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Project Controls EXPO
London, UK

# How a Digital PMO should add value not cost

**Behind the buzzwords of BIM, EVM and Digital Twins**

SWITCH ON
ENGINEERING & DIGITAL FOR ENERGY TRANSITION

# Why Me?

**IAIN CAMERON**

Director at Assystem

Chartered Civil Engineer

- Infrastructure Experience – 30 yrs
- Contracting, Client and Consulting
- PMO and Controls Subject Matter Expert
- Multiple Infrastructure Domains
- Worldwide Assignments
- Sharing of Experience & Learning

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# WHY A DIGITAL PMO?

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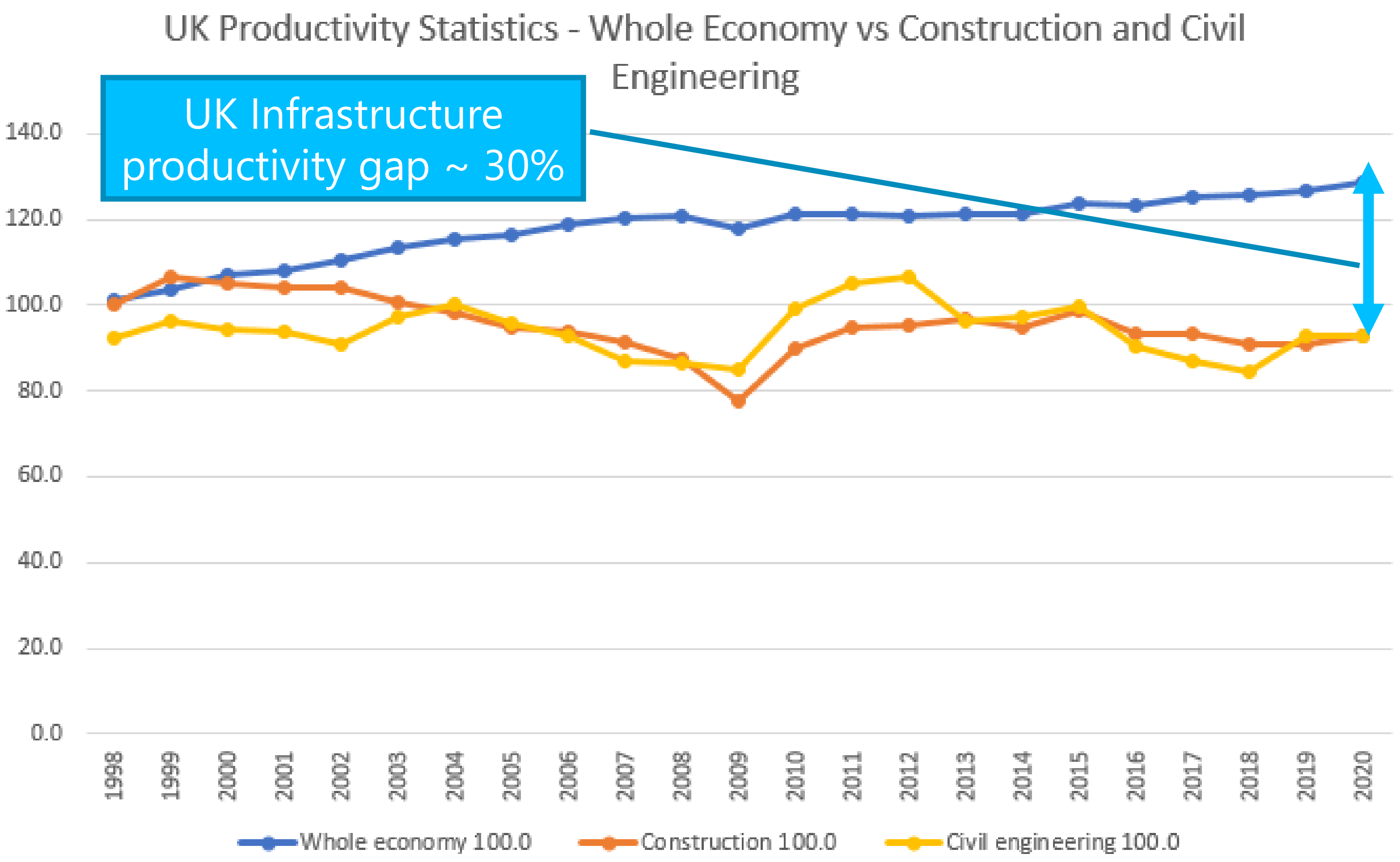
ENGINEERING & DIGITAL FOR ENERGY TRANSITION

