



INTERNATIONAL UNION
OF RAILWAYS

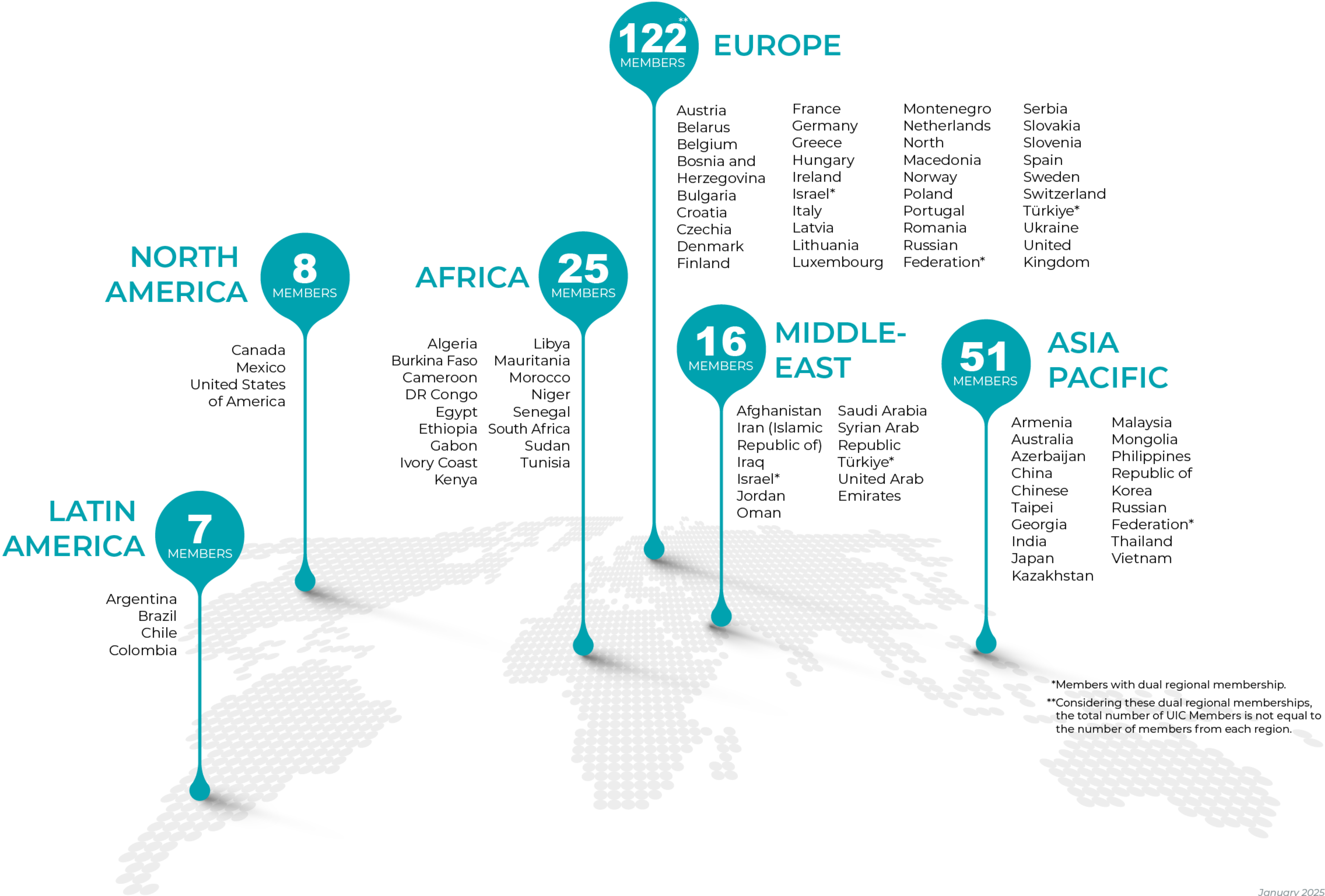
Asset Management Seminar

Pietrarsa, Naples – 2 October 2025

UIC in figures



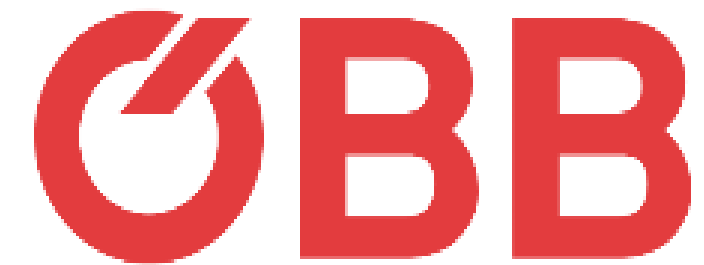
UIC in 2025



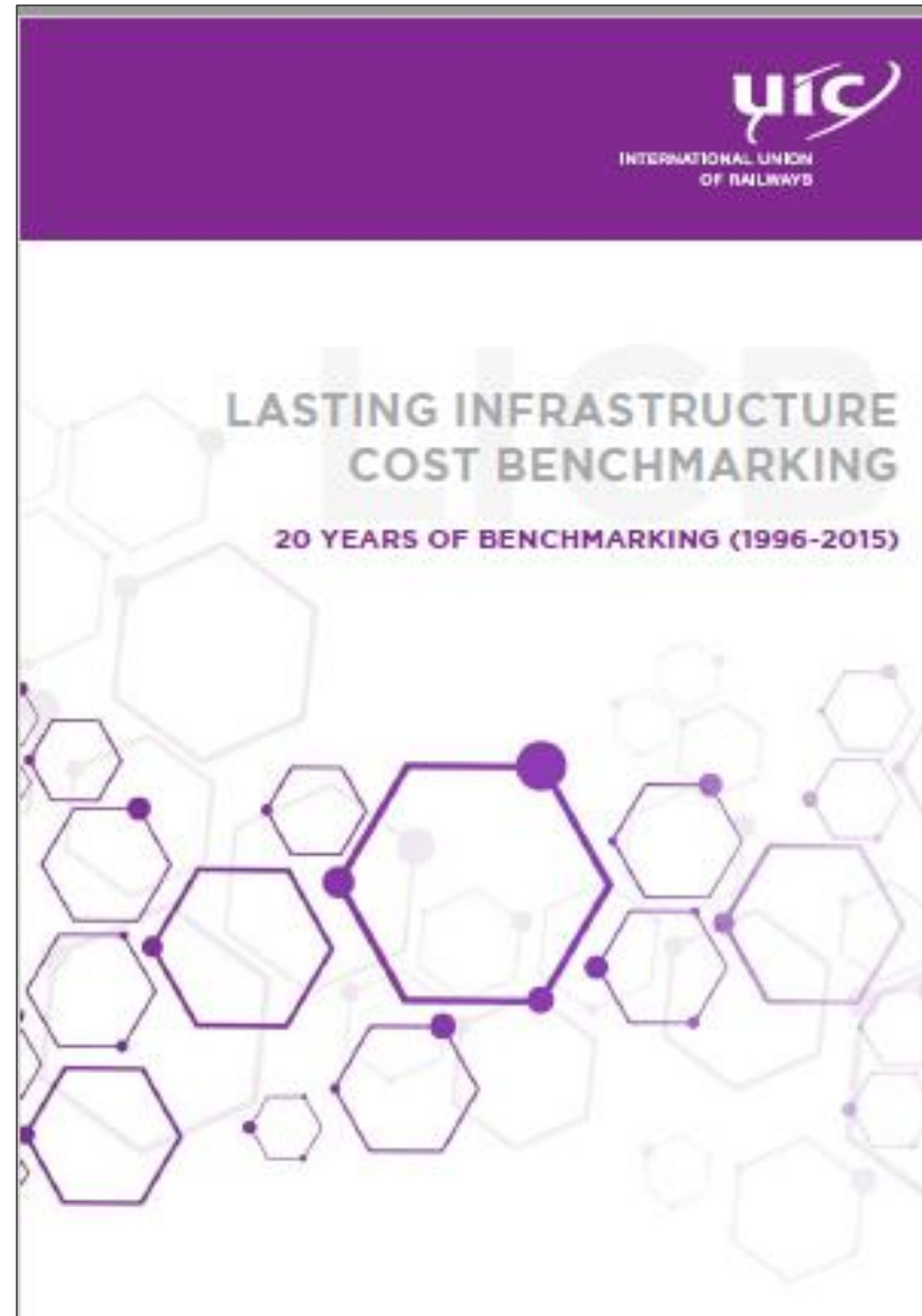
*Members with dual regional membership.
**Considering these dual regional memberships, the total number of UIC Members is not equal to the number of members from each region.

Role of the Asset Management Sector

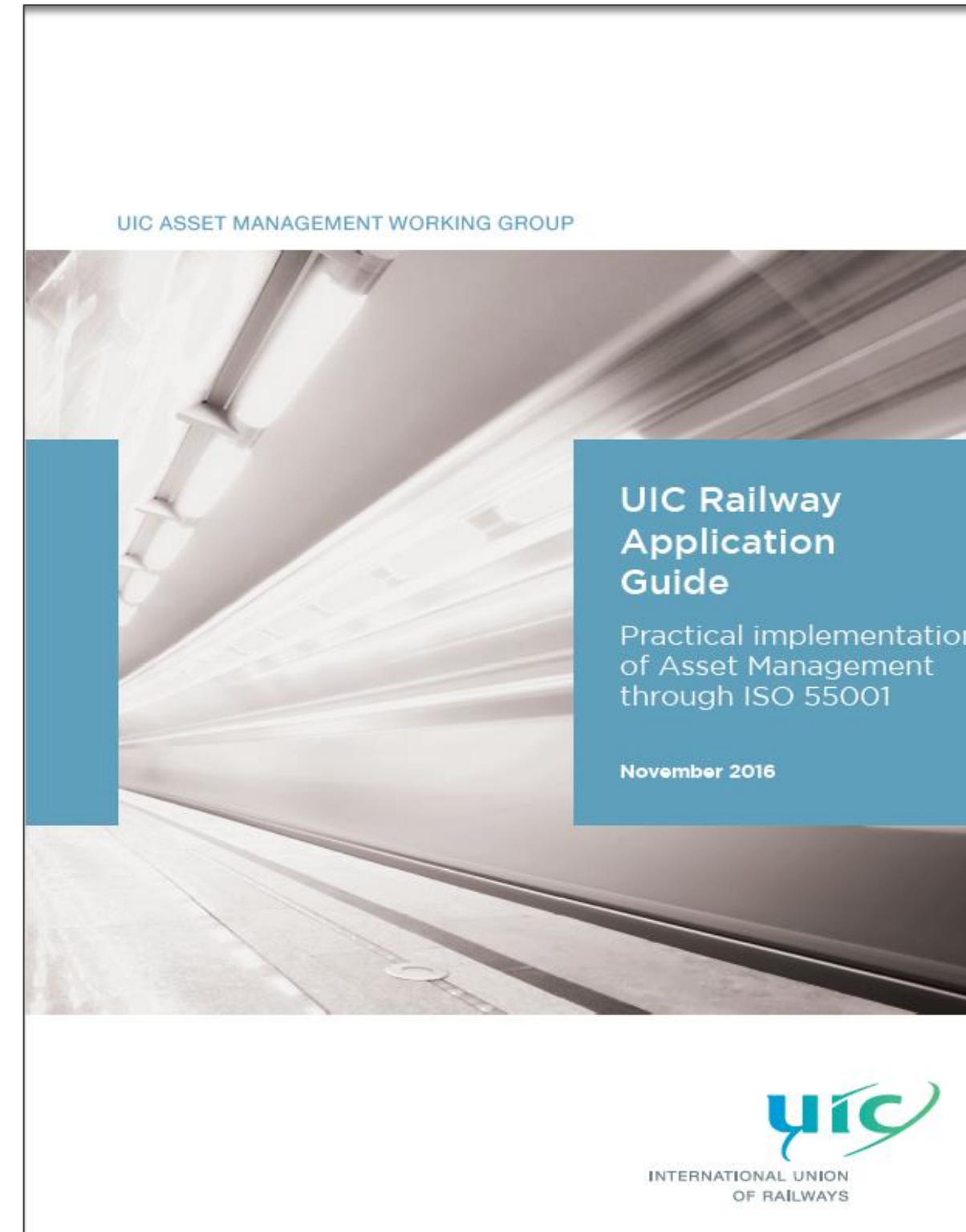
- Collaboration between several railways lasting more than ten years
 - Provides a common interpretation for the growing discipline of Asset management
 - Facilitates benchmarking and exchange of good practices
 - Supports railways in achieving certification to the global Asset Management standard (ISO 55001)
 - Provides leadership on high-impact Asset Management initiatives
 - Organises seminars to share knowledge and address emerging challenges
 - Delivers tailored training programmes to build capability and promote improvement across the sector



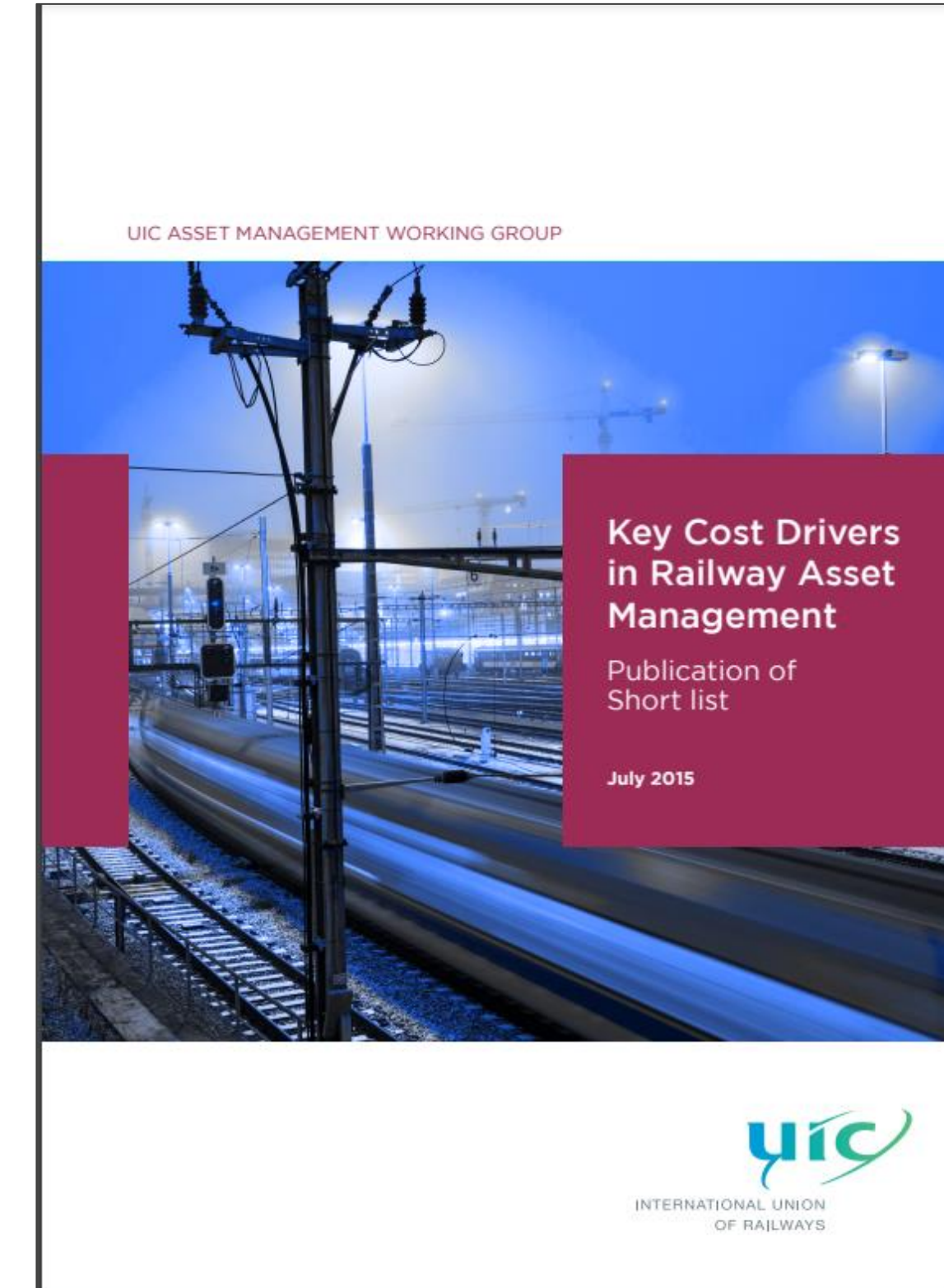
Previous Projects 1



Cost benchmarking
between member
organisations

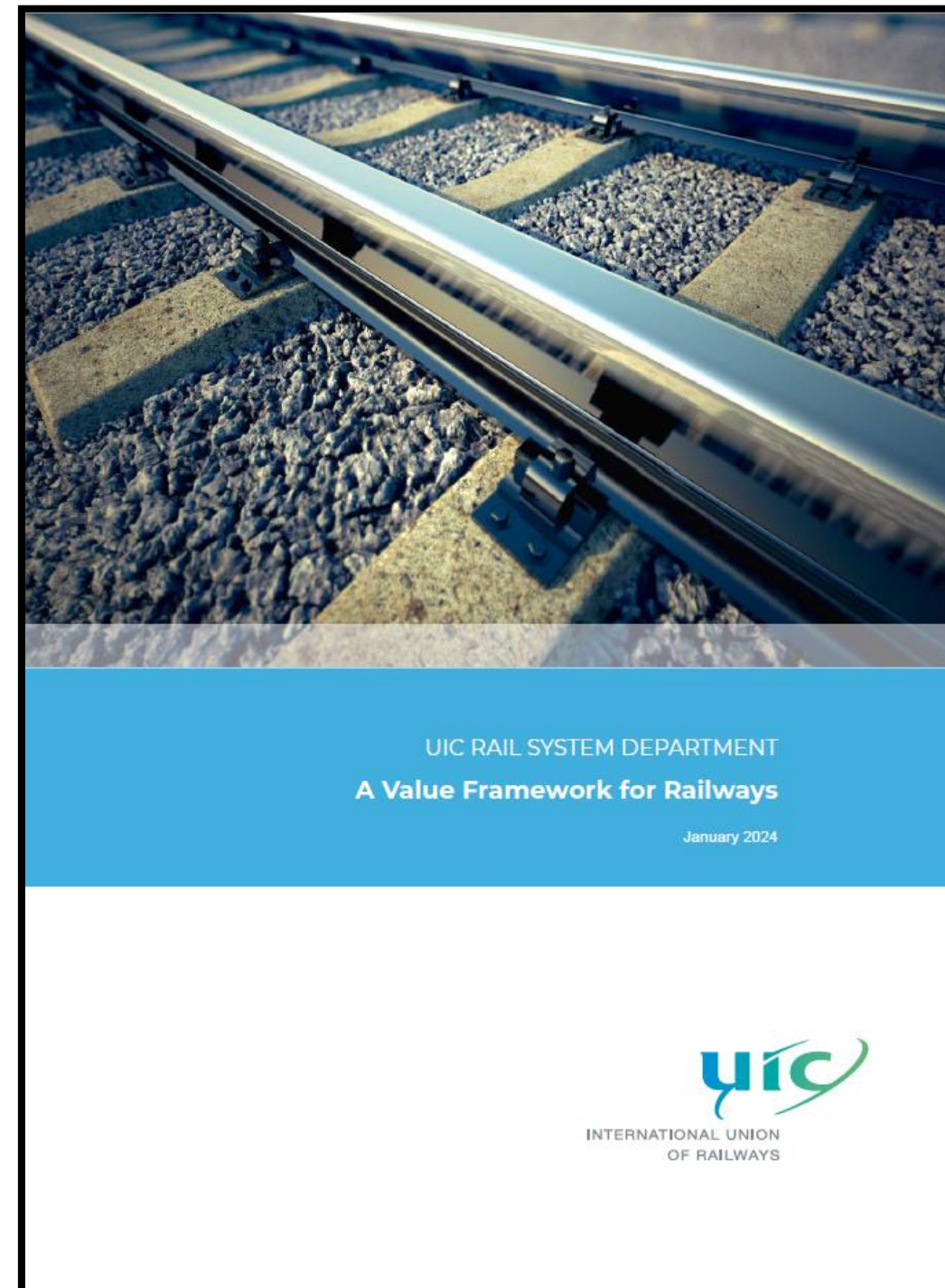


Guidance on the
implementation of ISO
55001

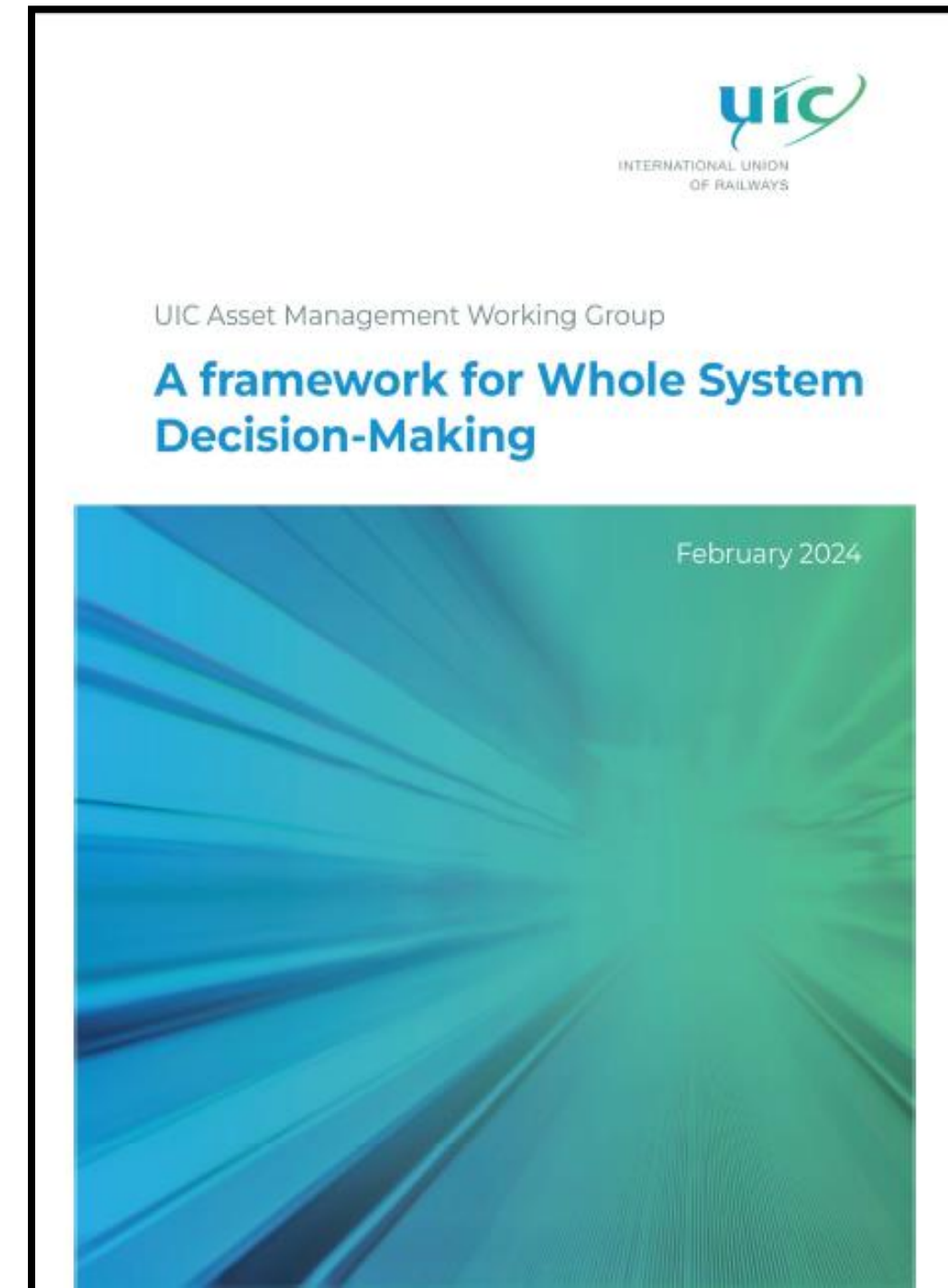


Analysis of key cost
drivers in railway asset
management

Previous Projects 2



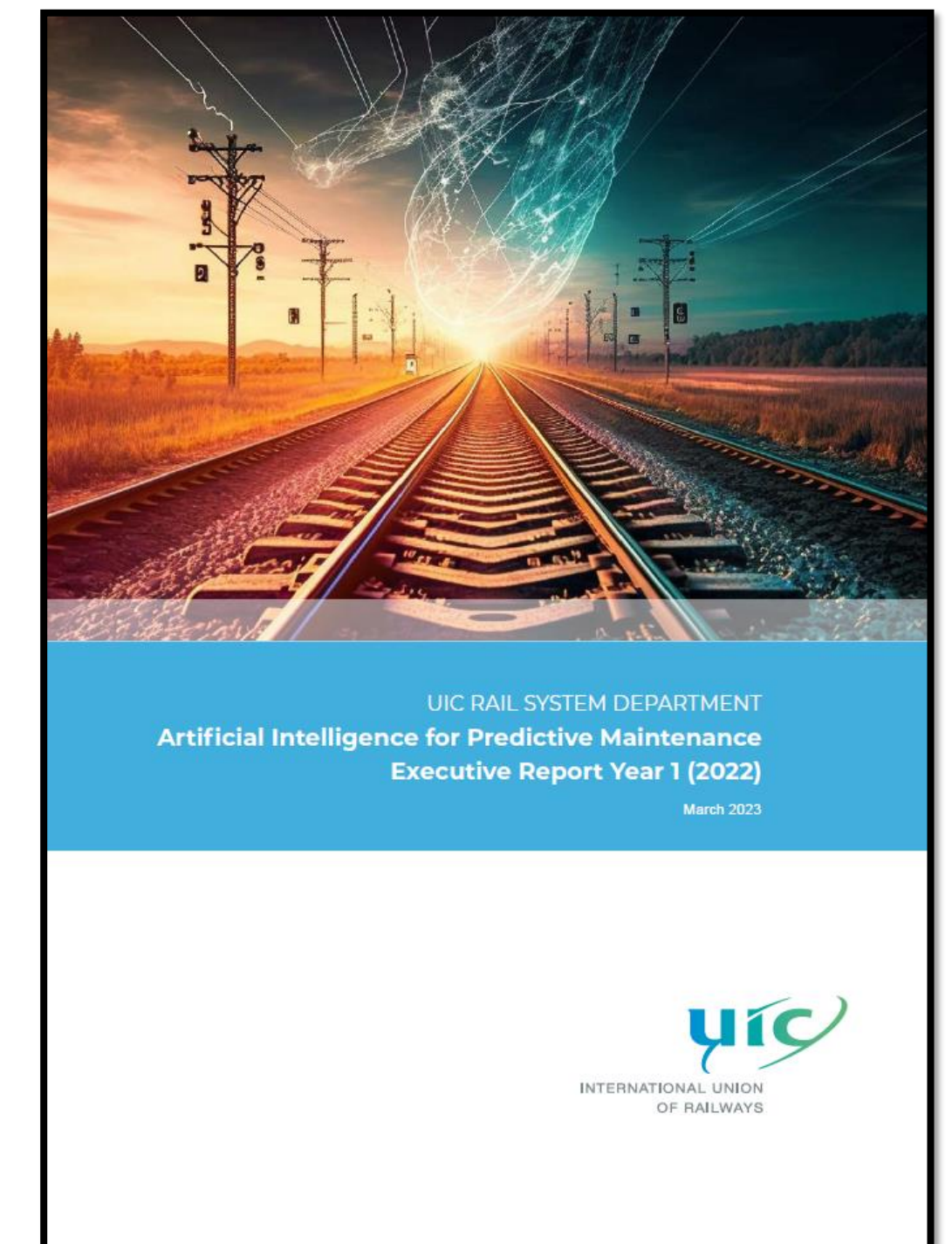
Developing a Value Framework for Railways



