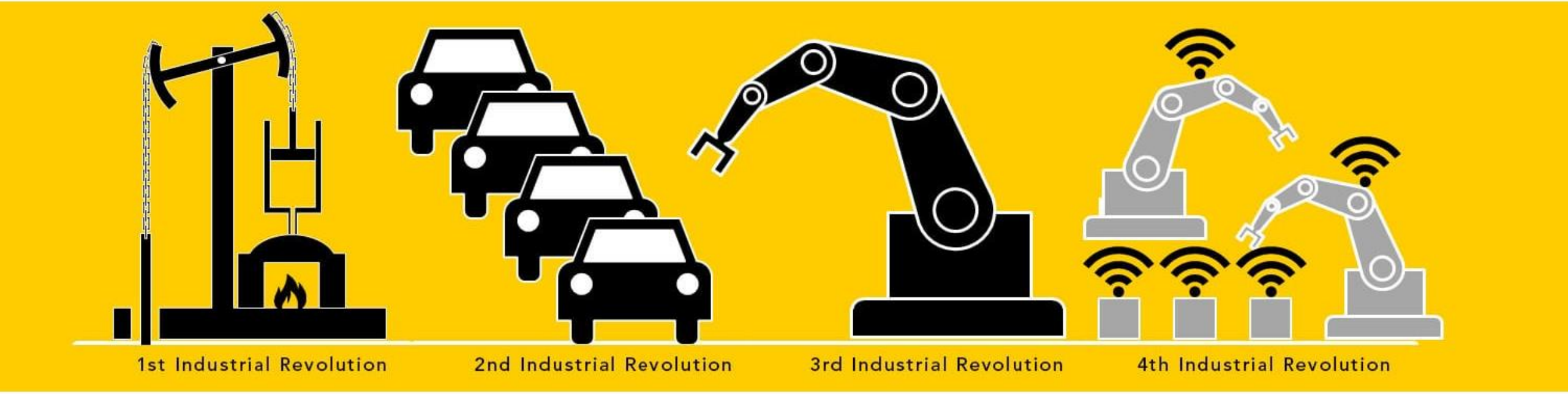
CAN INDUSTRY 4.0 IMPACT PROJECT EXECUTION?

Rice Annual Forum

Amish Sabharwal, EVP Americas, AVEVA

November 14, 2017 | Version 1

Industry 4.0



Steam Assembly Line Automation Digitalization

WHAT DOES DIGITALIZATION MEAN?

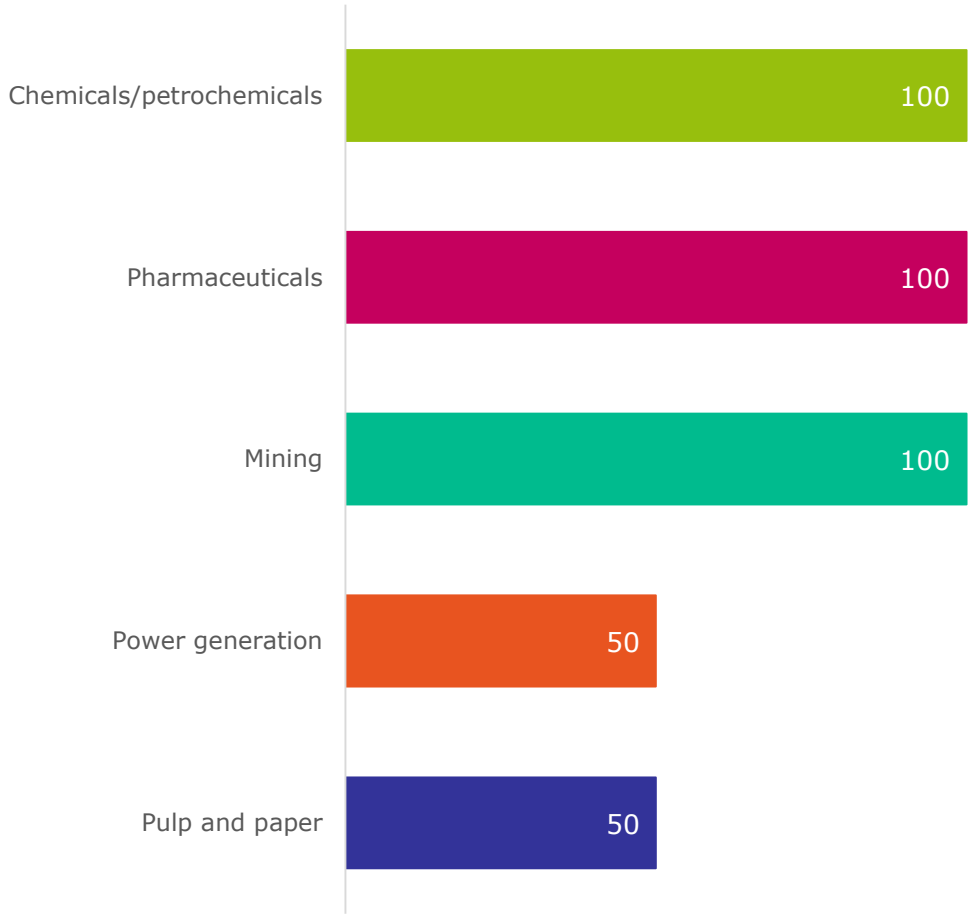
“**Digitalization** is the use of digital technologies to change a business model and provide new revenue and value-producing opportunities”
-Gartner

DIGITALIZATION

AVEVA
Research results

October 2017

DEMOGRAPHICS



400 senior decision makers with responsibility or involvement in software purchasing decisions were interviewed in August and September 2017, split across the below sectors and countries…

Chemicals/petrochemicals - US, Singapore, Russia, Netherlands, Germany, Belgium

Pharmaceuticals - US, Ireland, UK, South Africa, France, Belgium, Switzerland, Germany

Mining – US, South Africa, Australia, Russia, Ukraine, Chile, Peru

Power generation - US, Canada, UK, Germany, Japan, China, France

Pulp and paper – US, Canada, Finland, Sweden, Brazil, Russia

Figure D1: "Within which primary sector is your organisation?", *asked to all respondents (400)*

PRIORITISATION OF PLANT DIGITALISATION

Overall, across all sectors surveyed, plant digitalisation is most likely to be seen as the number one/top priority (26%) compared to other areas of digital transformation

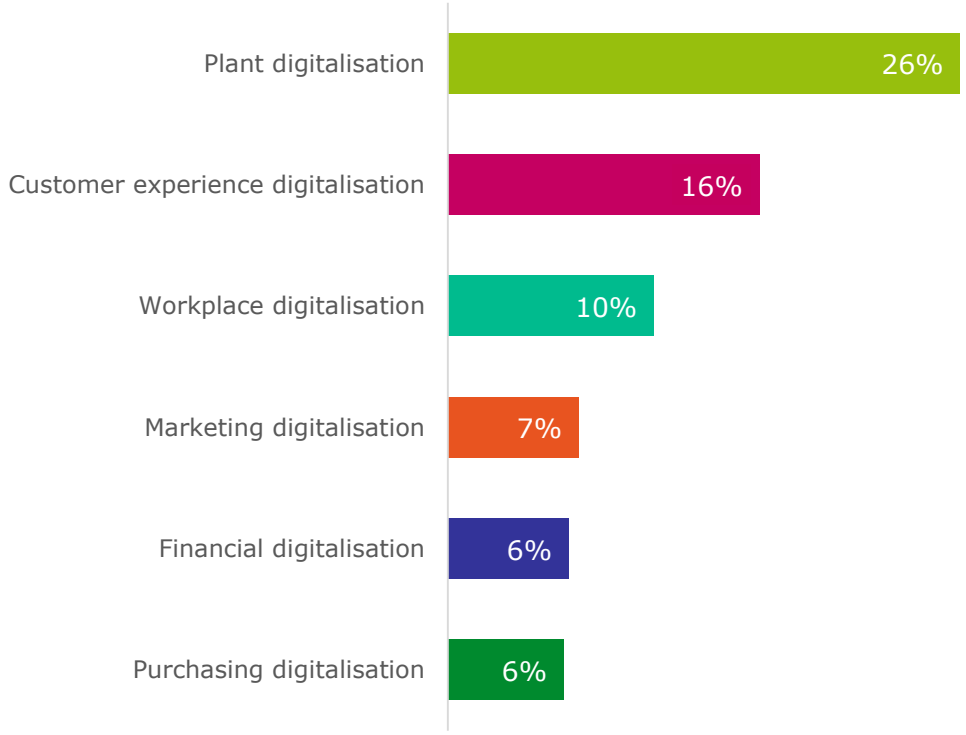


Figure 2: *Analysis showing the percentage of respondents who report that each of the above digitalisation initiatives are the number one/top priority for their organisation, asked to all respondents (400)*

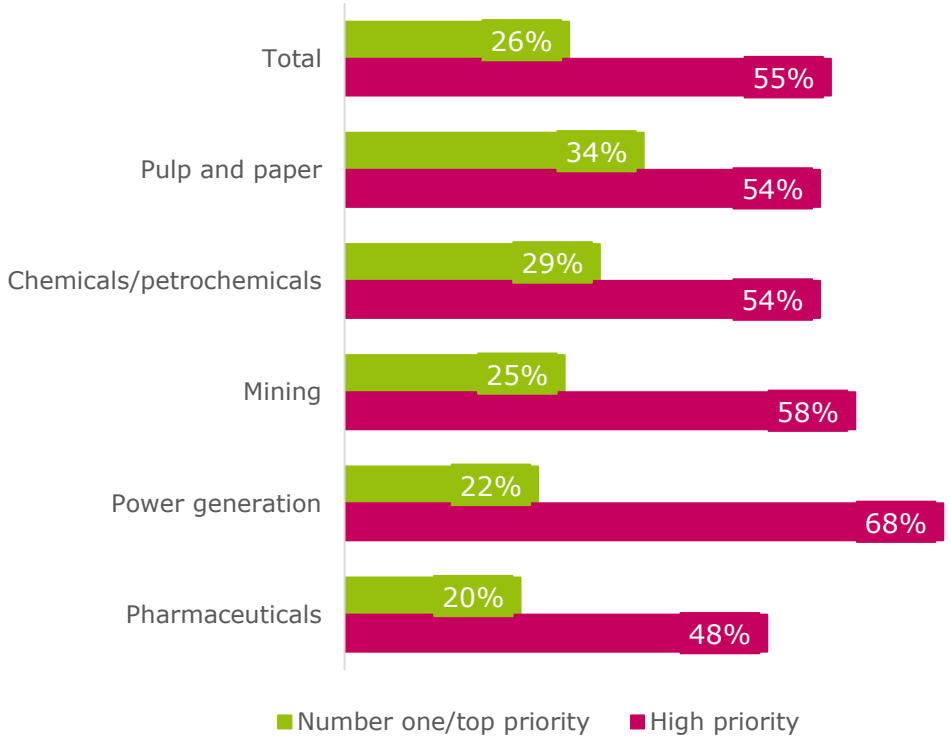


Figure 3: *Analysis showing the percentage of respondents who report that plant digitalisation is the number one/top priority or a high priority for their organisation, split by sector, asked to all respondents (400)*