# The importance of productivity in Infrastructure (aka Construction and Civil Engineering)

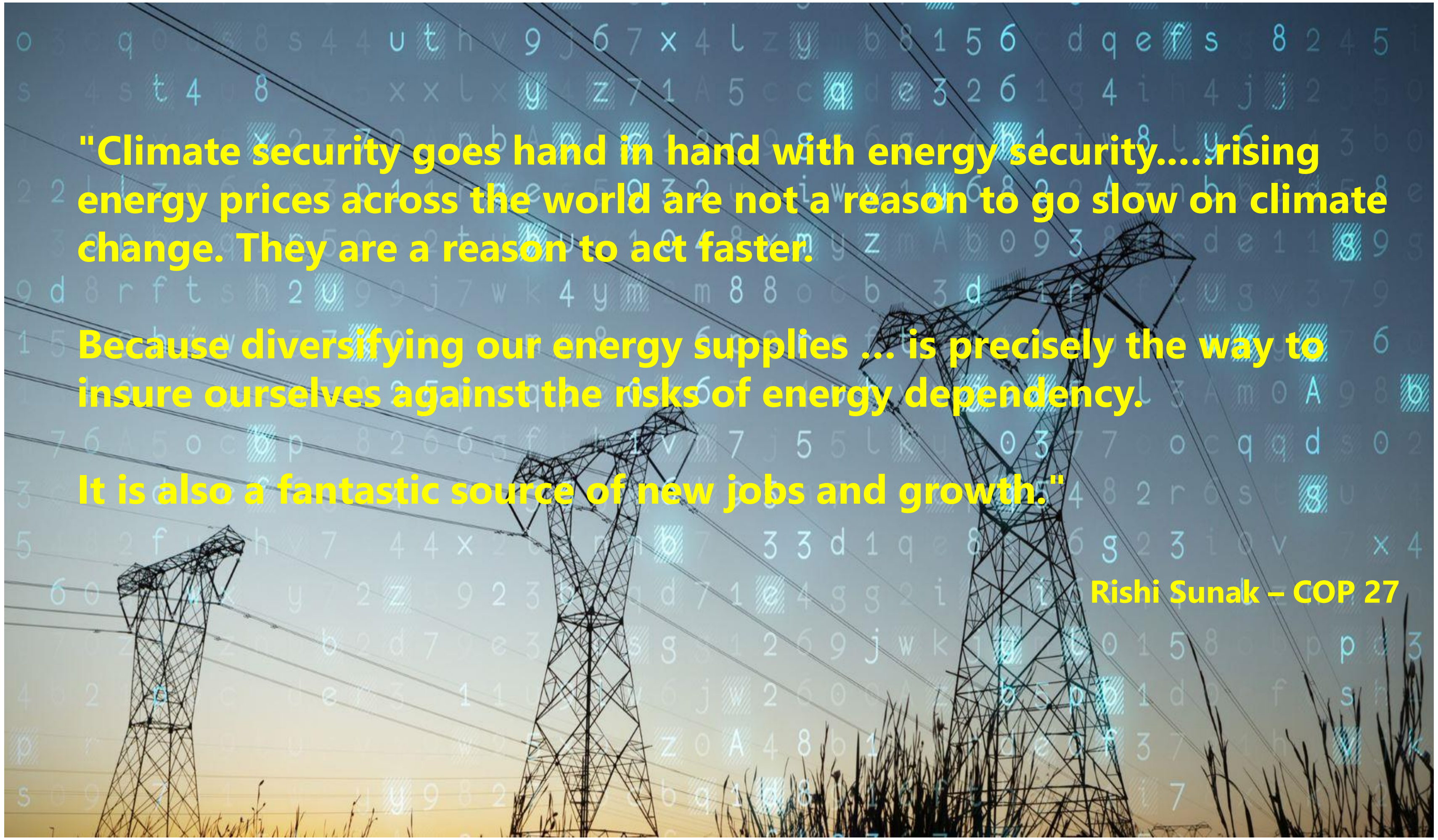



- Productivity gap equates to ~£10.1Bn annually
- Projected net zero carbon funding = £10Bn annually
- Improving infrastructure productivity equates to net zero carbon
- Productivity = Value Added / People Hours
- Increase Value
- Lower People Hours
- Develop and integrate technology and data skills into Infrastructure PMO

"Productivity isn't everything, but in the long run it is almost everything."

Paul Krugman, Nobel Laureate 1994, Economics

# The importance of energy security




- Pursuit of energy resources currently contributes to international conflict and climate change
- Limited minerals, fossil fuels
- Solar, wind, hydrogen, nuclear all important in electrification and carbon reduction
- Investment in generation and transmission infrastructure needs to increase

Productivity + energy security => prioritise increasing infrastructure value and reducing people hrs

# What adds value in infrastructure delivery?

"..study highlighted...average productivity between 2 groups varied by more than 50%...the **rewards for finding out what affected these variances could be huge**..."

CIOB productivity report https://www.ciob.org/media/59/download))

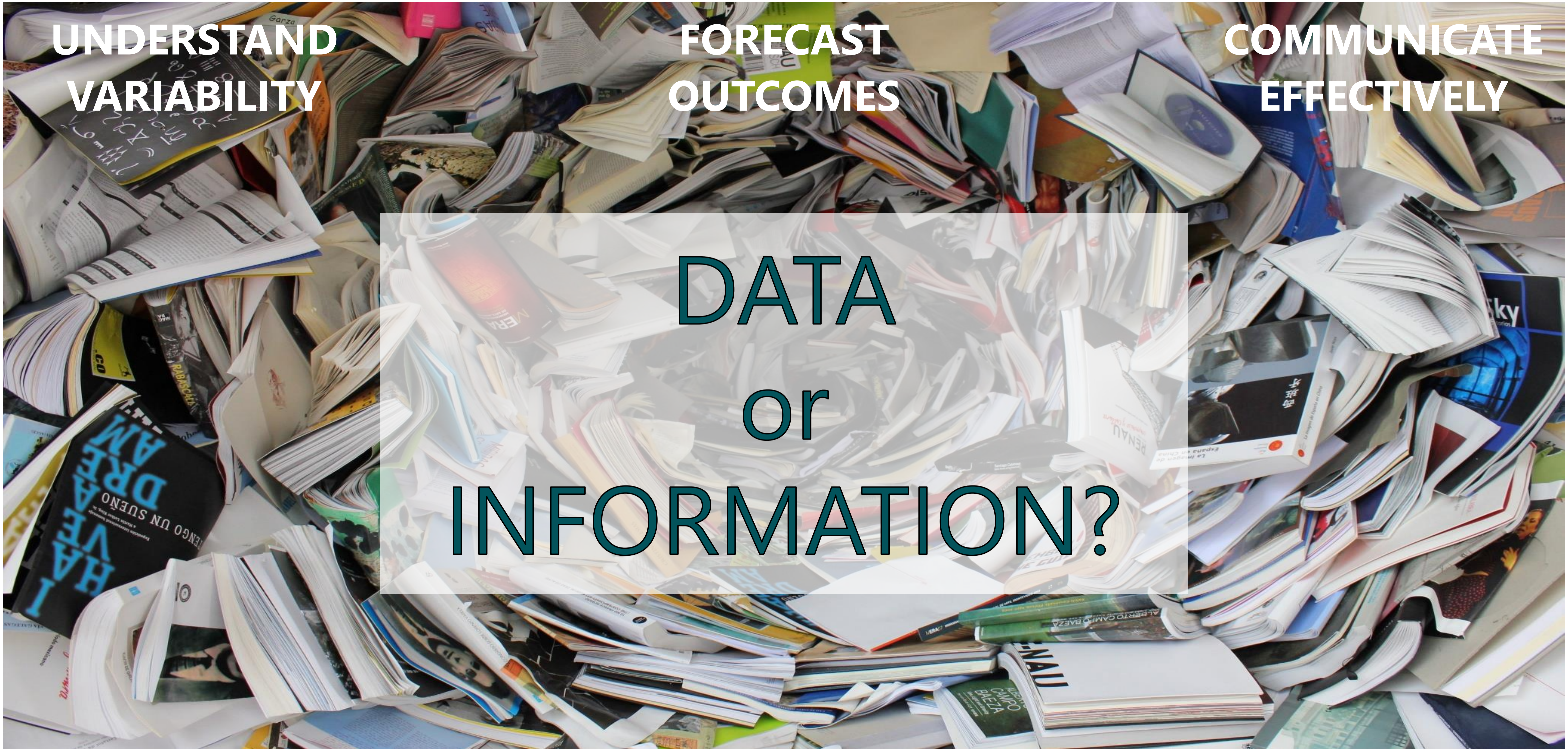

"outcomes of this research show **predictability** to be.. value increasing mechanism"

