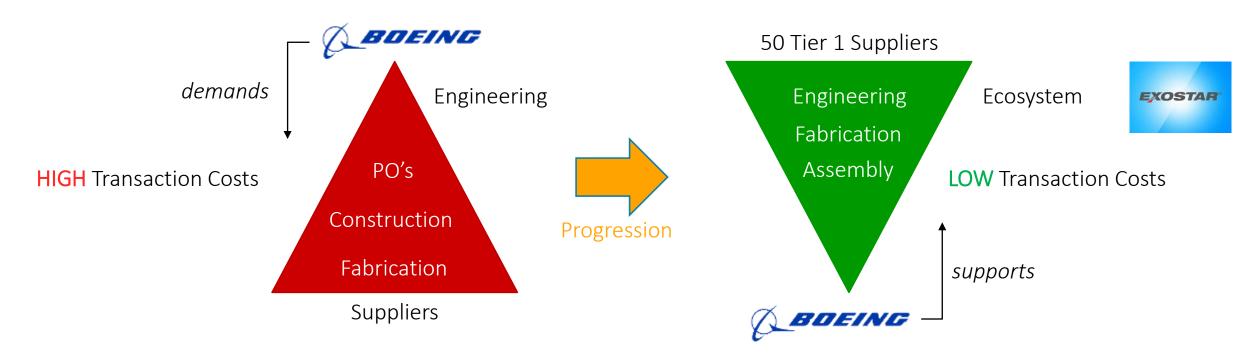
Applying Breakthroughs from Other Industries

- Relational contracting (not roll-up, M&A)
- New industry compensation models (hour-based billing, ROI/ROCE)
- Global sourcing and transfer pricing
 - Elimination of RFPs and POs
 - Cognitive computing
- Two contracts for a project?
 - Investors and providers
 - C/R and LS = transactional costs





B787 Development Cost: From \$10B to \$6B (-40%)
B787 Development Time: From 6 Years to 4 Years (-33%)



New Sources of Capital

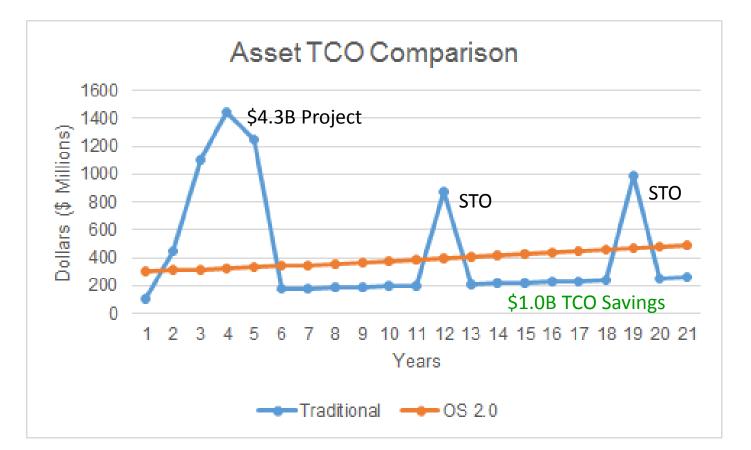
- Owners do three things:
 - 🗸 Idea
 - Capital (can come from anywhere)
 - Operations (can be contracted)
- Crowdsourcing capital?
- Listing projects on stock exchange?
- Leverage capital from supply community (facil
- New credit options for suppliers



Flexible Approach to Capital Markets and Investment

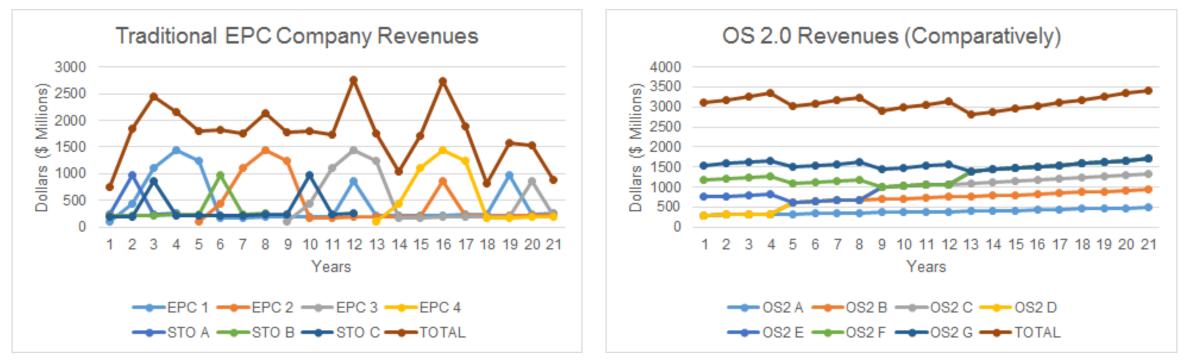
Leasing Model

- Financial markets prefer to spread risk by making many small loans
- Initial capital requirements vs. overtime
- Commercial finance vs.
 investment banking
- Equity participation (improve quality, ROI)