DIGITAL TECHNOLOGIES OFFERING THE GREATEST OPPORTUNITIES TO EXPLOIT

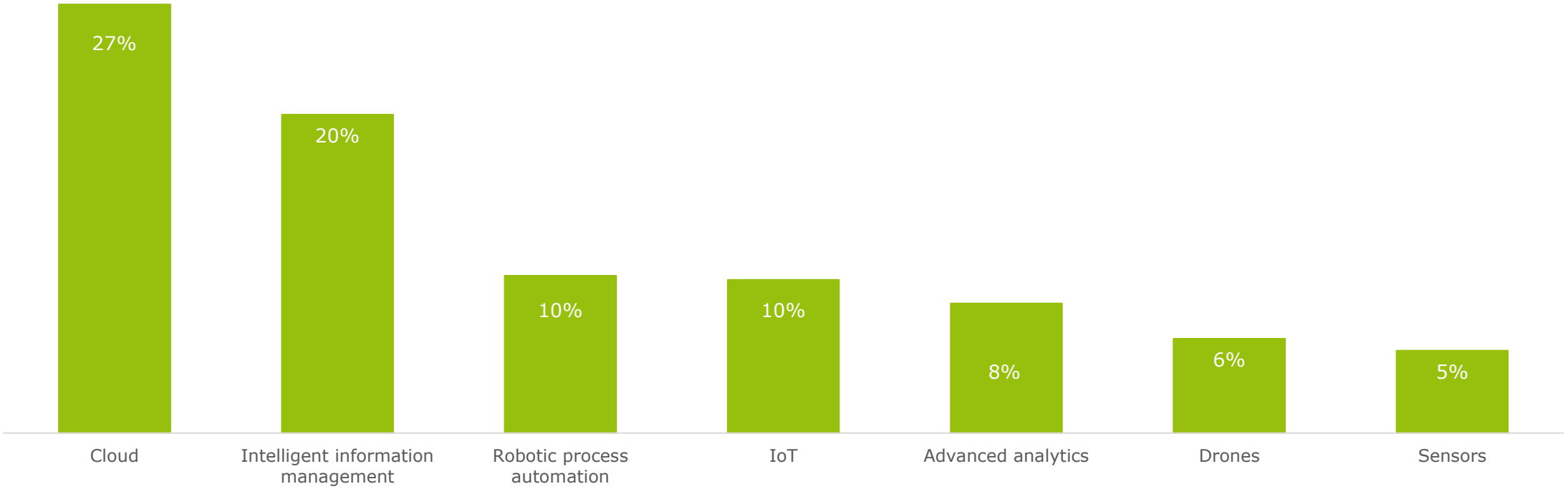


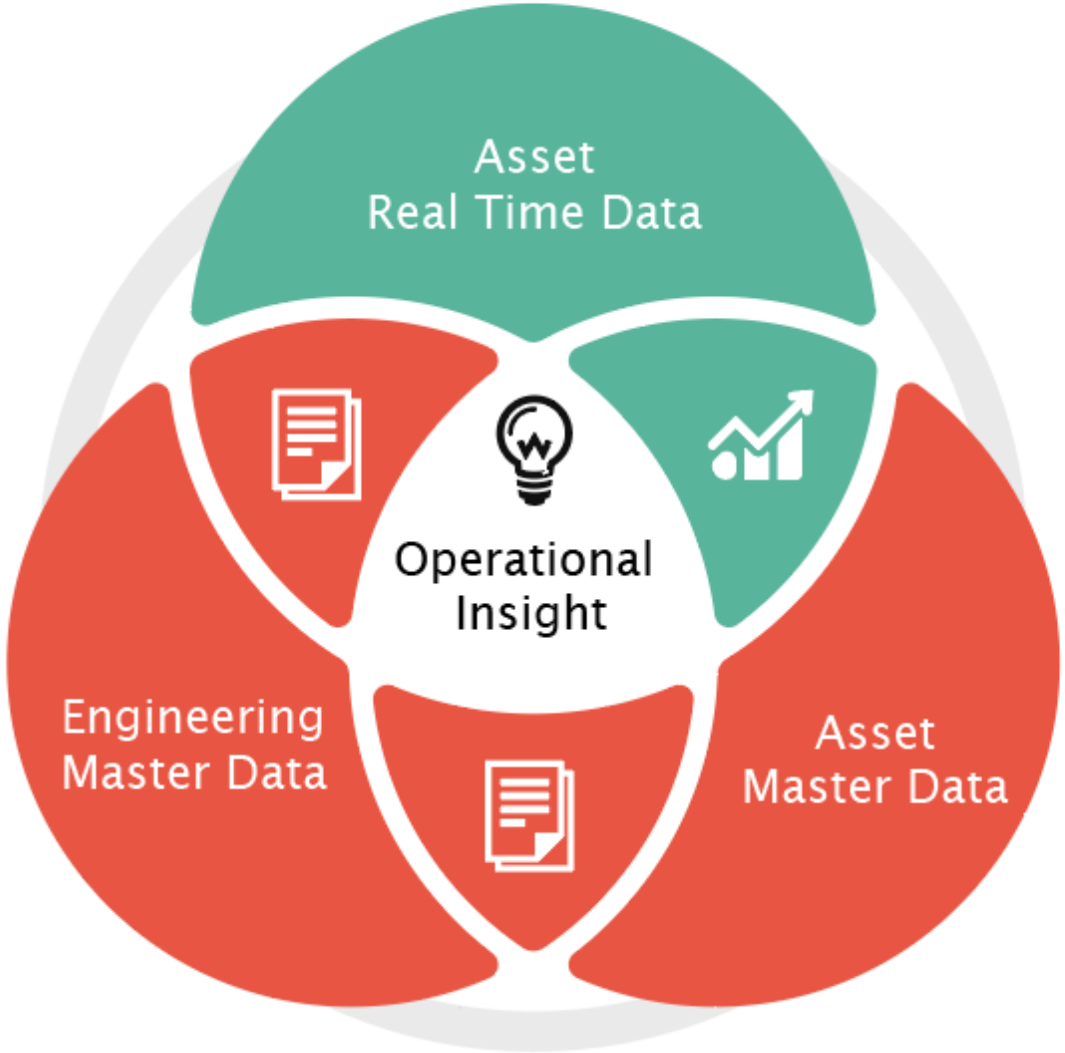
Figure 25: *Analysis showing the top seven most commonly reported digital technologies that offer the greatest opportunity to exploit, split by sector, asked to all respondents (400)*

Cloud and intelligent information management are top priorities!

INTELLIGENT INFORMATION MANAGEMENT
PLANT OPERATIONS PERSPECTIVE

Asset Real Time Data

- Transactional data
- Real / near time feeds
- Sensor data (IoT)
- Operational technology (OT)



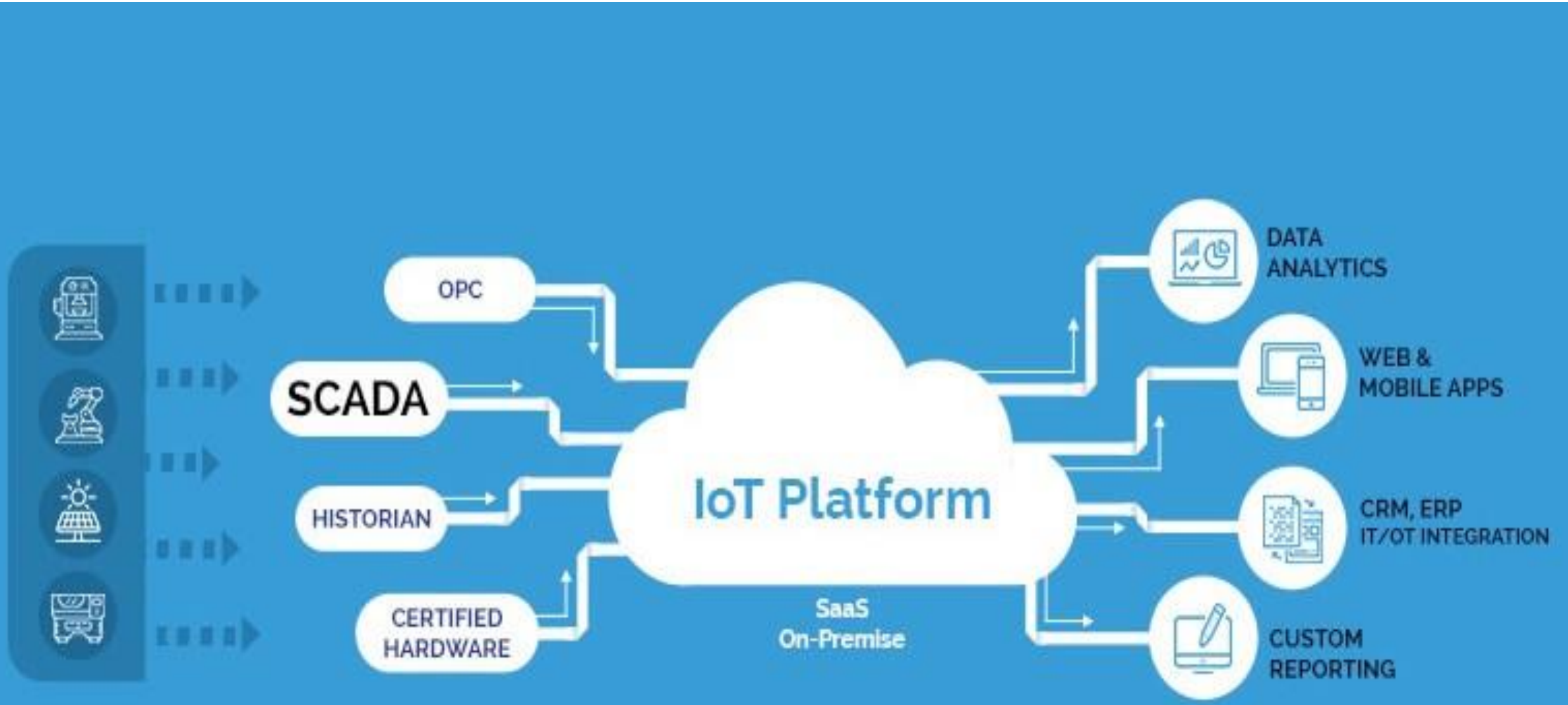
Engineering Master Data

- Non-transactional data
- Engineered lifecycle data
- Authored in AVEVA tools*
- DAaaS

Asset Master Data

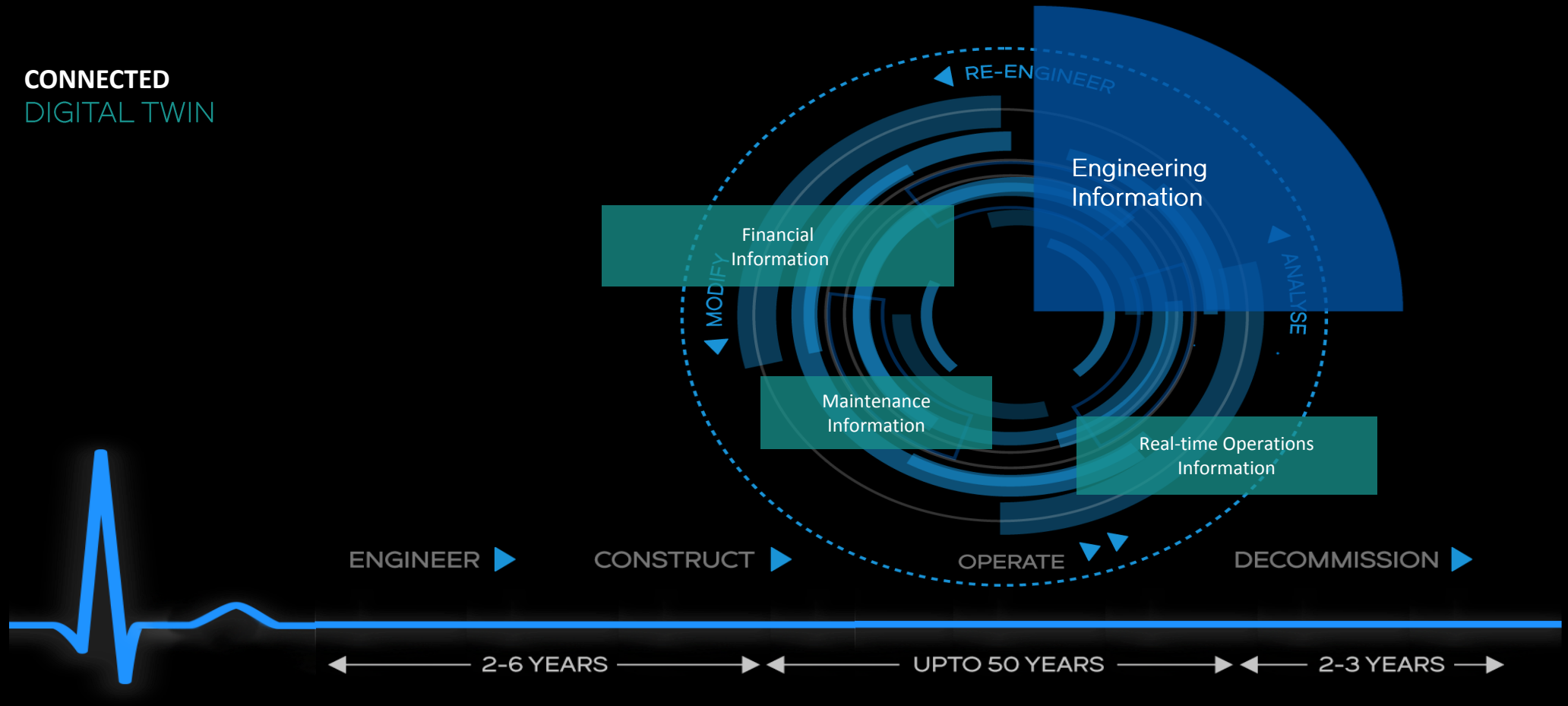
- Non-transactional data
- Vendor / catalogue data
- SPIR / Procurement
- EAM Maintenance / APM