Construction Industry Institute https://www.construction-institute.org/resources/knowledgebase/knowledge-areas/project-planning/topics/rt-291


" productivity is strongly influenced by ability of site management to **communicate well**"

CIOB productivity report https://www.ciob.org/media/59/download))

# The relevance of the Digital Project Management Office



# The relevance of the Digital Project Management Office




The effective Digital PMO:

- Uses electronic data EVERYWHERE to AUTOMATE services and COMMUNICATE messages
- SIMPLY specifies digital artefact TRANSMISSION across supply chain boundaries
- VALIDATES digital data and meta-data to confirm it is appropriate
- Uses TECHNOLOGY to synthesise INFORMATION from DATA
- Improves delivery outcomes by presenting results INFLUENTIALLY, VISUALLY and SIMPLY
- Provides the governance behind forecasts and data to ensure INTEGRITY and RELIABILITY

# A services vision

Feasibility/Concept → Detail → Delivery → Operation

- Engineering Requirements & Simulation
- Govern Asset Modelling – 2D/3D
- Planning the Assets – cost & schedule
- QA for sub-sections of the Assets
- Monitoring delivery of the Assets – change & controls
- Handover and/or operation of the Assets

# A services vision

**Exchange Information Requirements**
Documents
BIM
Planning etc..

**Project Information Requirements**
Documents
BIM
Planning etc..

**Asset Information Requirements**
Global/National Standards
Operational Standards
Reference Data Standards

### Engineering Requirements & Modelling, Simulation

- Requirements mgt system
- Simulations (maybe with a BIM or other engineering models)

ENGINEERING REQUIREMENTS

### Governing Asset Modelling – 2D/3D

BIM & GIS Schemas

- BIM authoring tools
- Insist on IFC formats (+ native if needed)
- Consider Meta-Data very carefully

### Planning the Assets – cost & schedule

Cost, Scheduling Schemas

- Scheduling Solution Estimating Solution
- Estimate qtys derived from BIM?
- Time-phase

### QA for sub-sections for of Assets

Engineering Content Schemas

- Engineering solutions as required for calculations
- Common Data Environment

### Monitoring delivery of the Assets – change & controls

EVM & Payment Schemas

- Contract Mgt system Controls solution off-the-shelf but often bespoke for temporary organisations

PROJECT INFORMATION MODEL – PIM – **RED describes digital data requirements or 'Data Building Blocks' and 'Schemas'** in EXCHANGE INFORMATION REQUIREMENTS (EIR)

### Handover and/or operation of the Assets

- Asset Management Solution
- Visually enable if practicable

ASSET INFORMATION MODEL

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# UNDERSTAND VARIABILITY

## A SIMPLE EXAMPLE OF HOW DATA CLASSIFICATION CAN CONTRIBUTE

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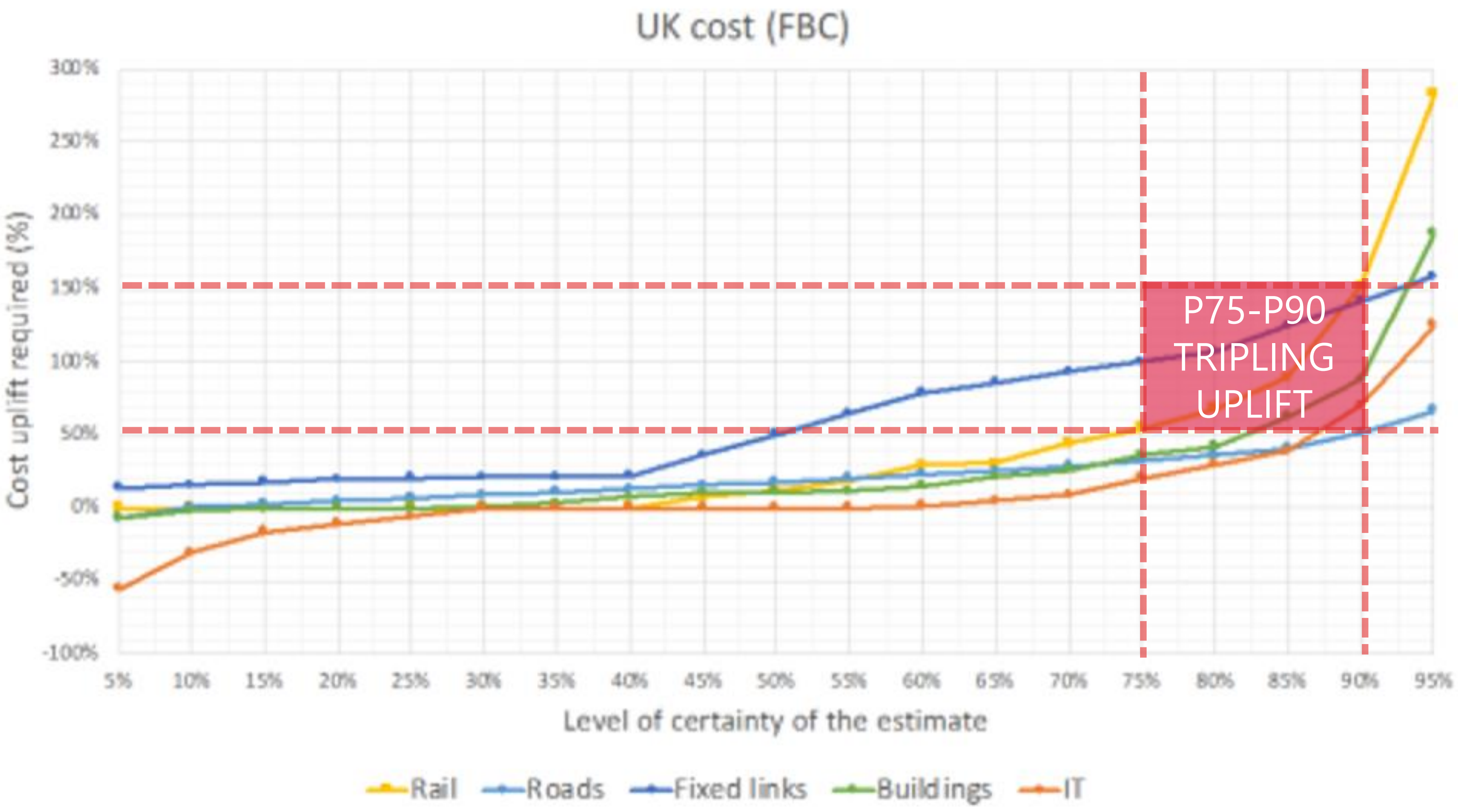
# Reference Class Forecasting