A Framework for Whole-System Decision-Making



Benefits from Big Data in Railway Asset Management



Artificial Intelligence for Predictive Maintenance

←
Wisdom project
→

Scan QR code for the UIC Railway publication shop



Participating organisations



TIME	MAIN SESSIONS	MODERATOR	TOPICS	SPEAKERS		
9:00 - 9:15	WELCOME COFFEE					
9:15 - 10:40	Opening Session	Nuno Almeida	Welcome Remarks and Seminar Objectives	Donatella Fochesato (RFI), Chair of the Asset Management Group & Konstantina Kopsalidou (UIC), Senior Advisor Infrastructure & Asset Management		
	Session 1 Leadership & Culture in Asset Management		What is an “asset management culture”?	Mark Sexton (AMCL)		
			Evolution of ISO55000-series : What's new and how these be utilised for railways	Thomas Goodyer (Chair of ISO/TC 251)		
			Change management within asset management	Sol Mendoza, Lorena Ibeas Arce (ADIF)		
10:40-11:00			Q&A			
			COFFEE BREAK			
			Session 2 Strategy and Performance	Vivianne Karlsson Anna-Karin Salmi	Measuring strategies through value performance indicators - Balance Scorecard	Manfredi Bruccoleri (Palermo University) + RFI
					Self- financing in Asset Management	Celso de Azevedo (Assetsman)
From values to actionable strategy - Developing an expandable prognosis approach for strategic asset management based on a single point of truth	Christian Blättler, Alison Cowley (AFRY)					
IAM Subject Specific Guidance 13: Systems Engineering	Grame Hind (AMCL)					
11:00-12:35			Q&A			

12:35-14:00	LUNCH			
14:00-15:15	Session 3 Decision Making	Celso de Azevedo	The importance of Value in strategic decision making	Cristiano Martincigh (IFS Copperleaf)
			Total Cost of Ownership	Roberto Pinto (Bergamo University) + RFI
			WISDOM	Adalberto Polenghi (Politecnico Milano)
			Q&A	
15:15-15:30	BREAK			
15:30-16:40	Session 4 Maintenance/Asset Portfolio	Mark Sexton	Railway Maintenance Backlog	Vesa Männistö (FTIA)
			Irish Rail’s Asset Management Digital Vision is to deliver "trusted information at your fingertips"	Jude Carey (Irish Rail)
			Manage real estate and infrastructure assets with geospatial digital twins	Alfonso Perna (ACCA Software)
			Q&A	
16:40-17:00	Closing Remarks		Recap of the day	Donatella Fochesato (RFI), Chair of the Asset Management Group
			Future collaboration and next steps	

Housekeeping Rules

- **Mobile phones:** Please switch to silent mode during sessions.
- **Refreshments:** Coffee break inside and lunch break will be held on the lower floor
- **Wi-Fi access:** Wifi Station no password required
- **Questions:** Please scan the QR code
- **Timing:** Please return promptly after breaks so we can keep to schedule
- **Emergency procedures:** Please follow staff instructions



The sessions will be recorded, and photos may be taken.
By attending, you consent to this.



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THANK YOU FOR YOUR ATTENTION

Donatella Fochesato
d.fochesato@rfi.it

AMWG Chair

Konstantina Kopsalidou
Kopsalidou@UIC.ORG

AMWG Coordinator

ASSET MANAGEMENT
Working Group



INTERNATIONAL UNION
OF RAILWAYS

Session 1

Leadership & Culture in Asset Management



Mark Sexton
(AMCL)



Thomas Goodyer
(Chair of ISO/TC 251)



Lorena Ibeas Arce
(ADIF)



Sol Mendoza
(ADIF)



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Asset Management Seminar

Pietrarsa, Naples – 2 October 2025

What is an Asset Management Culture
Mark Sexton

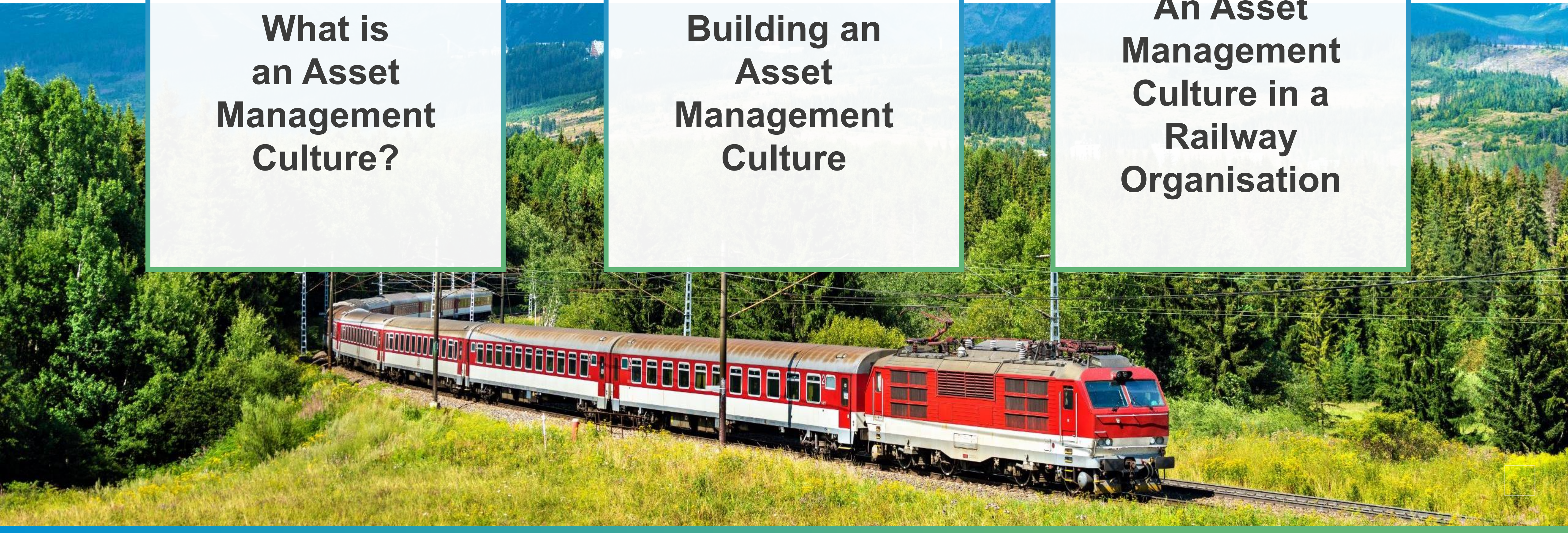
Introduction

What we are going to cover

**What is
an Asset
Management
Culture?**

**Building an
Asset
Management
Culture**

**An Asset
Management
Culture in a
Railway
Organisation**



What is an Asset Management Culture

What is the culture of a business?

“It's is the way things are done here!”

Andy Hargreaves

It's the things that the people and the business care about, that influences the way the employees work

“Culture refers to the personality of an organisation, the shared beliefs and the unwritten ground rules which determine the ways in which the organisation and its people behave and solve business problems.”

Edgar Schein

“If you want to understand the culture of a business - try to change something.”

What makes up a culture

Rituals

Language, stories, and myths, for example, sometimes defined as beliefs about what is true.

Tacit Assumptions

Not necessarily explicitly defined or even acknowledge, including both what matters most and taboos (what should never happen). The world of 'unspoken rules.'

Values

What the organisation and people within it feel is important.

Artefacts

Attributes that can be seen, felt and heard by the uninitiated observer such as offices, furnishings, visible awards, the way people dress, company slogans.

What makes up a culture

Rituals

Language, stories, and myths, for example, sometimes defined as **beliefs about what is true.**

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Values

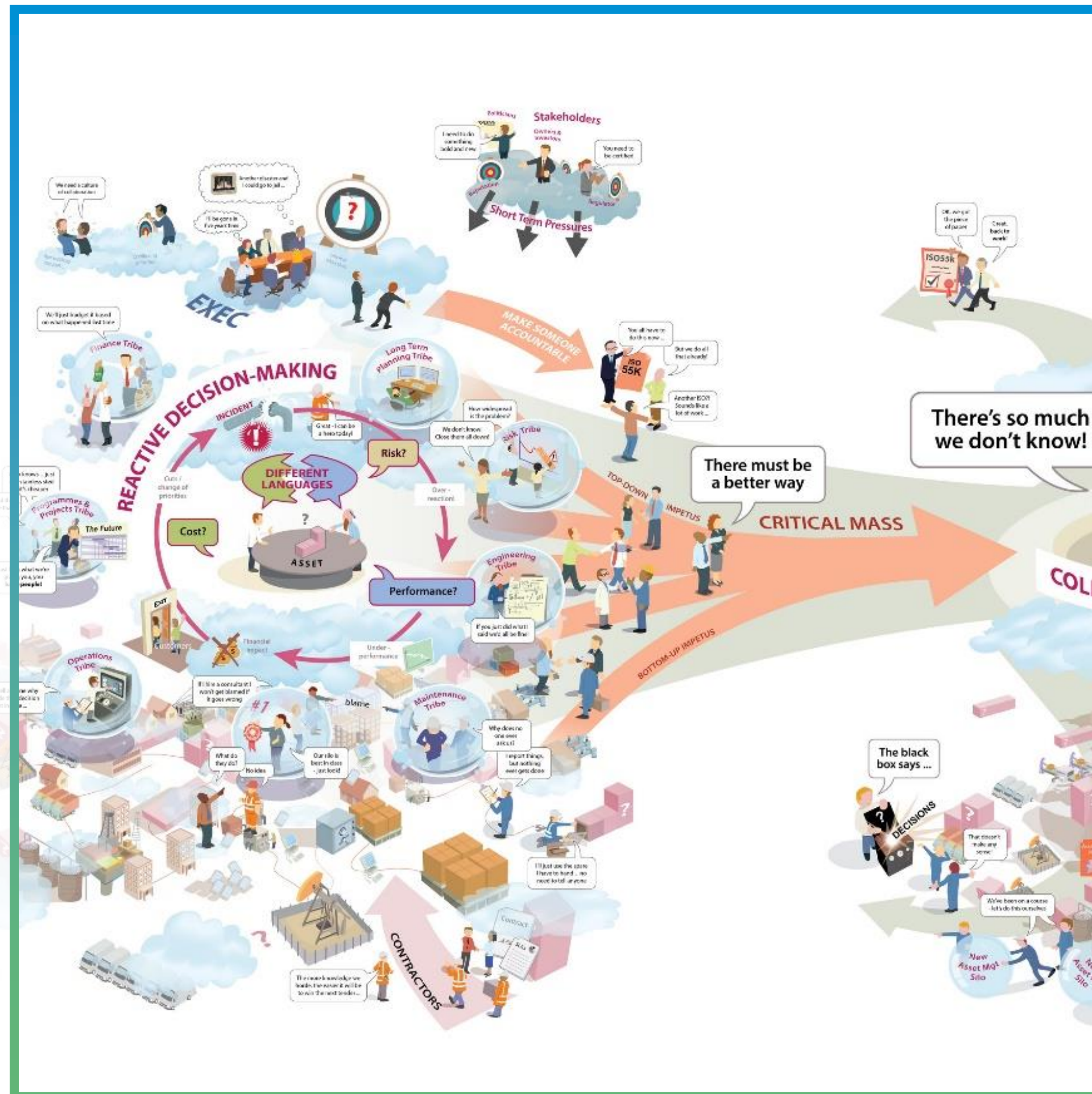
What the organisation and people within it feel is important.

Artefacts

Attributes that can be seen, felt and heard by the uninitiated observer such as offices, furnishings, visible awards, the way people dress, **company slogans.**

What is an Asset Management Culture

Asset Management Characteristics



What is an Asset Management Culture

How does it feel?



Question for the Audience

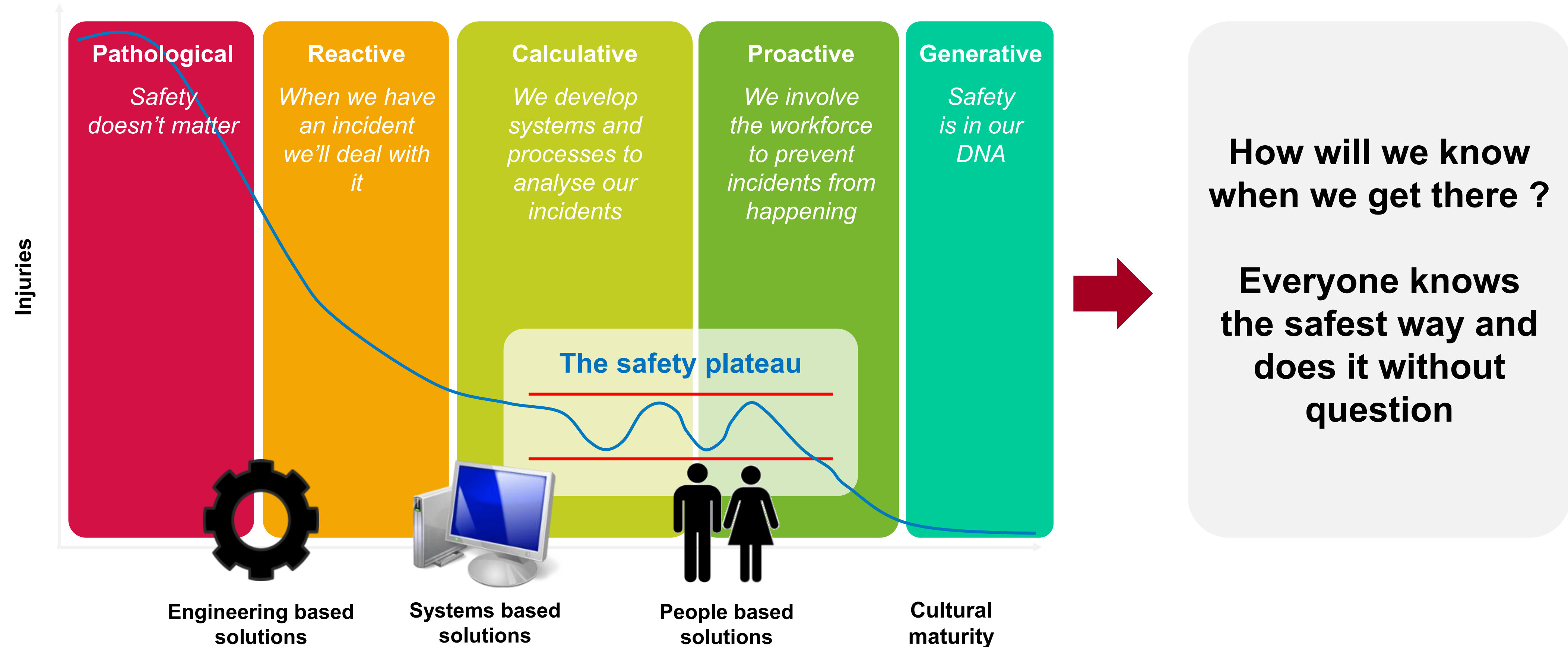
Should an infrastructure organisation have an Asset Management Department?

Yes

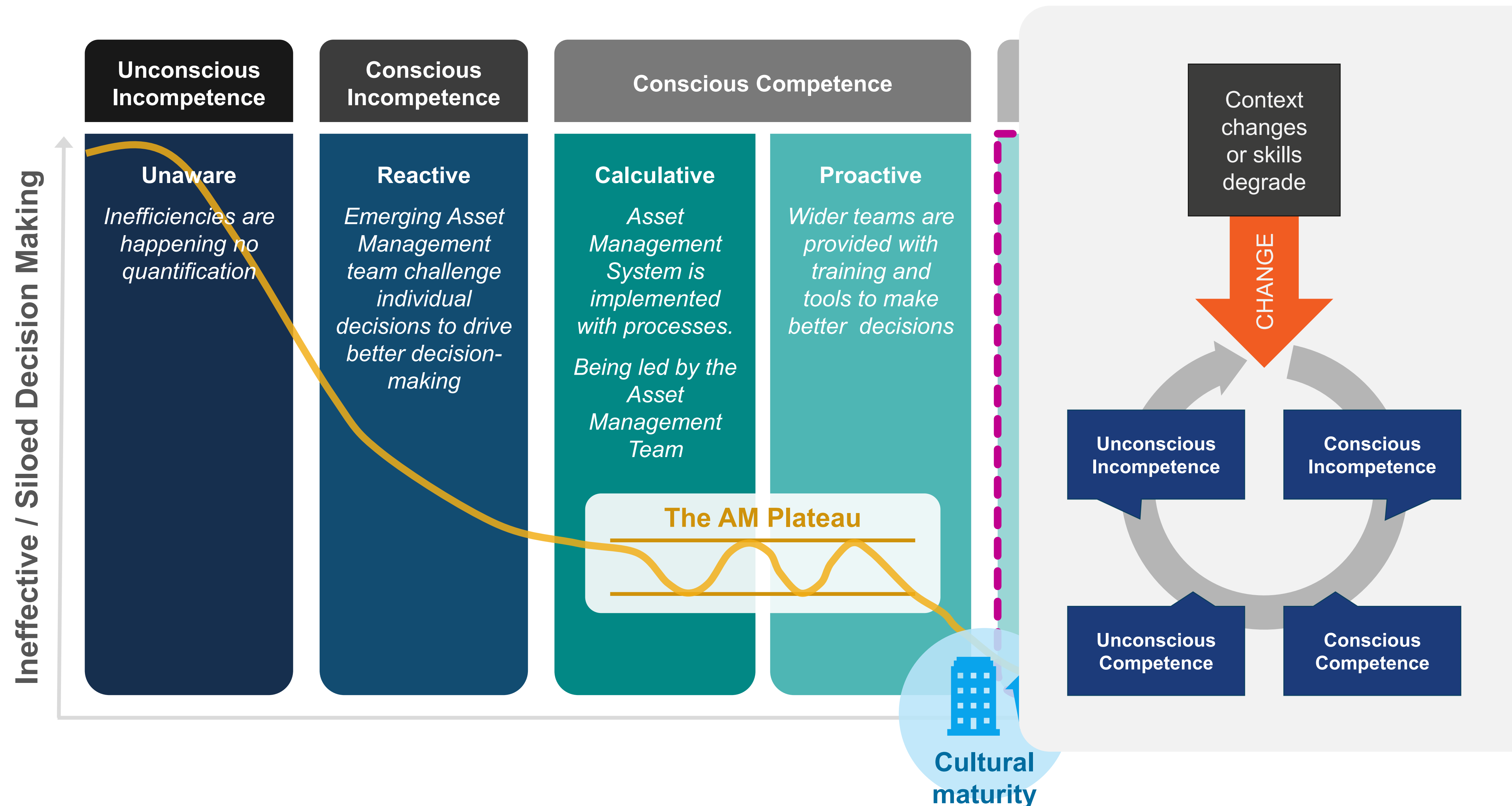
No

Building an Asset Management Culture

Safety Maturity – Safety Culture?



Asset Management Culture



Pros and Cons of having an Asset Management Department

Pros



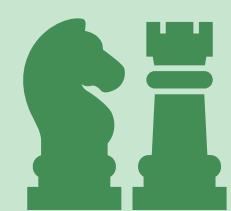
Asset Management evangelists – continue the process of education and awareness – maintain the Asset Management Culture



Encourages, leads, facilitates integration and collaborative working



Maintains and develops corporate approach to Asset Management



Owens the strategy for the system of assets



Captures the Asset Management benefits



Provides asset management resilience as personnel & business change

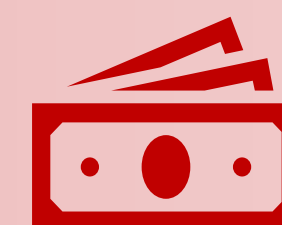


Provides independent challenge to decisions

Cons



The business see Asset Management as something that is done by the Asset Management Department



Costs of additional department

Building an Asset Management Culture

Leadership

set the example but also asking the right questions and provide the right challenges

Encourage the right environment

encourage and incentivise Asset Management thinking

Design the organization

to fit and enable your Asset Management Approach

Establish good practice

examples and stories

Start small

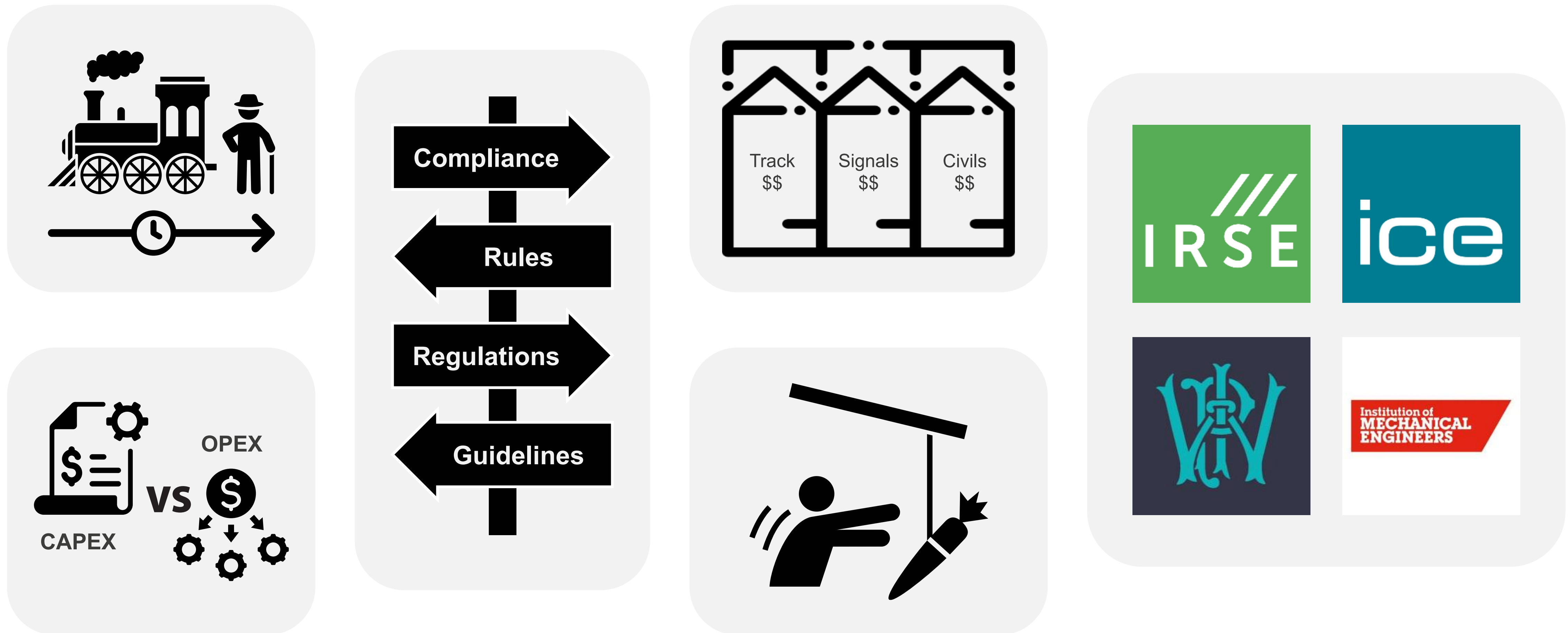
build the ethos in small teams, then bleed it into the rest of the business