Impact of Leasing on Contractors and Suppliers

- Cash flow leveling (Wall Street loves predictability)
- Ride out market's peaks and valleys



Flexible Approach to Capital Markets and Investment

- Can we better align market analyses and production projections for a new asset with its development and operation?
 - Build more facilities, each with less capacity and continually re-analyze those decisions in real-time?
 - Initial build = ~40% of forecast capacity
- Take advantage of tax laws, tariffs, domiciles, and depreciation
- Lifecycle Asset Class (MACRS)



Risk, Insurance, Surety and Bonding



- Lack of trust = protectionist schemes
 - Unfair allocation of risk is common
 - Can we engineer trust back into the system?
- Duplicative insurance (400% excess insurance is common)
- Entire cost centers may be unnecessary

Workforce of the Future

- Effective leadership (financial, decision-making)
- Organizational engineering (project team dynamics)
- Communications and information flow
- Recruitment, retention, training
- Human / technology / digital interface

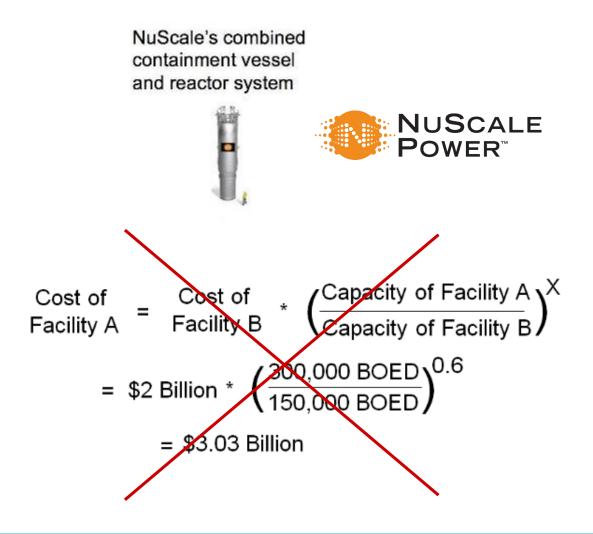
1/6th workers at site (shift workers to manufacturing setting)



Generative Design & Miniaturization

- Modularization AND Miniaturization
- Preassemblies (mass customization)
- Design reuse and improvement
- Supplier-led design
- Digital twin technology
- Process Intensification (MCPI)





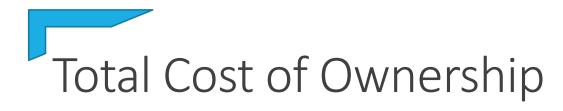
New Production Methods

- New Management Science (*AGILE* planning, lean, project controls, estimating, etc.)
- Modeling and simulation (Lego path of construction)
- Modular, Miniature (no STO – CAPEX / OPEX)
- Economies of scale and repetition
- Computer-aided, factory-based production



RESULTS: Expected Impact

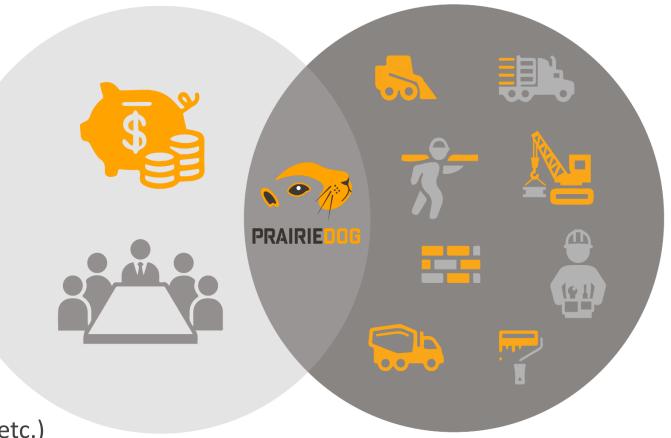
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- 35% cost reduction
- 50% cycle time reduction
- 60% better ROCE*
- 250% more projects

Plus...

 300% more profit for PrairieDog participants (e.g. engineers, suppliers, constructors, etc.)