To get increasing CERTAINTY of COST or TIME (horizontal axis)
Apply different UPLIFTS to COST OR TIME bases (vertical axis)

- 5 Reference Classes here; at 'Project' level
- Collect Initial Business Case, Final Business Case and Out-turn data on cost and duration of each Project
- To develop, establish more reference classes with authentic data; at a level of detail below 'Project' e.g. Control Account
- Create Control Accounts that can be cross-referenced to global standards

# Classifying Scope – a Delivery Matrix

| | 97937<br>Station - Westmead<br>MRS-M11-WMD-SN650 | 97954<br>Station - Parramatta<br>MRS-M11-PTA-SN600 | 98584<br>Station - Olympic Park<br>MRS-M11-OLP-SN400 | 98946<br>Station - North Strathfield<br>MRS-M11-NST-SN350 | 98961<br>Station - Burwood North<br>MRS-M11-BWT-SN300 | 99475<br>Station - Five Dock<br>MRS-M11-FDK-SN250 | 99960<br>Station - The Bays<br>MRS-M11-TBY-SN200 | 99975<br>Station - Pyrmont<br>MRS-M11-PYR-SN150 | 99989<br>Station - Hunter Street (Sydney CBD)<br>MRS-M11-SCB-SN100 |
|---|---|---|---|---|---|---|---|---|---|
| SM.1 SM-965 Places | | | | | | | | | |
| SM.1.1 SM-966 Stations | | | | | | | | | |
| SM.1.1.1 SM-967 Station Earthworks | | | | | | | | | |
| SM.1.1.1.1 SM-968 Underground station earthworks | | | | | | | | | |
| SM.1.1.1.2 SM-973 At-grade station earthworks | | | | | | | | | |
| SM.1.1.2 SM-975 Station structure | | | | | | | | | |
| SM.1.1.2.1 SM-976 Station foundations | | | | | | | | | |
| SM.1.1.2.2 SM-977 Station retaining structures and walls | | | | | | | | | |
| SM.1.1.2.3 SM-978 Station water and wastewater infrastructure | | | | | | | | | |
| SM.1.1.2.4 SM-979 Station building structures | | | | | | | | | |
| SM.1.1.3 SM-980 Underground station structures | | | | | | | | | |
| SM.1.1.3.1 SM-981 Station box structure | | | | | | | | | |
| SM.1.1.3.2 SM-982 Station cavern structure | | | | | | | | | |
| SM.1.1.3.3 SM-983 Station adit structure | | | | | | | | | |
| SM.1.1.3.4 SM-984 Station shaft structure | | | | | | | | | |
| SM.1.1.4 SM-991 Station fitout | | | | | | | | | |
| SM.1.1.4.1 SM-992 Station entrance | | | | | | | | | |
| SM.1.1.4.10 SM-1001 Mezzanine level | | | | | | | | | |
| SM.1.1.4.11 SM-1002 Platform | | | | | | | | | |
| SM.1.1.4.12 SM-1003 Canopies and awnings | | | | | | | | | |
| SM.1.1.4.13 SM-1004 Customer toilets | | | | | | | | | |
| SM.1.1.4.14 SM-1005 Station seating | | | | | | | | | |
| SM.1.1.4.15 SM-1006 Station facades | | | | | | | | | |
| SM.1.1.4.16 SM-1007 Station systems supporting infrastructure | | | | | | | | | |
| SM.1.1.4.17 SM-1009 Station acoustics | | | | | | | | | |
| SM.1.1.4.18 SM-1010 Building Ventilation | | | | | | | | | |
| SM.1.1.4.19 SM-1011 Back of house areas | | | | | | | | | |
| SM.1.1.4.2 SM-993 Gateline | | | | | | | | | |
| SM.1.1.4.3 SM-994 Station adit | | | | | | | | | |
| SM.1.1.4.4 SM-995 Station shaft | | | | | | | | | |
| SM.1.1.4.5 SM-996 Station stairways | | | | | | | | | |
| SM.1.1.4.6 SM-997 Station public art | | | | | | | | | |
| SM.1.1.4.7 SM-998 Emergency areas | | | | | | | | | |
| SM.1.1.4.8 SM-999 Station fitout branding, wayfinding, signage and customer information | | | | | | | | | |
| SM.1.1.4.9 SM-1000 Station concourse | | | | | | | | | |
| SM.1.1.5 SM-1029 Station systems | | | | | | | | | |
| SM.1.1.5.1 SM-1044 Station lighting | | | | | | | | | |
| SM.1.1.5.10 SM-1048 Station Hydraulics, Plumbing and Sewage | | | | | | | | | |
| SM.1.1.5.11 SM-1055 Station Vertical Transport | | | | | | | | | |
| SM.1.1.5.12 SM-1060 Payment and Access Systems | | | | | | | | | |
| SM.1.1.5.13 SM-1063 Station advertising and secondary revenue systems | | | | | | | | | |
| SM.1.1.5.14 SM-1066 Station communication & information Systems | | | | | | | | | |
| SM.1.1.5.15 SM-1090 Station fire detection and suppression systems | | | | | | | | | |
| SM.1.1.5.18 SM-1043 Station earthing, bonding and isolation | | | | | | | | | |
| SM.1.1.5.4 SM-1050 Environmental control system | | | | | | | | | |
| SM.1.1.5.5 SM-1065 Building Management Control Systems (BMCS) | | | | | | | | | |
| SM.1.1.5.6 SM-1091 Automated external defibrillators | | | | | | | | | |
| SM.1.1.5.8 SM-1093 Station Combined Service Route | | | | | | | | | |
| SM.1.1.5.9 SM-1036 Station LV supply and distribution | | | | | | | | | |