IOT IS ALL ABOUT REAL TIME OPERATIONAL INFORMATION



WHAT ABOUT ENGINEERING INFORMATION?

CONNECTED
DIGITAL TWIN

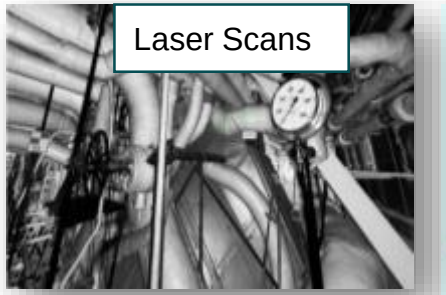


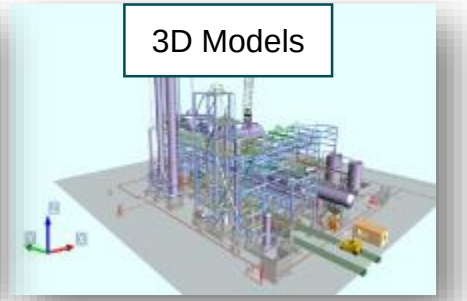
ENGINEERING INFORMATION

Engineering Information

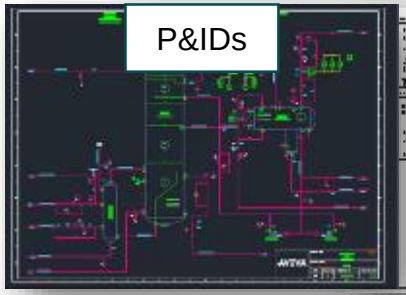
=

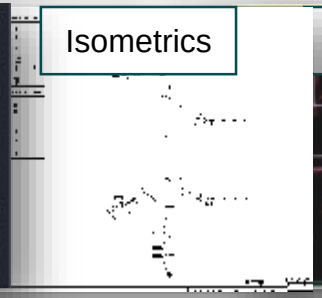
3D



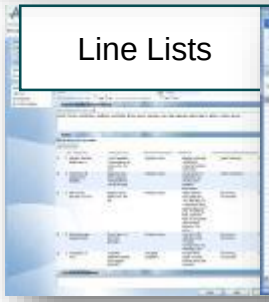


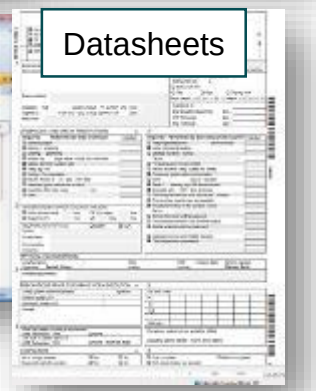
2D





1D

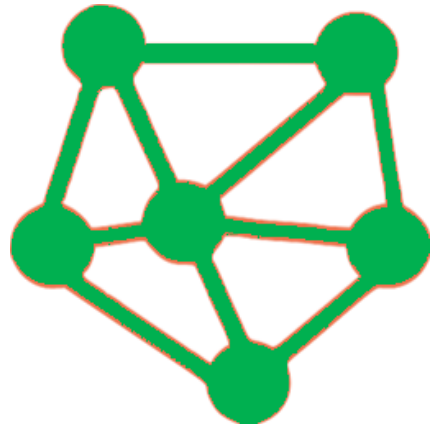




+

Status information / Maturity

Relationships / Context



THE PROBLEM?

EPC

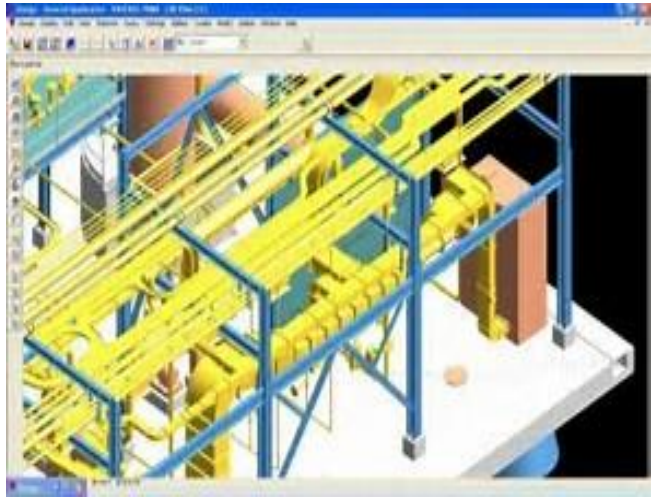
HANDOVER

Owner

Document Centric

EPC 4.0

Drafting Table



CADD
(PDMS)

Global
Execution

Digital
Asset


BLK
AIRBUS

BARRIERS TO ADOPTION

Your proposal is Innovative. Unfortunately, we won't be able to use it because we've never tried something like this before.

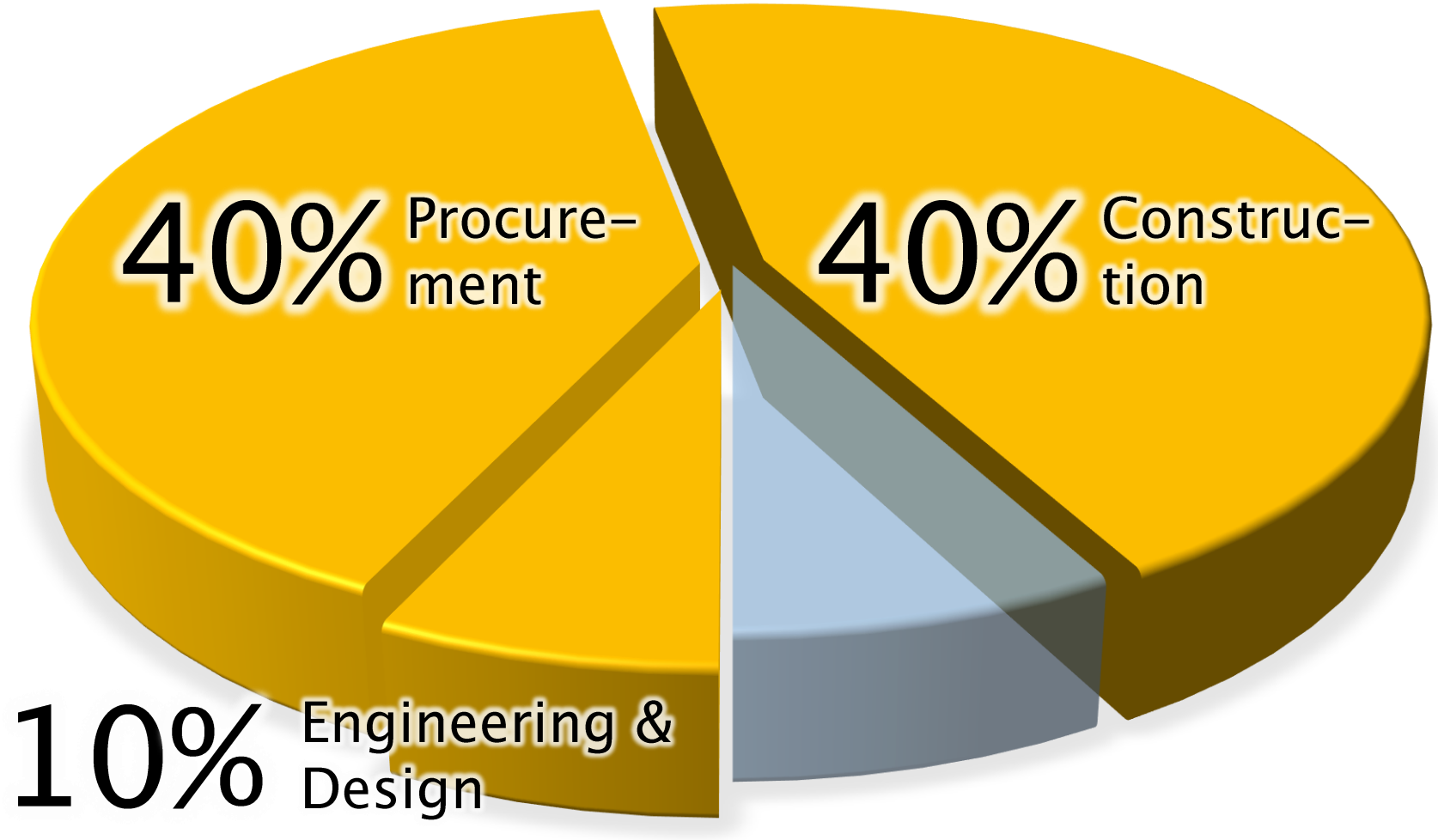
EPC 4.0
ASK YOURSELF…

- Can we propagate engineering and design changes quickly and reliably across all disciplines?
- Can we incorporate late changes to design with minimal impact to execution?
- Can we quickly and reliably recalculate TIC as the design changes?
- Can we incorporate additional cost reduction cycles without impacting schedule?
- Do our projects pass over from good ideas that are too late?
- Can we reliably and automatically produce engineering and construction deliverables from your source tools?
- Do we resort to offshore “value” centers (EPC 3.0) to produce deliverables?