Education / Training & Business Thinking

give people space and incentivise them to think about the wider business

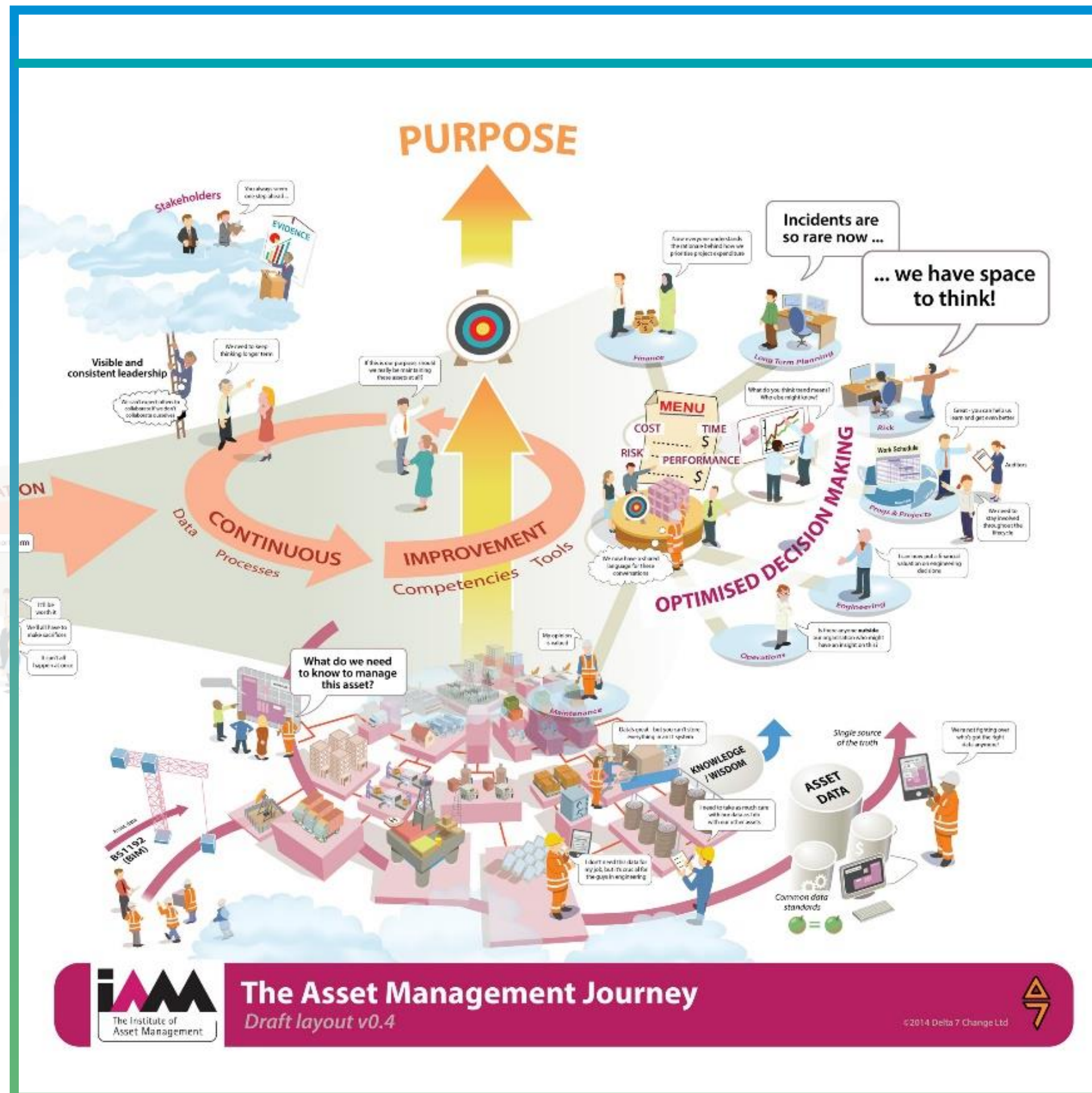
Asset Management Culture in a Rail Organisation

Some Challenges to Building an Asset Management Culture in the Rail Industry



What is an Asset Management Culture

Asset Management Characteristics



- It is a **transport organisation**, and everyone is aligned with a common strategy
- Recognition that it is a **system of assets and business services** (e.g. assets, asset information, planning, finance, HR etc.)
- Decisions are made around an agreed, **common framework of values** (outcomes) supported by multiple information sources
- **Cross Disciplinary/Functional Teams** work together
- Some 'routes', 'assets', outcomes are more important than others
- Information is recognised as an asset with value and is cared for
- Standards and existing working practices are challenged and changed to drive improvements

In Summary – What is an Asset Management Culture



None of what I have presented is unique to an Asset Management or Railway organisation

One size does not fit all – especially with respect to culture

Is an Asset Management Culture just:

A culture that delivers the best outcomes for your organisation?



Q & A

Session 1: Leadership & Culture in Asset Management Q&A



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mark.sexton@amcl.com

ASSET MANAGEMENT
Working Group



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Asset Management Seminar

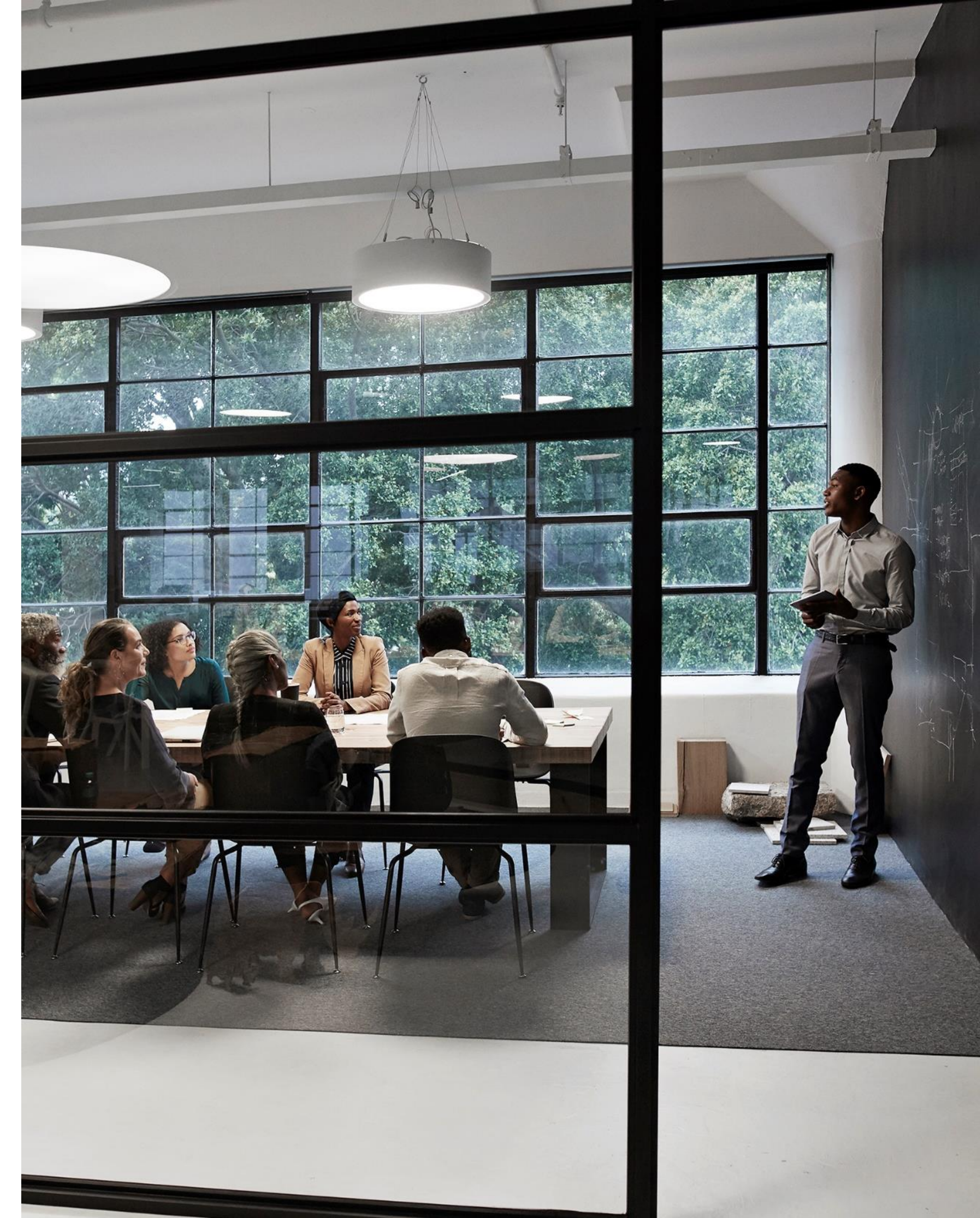
Pietrarsa, Naples – 2 October 2025

Evolution of ISO 55000 series:
What's new and how can these be utilised for
railways

Thomas Goodyer

Agenda

- Introduction and background
- ISO 55xxx
 - ▶ *The series today*
 - ▶ *Work underway*
- What's next for us?
- Rail sector specifics
- Get involved!



Speaker

Tom Goodyer



Chair, ISO/TC 251 (Asset Management)

Head of Strategic Asset Management, WSP UK

Global Lead, Asset Management, WSP Global

Mechanical Engineer

Rail, highways, power generation, airports and government

ISO/TC 251

Purpose: *“Standardization in the field of asset management”*

- Members are the National Standards Bodies (NSBs) of countries e.g.:
 - Standards Council of Canada, British Standards Institution etc. (more on the next slide)
- NSBs appoint Mirror Committees (like AMS/1 for the UK) who can send delegates to participate
 - Rules can differ greatly between countries re: who is allowed to join
- TC 251 has rules to adhere to about deciding what new work it wants to create, revisions to be made, or standards to be withdrawn
 - Our next Strategic Business Plan will detail some of this

TC251's Expanding International Membership

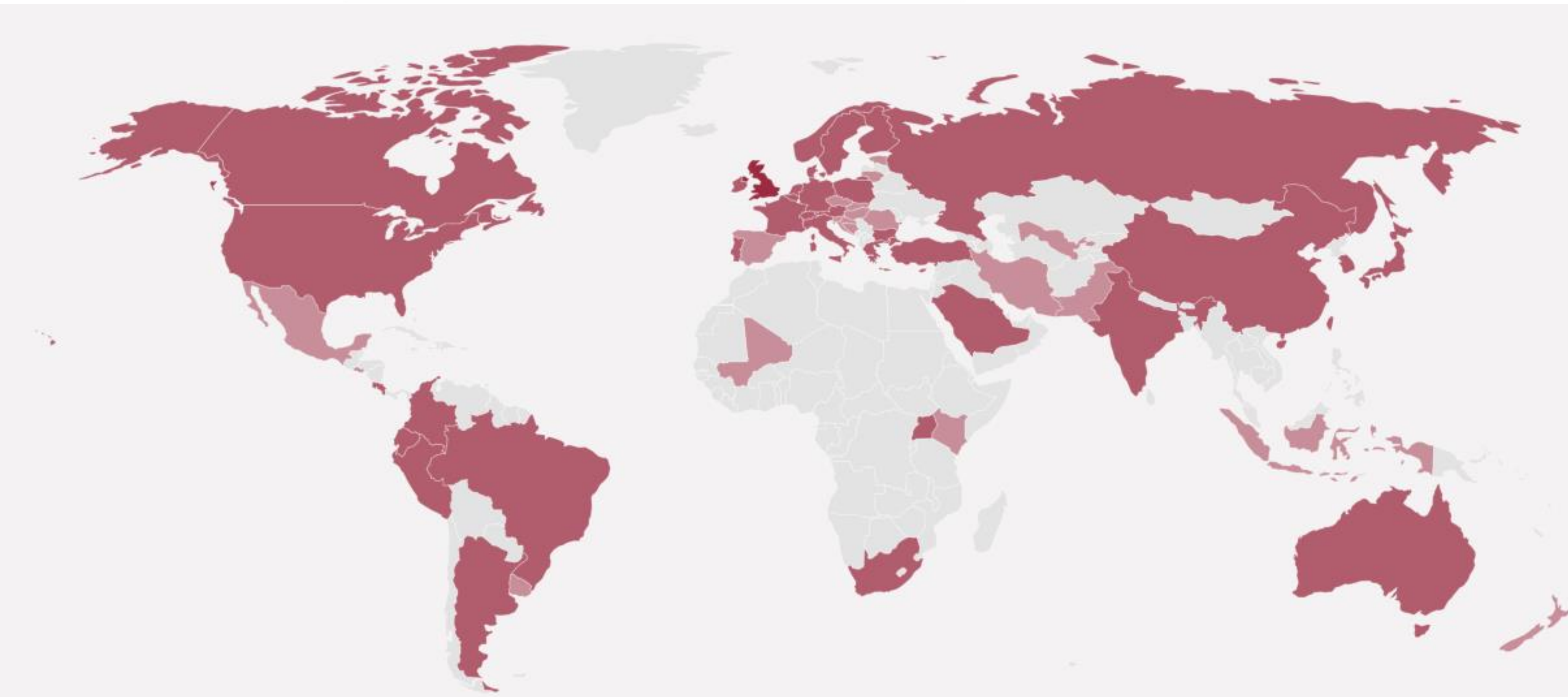
39

Participating members

21

Observing members

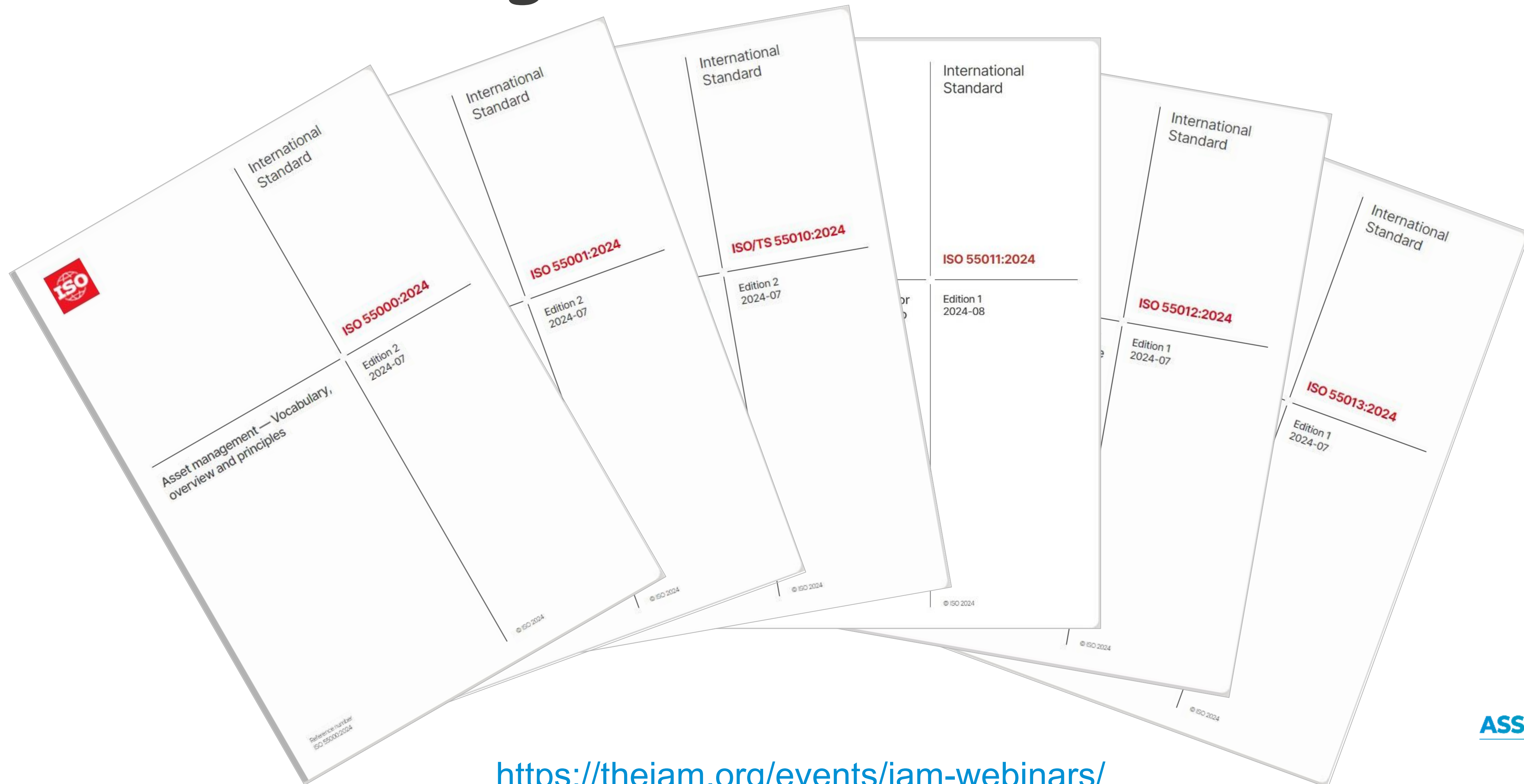
2015: 37 Members
2025: 60 Members



- Secretariat (UK)
- P members
- O members

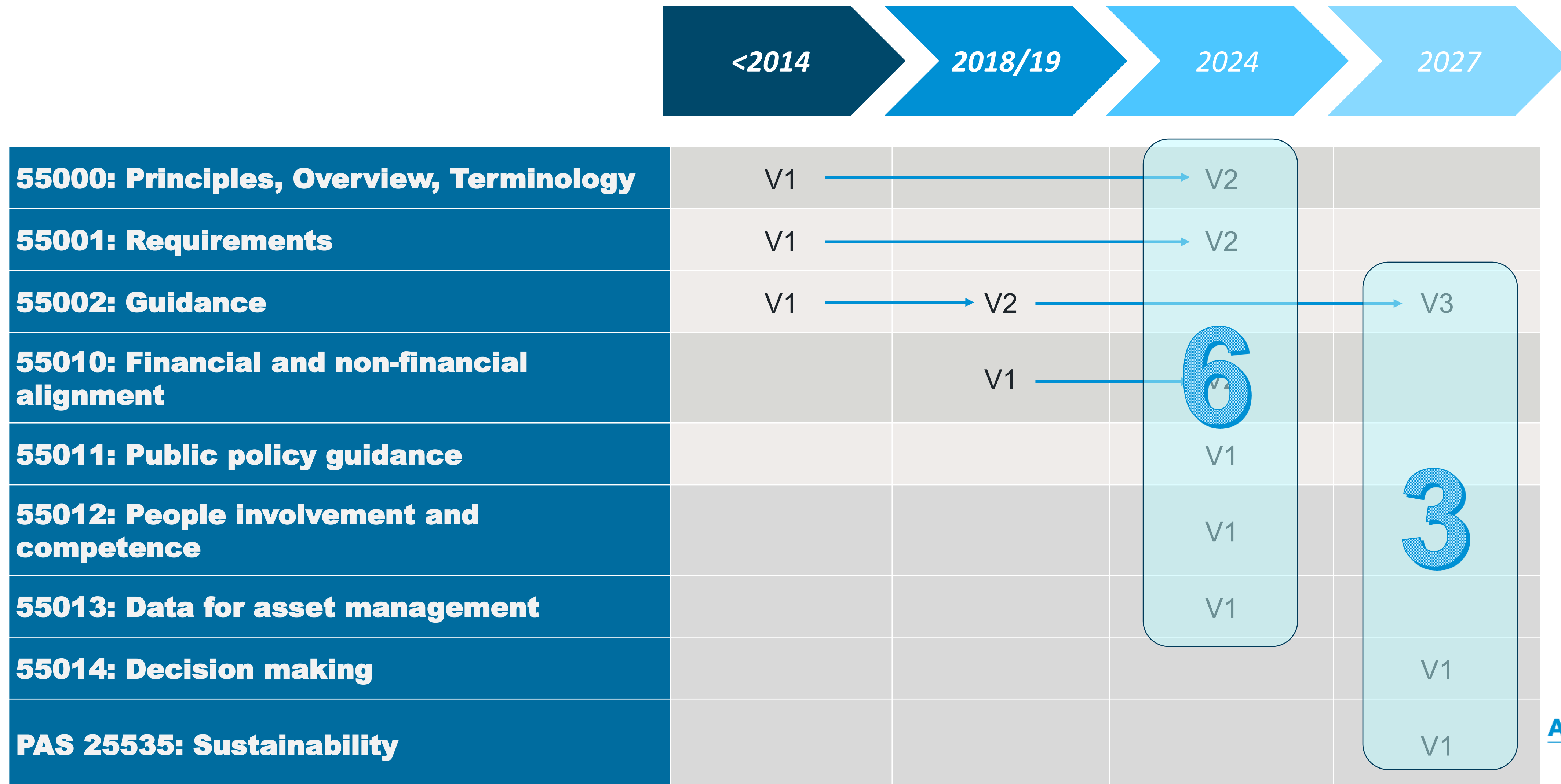
ISO 5500x series of standards

What has changed?



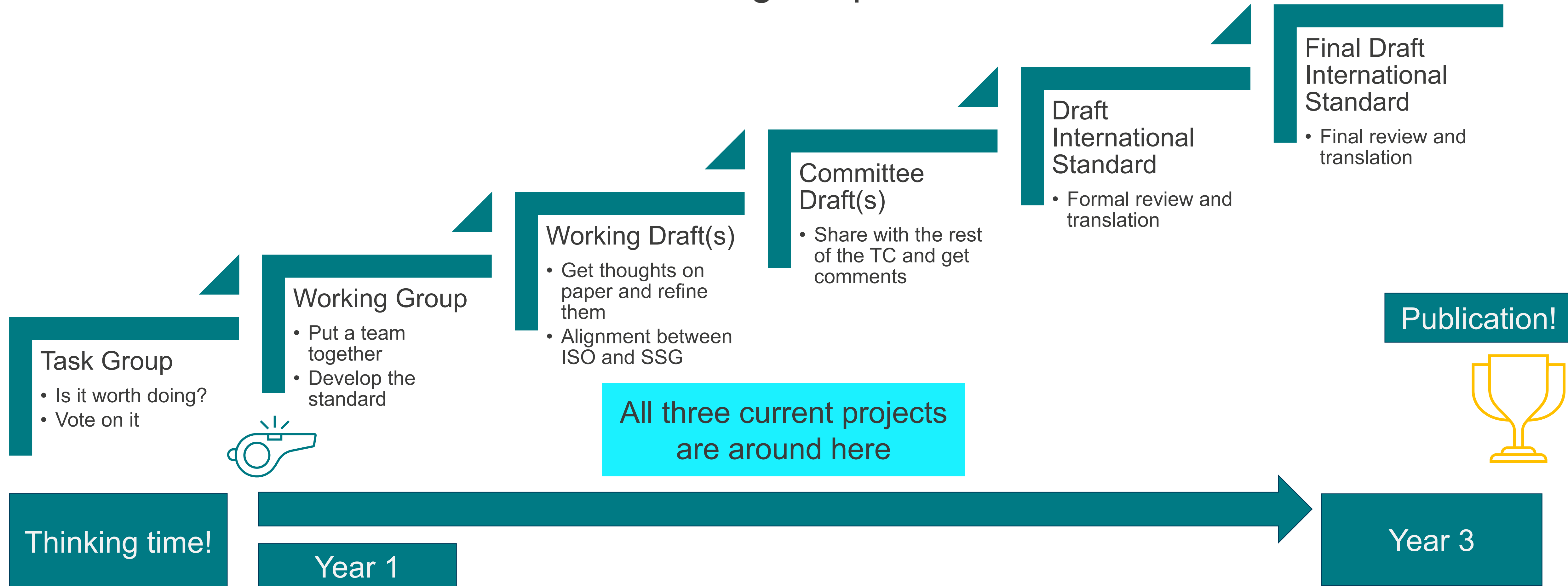
<https://theiam.org/events/iam-webinars/>

ISO 5500x series of standards



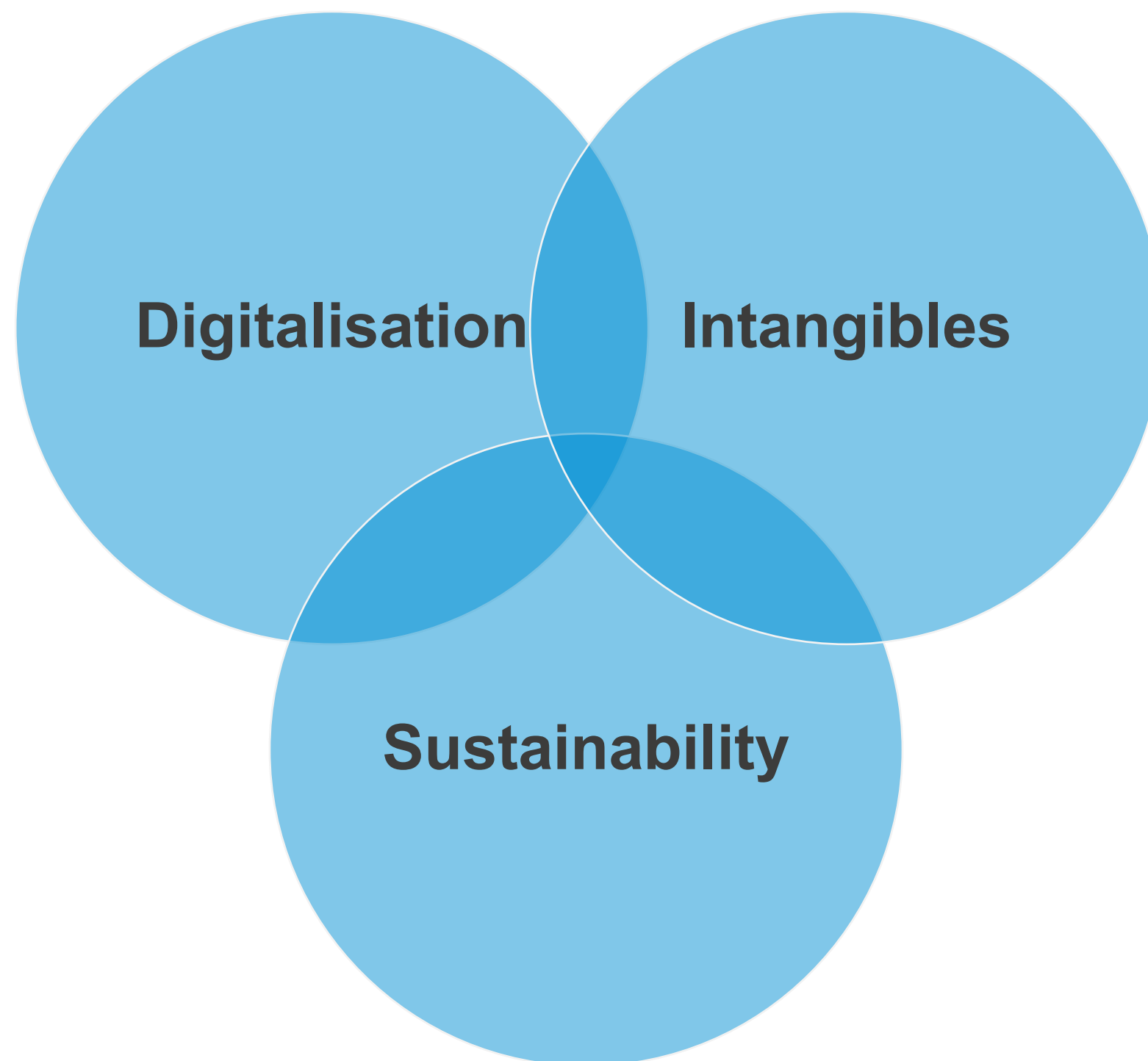
Creating ISO standards

ISO Standards have a ~3-year development process to establish international consensus on good practice.