- 2 basic structures: Asset Breakdown, Location Breakdown
- ABS = general for organisation/industry
- LBS = project specific
- Intersection = Control Account
- Colour codes can indicate Contracting Strategy
- 3rd structure = Lifecycle: concept, detail, construct, commission
- 'Cube' Intersection = WBS
- PowerBI – right-click and 'drill through' to hyperlinks to web-based Scope Book, Requirements matrix, ITP…

# Structure control accounts using ABS & LBS

| | CONTRACT XYZ | Abutment 1 | Pier 2 | Pier 3 | Pier 4 | Abutment 5 | Deck A | Ground Access | Embankment XYZ |
|---|---|---|---|---|---|---|---|---|---|
| ABS | Description | A.A.A | A.A.B | A.A.C | A.A.D | A.A.E | A.A.F | A.A.G | A.B.0 |
| 2.1.0 | Foundations | | X | X | X | | | | |
| 2.2.1 | Piers | | X | X | X | | | | |
| 2.2.2 | Abutments | X | | | | X | | | |
| 2.3.1 | Bearings | | X | X | X | | | | |
| 2.3.2 | Deck structure | | | | | | X | | |
| 2.3.3 | Parapets | | | | | | X | | X |
| 2.3.4 | Waterproofing & Drainage System | | | | | | | X | X |
| 3.3.1 | Catchpits | | | | | | | | X |
| 3.3.2 | Gullies | | | | | | | | X |

- Define Asset Breakdown (ABS) – with UoM for productivity and Uniclass EF code
- Define Location Breakdown (LBS) and Uniclass SL code
- Define the Delivery Matrix – map to Uniclass

| | | Administrative, commercial and protective service spaces | Cultural, educational, scientific and information spaces | Industrial spaces | Water and land management spaces | Medical, health, welfare and sanitary spaces |
|---|---|---|---|---|---|---|
| | | SL_20 | SL_25 | SL_30 | SL_32 | SL_35 |
| Structural elements | EF_20 | | | | | |
| Wall and barrier elements | EF_25 | | | | | |
| Roofs, floor and paving elements | EF_30 | | | | | |
| Stairs and ramps | EF_35 | | | | | |
| Signage, fittings, furnishings and equipment | EF_40 | | | | | |
| Piped supply functions | EF_55 | | | | | |
| Transport functions | EF_80 | | | | | |

# COMMUNICATE EFFECTIVELY

## SIMPLE EXAMPLES OF HOW DIGITISATION AND VISUALISATION CAN HELP

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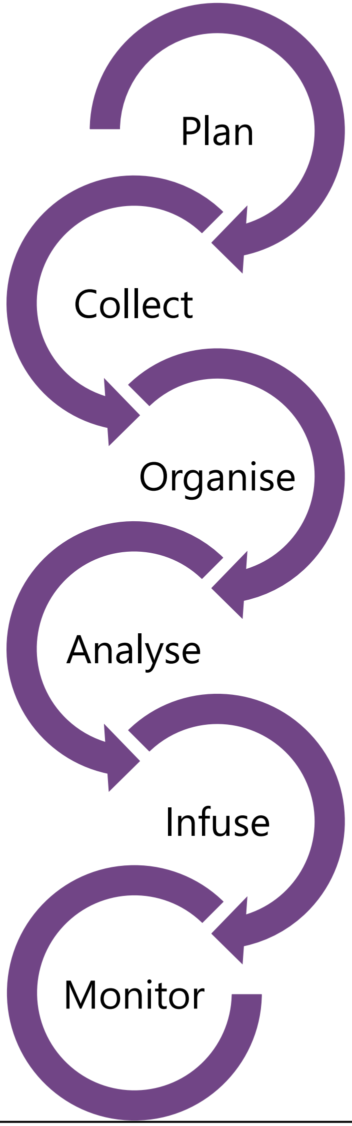
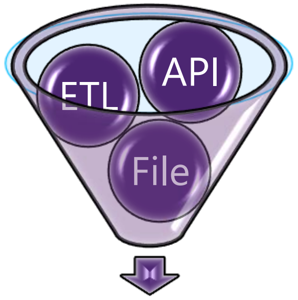
# Example – DataOps rapid report building and data integration