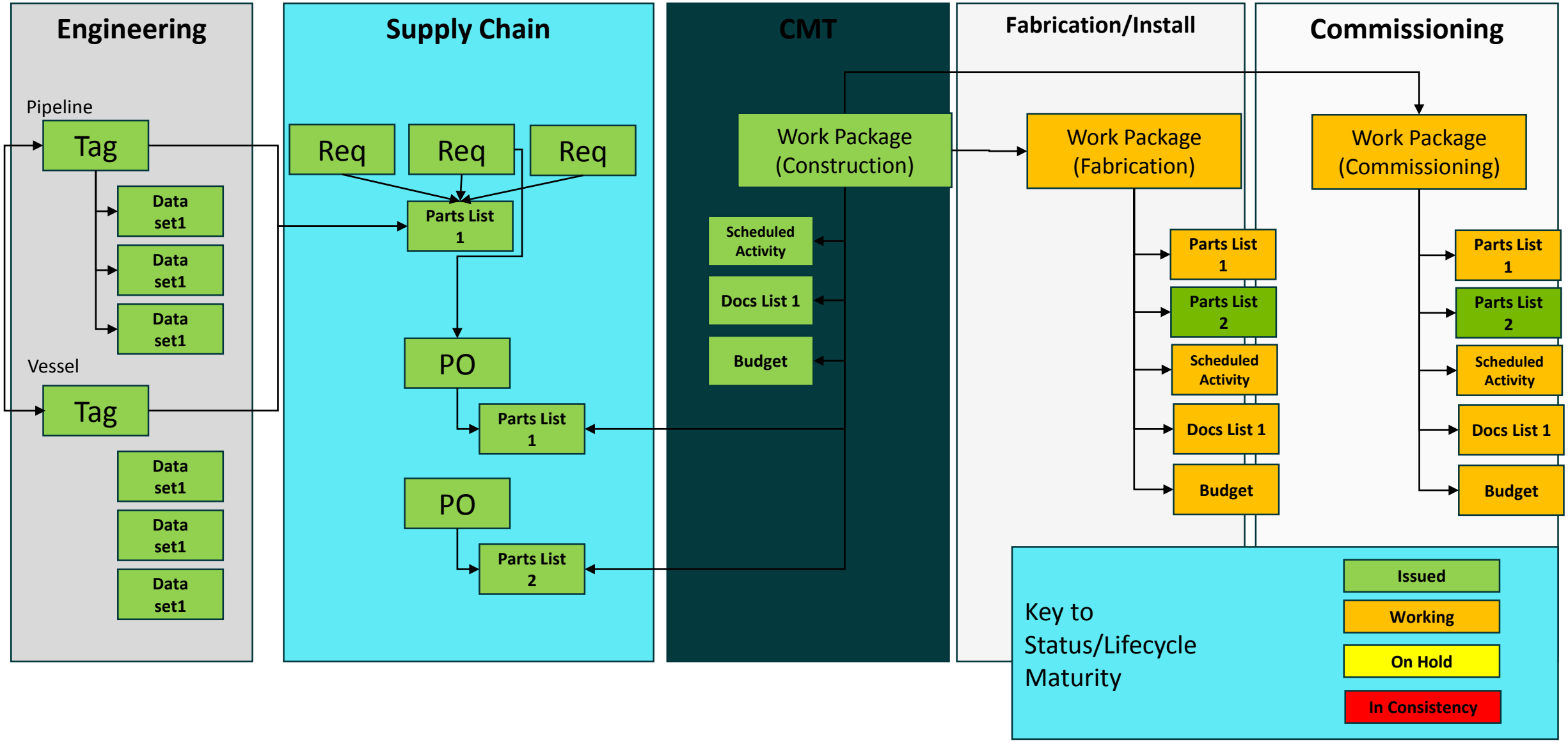
False confidence

Why does ”business as usual” lead to additional 2.4% cost of total project budget?

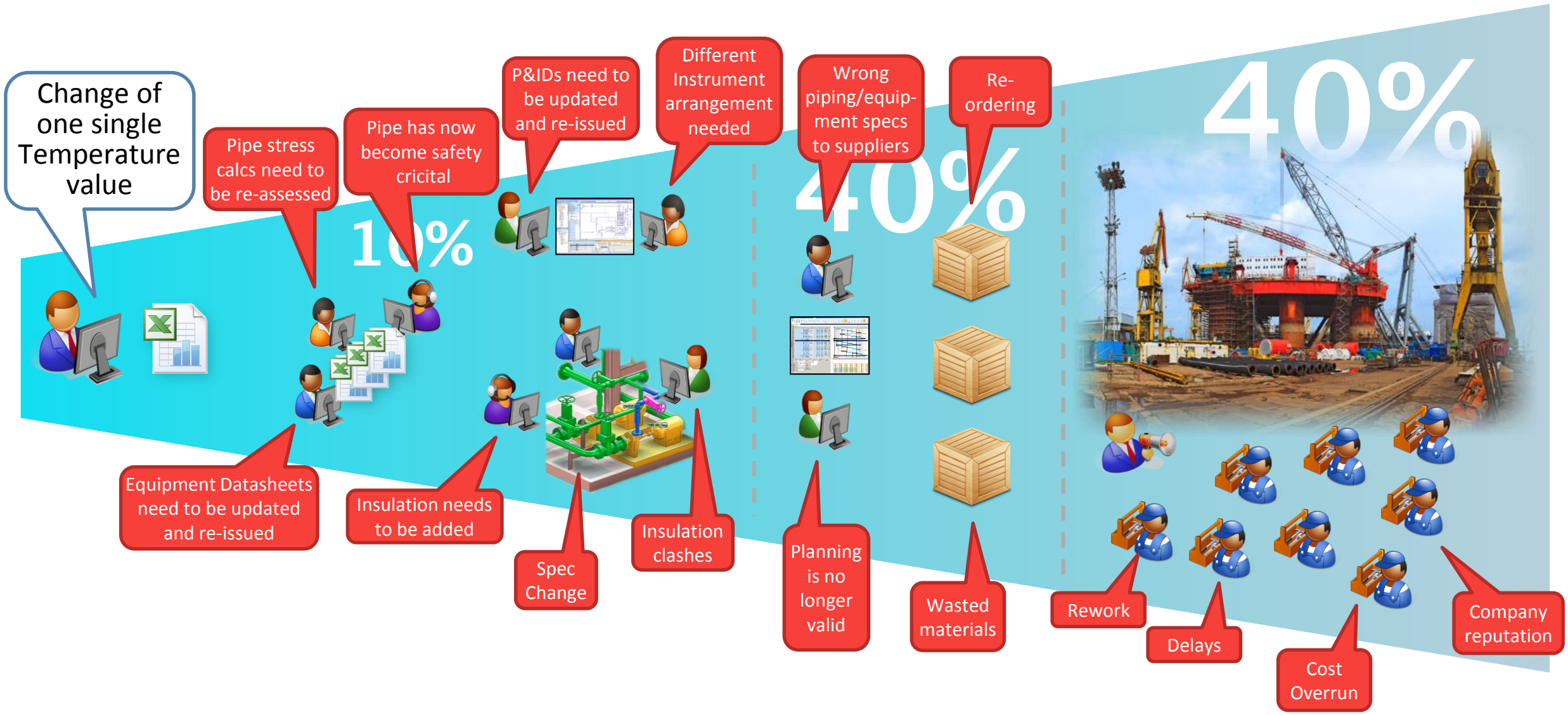
TYPICAL PROJECT COST BREAKDOWN



EXAMPLE OF EPC DATA CHALLENGE



WORK PROCESS



ENHANCING QUALITY AND COMPLETENESS OF DESIGN DELIVERABLES

Jeyoung Woo, M.S.

The University of Texas at Austin

This presentation is based on the research outputs by Research Team 320 supported by the Construction Industry Institute ™

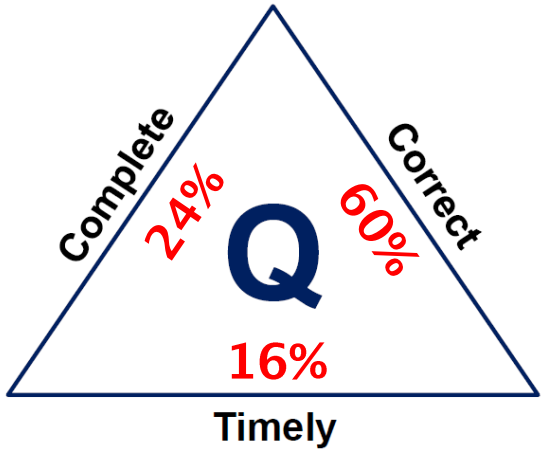
THE 11 MOST PROBLEMATIC DELIVERABLES

1. FEED (Front-End Engineering Design) Validation Deliverables
2. Level 3 Baseline Schedule
3. Constructability Inputs
4. P&IDs(Piping & Instrumentation Diagrams)
5. Equipment Specifications & Data Sheets
6. Maintainability Inputs
7. Vendor Data
8. 3D Model (& Clash Detection)
9. Piping Routing and Isometrics
10. Nozzles, Ladders, and Platform for Towers/Vessels/Tanks
11. Miscellaneous Pipe Support Drawings

This information is based on the research outputs by Research Team 320 supported by the Construction Industry Institute.™

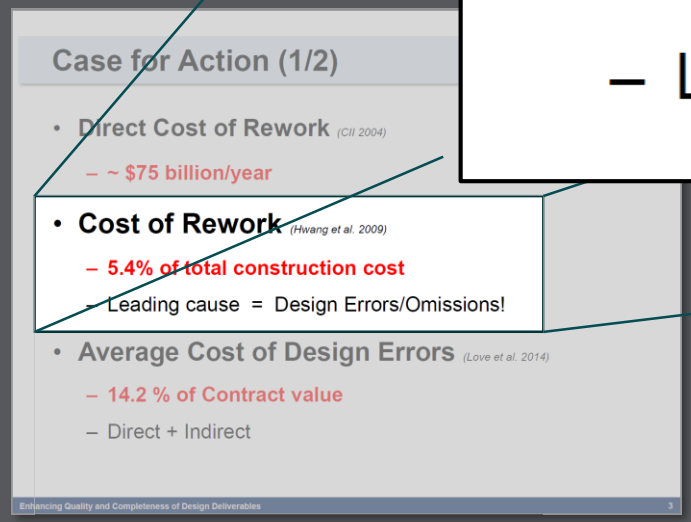
Design Quality Essentials

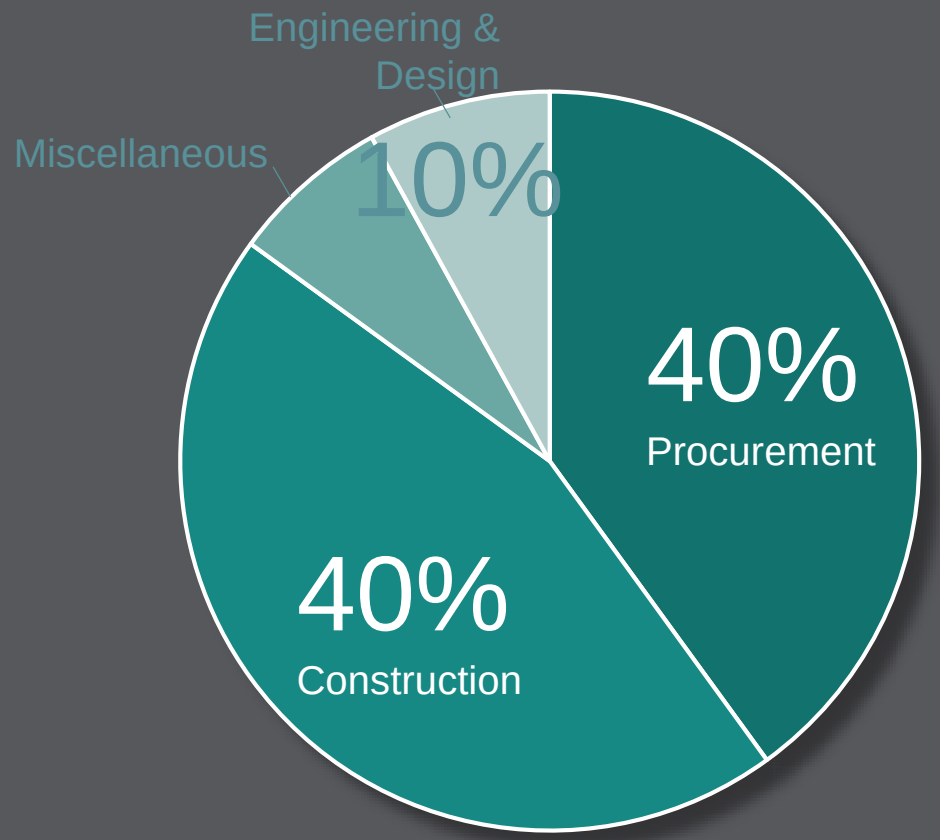
- **Essential criteria of design quality**
  (Andi and Minato 2003, O'Connor et al. 2007, and Tilley et al. 1997)



The industry survey (N=36) identified 798 common defects associated with the 11 problematic deliverables. RT-320 consolidated and aggregated these common defects, developing a list of 73 significant design deliverable defects (6.63 defects per deliverable on average). Among the 73 defects, 24 percent pertain to completeness, 60 percent pertain to correctness, and 16 percent pertain to timeliness.