ISO 5500x over the horizon

Established priorities:



Remit:

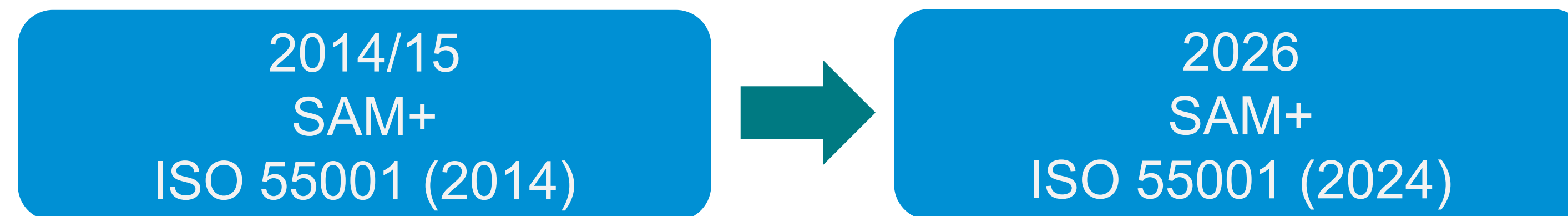
“Standardisation in the field of Asset Management”

Proposals:

1. Accelerated updates to existing standards
2. Integration of existing standards
3. Intangibles asset management
4. Lifecycle planning

Using our flagship standard, ISO 55001

- Our only “requirements” standard is ISO 55001
- Therefore an organisation can be certified against it
- ISO 55001 (2024) is now out
- Accreditation Bodies (ABs) have begun “accrediting” Certifying Bodies (CBs)
- Certifying Bodies can now audit you to ISO 55001 (2024) in most countries
- Pick a CB that complies with ISO 17021-5 (re competence)
- No industry standard yet for exactly how the CB does an audit

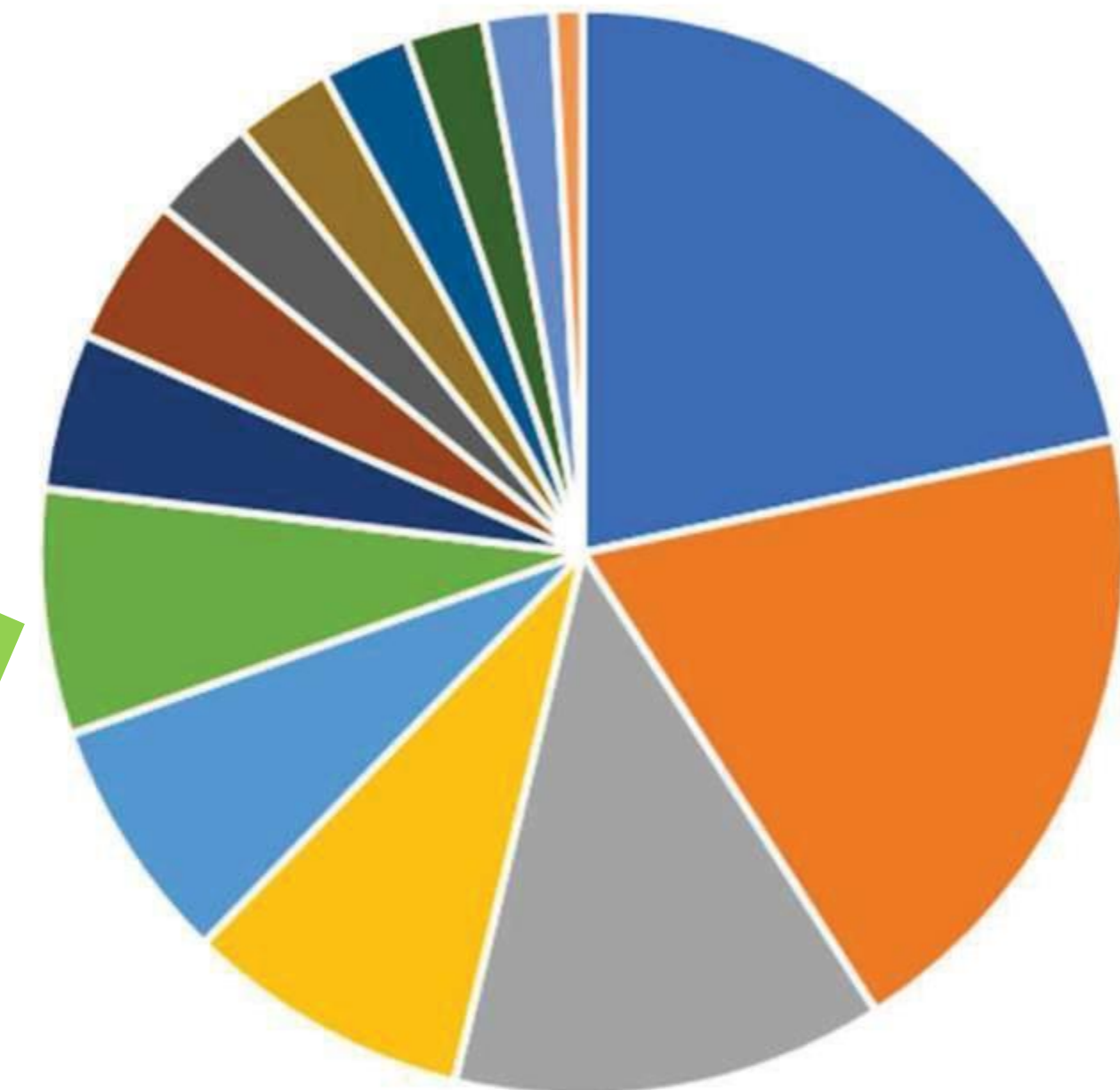
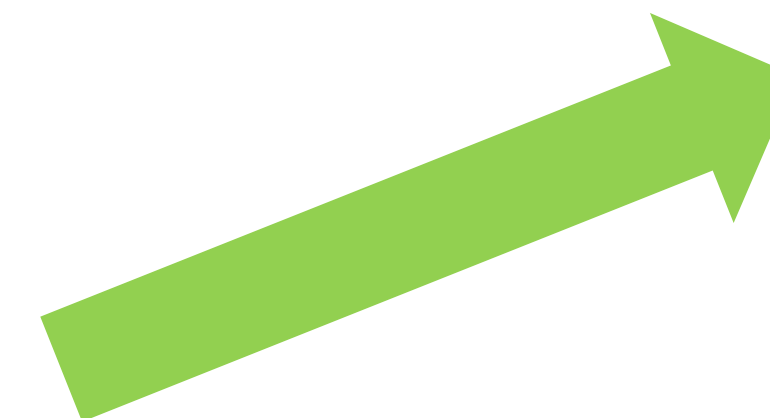


Adoption of ISO 5500x in Rail - Certifications

KCO April 2025

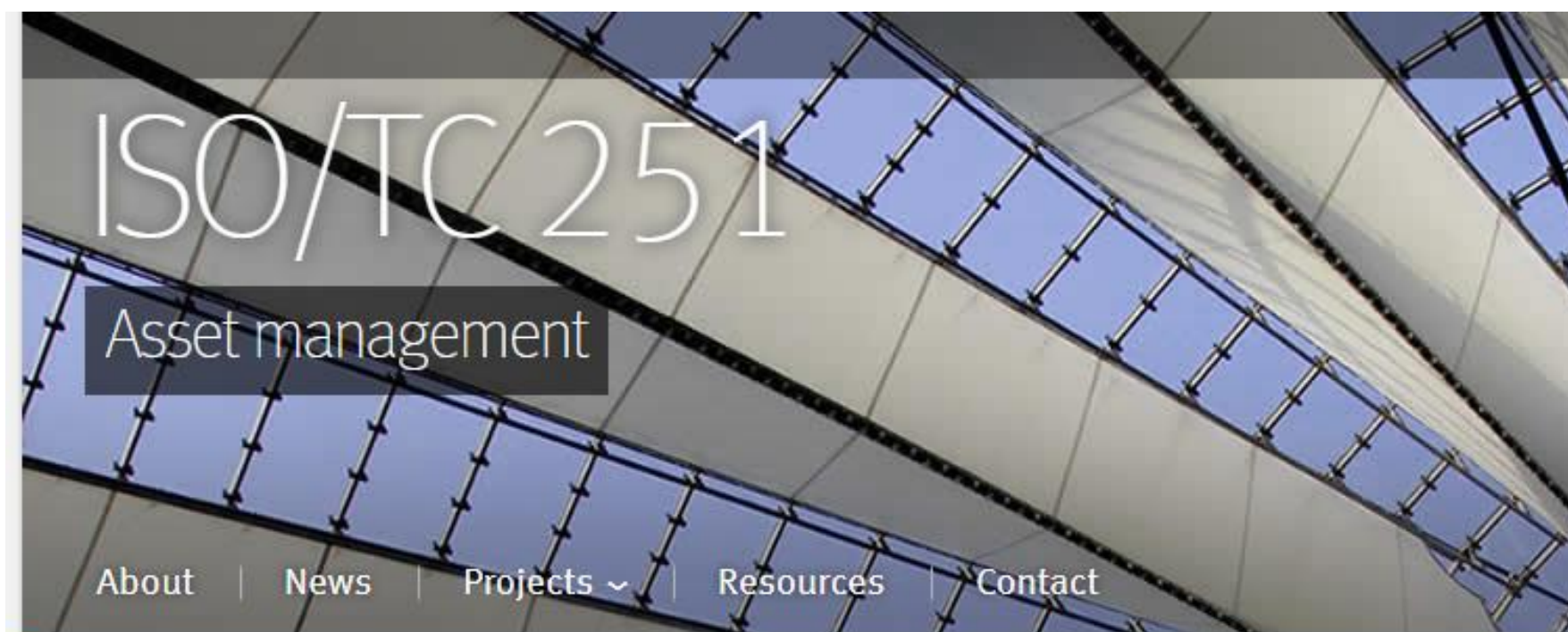
- Slow progress in 2024/25
- 350 entries
- Register certified companies at submissions@iso55000.org

- *Whole “Transport” sector*
- *Rail is less than half*
- *~20*
- ***ONE active UIC member***



Electrical Utilities	Water & Waste Utilities	Facilities Management
Infrastructure	Engineering & Construction	Transportation
Ports & Airports	Gas Utilities	Mining
Oil & Gas	Manufacturing	Government
Industrial, Process, etc.	Health Services	

Adoption of ISO 5500x in Rail - Materials



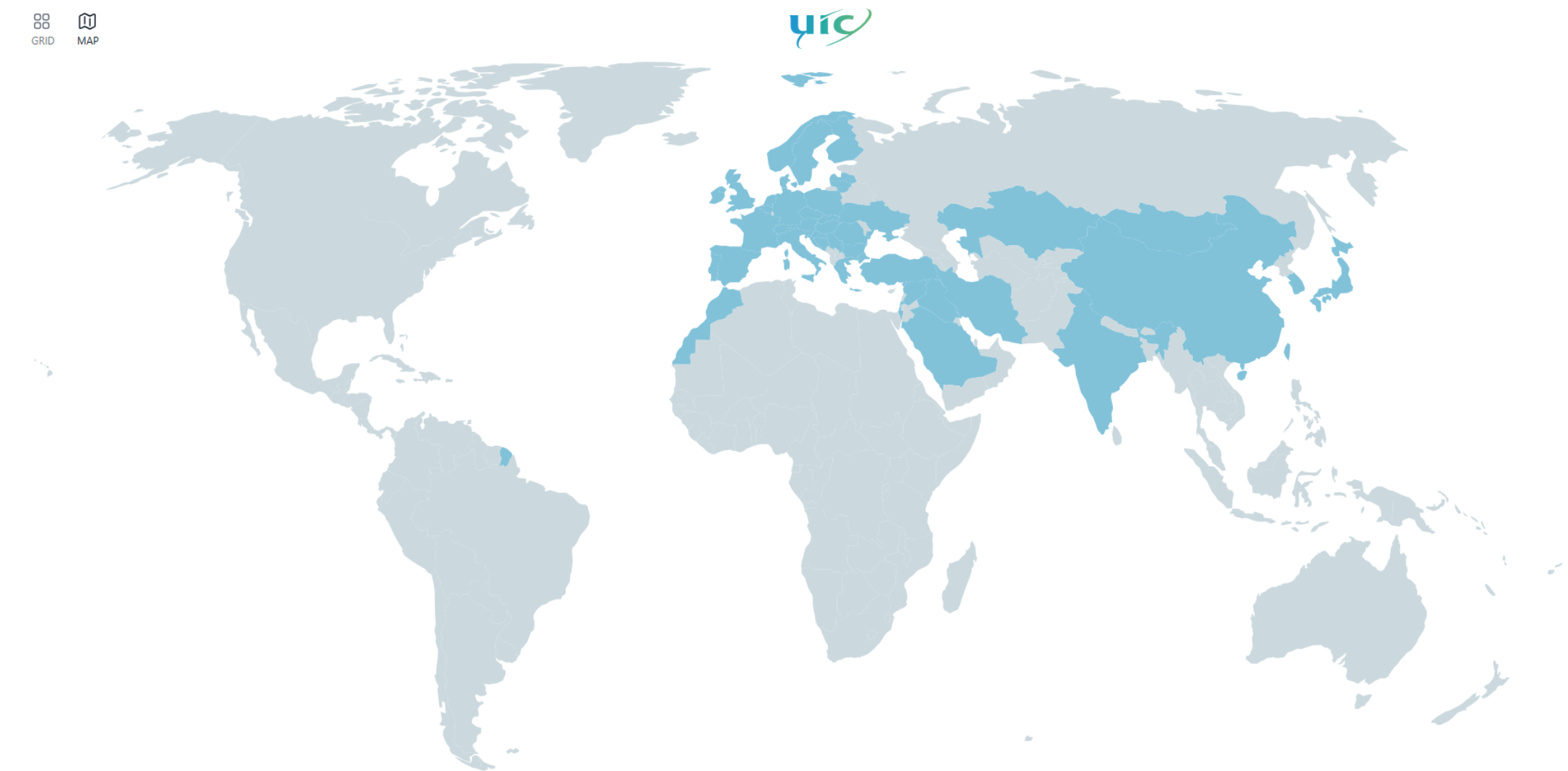
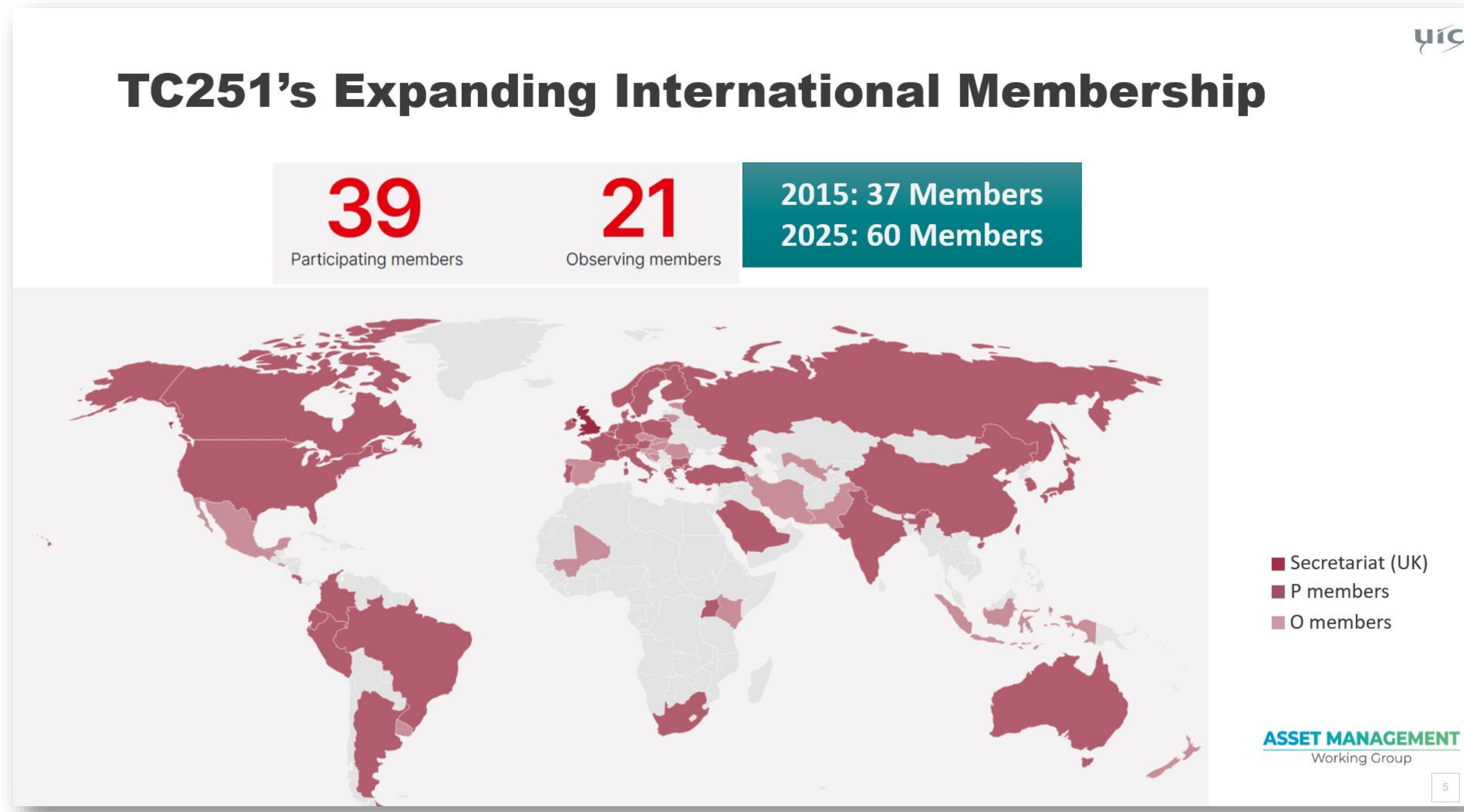
Case Studies

Below you will find a list of videos and PDF case studies, success stories and newsworthy items around the adoption of ISO 55001. We're always keen to hear more stories – please don't hesitate to [contact us](#) if you wish to contribute to this page.

- NEW - MGBahn:** Asset management in the Alps
Case Study May 2025 PDF – [English](#) – [Français](#) – [Deutsch](#)
- NEW - DSB:** Asset management in railways – [Video](#)
- NEW - US Army Corps of Engineers:** The asset management journey – [Video](#)
- NEW - Rijkswaterstaat:** ISO 55001 brings clarity to asset management – [Video](#)
- NEW - Novo Nordisk:** Asset management in the pharma sector – [Video](#)
- SinoOcean:** Leading in offshore assets management with ISO 55001
Case Study January 2025 PDF – [English](#)
- Suez:** Benefits of asset management in water & wastewater – [Video](#)
- CERIU:** Municipal asset management in Quebec, Canada – [Video](#)
- SMRT Trains:** Providing more reliable train services with ISO 55001
Case Study March 2024 PDF – [English](#)
- ENEL Brasil:** Gaining regulatory approval through asset management – [Video](#)
- AES Brasil:** Benefits of asset management in a multinational group – [Video](#)
- Ecopetrol, Energía de Bogotá, ISA Intercolombia and Frontera Energy:** the CEO's of four large Colombian corporations talk about their success using asset management as a



Adoption of ISO 5500x in Rail - Representation



Participating members

23 countries:

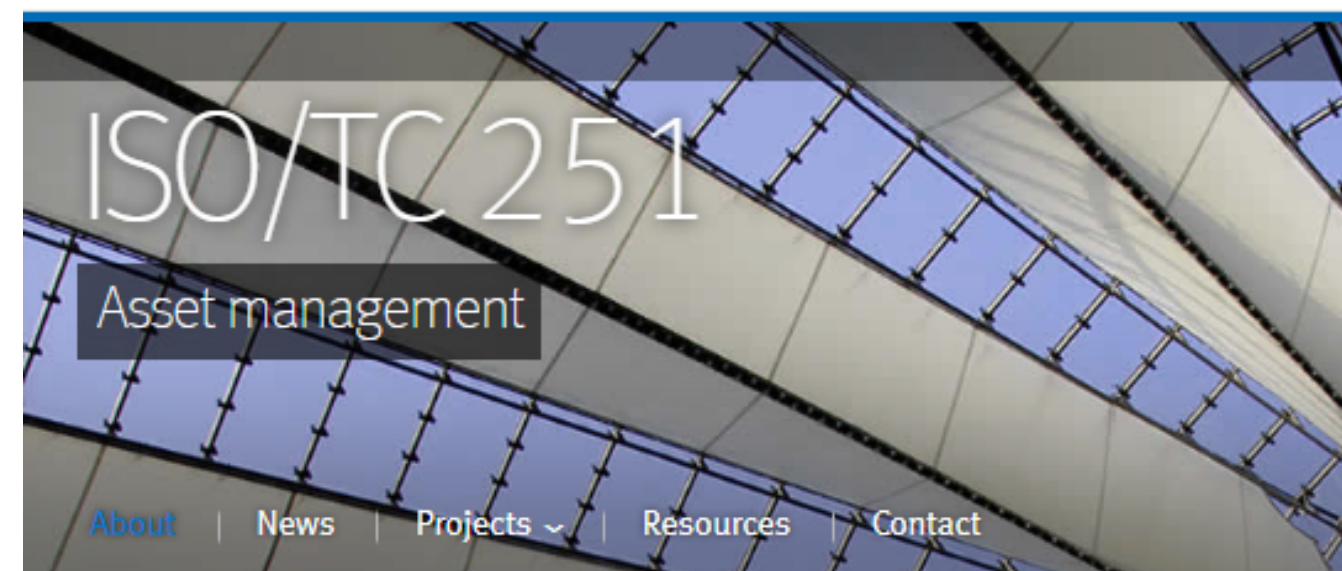
Austria
 Belgium
 Bulgaria
 China
 Denmark
 Finland

France
 Germany
 Greece
 India
 Ireland
 Italy

Japan
 Korea
 Netherlands
 Norway
 Poland
 Portugal

Saudi Arabia
 Slovenia
 Sweden
 Switzerland
 United Kingdom

Visit committee.iso.org/tc251



Assets are fundamental to your organization

Managing them in a controlled manner optimizes cost and risk, allowing timely and fact based decisions and delivers value in meeting your objectives.

What is Asset Management?

Asset management coordinates the financial, operational, maintenance, risk, and other asset-related activities of an organization to realize more value from its assets. This international standard suite focuses on managing physical and intangible assets.

What is ISO 55001?

ISO 55001 defines the requirements for a management system for asset management.

The ISO 55001 management system provides a framework to establish asset management policies, objectives, processes and governance, and facilitates an organization's achievement of its strategic goals. ISO 55001 utilizes a structured, effective, and efficient process that drives continual improvement and ongoing value creation by managing asset-related cost, performance and risk. ISO 55000 and ISO 55002 complement ISO 55001 by providing the overview, principles, and terminology (ISO 55000) and guidance for its application (ISO 55002).

This standard focuses on the need for a management system, and thus does not specify financial, accounting, or technical requirements for managing specific asset types.

Why is ISO 55001 important?

Compliance with the ISO 55001 standard can support organizations that are striving for a culture of proactive, continual improvement, and can drive an organization's effectiveness and efficiency in the realization of increased value from its assets. It reflects the latest thinking and best practices in asset management.

Developing and implementing an asset management framework based on the ISO 55001 standard demonstrates to internal and external stakeholders (e.g. regulators, customers, insurers) that the organization manages its performance, risks, and costs in a very effective



Learn more about ISO 55001

A large body of knowledge already exists relating to asset management in general. Resources are available including those mentioned below.

General Asset Management



The Global Forum on Maintenance & Asset Management is an association of professional societies formed for the purpose of sharing and for informing professional societies. It publishes the **GFMAM ISO 55001** Guide. Visit www.gfmam.org



The Institute of Asset Management is for those involved in acquiring, managing, and disposing of assets – especially critical assets. The Institute is for professionals furthering their knowledge of Asset Management. It publishes the **Asset Management Body of Knowledge** growing body of **Subject Specific Guidelines** including **maintaining a Strategic Asset Management Plan** details.



The Asset Management Council is an organisation at the forefront of asset management across all roles, both in Australia and internationally. It publishes the **Guide to ISO 55001** and the growing **Asset Management Body of Knowledge** details.



Publications

TC251 is in the process of developing guidance articles that clarify and further document specific aspects of the ISO 55000 series of standards. Articles will be published in this section as they become available.