Future Prognosis: Escalating Costs?*

Nominal \$100M **Heavy Industrial Project**

Data Averaged Across Multiple **Capital Projects**

(1998 Baseline, adjusted for inflation)

1998		2018 (Actual)								38 (Proje
Typical Project Cost Breakdown	Sub- %	Proj. %	% of	Total Cost \$M		lation	% of	Total Cost \$M	Escalation	% of
			Total	(1998 dollars)	Fa	ictor	Total	(1998 dollars)	Factor (proj)	Total
Major Process Equipment		0.32								
Vessels	0.31		0.099	9.92	2	.20	0.098	21.82	5.60	0.098
Pumps	0.28		0.090	8.96	2	.20	0.089	19.71	5.60	0.088
Exchangers	0.22		0.070	7.04	2	.20	0.070	15.49	5.60	0.069
Heaters	0.07		0.022	2.24	2	.20	0.022	4.93	5.60	0.022
Compressors	0.06		0.019	1.92	2	.20	0.019	4.22	5.60	0.019
Other Mechanical Equipment	0.06		0.019	1.92	2	.20	0.019	4.22	5.60	0.019
			32.0%	32.00		-	31.8%	70.40		31.6%
Bulk Commodity Materials		0.22								
Piping	0.40		0.088	8.80	2	.60	0.103	22.88	6.65	0.103
Structural Steel	0.16		0.035	3.52	2	.60	0.041	9.15	6.65	0.041
Electrical	0.15		0.033	3.30	1	.80	0.027	5.94	4.50	0.026
Concrete	0.13		0.029	2.86	1	.75	0.023	5.01	4.25	0.021
Instrumentation	0.11		0.024	2.42	1	.80	0.020	4.36	4.50	0.019
Paint & Insulation	0.05		0.011	1.10	1	.75	0.009	1.93	4.25	0.008
			22.0%	22.00		_	22.2%	49.26		21.9%
Field Indirect Construction		0.19								
Craft Payroll Taxes, Benefits, Insurance	0.25		0.048	4.75	2	.40	0.051	11.40	6.65	0.056
Support Labor	0.20		0.038	3.80	2	.20	0.038	8.36	5.45	0.036
Construction Equipment	0.16		0.030	3.04	1	.75	0.024	5.32	4.25	0.023
Field Overhead	0.13		0.025	2.47	2	.20	0.025	5.43	5.45	0.024
Small Tools & Consumables	0.08		0.015	1.52		.75	0.012	2.66	4.25	0.011
Field Staff	0.13		0.025	2.47		.20	0.025	5.43	5.45	0.024
Temporary Facilities	0.05		0.010	0.95		.75	0.007	1.66	4.25	0.007
			19.0%	19.00		-	18.2%	40.27		18.1%
Home Office Engineering		0.15	2010/0	15100			10.12/0			1011/0
Project (Mgmt, Accounting, Controls, Estimating)	0.15	0.115	0.023	2.25	2	.20	0.022	4.95	5.45	0.022
Process & Specialty Engineering	0.04		0.006	0.60		.20	0.006	1.32	5.45	0.006
Engineering	0.69		0.104	10.35		.20	0.103	22.77	5.45	0.099
Procurement (Purchasing, Contracts, Inspection)	0.11		0.017	1.65		.20	0.016	3.63	5.45	0.016
Business Services	0.01		0.002	0.15		.20	0.001	0.33	5.45	0.001
business services	0.01		15.0%	15.00	-	-	14.9%	33.00	5.45	14.4%
Field Direct Labor		0.12	13.0%	15.00			14.576	33.00		14.470
Piping	0.36	0.12	0.043	4.32	2	.40	0.047	10.37	6.65	0.051
Civil	0.16		0.043	1.92		.40	0.047	4.61	6.65	0.022
Electrical	0.10		0.019	1.44		40	0.021	3.46	6.65	0.022
Equipment	0.12		0.014	1.44		.40	0.018	3.46	6.65	0.017
Structural Steel	0.11		0.013	1.32		40	0.014	3.17	6.65	0.015
Instrumentation	0.11		0.013	1.08		40	0.014	2.59	6.65	0.013
Paint & Insulation	0.09					.40			6.65	
Paint & Insulation	0.05		0.006	0.60	4	.40 _	0.006	1.44	0.05	0.007
			12.0%	12.00		-	13.0%	28.80		14.1%
			100.0%	100.0			100.0%	221.7		100.0%
L					L			122%	L	

Projected) % of

Total Cost \$M

(1998 dollars)