Cyber-secure IT physical (or virtual) environment


Validation against Master Data Environment Building Blocks

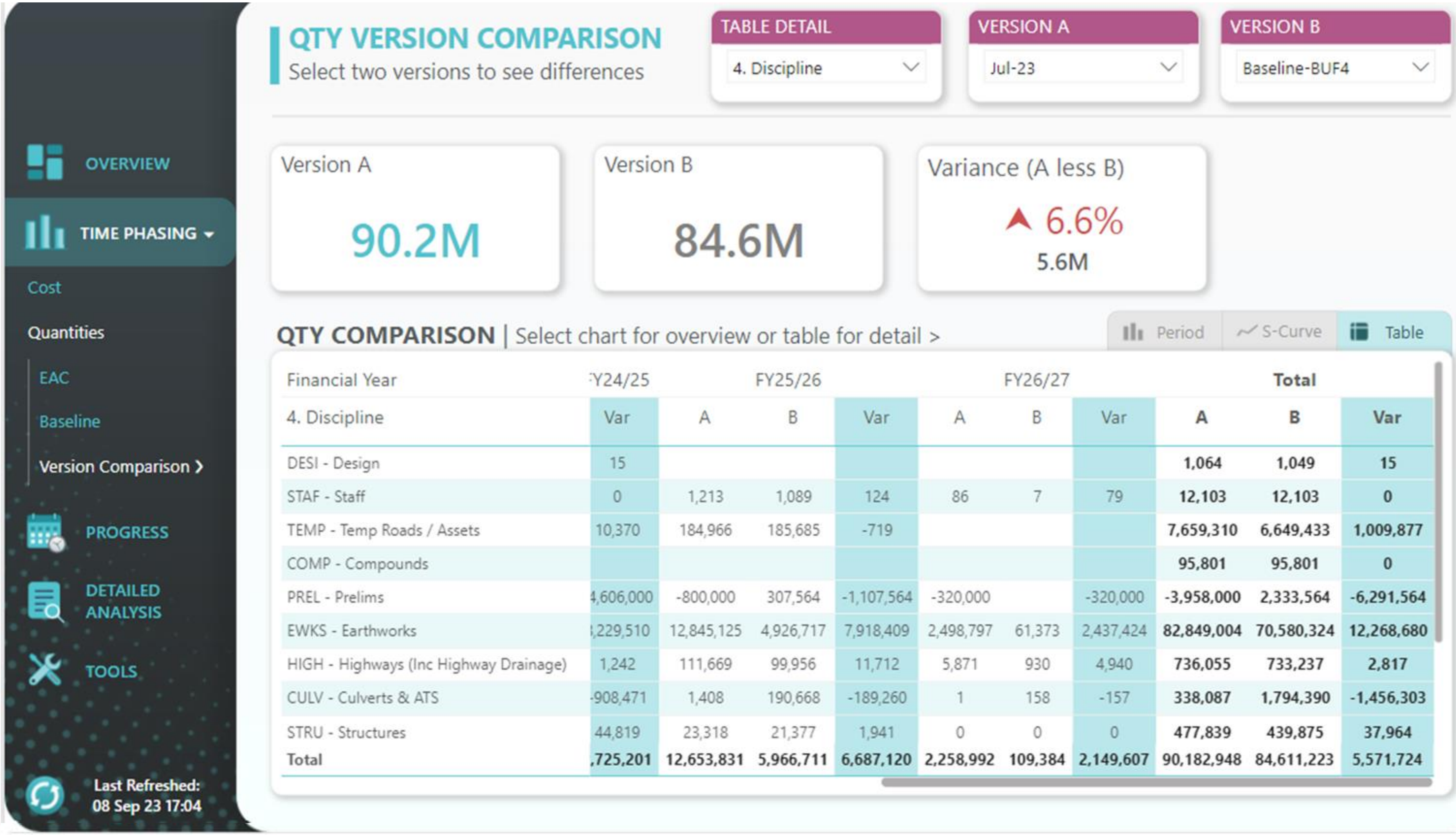



Data Model


On demand informative, responsive intuitive information

# Example – Integrating Performance Information & Visualisation for Portfolio

# Example – Integration for Cost/Time Performance Diagnostics




| Financial Year | FY24/25 | FY25/26 | | | FY26/27 | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 4. Discipline | Var | A | B | Var | A | B | Var | A | B | Var |
| DESI - Design | 15 | | | | | | | 1,064 | 1,049 | 15 |
| STAF - Staff | 0 | 1,213 | 1,089 | 124 | 86 | 7 | 79 | 12,103 | 12,103 | 0 |
| TEMP - Temp Roads / Assets | 10,370 | 184,966 | 185,685 | -719 | | | | 7,659,310 | 6,649,433 | 1,009,877 |
| COMP - Compounds | | | | | | | | 95,801 | 95,801 | 0 |
| PREL - Prelims | 4,606,000 | -800,000 | 307,564 | -1,107,564 | -320,000 | | -320,000 | -3,958,000 | 2,333,564 | -6,291,564 |
| EWKS - Earthworks | ,229,510 | 12,845,125 | 4,926,717 | 7,918,409 | 2,498,797 | 61,373 | 2,437,424 | 82,849,004 | 70,580,324 | 12,268,680 |
| HIGH - Highways (Inc Highway Drainage) | 1,242 | 111,669 | 99,956 | 11,712 | 5,871 | 930 | 4,940 | 736,055 | 733,237 | 2,817 |
| CULV - Culverts & ATS | -908,471 | 1,408 | 190,668 | -189,260 | 1 | 158 | -157 | 338,087 | 1,794,390 | -1,456,303 |
| STRU - Structures | 44,819 | 23,318 | 21,377 | 1,941 | 0 | 0 | 0 | 477,839 | 439,875 | 37,964 |
| Total | ,725,201 | 12,653,831 | 5,966,711 | 6,687,120 | 2,258,992 | 109,384 | 2,149,607 | 90,182,948 | 84,611,223 | 5,571,724 |

- Use to triangulate with ‘observations’ and test accuracy/consistency
- How does EAC compare with my budget or funding limit?
- What are the major Compensation Events implemented in the month?
- Where are the variances in forecasting accuracy?
- Click on a tile to expand
- Go back and review any period
- Compare any period with any other period
- Change row configuration/drill in
- Quantities AND Costs

# Benefits – Integration for Cost/Time Performance Diagnostics

## Performance

Time is critical in the reporting cycle.

Month end data consolidation can take over 12 hours to generate monthly report.

We achieve it in less than **5 minutes.**

## IP Ownership

Using standard cloud tools, Assystem own **100%** of the dashboard and integrations, and aren't tied to any one vendor's system.

We can **respond** and develop to evolving requirements, without relying on 3rd parties.

## Accountability

**Simplifying** the processes gives Executives and Project Controls Managers more confidence in using the system.

This increases **accountability** and **ownership**.

## Decision making

Giving decision makers better data faster has a powerful positive impact.