NEW: Asset Management

Sustainability of assets and performance for many companies. To achieve this, several companies have begun implementing a circular economy management can align with circular economy PDF in: [English](#).



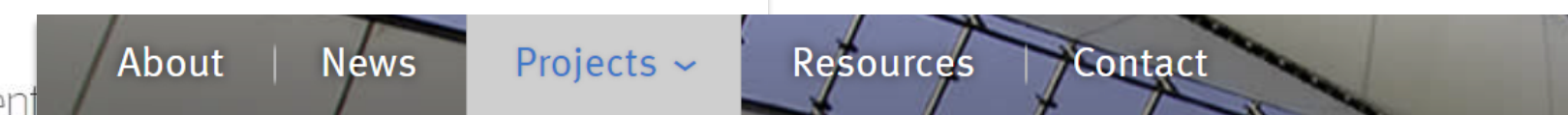
Aligning Asset Management Reporting Approaches

This article highlights the differences associated with current asset management best practices, and outlines how they can handle those differences in a consistent approach. Available as PDF in: [English](#).



Guidance on the Alignment of Asset Management

A well-known problem with the delivery of services stems from the conflicting effects, when people in various functions do not meet this expectation together do not meet this expectation present in various functions of the impact on asset management [Chinese](#).



Ongoing | Published

ISO 55011 - Guidance for development and application of public policy to enable asset management

Why ISO 55011?

For governments and public policy authorities, good asset management is a key enabler for those seeking to balance investment in immediate needs with long-term goals to achieve desired societal outcomes, including achievement of the United Nations' [Sustainable Development Goals](#). Developing public policy in a way that promotes good asset management is important for governments and their public policy authorities to make the best use of public resources while maximizing social and financial return on investments.

Who is leading the development of ISO 55011?

ISO TC 251's WG7 is working on ISO 55011 to provide guidance for establishing and sustaining an enabling environment for asset management through public policy - applicable to national, provincial or local governments or their agencies.

World-class experts and world-class



Kyoto in 2026!

But also increasing virtual meetings for greater participation



ISO TC 251 Meetings



They're your standards!

Standards are increasingly important!

Developed by domain experts which could be you.

- Share best practices
- Shape the future of asset management
- Learn from each other
- Build a strong network

Sign up through your National Standards Body

- Full list at www.iso.org/members



Session 1: Leadership & Culture in Asset Management Q&A



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THANK YOU FOR YOUR ATTENTION

Thomas Goodyer
thomas.goodyer@wsp.com

ASSET MANAGEMENT
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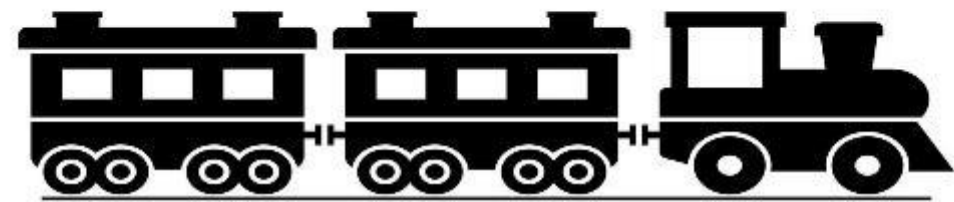
Asset Management Seminar

Pietrarsa, Naples – 2 October 2025

CHANGE MANAGEMENT WITHIN ASSET MANAGEMENT

Lorena Ibeas
Sol Mendoza

The JOURNEY of CHANGE



RESISTANCE TO
ORGANISATIONAL
CHANGE



DATA
MANAGEMENT



ALIGNMENT WITH
STRATEGIC
OBJECTIVES



INTEGRATION OF
NEW
TECHNOLOGIES



TRAINING AND
COMPETENCES



REGULATORY
COMPLIANCE AND
SAFETY

STATION #1

RESISTANCE TO ORGANISATIONAL CHANGE



STATION #1: RESISTANCE TO ORGANISATIONAL CHANGE

Why does resistance to organisational change occur?

Resistance to change is a natural reaction of people when facing the unknown or the possibility of losing control, status or security.

In the railway context, this is reinforced by:

- **Highly structured and hierarchical** environments
- Employees' **long history** with **traditional methods**
- Perception that change may put at **risk operational safety**



STATION #1: RESISTANCE TO ORGANISATIONAL CHANGE

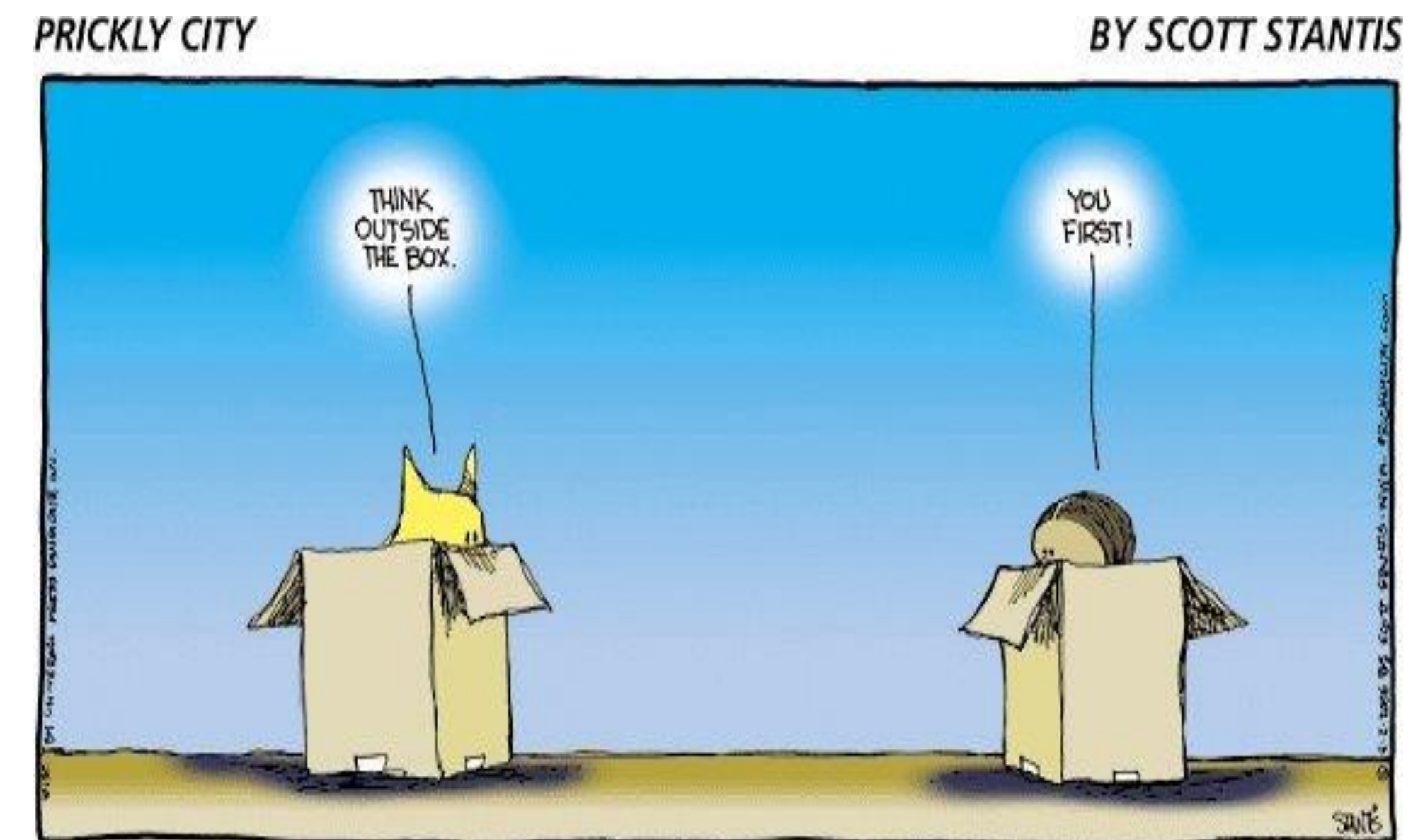
Levels of resistance to organisational change

Individual resistance

- Fear of losing job or not being qualified
- Lack of understanding of the purpose of change
- Preference for routine and familiarity

Organisational resistance

- Bureaucratic processes that slow down decision-making
- Lack of committed leadership
- Organisational culture that values stability over innovation



STATION #1: RESISTANCE TO ORGANISATIONAL CHANGE

Strategies for managing resistance to change

- Clear and constant communication
- Active staff participation
- Visible and committed leadership
- Training and support
- Recognition and positive reinforcement





STATION #1: RESISTANCE TO ORGANISATIONAL CHANGE

ADIF Case

CHALLENGES

Long-term project

Struggle to show immediate and tangible results

New concept project within the organization

Lack of knowledge of employees

Change of organization mindset

Tedious process that could be discouraging

STRATEGIES

Communication actions:

- Posts in ADIF intranet
- Informative e-mails customized to recipients
- Project road map to interested parties
- Information on next steps
- Use cases

STATION #2

INTEGRATION OF NEW TECHNOLOGIES



STATION #2: INTEGRATION OF NEW TECHNOLOGIES

Main technical challenges

- Legacy systems
- Interoperability
- Cybersecurity

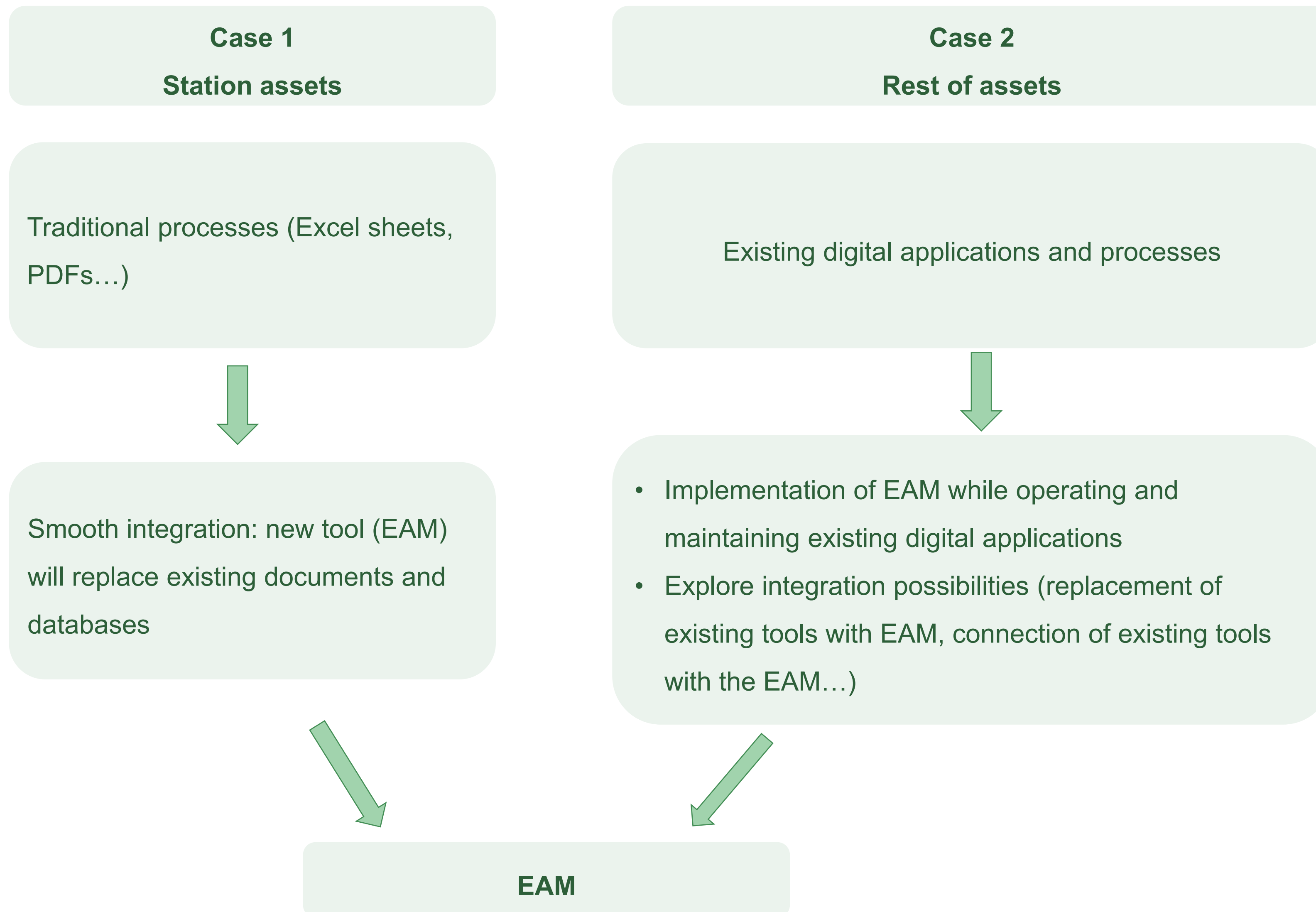


STATION #2: INTEGRATION OF NEW TECHNOLOGIES Strategies for a successful integration

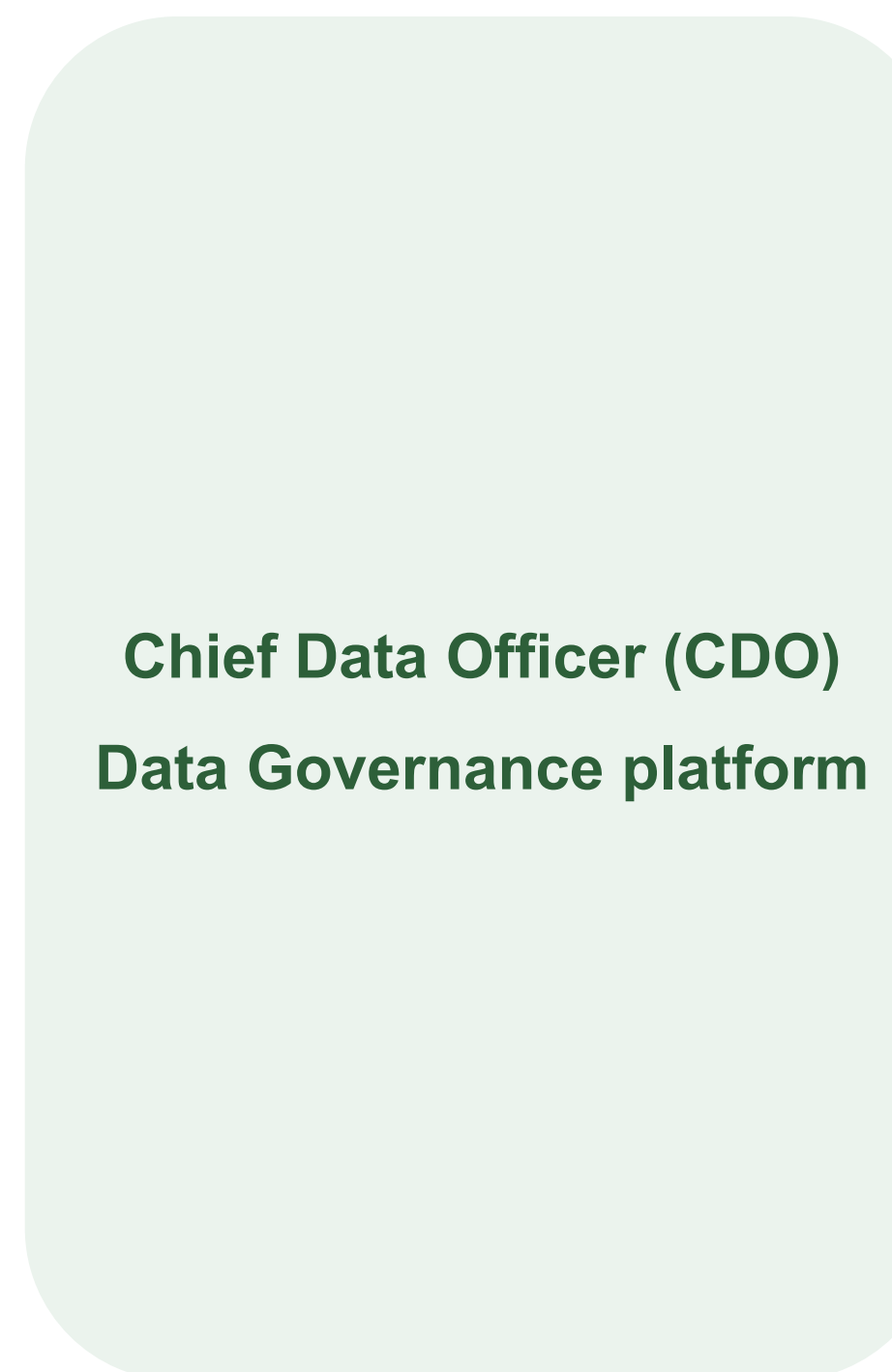
- Assessment of the current situation
- Design of an integrated technology architecture
- Progressive implementation (in phases)
- Data governance
- Collaboration with technology providers

STATION #2: INTEGRATION OF NEW TECHNOLOGIES

ADIF Case



STRATEGIES



STATION #3

DATA MANAGEMENT



STATION #3: DATA MANAGEMENT

Why is data management a challenge?

Modern asset management relies on accurate, complete, and up-to-date data to make informed decisions about maintenance, renovation, investment, and operation.

However, in the railway environment, this is complicated by:

- The large number of assets and its diversity (tracks, catenaries, signals, tunnels, stations, etc.)
- The geographical dispersion of data
- The coexistence of analogue and digital formats
- The lack of a data management culture





STATION #3: DATA MANAGEMENT

Main challenges in data management

- Data quality
- Digitalisation of physical assets
- Information silos



DO WE TRUST THIS DATA?

Dataedo /cartoon

Piotr@Dataedo

STATION #3: DATA MANAGEMENT

Strategies for the improvement of data management

- Implement a data governance strategy
- Database unification
- Systematic digitalisation
- Integration with operating systems
- Data training and culture



SO YOU'RE TELLING ME THIS WILL TURN INTO VALUE?

Dataedo /cartoon

Piot@Dataedo

STATION #3: DATA MANAGEMENT

ADIF Case

ADIF 5+5 CAMBIO CULTURAL

5 REFLEXIONES QUE NOS HACEMOS



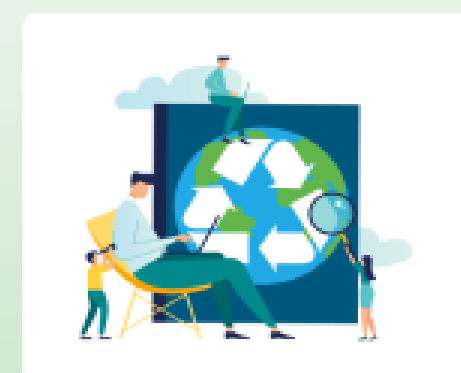
¿Estoy compartiendo la información que necesitan otros?



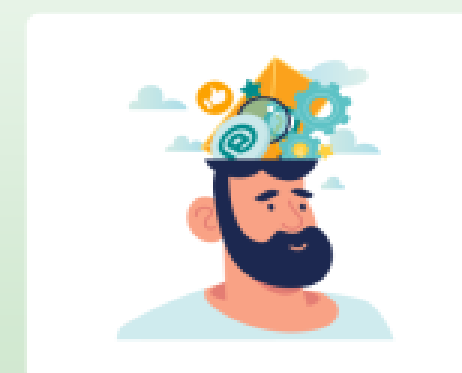
¿Hay una forma mejor de hacer las cosas? ¿Más eficiente, más útil?



¿Actúo de forma ética y honesta?



¿Cuido del medioambiente? Cada una de mis acciones cuenta.



¿Qué papel puedo jugar yo en este proceso de cambio?

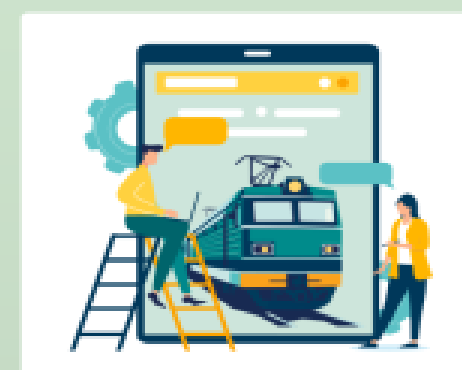
5 PRINCIPIOS QUE SEGUIMOS



Soy responsable de mi desarrollo profesional y facilito el de mis compañeros.



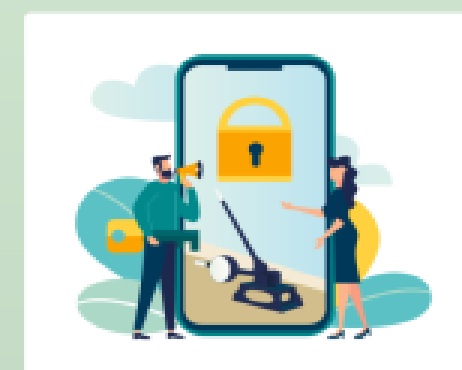
Escucho sin prejuizar y busco puntos de vista diferentes que enriquezcan mis decisiones.



Trabajo siendo consciente de que presto un servicio público, esencial para la sociedad.



Busco activamente responder a las necesidades de mis clientes internos y externos.



Estoy alerta ante los riesgos y vigilo la eficacia de sus barreras, cualquier detalle puede afectar a la operación.



#cambias tú, cambia adif

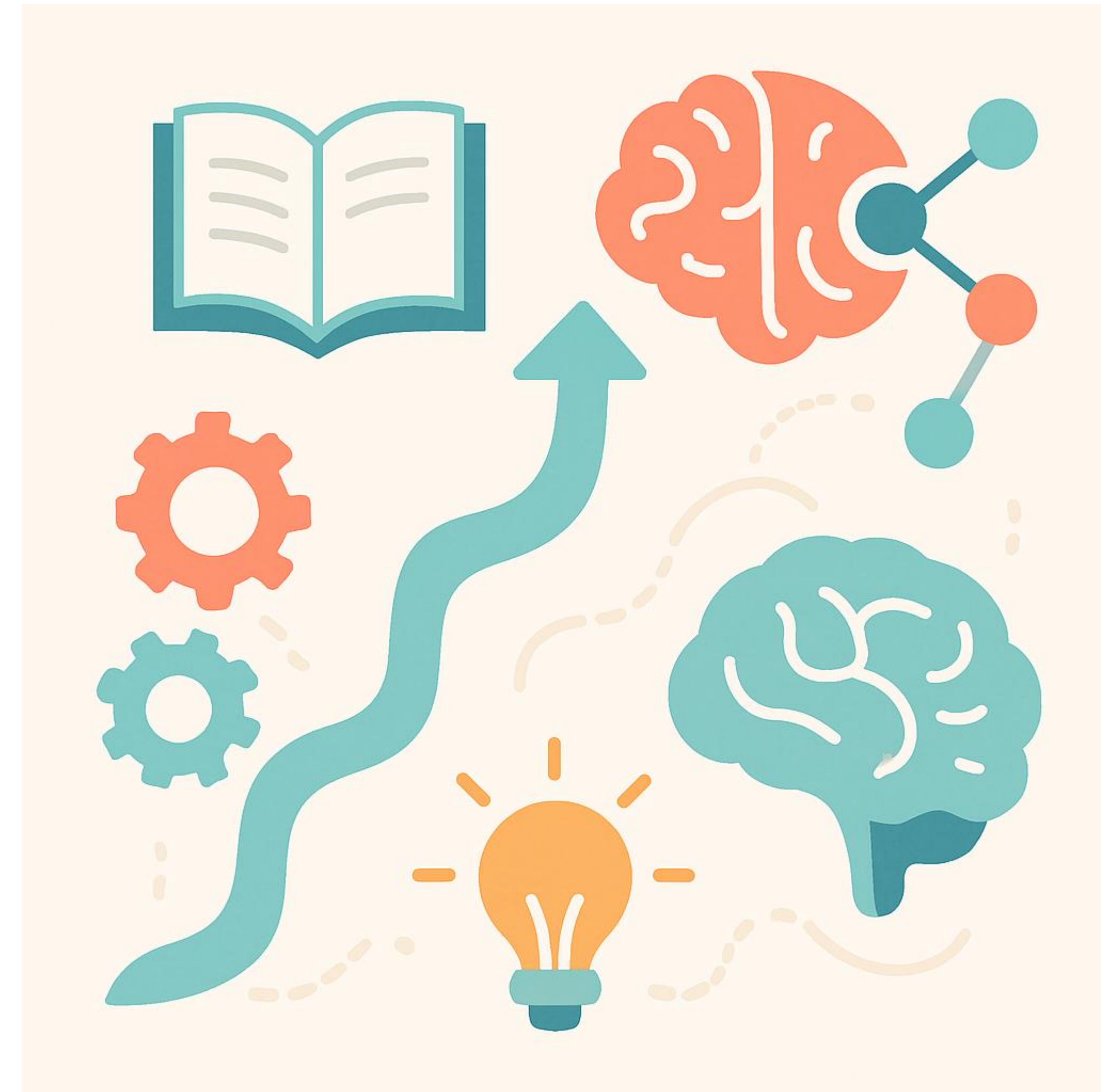
Cultural Change

ADIF has implemented this initiative to transform, improve and keep updated its organizational culture including:

- Digital transformation
- Safety culture
- Sustainability
- Railway market liberalisation
- Social initiatives