- **Cost of Rework** *(Hwang et al. 2009)*
  - **5.4% of total construction cost**
  - Leading cause = Design Errors/Omissions!





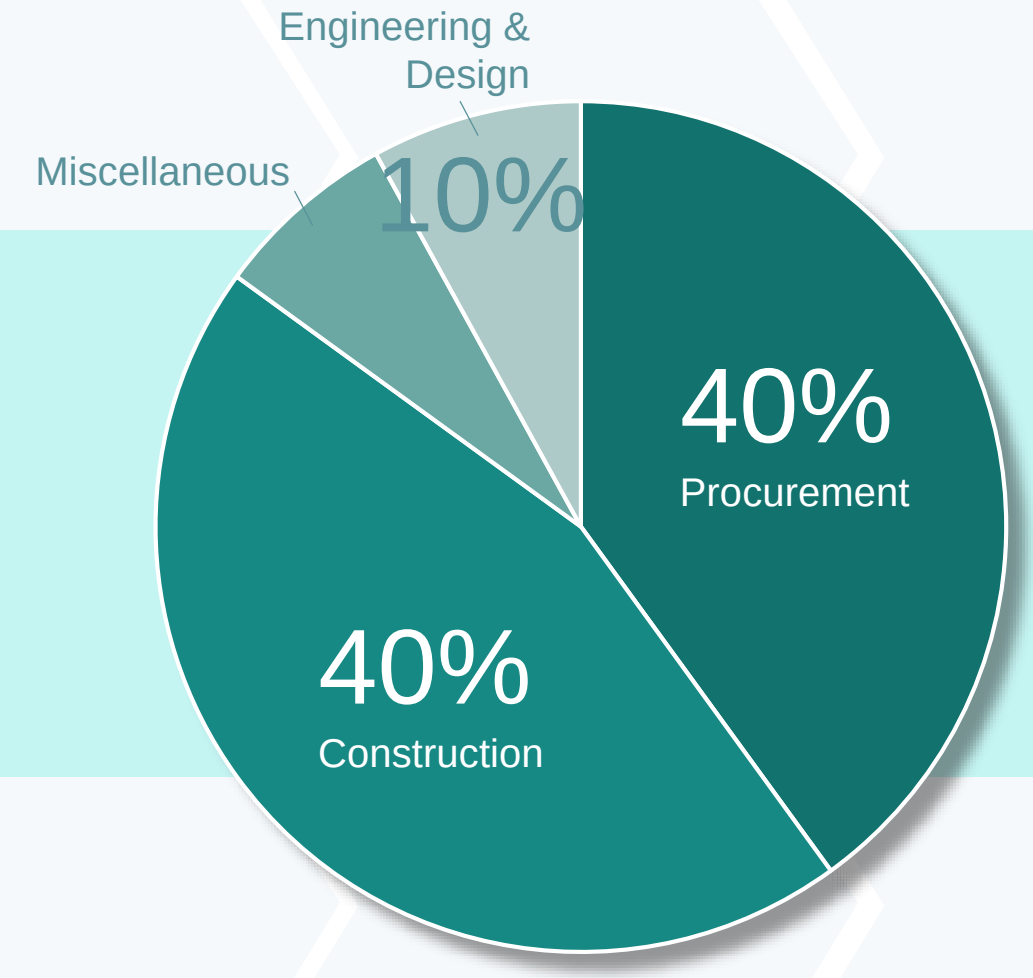
AVERAGE COST OF ENGINEERING ERRORS

14.2%

of contract value

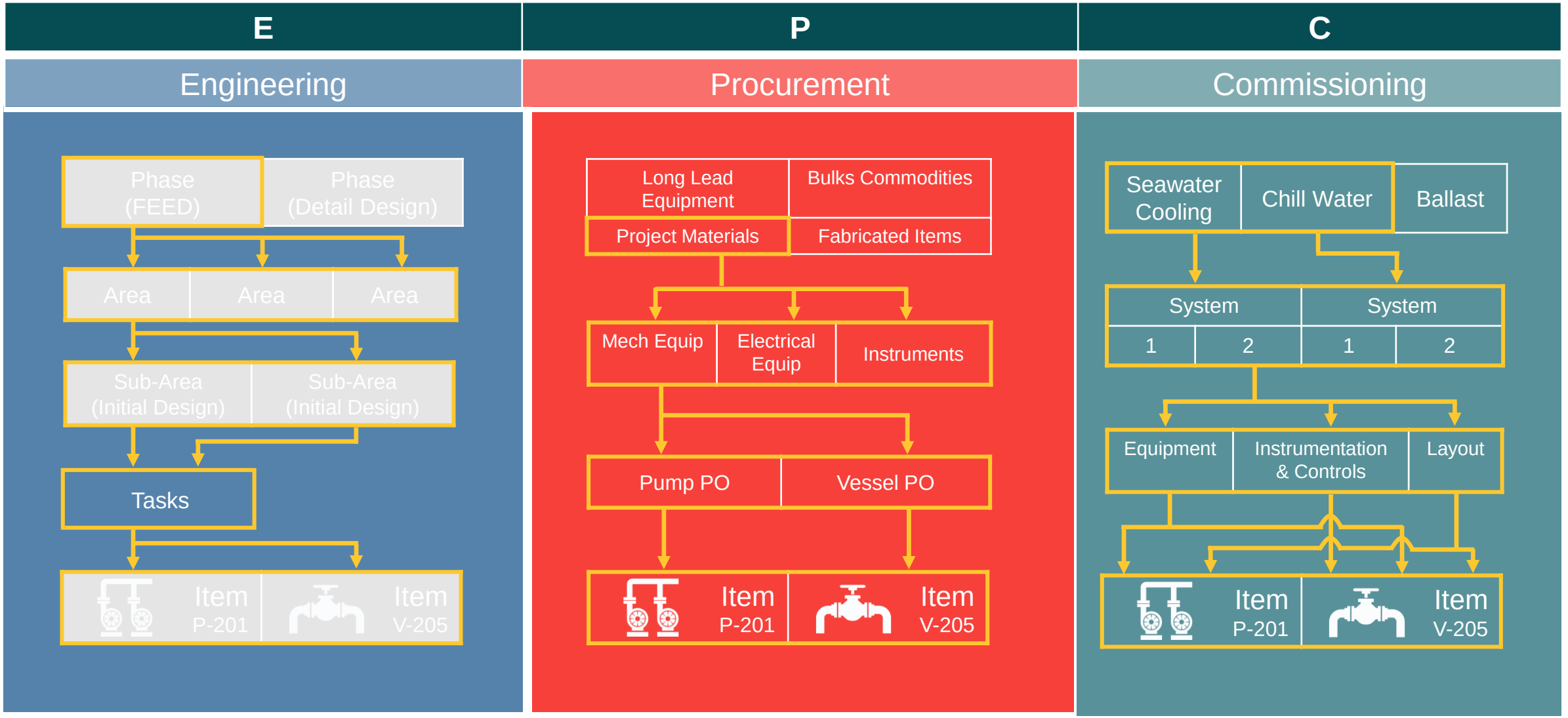
Direct + Indirect

(Love et al. 2014)