55.55

50.18

39.42

12.54

10.75

10.75

179.20

58.52

23.41

14.85

12.16

10.89

4.68

124.50

31.59

20.71

12.92

13.46

6.46

13.46

4.04

102.64

12.26

3.27

56.41

8.99

0.82

81.75

28.73 12.77

9.58

8.78

8.78

7.18

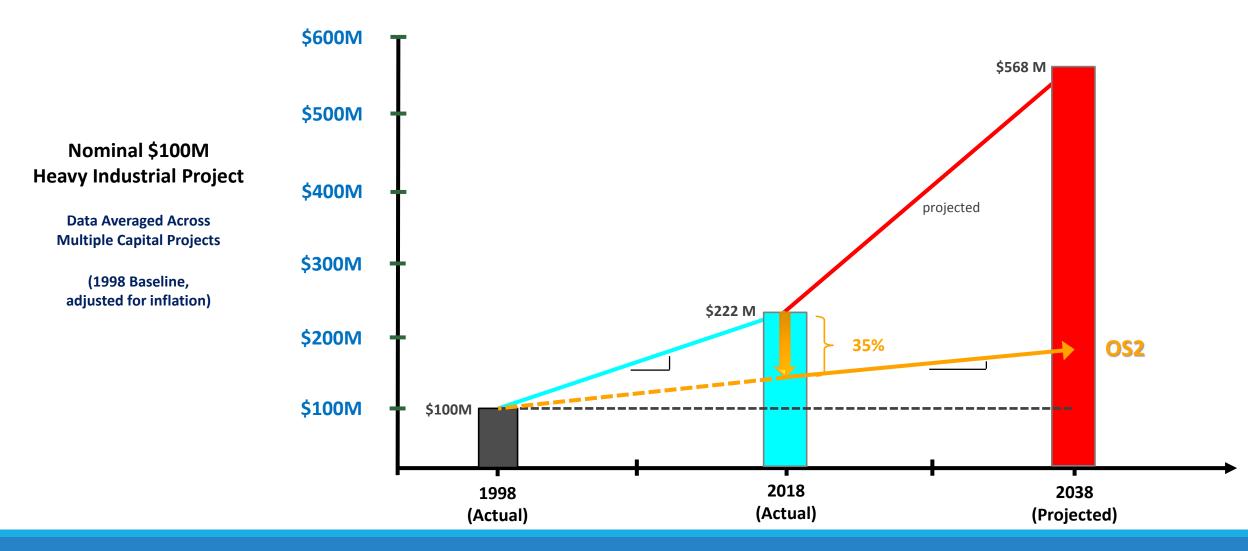
3.99

79.80

567.9

468%







Analysis performed by CII Performance Improvement Group (March 2013) * Each project was normalized to \$250M



100% FEP complete PRIOR to PROCUREMENT start (n = 97)

100/01 21 00 mp.							•																Over	all 22	25 W	eeks																						
Weeks		5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	10	05 11	0 11	51	20 1	25	L 30 1	135 1	40 1	45 1	.50 1	155	160 1	.65	170	175	180) 18	5 19	0 19!	5 200	0 20	05 21	0 21	5 2	20 2	225
FEP		62 we	eks																																													
Design																91 we	eks																															
Procurement	EPC																		92 w	eeks																												
Construction		L																									9	3 weel	(S																			
Start-up																																											25	weeks				
LESS THAN 100% Weeks	FEP comp				PRO						53) 50	55	60	65	70	75	90	85	<mark>0ve</mark> 90	erall : 95	190 W 100			0 11	E 1	20 1	25	120 4	25 1	40 1	AE 1	E0 1	155	160 1	65	170	175	190	10	E 16	4			/eek				
FEP	1	5 76 we		15	20	25	50	35	40	43	50	33	00	03	70	/3	00	65	50	33	100	10	12 11	0 11	5 1	20 1	25		133 1	40 1	45 1	. 00	135	100 1	.05	1/0	1/5	100	, 10	2 13	0 19	> 200	J 20	12 21	12 0.	.5 2	20 2	.25
Design		70 WC	CKS										85 we	eks					1										(
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Construction	I LPC																			1		78	weeks												1			1		+	+-	+	+					
Start-up																																					22 we	eeks	- 8	Ċ.			-					
PrairieDog Platfo	orm via OS															Week																									50%							_
Weeks	3	8		15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	10)5 11(0 11	5 1	20 1	25	L 30 1	L 3 5 1	40 1	45 1	50 1	155	160 1	.65	170	175	180) 18	5 19	0 19!	5 200	0 20	05 21	0 21	5 2	20 2	225
Agile Planning		~113																																				ļ										
Concurrent Design*		ļ	~70 we																																			ļ										
Manuf. & Fabr.	OS2				~82 we	eks						, ,																																				
On-Site Assembly															~40 w	eeks																						ļ										
Start-up]					ſ	~92 we	eks																																								