STATION #4

TRAINING AND COMPETENCES



STATION #4: TRAINING AND COMPETENCES

Main challenges

- Skills gap
- Resistance to learning
- Lack of structured programs



STATION #4: TRAINING AND COMPETENCES

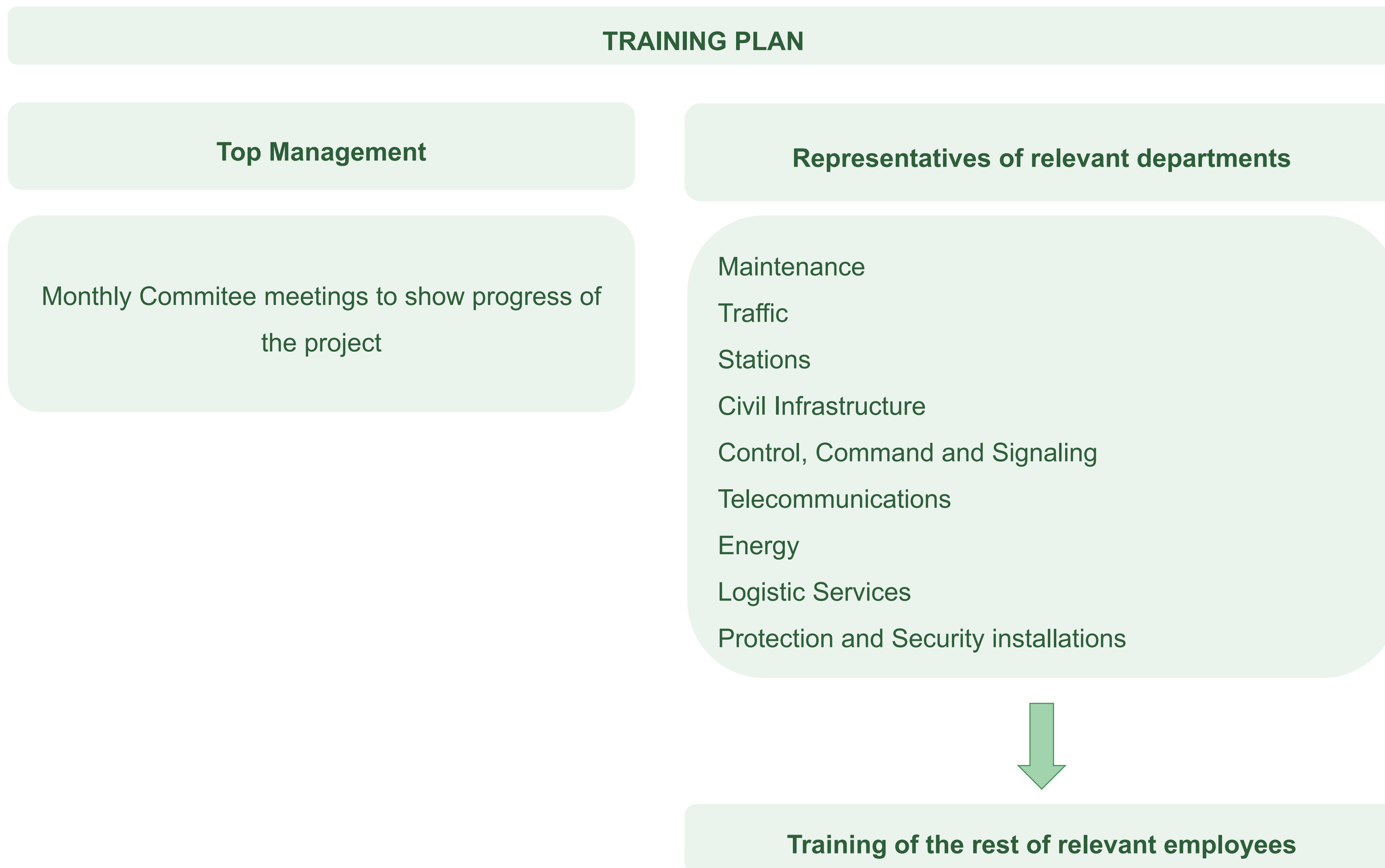
Building skills for digital adoption

- Skills assessment
- Design of customized training plans
- Practical and continuous training
- Mentorship and practice groups
- Recognition and motivation



STATION #4: TRAINING AND COMPETENCES

ADIF Case



STATION #5

ALIGNMENT WITH STRATEGIC OBJECTIVES



STATION #5: ALIGNMENT WITH STRATEGIC OBJECTIVES

Operational – Strategic disconnection

Many times, asset management projects are focused on technical or maintenance problems offering short term solutions which may not be aligned with strategic (long- term) objectives.

- Lack of a common vision
- Poor definition of indicators
- Focus on short term results



STATION #5: ALIGNMENT WITH STRATEGIC OBJECTIVES

How to achieve strategic and operational alignment?

- Definition of a Strategic Asset Management Plan (ISO 55001)
- Definition of an Asset Management Policy
- Translation of strategic objectives into operational plans
- Definition of strategic KPIs
- Engagement of all levels
- Report achievements from a strategic perspective



STATION #5: ALIGNMENT WITH STRATEGIC OBJECTIVES

ADIF case



STATION #6

REGULATORY COMPLIANCE AND SAFETY



STATION #6: REGULATORY COMPLIANCE AND SAFETY

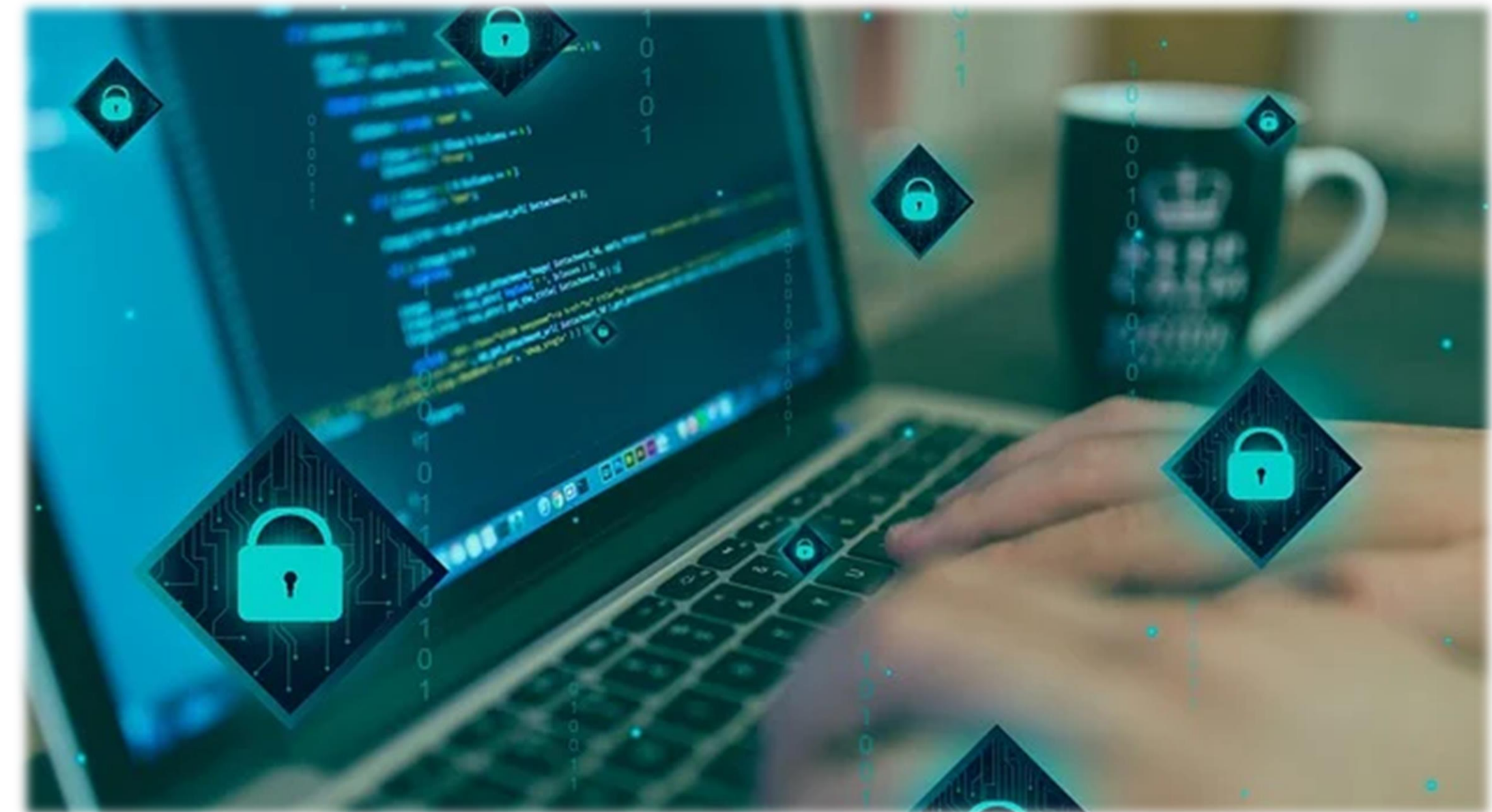
Main challenges

- Complex and evolving regulations
- Risk management
- Audits and Traceability
- Cybersecurity



STATION #6: REGULATORY COMPLIANCE AND SAFETY Strategies

- Integration with existing processes
- Impact assessment and risk analysis
- Automated traceability
- Regulatory and safety training
- Collaboration with regulatory bodies



STATION #6: REGULATORY COMPLIANCE AND SAFETY

ADIF case



Best Measurement of Leadership Development Impact



Best Leadership Development Programme



Session 1: Leadership & Culture in Asset Management Q&A



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THANK YOU FOR YOUR ATTENTION

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Sol Mendoza
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ASSET MANAGEMENT
Working Group



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Session 2

Strategy and Performance



Manfredi Bruccoleri
(Palermo University)



Celso de Azevedo
(Assetsman)



Christian Blättler
(AFRY)



Alison Cowley
(AFRY)



Grame Hind
(AMCL)



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OF RAILWAYS

Asset Management Seminar

Pietrarsa, Naples – 2 October 2025

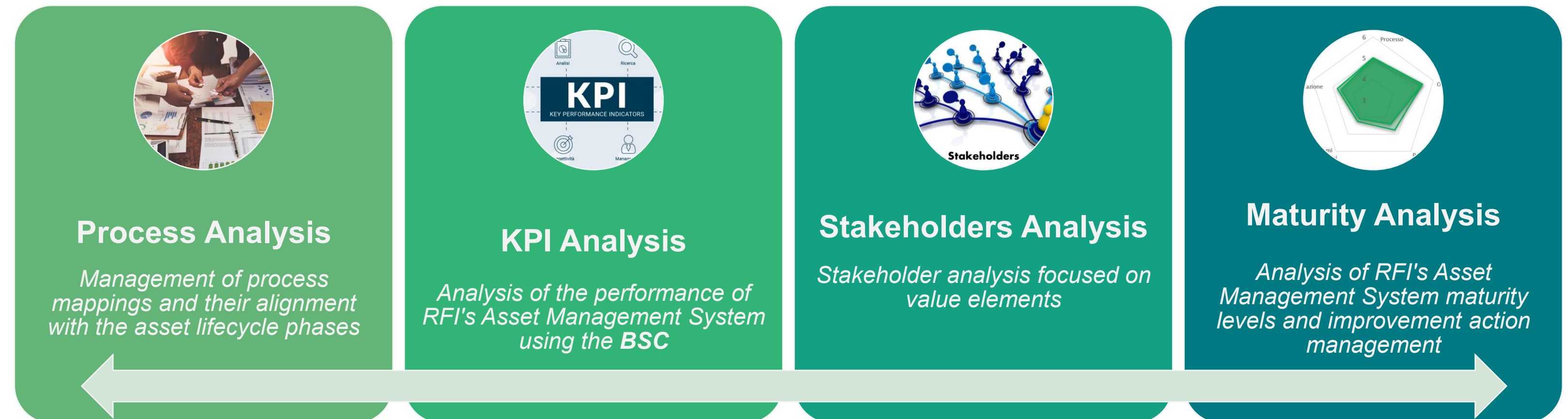
Measuring strategies through value performance
indicators - Balance Scorecard

Manfredi Bruccoleri

Measuring strategies through value performance indicators - Balance Scorecard

In the 2024-2025 year, AM of RFI collaborated with the Palermo University on two research projects titled:

- "Definition of the technical and functional specifications of the IT Asset Management system"
- "Development of a methodology for assessing the maturity of RFI's Asset Management System"



	Technical Specification
Asset management — Guidance on the alignment of financial and non-financial functions in asset management <i>Gestion d'actifs — Recommandations relatives à l'alignement des fonctions financières et non financières dans la gestion d'actifs</i>	ISO/TS 55010 Second edition 2024-07

9.2 Performance measurement

Performance evaluation should be carried out in many layers against specific, measurable, achievable, relevant and time-based (SMART) objectives aligned to each layer.

It should start with a self-evaluation by every employee or team. The organization's managers should create a culture that enables and encourages such activities.

A subsequent layer of evaluation can be from regular performance reporting (e.g. with the support of a balanced scorecard). The balanced scorecard should report on financial and non-financial measurements to test the balance between performance, costs and risks. This should be carried out at a regular frequency. The benefits of regular performance reporting come from preparing the report itself, as well as from the discussion about it within the team or at other managerial levels. Based on these discussions, improvement actions can be initiated.



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The Story

ASSET MANAGEMENT
Working Group

The story of Progressive Insurance

Operations and Supply Chain Management

Top-Rated Insurance Company | Progressive

PROGRESSIVE

Explore Products Claims About Us Resources

1-866-407-4844 Log In

Welcome to Progressive

Falling leaves and savings please

Select Auto, or Bundle
and save 4% on average! ‡

- Auto
- Auto + Home
- Auto + Renters
- Auto + Condo

Choose from over 30 other products
[Or, continue previous quote](#)

- Life
- Home
- RV/Trailer >
- Renters
- Motorcycle
- Condo
- Boat/PWC
- More choices

Looking for a local expert? [Find an agent near you.](#)

Get the right protection to keep moving forward

The story of Progressive Insurance

BUSINESS INSIDER

PERSONAL FINANCE > INSURANCE > AUTO INSURANCE

The 10 Largest Auto Insurance Companies in 2025

- 10 Largest Car Insurance Companies
- Comparing Car Insurance Companies
- Specialty Auto Insurance Companies
- Tips for Choosing the Right Auto Insurance Company
- FAQ

10 Largest Car Insurance Companies

The largest auto insurance companies are the ones you often hear about. Major players in the insurance industry include State Farm, Progressive, GEICO, Allstate, and USAA.

Rank	Company Name	Market Share %
1	State Farm	18.87
2	Progressive	16.72
3	GEICO (Berkshire Hathaway)	11.63
4	Allstate	10.19
5	USAA	6.16
6	Farmers	3.76
7	Liberty Mutual	3.27
8	Travelers	2
9	Auto Club Enterprises (AAA)	1.80
10	American Family	1.72

Source: [2024 data from the National Association of Insurance Commissioners \(NAIC\)](#)

From 1991 to 2025

1991 → \$1.3 billion
2004 → \$9.5 billion
2024 → \$75.37 billion



The story of Progressive Insurance

Progressive Insurance (Ohio) grew from \$1.3 billion to \$9.5 billion in sales in 10 years (1991 → 2002)

What fashionable strategies did Progressive employ to achieve such an incredible growth?

- A. It was positioned in a high-growth industry
- B. It diversified into new businesses
- C. It went global
- D. It grew through M&A and clever marketing schemes
- E. None of the above



The story of Progressive Insurance

The secret of Progressive's success is simple: *It out-operated its competitors.*

How? By offering *lower prices* and *better services* than its rivals.

What enabled Progressive to have better prices and services was *operational innovation*, the invention and deployment of

new ways of doing work.

The story of Progressive Insurance

For most of its history, Progressive focused on high-risk drivers, a market that it served profitably through extremely precise pricing. But in the early 1990s, the insurer believed that much larger companies were about to enter this niche and emulate its approach to pricing; the company's managers realized it couldn't compete against larger players on a level playing field. So Progressive decided to win the game by changing the rules. It reinvented claims processing to lower its costs and boost customer satisfaction and retention.

The story of Progressive Insurance



“Immediate Response”
claim handling process from 10 days to 9 hours!

The story of Progressive Insurance

The “Immediate Response” claim handling process

A Claimant can reach a Progressive representative by phone 24 hours a day, and the representative then schedules a time when an adjuster will inspect the vehicle.

Adjuster no longer work out of offices from nine to five but out of mobile claims vans.

Instead of taking between seven and ten days for an adjuster to see the vehicle, Progressive’s target is now just nine hours

The adjuster not only examines the vehicle but also prepares an on-site estimate of the damage and, if possible, writes a check on the spot



The story of Progressive Insurance

This approach has many benefits. Claimants get faster service with less hassle, which means they're less likely to abandon Progressive because of an unsatisfactory claims experience. And the shortened cycle time reduced Progressive's costs dramatically. The cost of storing a damaged vehicle or renting a replacement car for one day—around \$28—is roughly equal to the expected underwriting profit on a six-month policy. It's not hard to calculate the savings this translates into for a company that handles more than 10,000 claims each day.

The story of Progressive Insurance

Other benefits for Progressive are an improved ability to detect fraud (because it is easier to conduct an accident investigation before skid marks wash away and witnesses leave the scene), lower operating costs (because fewer people are involved in handling the claim), and a reduction in claim payouts (because claimants often accept less money if it's given sooner and with less travail).

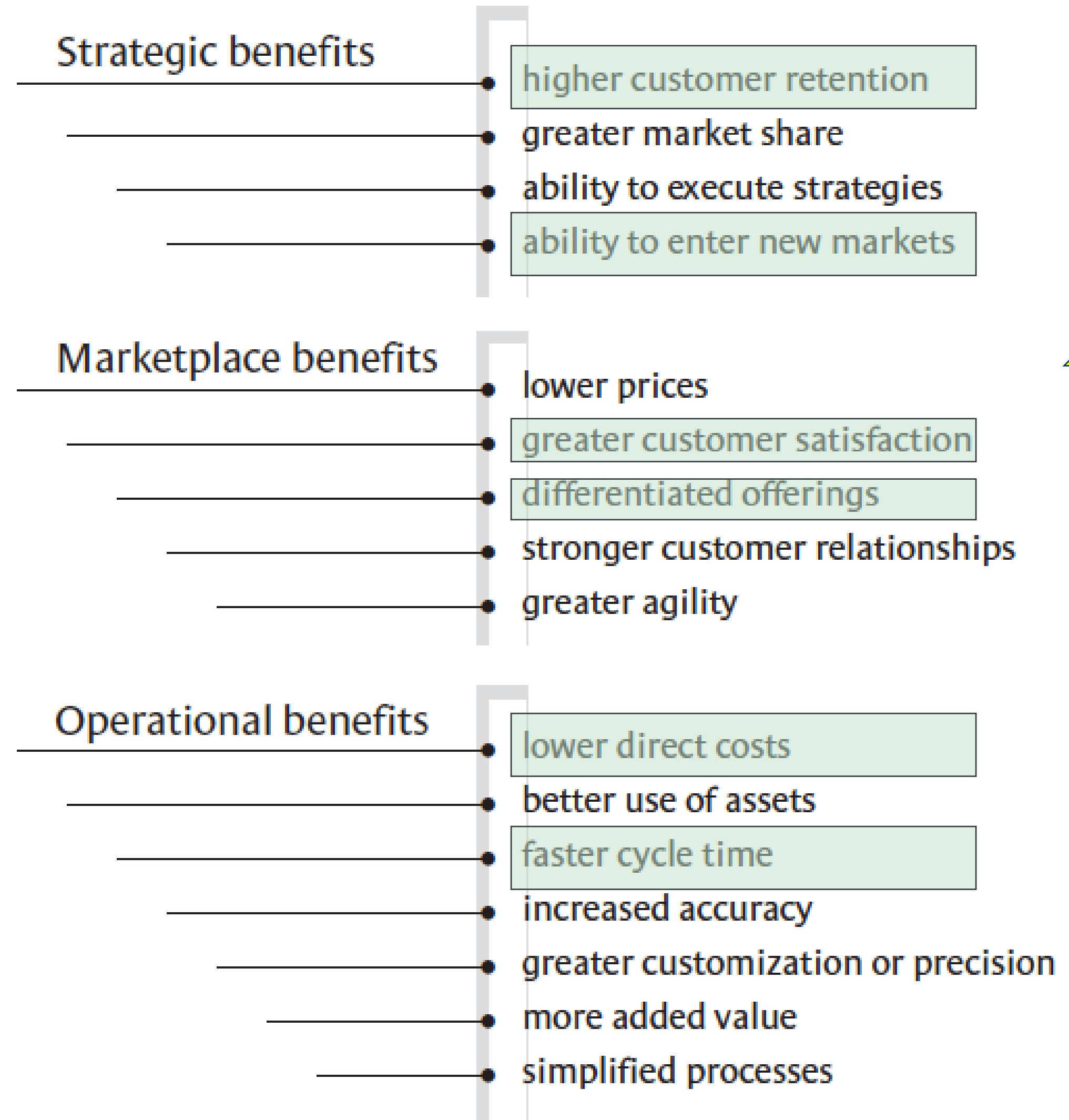
No single innovation conveys a lasting advantage!

In addition to Immediate Response, Progressive has also introduced other operational improvements and services for the customer

The Progressive Insurance case study

Operational Innovation can result in:

- direct operational performance improvements (*faster cycle time and lower costs*),
- which lead to superior market performance (*greater customer satisfaction and more highly differentiated products*).
- And improved market performance yields a host of strategic payoffs, from *higher customer retention to the ability to penetrate new markets*





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The Theory

Balanced Scorecard: the perspectives (1st generation)

A new (1992?) concept of
performance measurement
systems



Balanced Scorecard

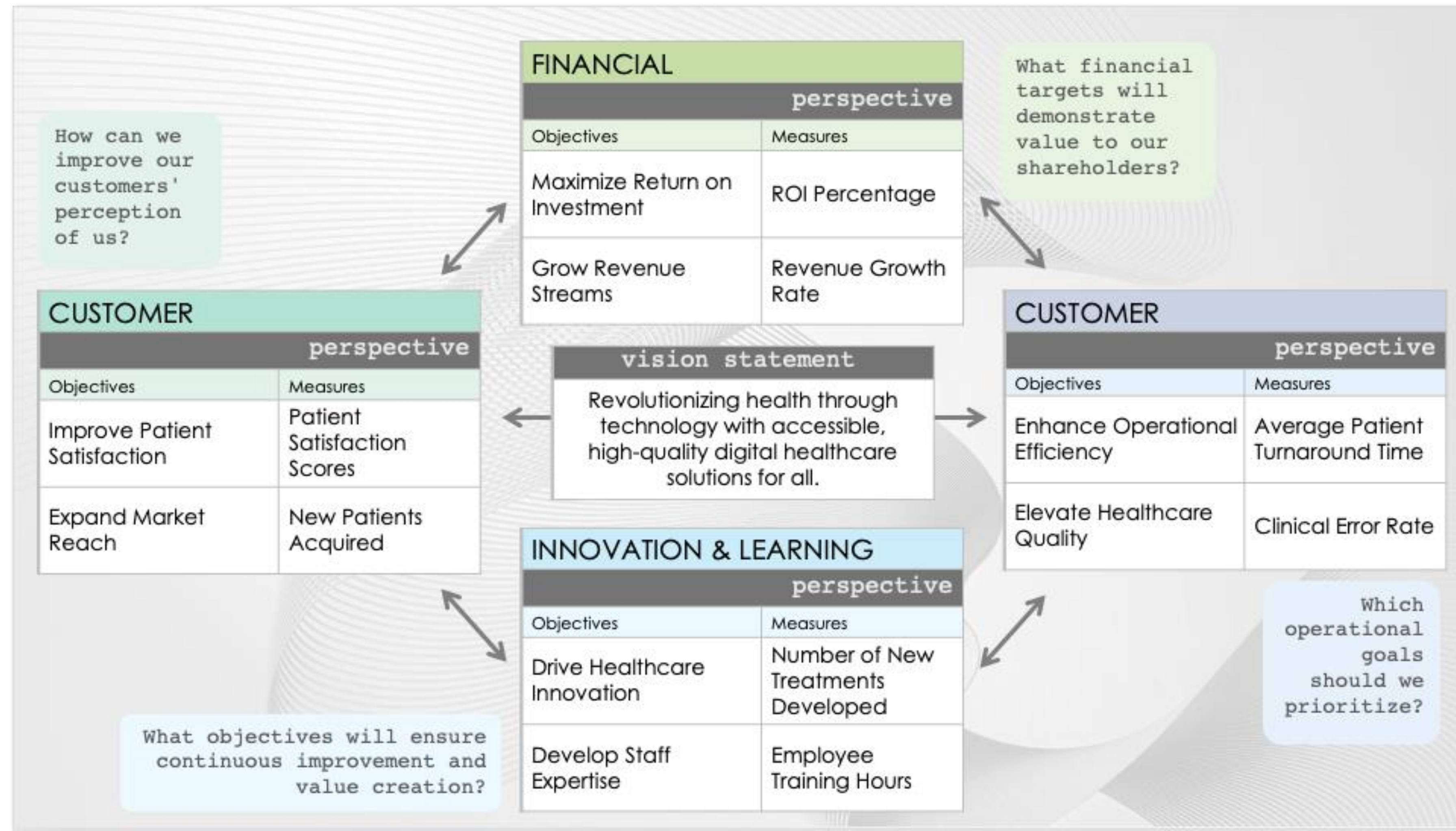
The Balanced Scorecard— Measures that Drive Performance

by Robert S. Kaplan and David P. Norton

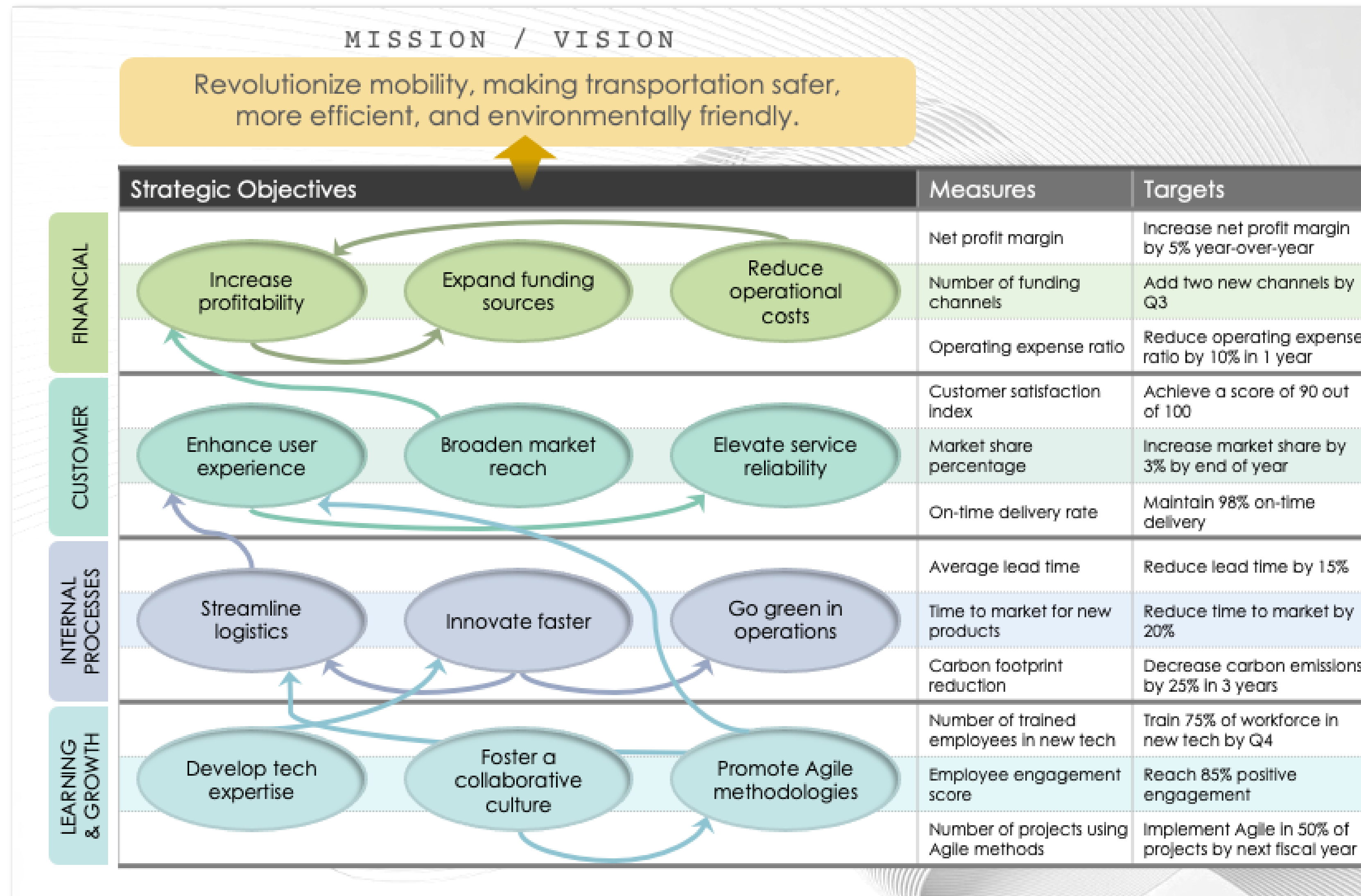
From the Magazine (January–February 1992)