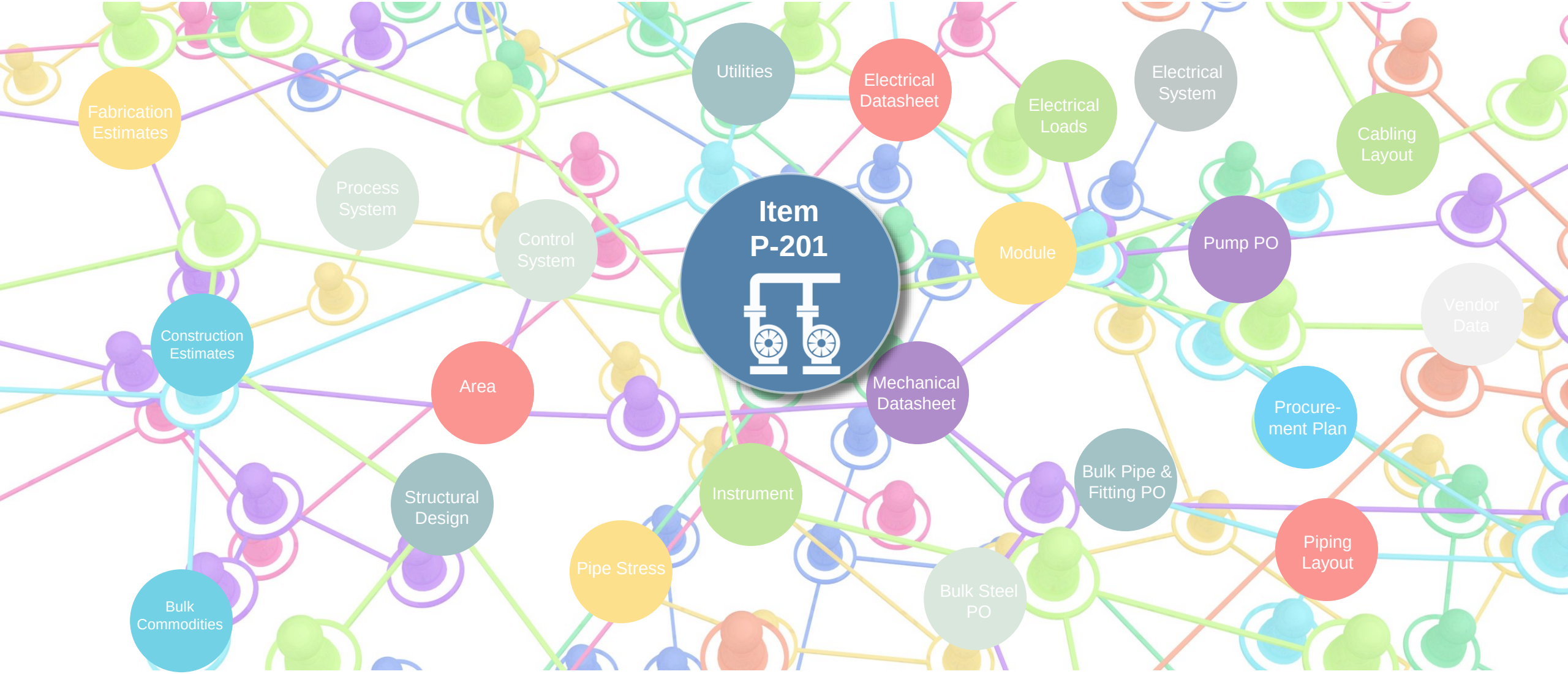


This presentation is based on the research outputs by

TYPICAL WBS HIERARCHY



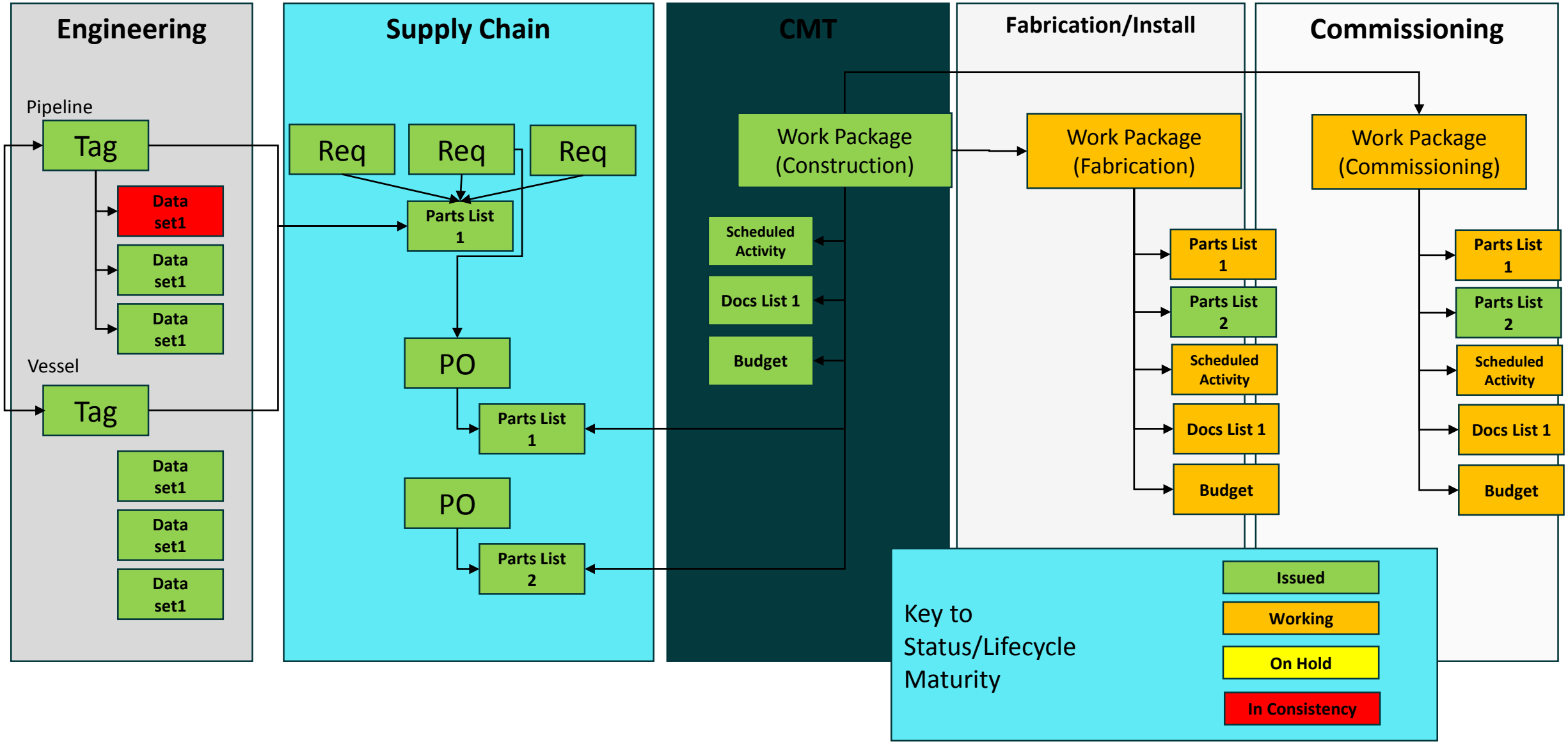
REALITY – WBS ARE RELATIONAL



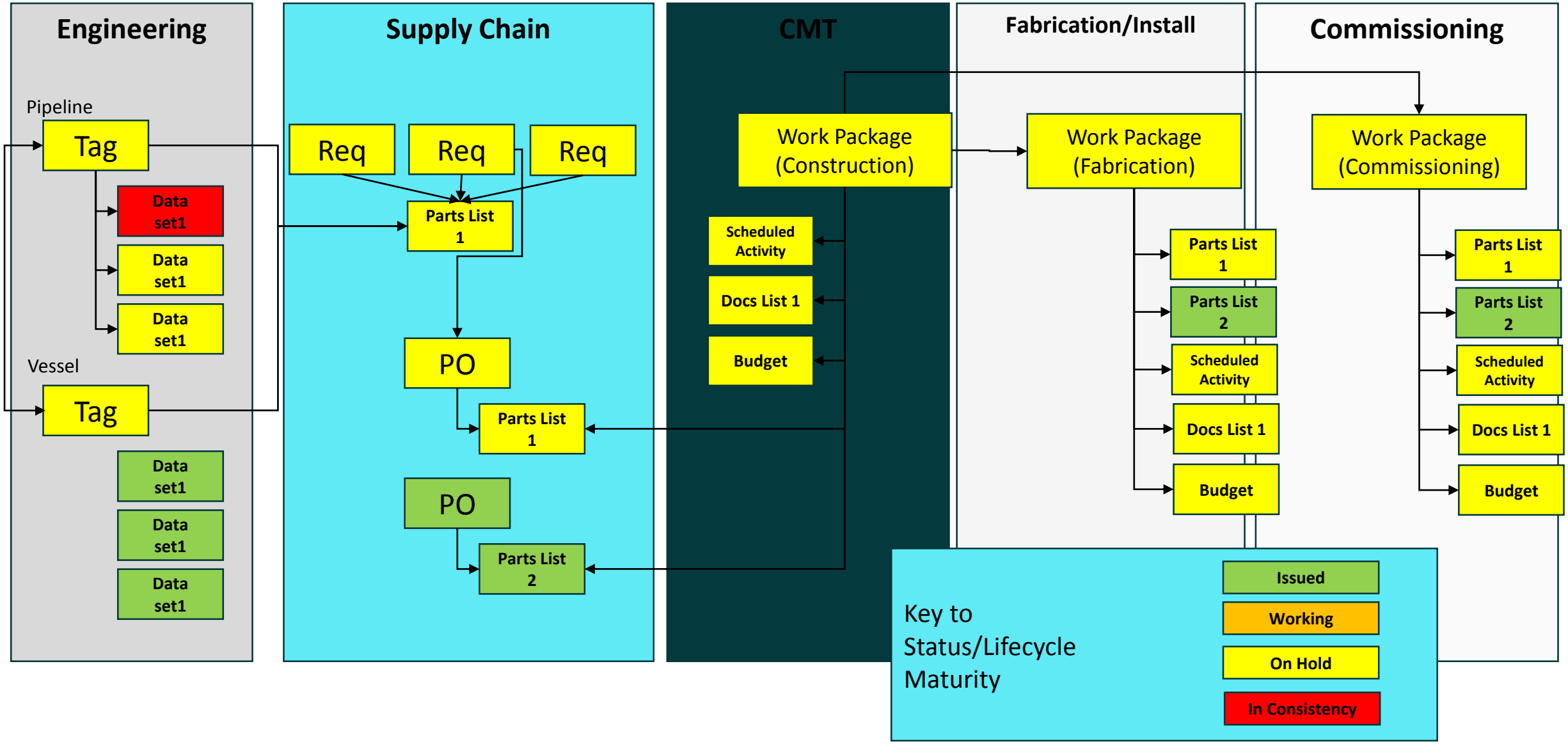
THE DATA CENTRIC PROJECT APPROACH

- Plan to manage complex Engineering Information in a relational not hierarchical way
- Go beyond technical data, captures data maturity, status and relationships
- Leverage a data authoring and storage system for Engineering Information that provides “single points of truth” for all data consumers
- Auditable/Traceable records of changes
- Generate Documents/Lists/Drawings from the data
- Allows data consumers to view data to meet their needs without creating new documents
- 24/7 information access – avoid lags in sharing discreet pieces of technical information