* Concurrent, Supplier-Led Design (Reuse ~70%; Custom ~30%)

Operating System 2.0 (OS2) Overview

- OS2 is a new business and commercial model for the capital projects industry
 - ✓ How can we use the capital project to enhance business outcomes?
 - ✓ How do we accelerate our organic growth by using our capital better?
- OS2 will enhance the health and stability of the industry
 - ✓ Intelligent finance, accounting, tax, legal platform for a globally-distributed industry
 - ✓ Participating companies can leverage their own capital
 - Provide enabling environment for point solutions to thrive
- Key words: Distributed, Speed, Agility
 - ✓ Reverse the trends toward costly vertical integration (distributed risk, finance)
 - ✓ Dramatic reduction in time for planning, selecting, engaging, integrating, executing

Industry Platform

- Modern business is confronted with:
 - ✓ Systems (legacy models and MIS)
 - Enabling technologies (Blockchain, AI)
 - Point solutions (applications)
 - Platforms (Android, AWS, etc.)
- No dominant single information platform for projects exists for the capital projects industry
- OS2 is "creating a new platform (think Android) for a healthy capital projects industry that fosters organic growth"

Companies & Consortiums Interested / Supporting OS2

OS2 Consortiums

OS2 Companies

1	AACE
2	ABC
3	AGC
4	AIA
5	BRE
6	CII
7	COAA
8	CURT
9	ECC
10	ECI / CE (EU)
11	ECRI
12	ECITB (UK)
13	EDRC (RSK)
14	IMPACT
15	LCI
16	NAC
17	NCCER
18	Pankow Foundation
19	PPI
20	Project Norway
21	RAPID (DoE/AIChE)

1	Air Products & Chemicals
2	Alberici
3	Andeavor
4	Autodesk
5	Baker Concrete
6	Barton Malow
7	BASF
8	Bechtel
9	Bentley
10	BHP
11	Black & Veatch
12	BMWC Constructors
13	BP
14	Brasfield & Gorrie
15	Brick & Mortar Ventures
16	Brock
17	Burns & McDonnell
18	Cenovus
19	Cianbro
20	Concord Technologies
21	Day & Zimmerman
22	Dow
23	Duke Energy
24	DuPont
25	Enbridge
26	ExxonMobil
27	General Electric

- ls i
- 28 General Motors 29 Gray Construction 30 Graycor Industrial 31 Fluor 32 Hargrove 33 Haskell 34 Hatch 35 Hexagon 36 Honeywell 37 IBM
 - 38 InEight
 - 39 Intelliwave
 - 40 ISC
 - 41 Jacobs
 - 42 Johns Manville
 - 43 Kajima
 - 44 KBR
 - 45 Kiewit
 - 46 LyondellBasell
 - 47 Mammoet Canada Western
 - 48 Matrix Service Co.
 - 49 McKinsey
 - 50 Metrolinx
 - 51 MetroPower
 - 52 Mitsubishi Heavy Industries
 - 53 Odebrecht
 - 54 Oneok
 - 55 Oracle

- 56 Owens Corning
- 57 Petronas
- 58 Pillsbury Law
- 59 Procter & Gamble
- 60 Pioneer
- 61 Praxair
- 62 PTAG
- 63 Rockefeller Group
- 64 Roeslein
- 65 Rosendin Electric
- 66 SABIC
- 67 Saudi Aramco
- 68 Saul Ewing Arnstein & Lehr
- 69 SBM Offshore
- 70 Shell
- 71 Skanska
- 72 Southern Company
- 73 Suncor
- 74 Stevens Engineering
- 75 Taft Stettinius & Hollister
- 76 Tecnimont SpA
- 77 Tradesmen International
- 78 United Group Services
- 79 United Rentals
- 80 Victaulic
- 81 Wood
- 82 WorleyParsons
- 83 Zurich



"By the industry, for the industry"



- Transformation is needed, if we do not do it, someone will do it for us!
- We (the Owners) need to address the business value of capital spending we are not in the business of building projects
- We (the Contractors) need to focus on providing value, not spending manhours
- Need to engage our legal, accounting, supply chain, etc. counterparts in the solution
- We cannot be afraid of change: Uber, VRBO, & Tesla have revolutionized their industries. We need to as well!



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