Balanced Scorecard: the KPI (1st generation)



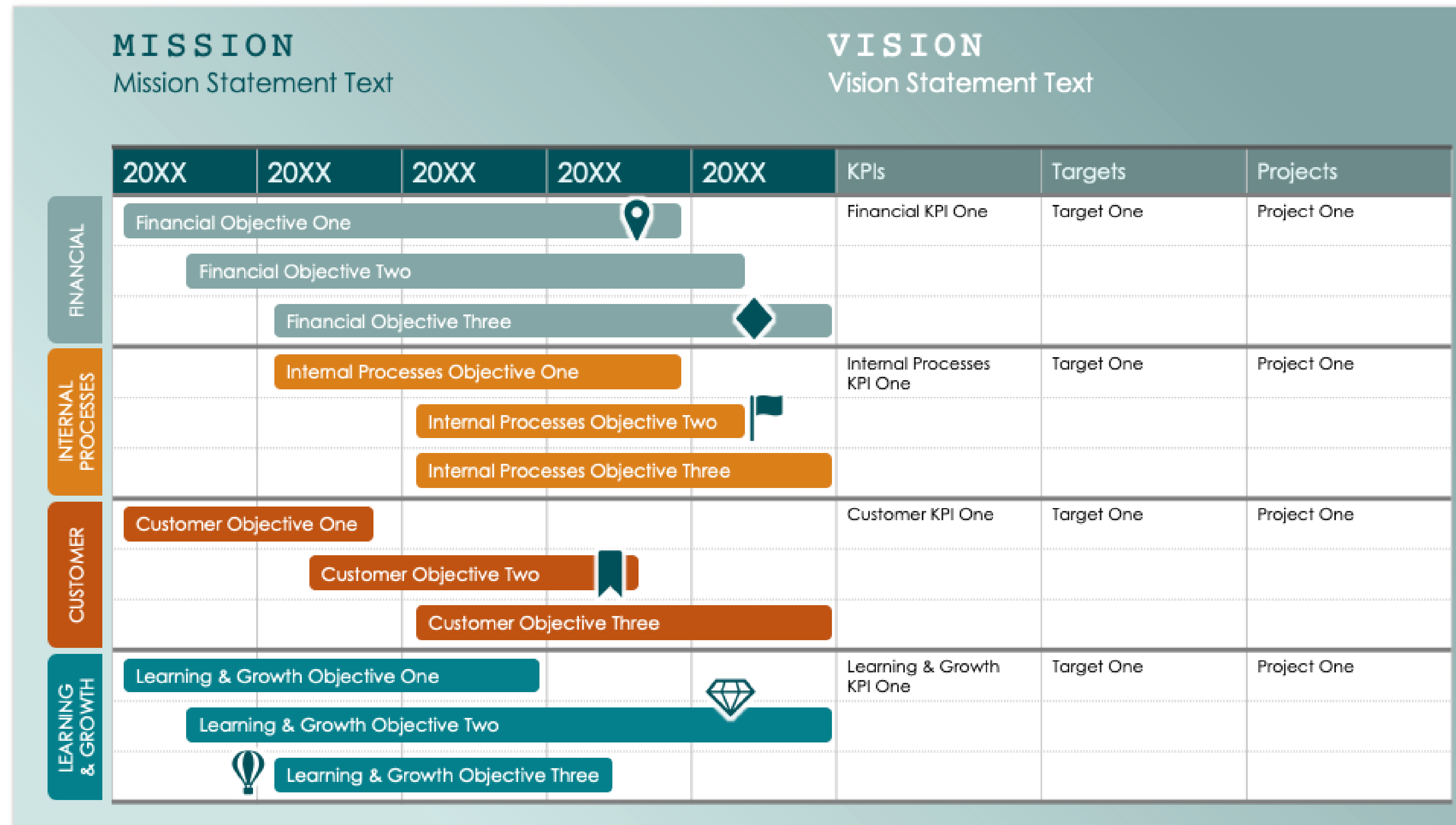
Balanced Scorecard: the strategy map (2nd generation)



Balanced Scorecard: Destination Statement (3rd generation)

Balanced Scorecard			
	K P I s	T A R G E T S	I N I T I A T I V E S
FINANCIAL	Cost savings percentage	5% annual cost saving	Implement eco-efficiency training
	Revenue from eco-friendly line	10% revenue growth in eco-line	Develop new eco-friendly product lines
	Market share in sustainable fashion	15% increase in market share	Market expansion strategy in sustainable markets
CUSTOMER	Brand recognition in sustainability surveys	Top 3 in sustainability brand recognition	Launch a 'Green is Gorgeous' marketing campaign
	Product quality score	90% positive quality reviews	Enhance customer service training on eco-products
	Customer retention rate	80% customer retention	Introduce a customer loyalty program for sustainable purchases
INTERNAL PROCESSES	Percentage of materials sourced sustainably	100% sustainable materials sourcing	Partner with sustainable suppliers
	Compliance with ethical standards	100% ethical standards compliance	Establish a monitoring system for ethical compliance
	Time to market for new products	Reduce new product development cycle by 20%	Innovate the product development process with eco-design principles
LEARNING & GROWTH	Employee training hours in sustainability	Cultivate sustainability expertise	Develop an in-house sustainability training program
	Number of sustainability certifications obtained	Foster employee advocacy	Achieve sustainability certifications for all products
	Technology upgrade completion rate	Upgrade sustainable tech	Invest in tech that reduces environmental footprint

Balanced Scorecard: initiatives' GANTT





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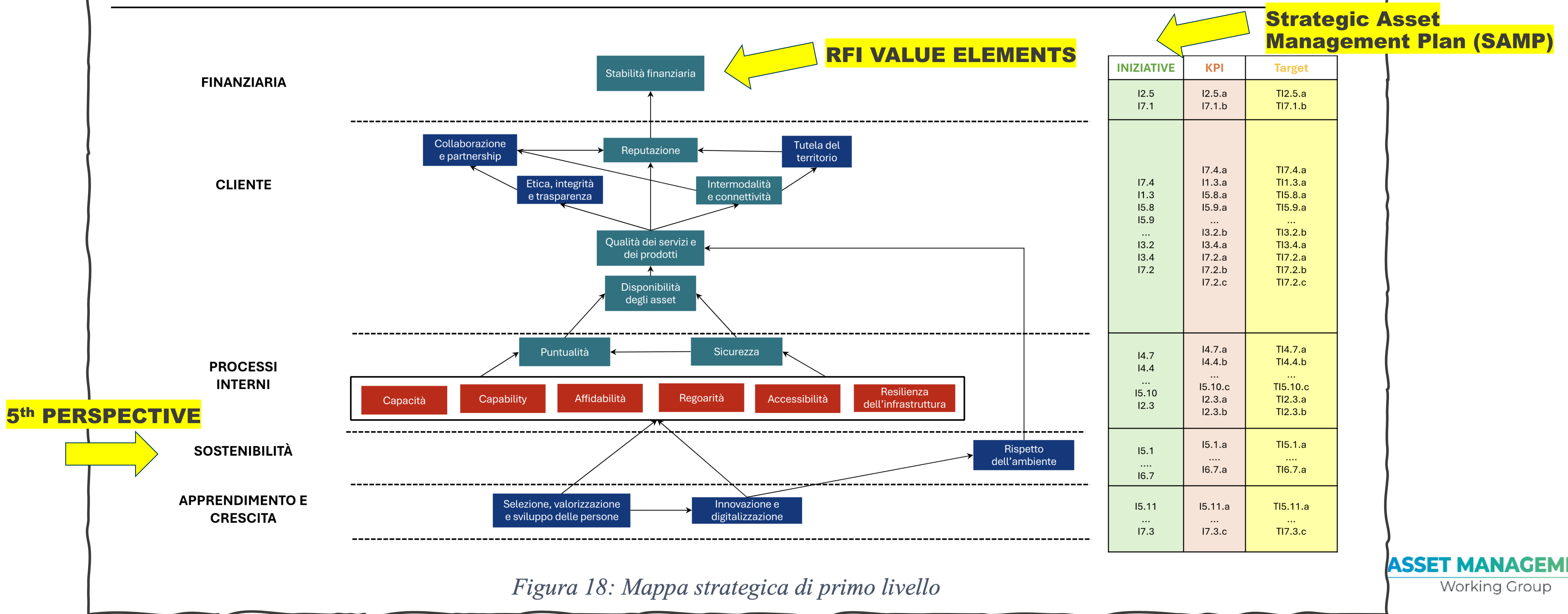
The Practice

Balanced Scorecard: RFI case study



Università
degli Studi
di Palermo

Ingegneria
Palermo Gestionale



Balanced Scorecard: RFI case study



Università
degli Studi
di Palermo

Ingegneria
Palermo Gestionale

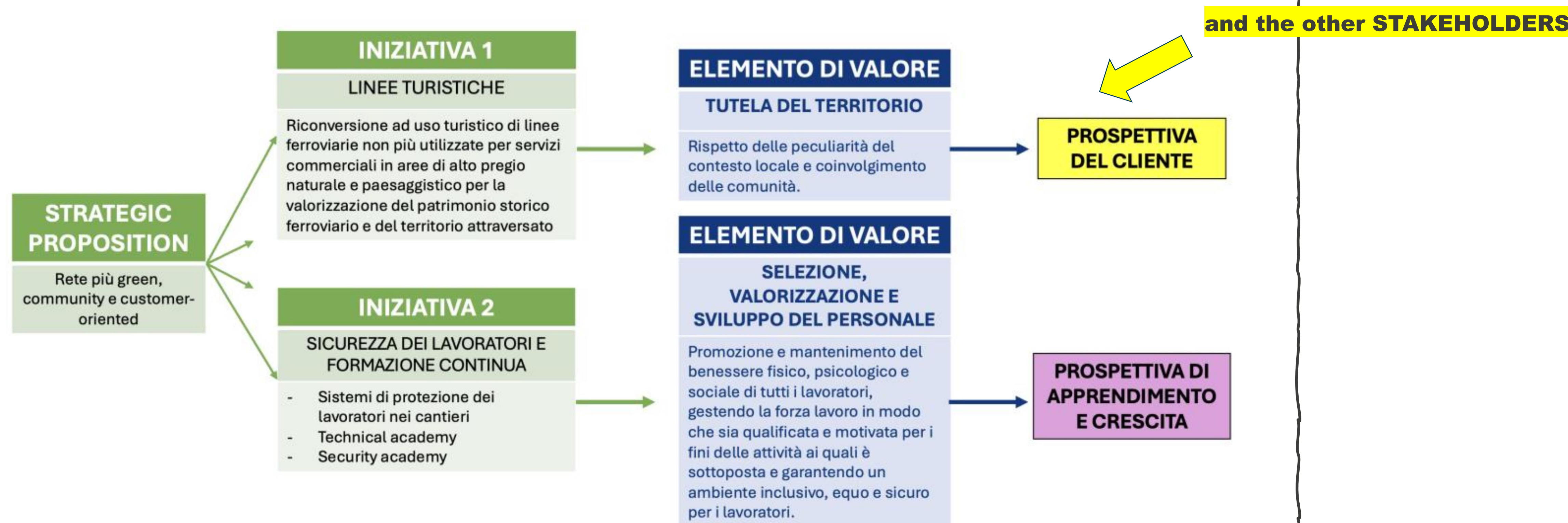


Figura 17: Esempio di associazione Iniziativa-Elemento di Valore

Balanced Scorecard: RFI case study (advanced)



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degli Studi
di Palermo

Ingegneria
Palermo Gestionale



RFI Process Mapping

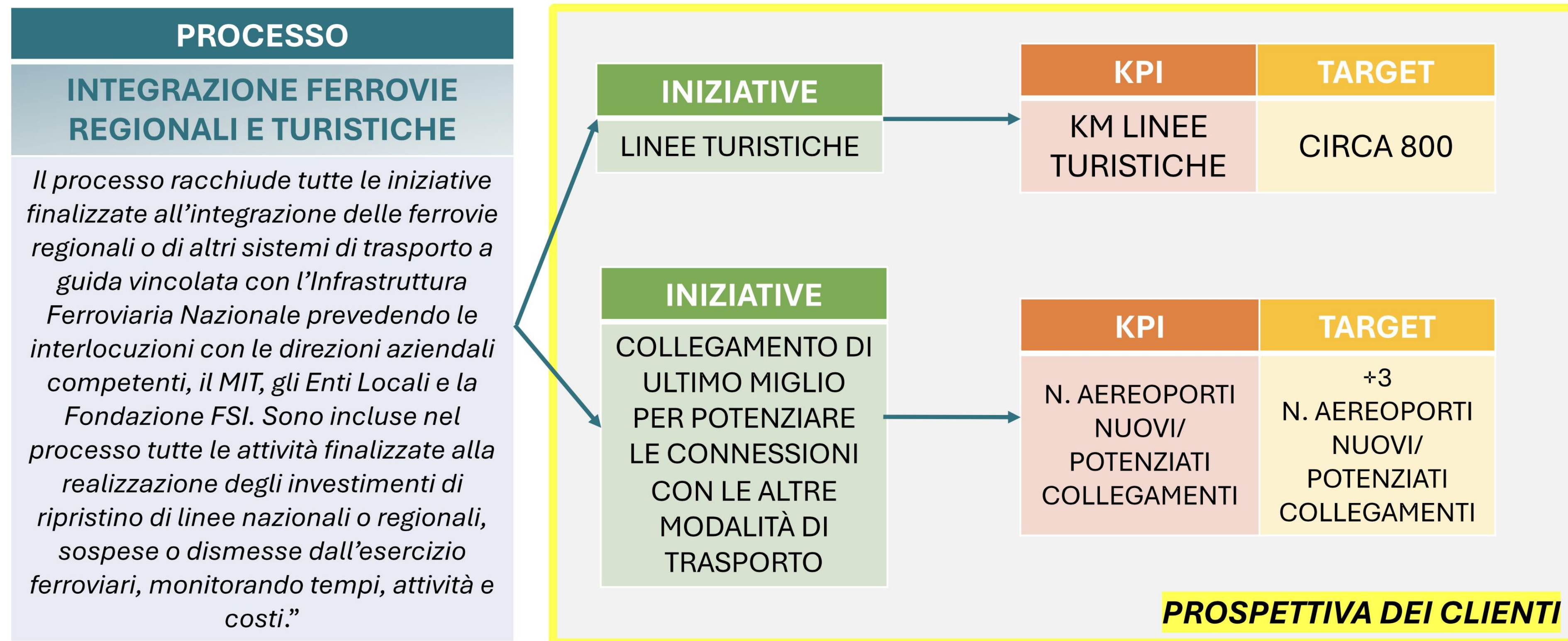
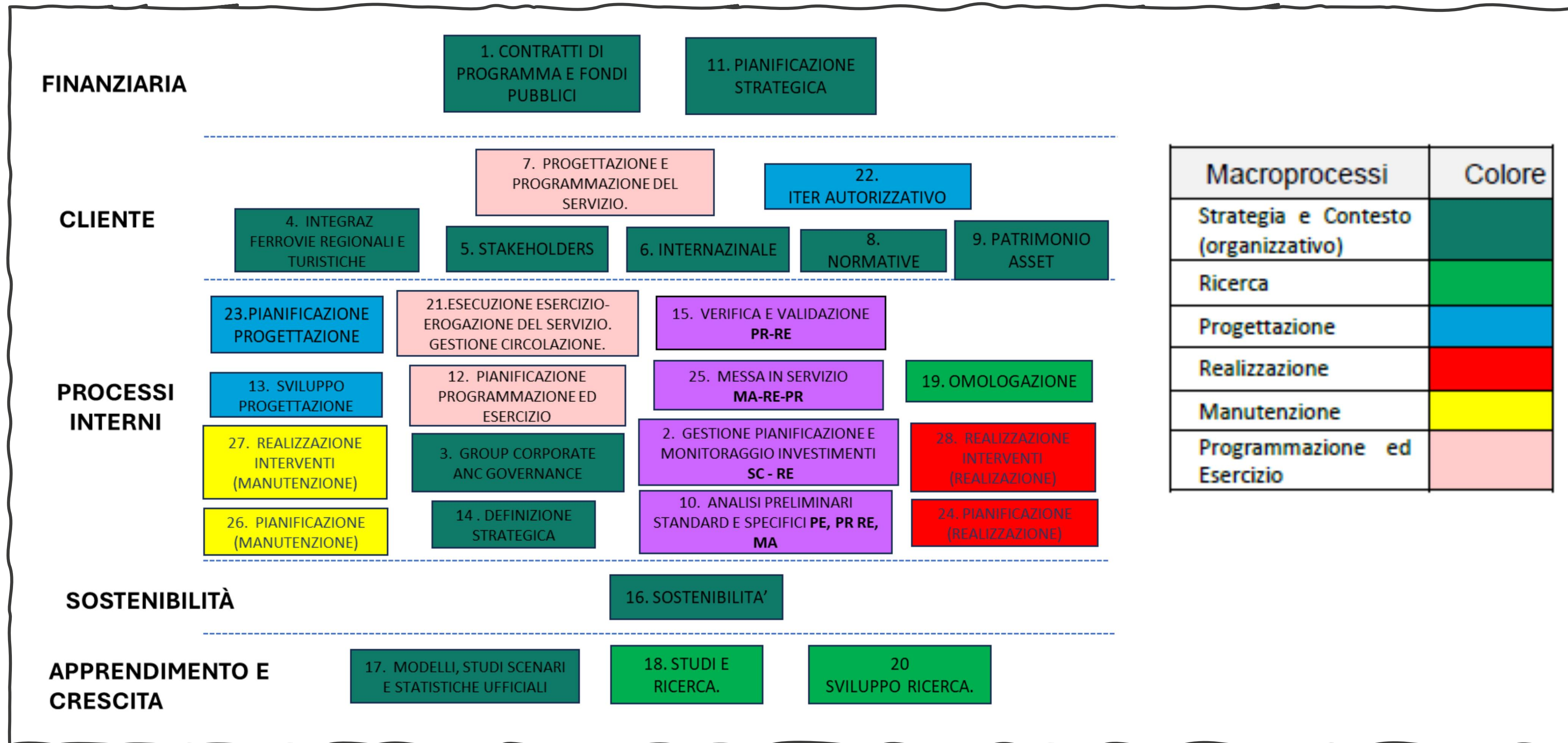


Figura 19: Associazione Processi di secondo livello alle iniziative di primo livello

Balanced Scorecard: RFI case study (advanced)



Balanced Scorecard: RFI case study (advanced)

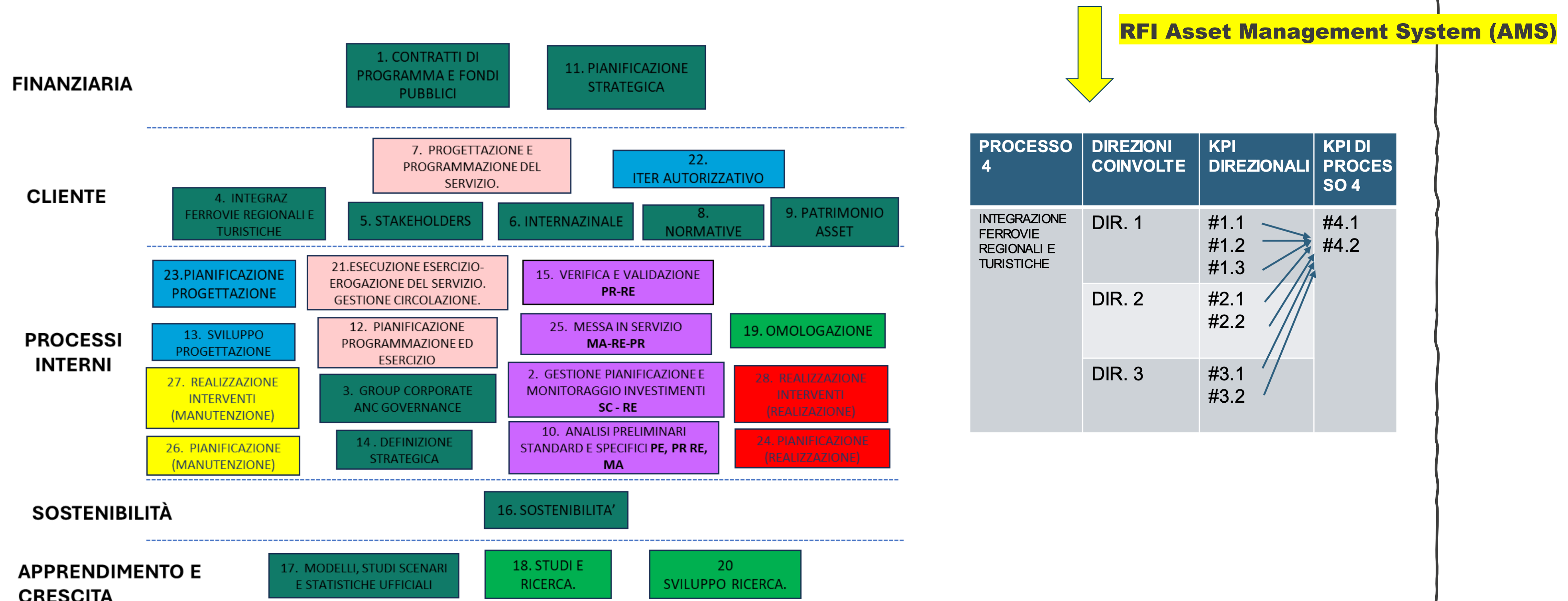
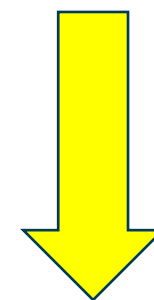


Figura 24: Identificazione KPI di processo

Balanced Scorecard in RFI: lesson learned

- performance measurement system VS performance management system
- Avoid too many indicators
- the process of implementing/adapting the Balanced Scorecard in your company is a valuable exercise



Asset Management as a Business Development Process

Session 2: Strategy and Performance Q&A



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THANK YOU FOR YOUR ATTENTION