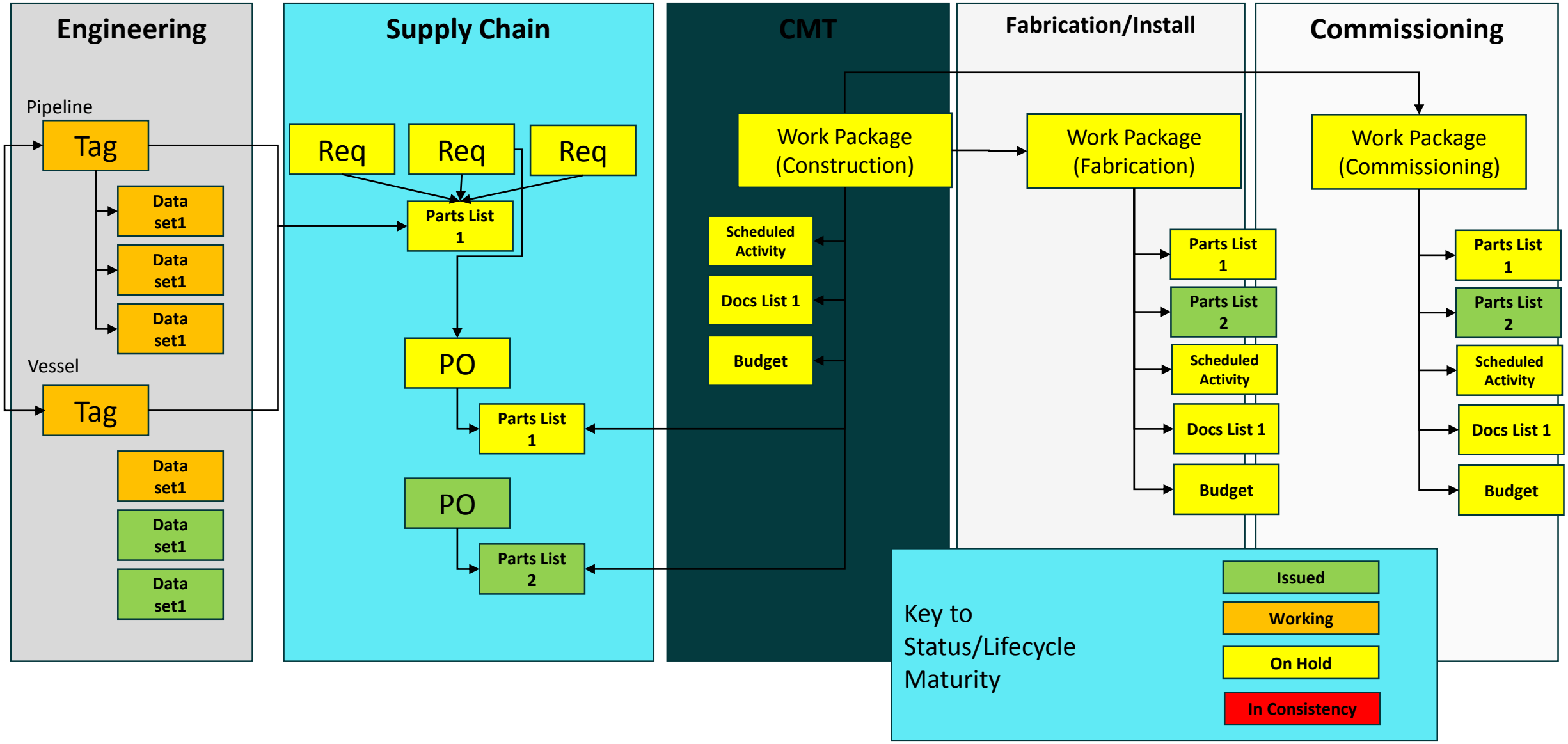
CHANGE INSTIGATED IN PROCESS



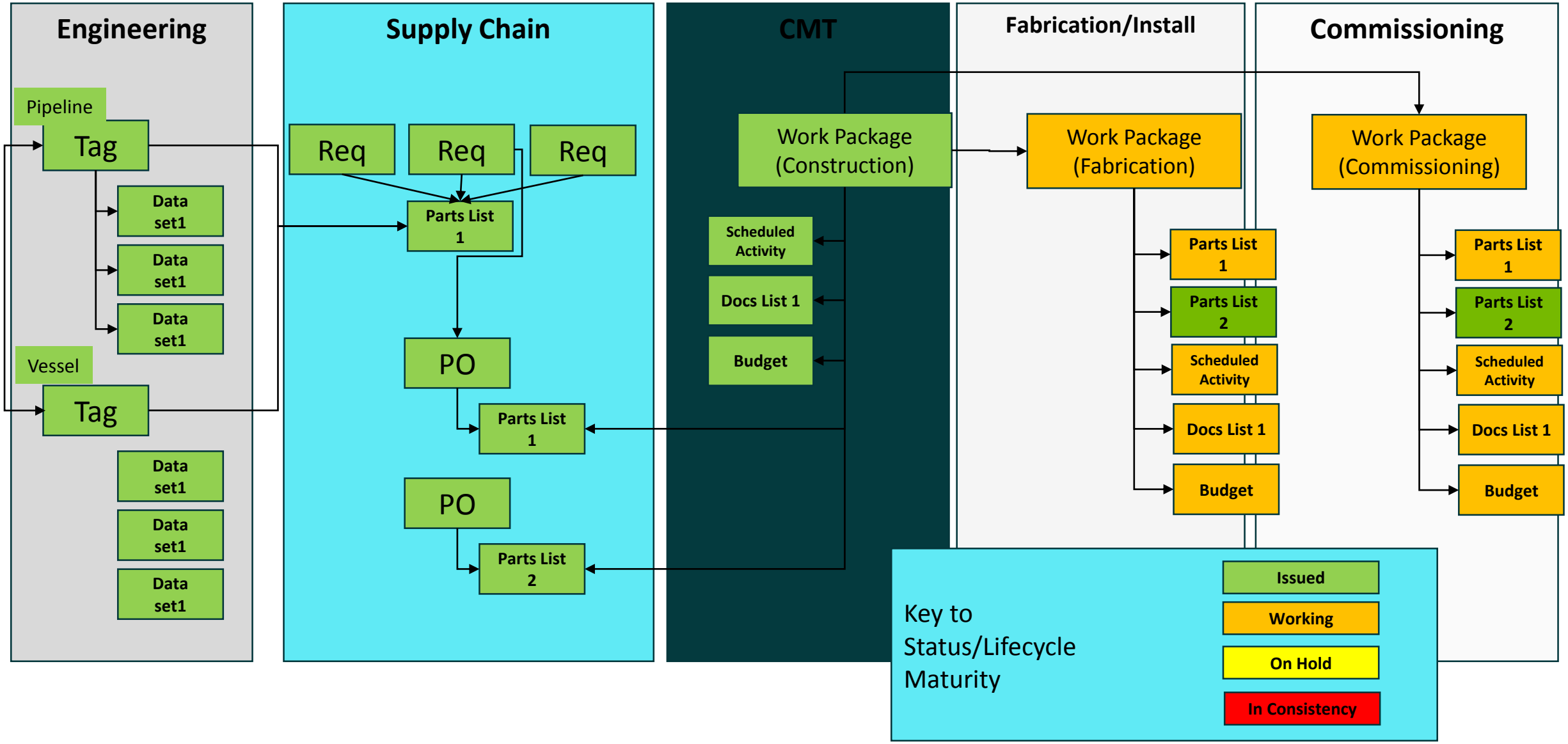
AFFECTED OBJECTS LOCKED DOWN



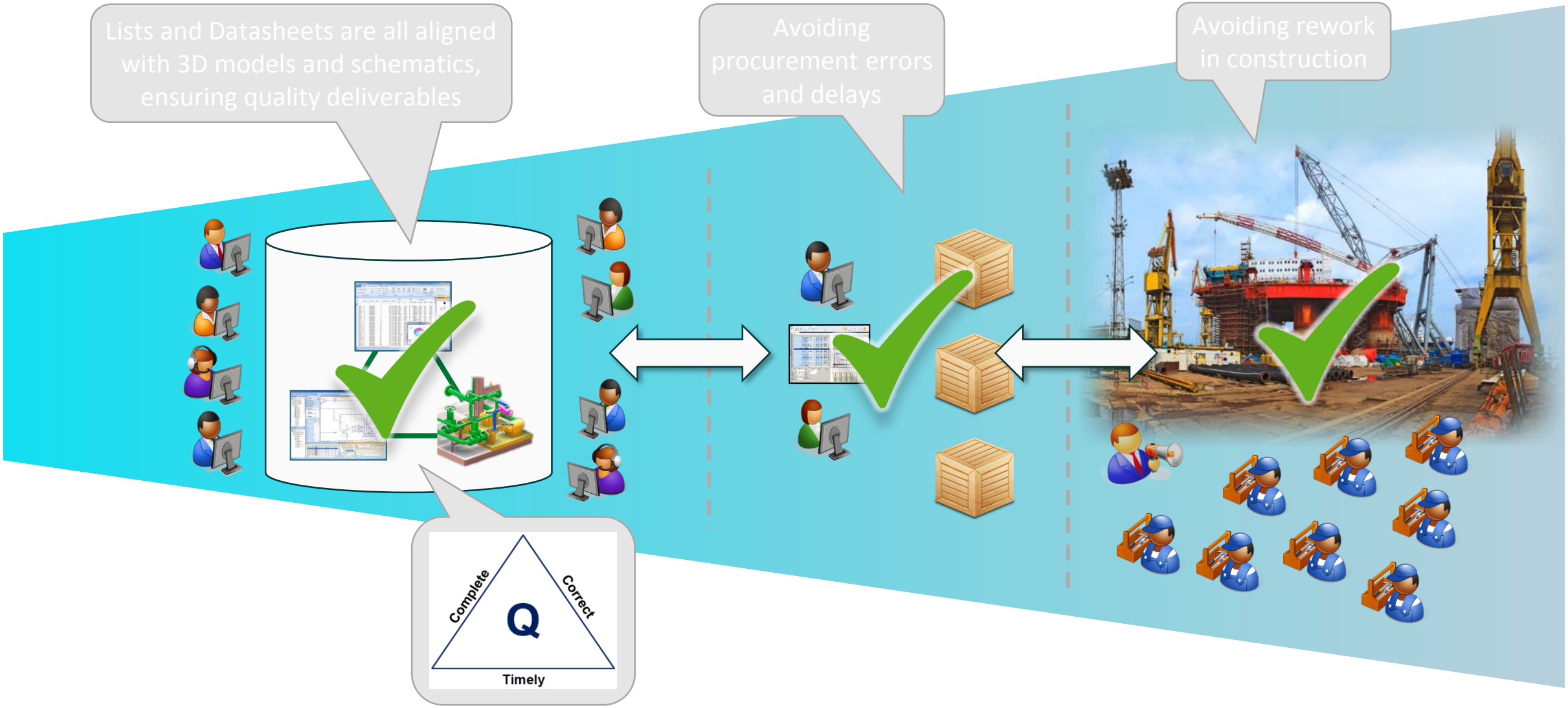
CHANGE PROPAGATED TO AFFECTED OBJECTS



ENGINEERING ITEM RE ISSUED AND ALL OTHER OBJECTS UPDATED.



IMPROVED WORK PROCESS



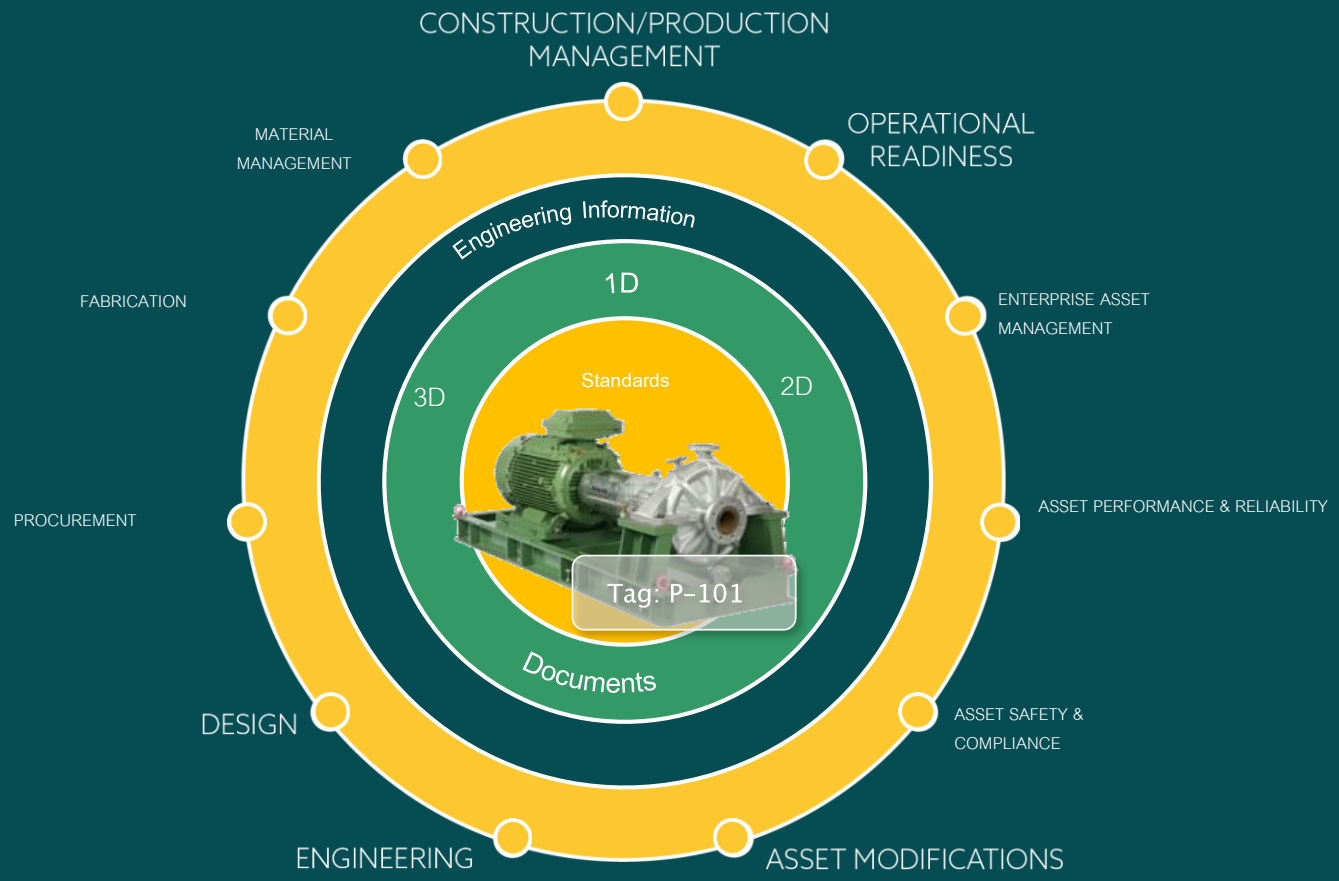
IMPACT OF AVEVA'S EPC 4.0 STRATEGY

- Engineering
- **Concept, FEED, Detail Design**
- Procurement
- Fabrication/Construction
- **Advanced Work packaging**
- **Workface Planning**
- **Materials Management**
- Commissioning and Startup