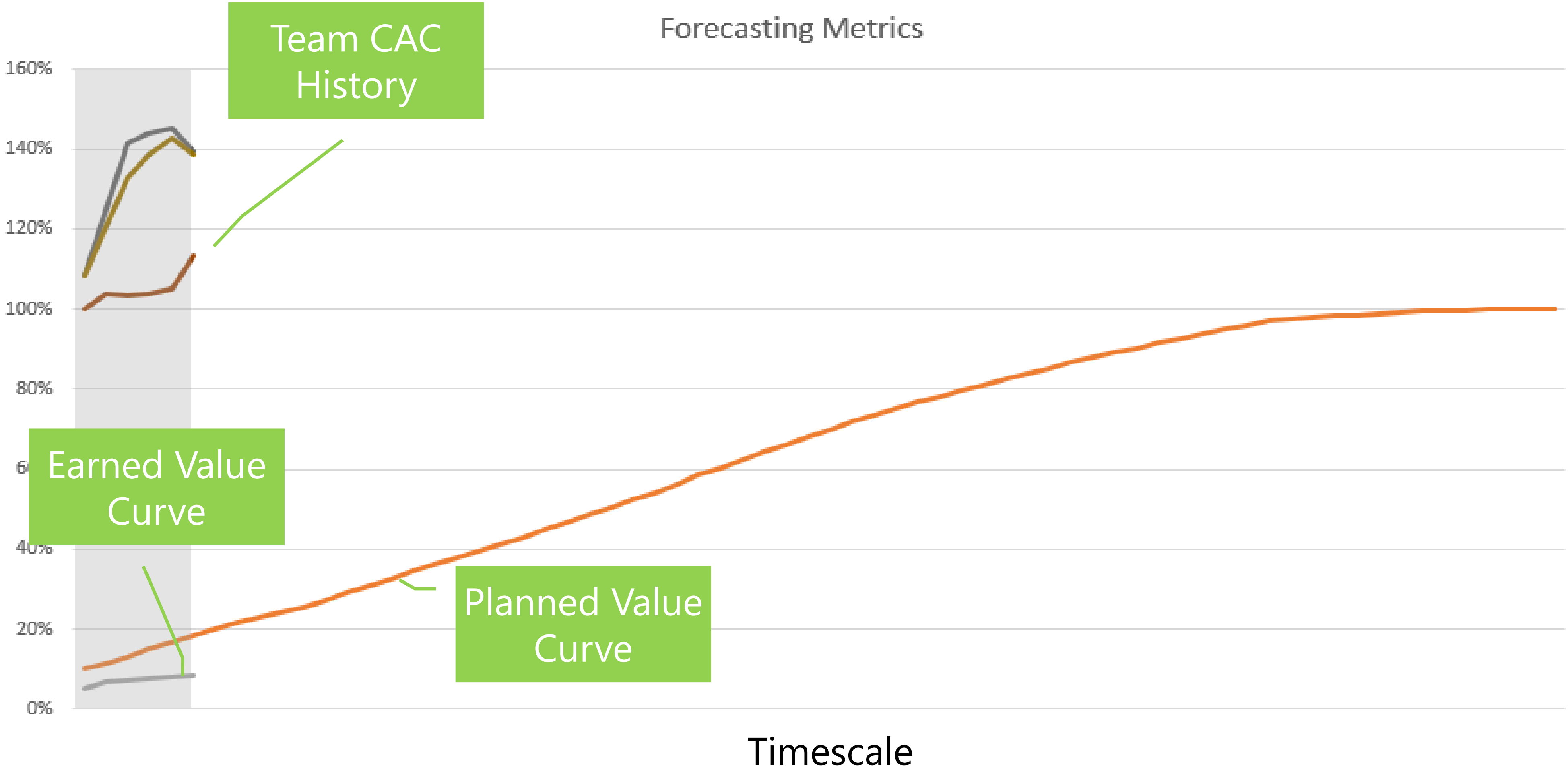
**Better decision making means better project outcomes.**