Data Centric Approach Saving Opportunity

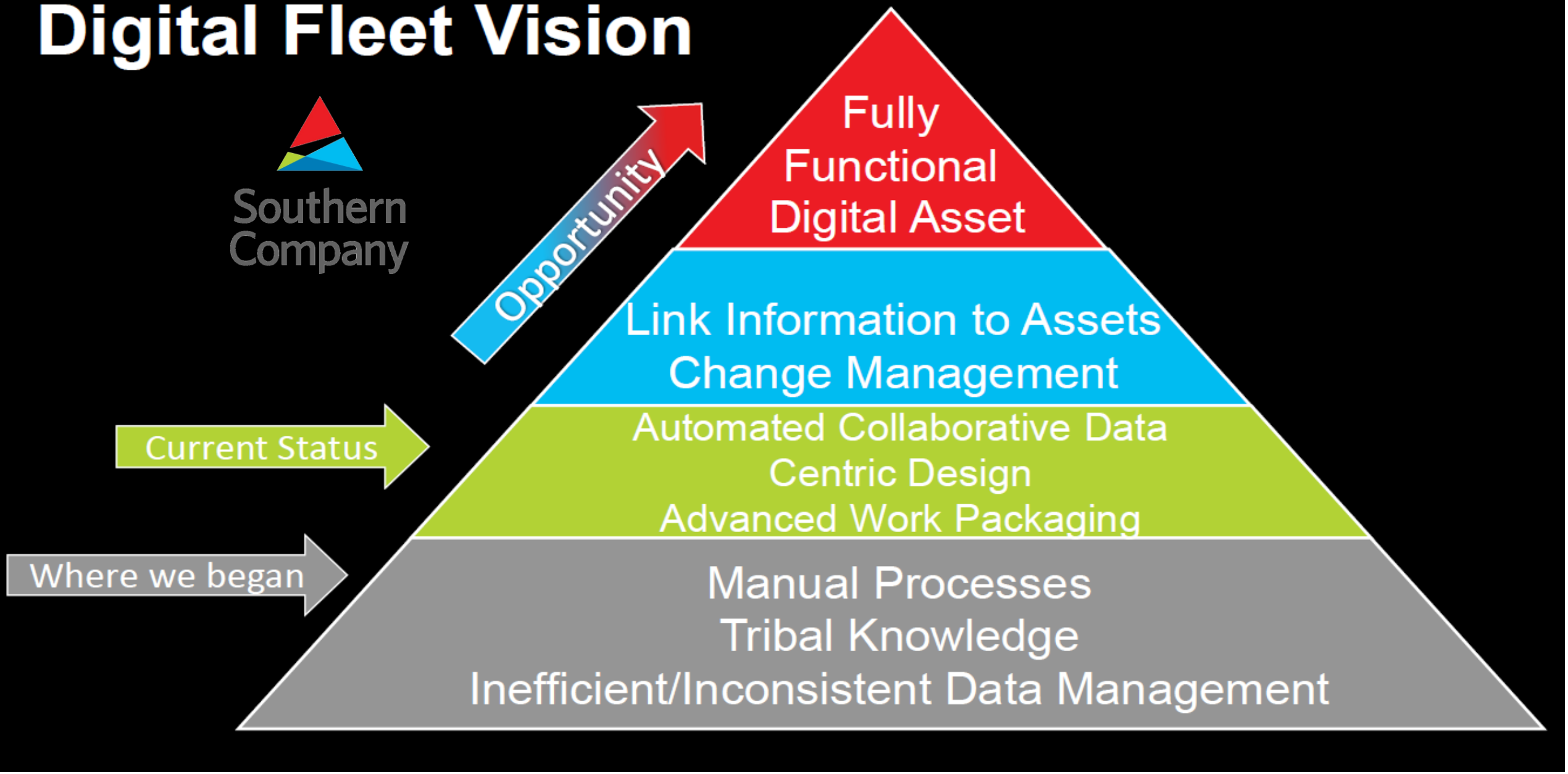
	% of TIC	Potential Savings	Est TIC Savings
Engineering	**10%**	**33%**	**3.3%**
Procurement	**40%**		**3.2%**
Tagged Items	15%	5%	0.8%
Bulks	15%	6%	0.9%
Field Contract Mgr	10%	15%	1.5%
Fab/Constr	**40%**		**2.5%**
Fab	10%	7%	0.7%
Constr	30%	6%	1.8%
C&SU	**5%**	**18%**	**0.9%**
Owners Costs	**5%**	**8%**	**0.4%**
Total			10.2%

AVEVA'S EPC 4.0 STRATEGY

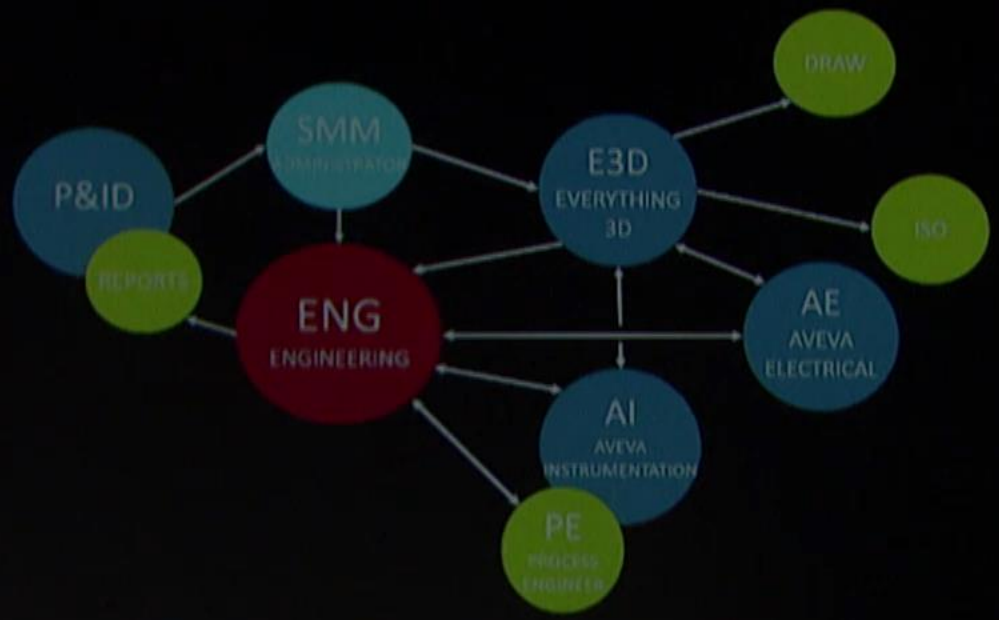


Digital Fleet Vision

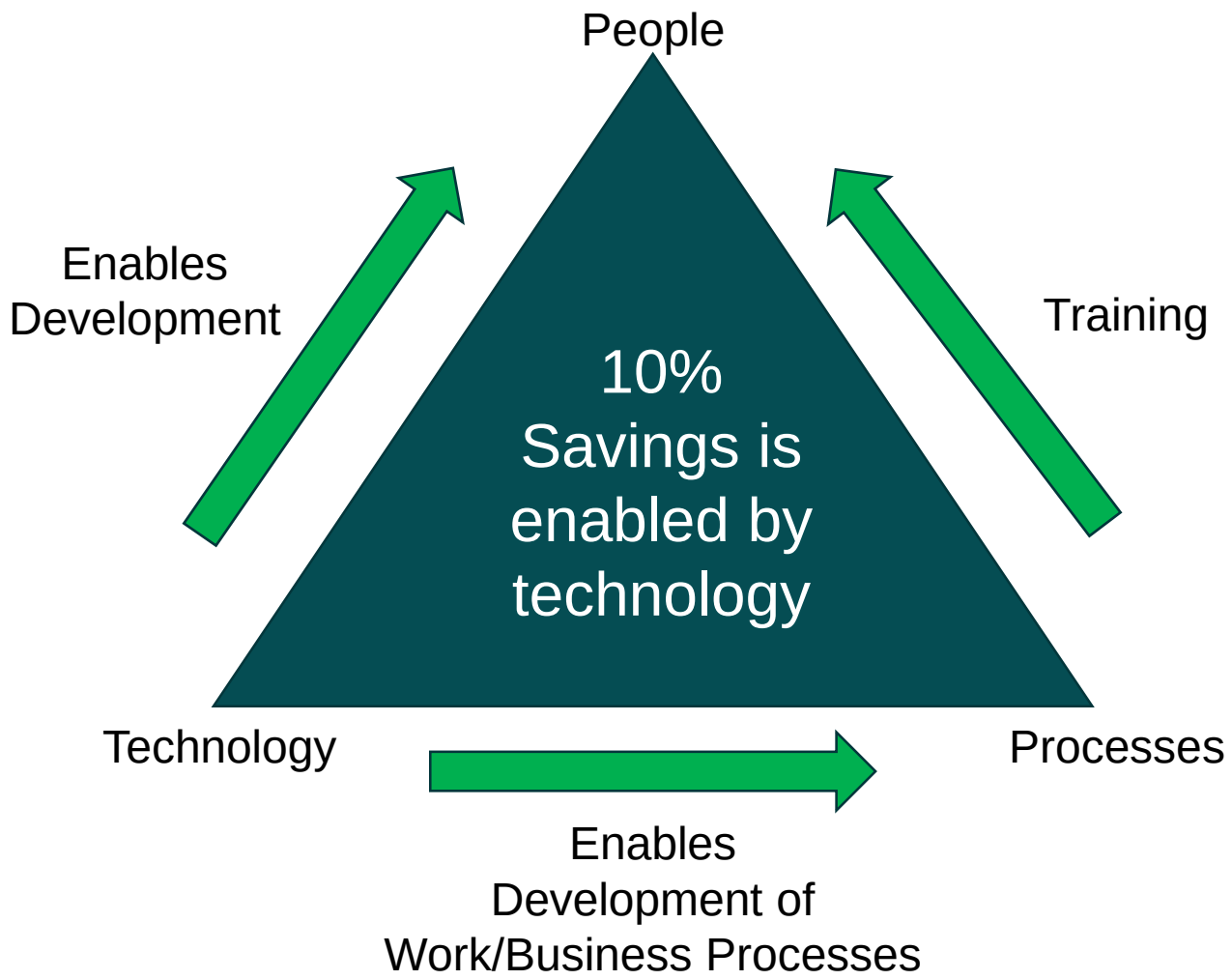
Southern Company



Digital Fleet Vision



THE IT'S NOT JUST ABOUT TECHNOLOGY

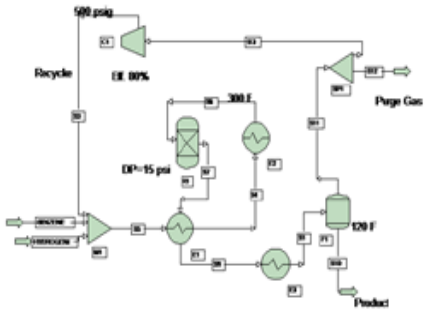


We are answering the need for efficiency from capital intensive industries….

Capital investment constraints: need to maximize utilization and efficiency of existing assets

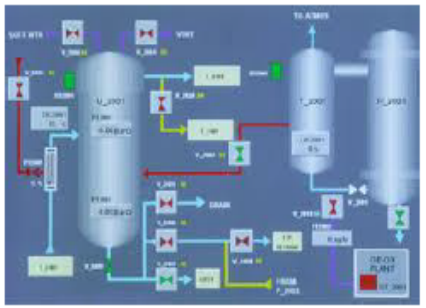
Project phase 2-6 years (1/3 of project spend) | Operations phase up to 50 years (2/3 of project spend)

Process Design



Plant Design Build & Upgrade

Operate and Maintain



Plant & Asset Optimization

Segmented Engineering

Manual process
Cost & time
Inefficiencies

Asset Lifecycle Management Gap

Manual process
Data complexity
Inefficiencies

To learn more about how AVEVA can help you execute projects more efficiently, visit http://www.aveva.com/en/Contact/

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@avevagroup

About AVEVA

AVEVA software and services enables our customers to solve the world's most complex engineering and design challenges. Discover how we can help you redefine engineering possibilities to successfully create and manage world-class capital-intensive assets. Headquartered in Cambridge, England, AVEVA employs more than 1,600 staff in 50 offices around the world.

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