# FORECAST OUTCOMES

## SIMPLE EXAMPLES OF HOW DIGITAL DATA INTEGRATION AND EARNED VALUE MANAGEMENT CAN HELP

# Example – Cost at Completion Forecast History

**Initial cost forecast increase – leading to desperately trying to identify cost savings**



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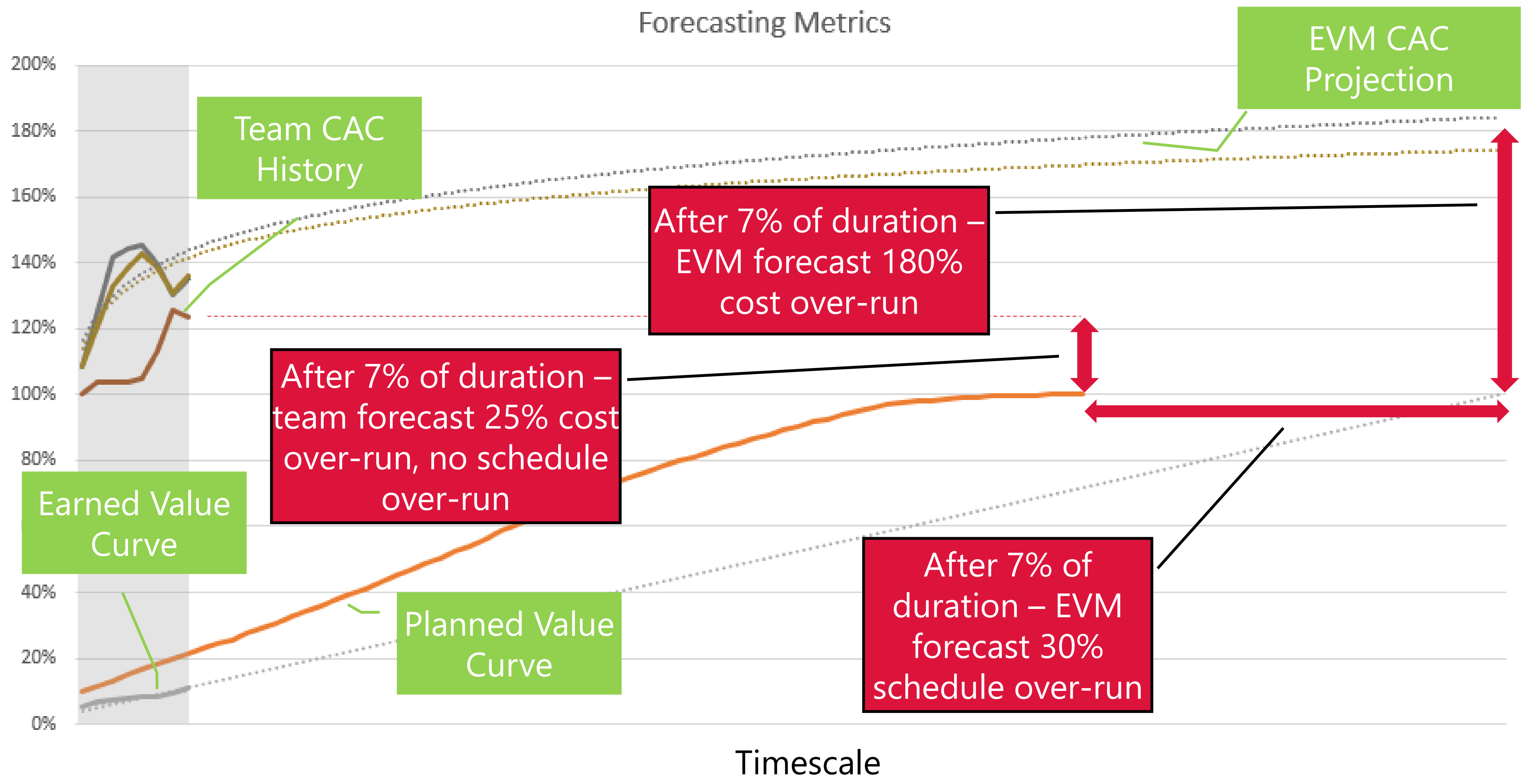
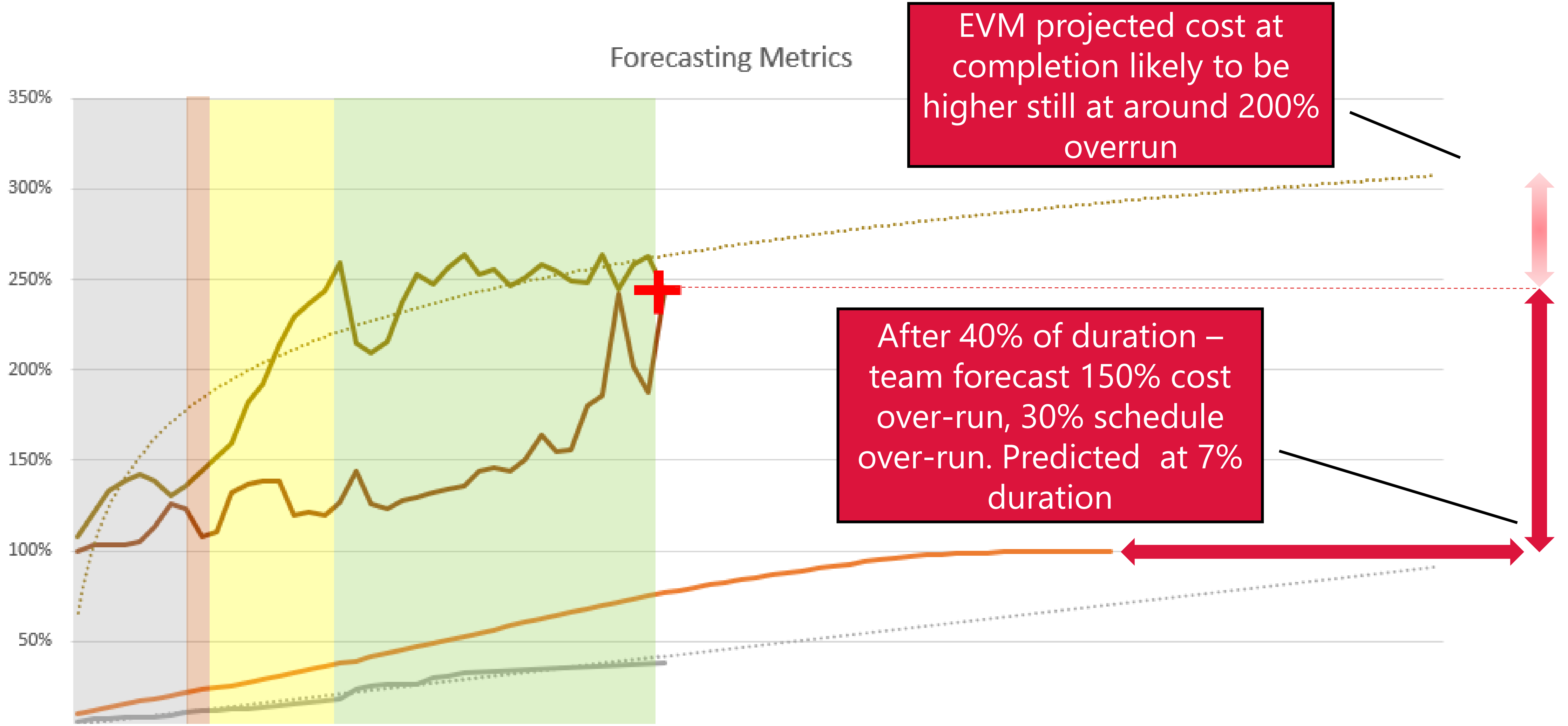


# Example – Cost at Completion Forecast History

**Two new schedule baselines – <u>40% elapsed time until 'reality' is 'accepted'</u>**




Half-way through project – opportunity to optimise or redefine is now lost - but situation predicted at 7% elapsed time. A good DPMO prevent this OR at least will maintain evidence as to what was predicted, when.

# TAKE-AWAYS

## INFRASTRUCTURE

We need to invest in energy security and alternative energies or lose quality of life

Infrastructure productivity lags other parts of the economy

## PRODUCTIVITY

Understanding variability, consistent forecasting and helping communication, are key enablers to help productivity

Digital PMO Processes/Data Models help

## DIGITAL

Can provide insights, at low cost, if well specified across the supply chain

Integrate digital skills with domain and controls experience in your PMO

## VARIABILITY

Build and use a few simple classifications

Validate your data

Hook up with academia maybe to help analyse the results

## FORECASTING

Use your digital data in reference class forecasting

Build the classifications into your EVM solution

Can be of forensic value and withstand heavy scrutiny

## COMUNICATE

Visualise everywhere you can find a use case

Simplify data transmission across supply chain

Work 'Agilely' with your data

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SWITCH ON

ENGINEERING & DIGITAL FOR ENERGY TRANSITION

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# THANK YOU.

## LOCATIONS

United Kingdom | France | Finland | Turkey | India
Uzbekistan | Saudi Arabia | Morocco | Egypt

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