Manfredi Bruccoleri
manfredi.bruccoleri@unipa.it

ASSET MANAGEMENT
Working Group



INTERNATIONAL UNION
OF RAILWAYS

Asset Management Seminar

Pietrarsa, Naples – 2 October 2025

SELF-FINANCING OF ASSET MANAGEMENT

Celso de Azevedo

SELF-FINANCING OF ASSET MANAGEMENT

2nd generation of decision-making support

Celso de Azevedo, Ph.D., FIAM

Founder & CEO ASSETSMAN

IAM Examination Board Member

Founder & Director of IFRAMI-GFMAM

Chair of French National ISO 55000 Committee

Celso de Azevedo



- **Founder and CEO of ASSETSMAN**
- **Engineer, MSC. and Ph.D. in Asset Management – Université de Paris – Sorbonne**
- **Official ISO 55001 certifier**
- **Chairman of the National Asset Management Committee of AFNOR – France**
- **Founder and International Director of IFRAMI – Institut Français d'Asset Management**
- **Professor and Pedagogical Manager – “Maintenance & Asset Management” – France, UK and Brazil**
- **Examination Board Member at the IAM Institute of Asset Management – UK (for Certificates & Diplomas)**
- **FIAM Fellow of Institute of Asset Management” - IAM (UK)**
- **Awarded “Knight of the National Order of Merit of the Legion Honor” by the French State**

DECISION MAKING



SUMMARY

Improving value extraction from assets through self-financing in asset management:

- Usual budget approaches
- Distinction of Useful life and Mature life of assets
- Cross funding of trade off scenarios in the decision-making process
- The 2nd generation of decision-making method in Asset Management
 - Opex savings for Useful life assets
 - Capex savings for Mature assets
- Conclusions

ORIGINAL APPROACH

THE LIVES OF ASSETS



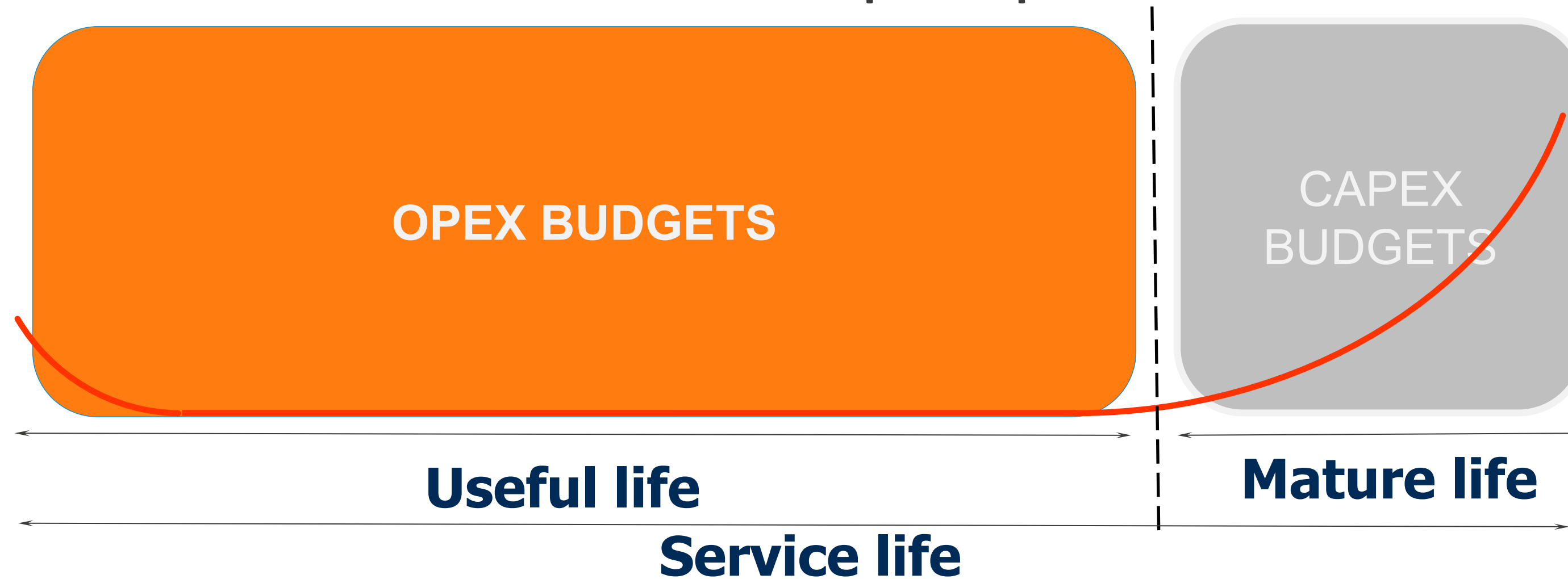
Current assumptions:

- We finance O&M in OPEX until the asset collapses
- We abusively model O&M with Weibull's Law by mixing populations in search of an “As Good As New” scenario thanks to the maintenance
- We do not anticipate Capex Sustaining needs and increase “Gray Debt” (Capex Backlog)

ORIGINAL APPROACH

THE LIVES OF ASSETS

... become more innovative when we separate phases

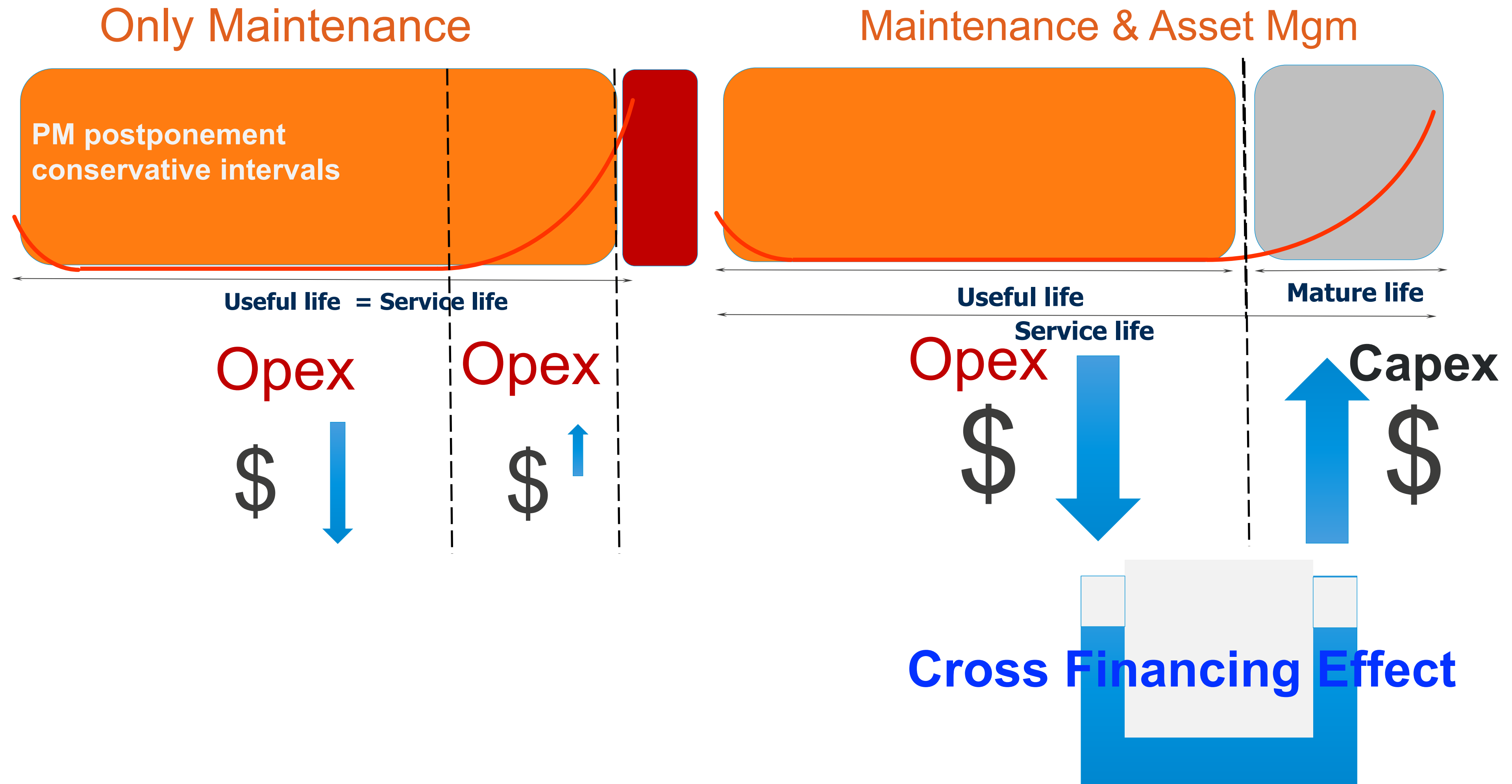


Original assumptions for self-financing:

- We classify assets into Useful Life and Mature Life
- We finance O&M in OPEX until the end of its Useful Life (and moderately in mature life)
- We finance the Mature Life phase with CAPEX for Replacement of the asset at the optimal time
- We avoid “Gray Debt” penalties (Capex Backlog)

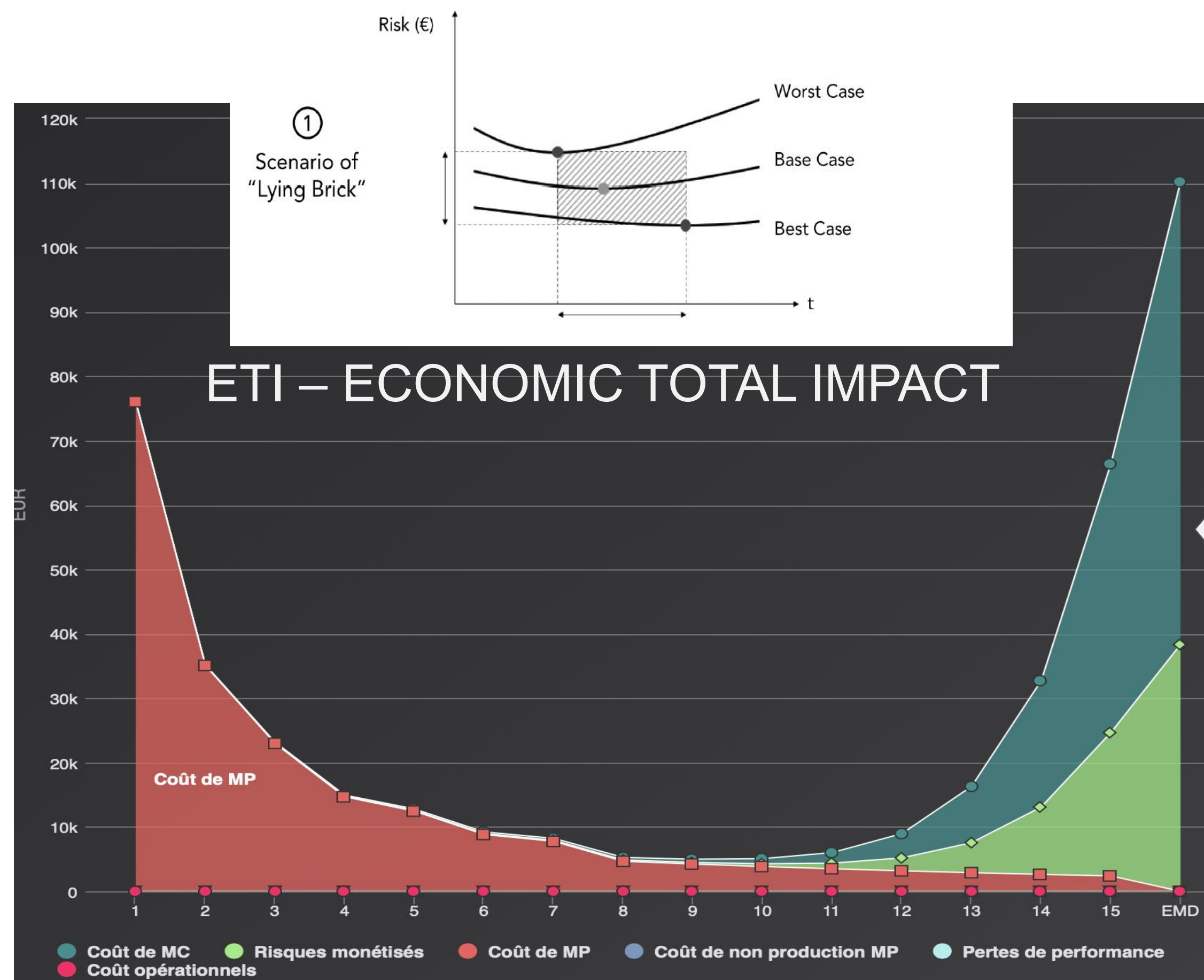
ORIGINAL APPROACH

THE LIVES OF ASSETS

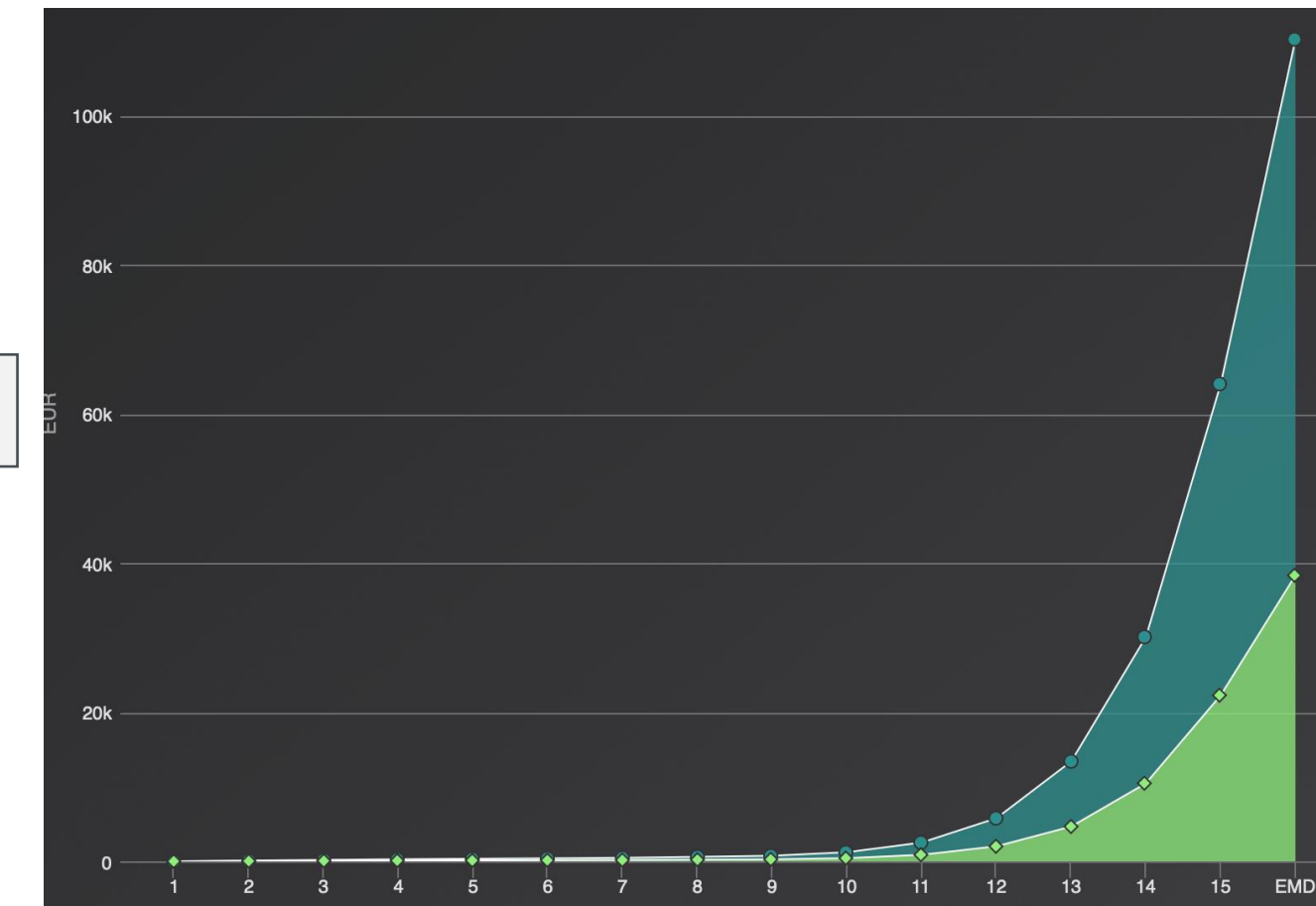


COST/RISK TRADE OFF MODEL FOR OPEX PM TASKS

Identify economically insensitive tasks

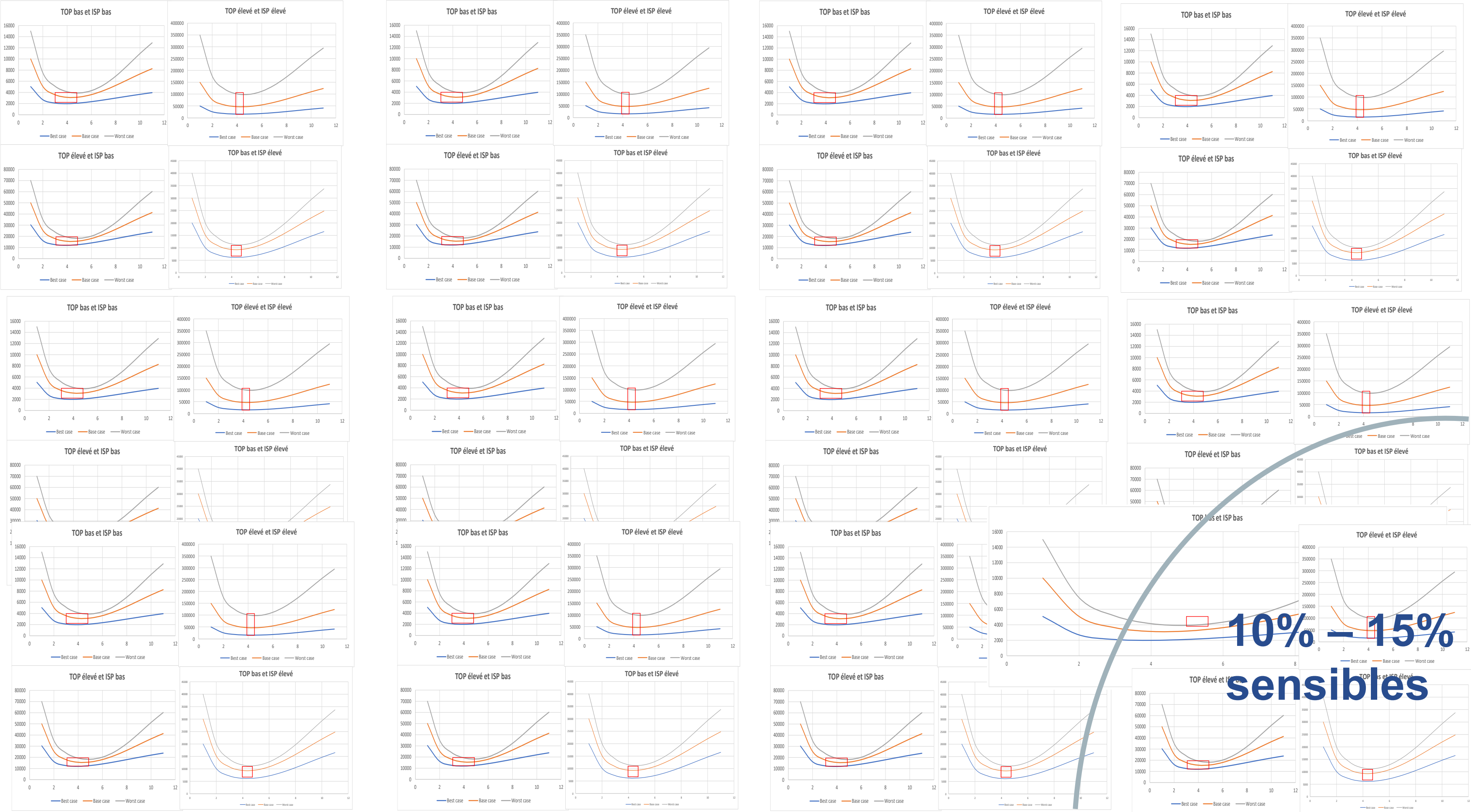


TAKING TO ACCOUNT THE
RISK MONETIZATION
OF NON-DECISION



COST SENSITIVITIES OF OPEX PM TASKS

Identify economically insensitive tasks



REVIEW OF THE PORT RAILS ASSET STRATEGY

ROUTE / AREA	Σ Δ TBI [R\$/week]				
	Level 1	Level 2	Level 3	Level 4	TOTAL
	≥ -1.000	< -1.000 e ≥ -5.000	< -5.000 e ≥ -10.000	> -10.000	
Route Bauxite A	-5.426	-5.459	0	-32.922	-43.807
Route Bauxite B + MHC-1	-3.942	-6.030	0	-105.894	-115.866
Ship loader 2 + Route 87A	-3.271	-43.076	-16.536	-112.277	-175.160
Ship loader 3 + Route 87D	-3.475	-29.221	-57.640	-265.772	-356.108
Area 12	-15.881	-17.508	0	-135.029	-168.418
Area 15	-1.934	0	0	-105.934	-107.868
Area 49	-22857	0	-6776	-151.691	-181.324
Area - Bauxite storage 1A_1B	-4.161	-56.355	0	-200.128	-260.644
Area 88 - NaOH unload	-1765	0	0	0	1.765
TOTAL	-62.712	-157.649	-80.952	-1.109.647	-1.410.960
%	4	11	6	79	100

ROUTE / AREA	Number of activities				
	Level 1	Level 2	Level 3	Level 4	TOTAL
Route Bauxite A	15	4	0	1	20
Route Bauxite B + MHC-1	13	4	0	4	21
Ship loader 2 + Route 87A	27	13	2	6	48
Ship loader 3 + Route 87D	34	8	10	5	57
Area 12	207	9	0	8	224
Area 15	22	0	0	6	28
Area 49	224	0	1	5	230
Area - Bauxite storage 1A_1B	89	15	0	8	112
Area 88 - NaOH unload	38	0	0	0	38
TOTAL	669	53	13	43	778
%	86	7	2	6	100

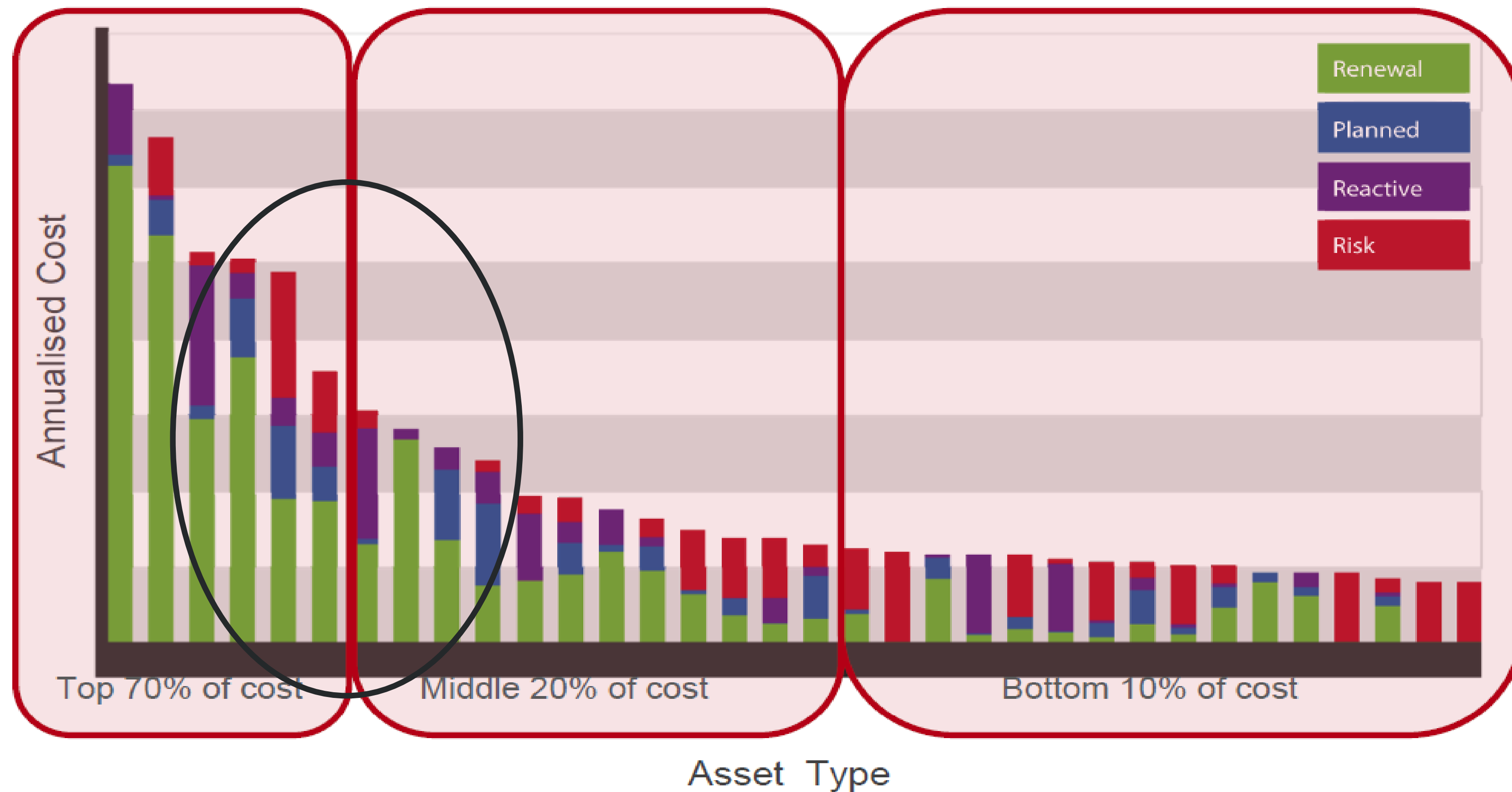
ASSETS IN USEFUL LIFE PHASE

- **The decision-making scenarios based on the trade off risk/cost approach surprise intuition:**
- **The monetization of risks opens up a multitude of new decision scenarios**
- **A large proportion of PM tasks are insensitive economically with the PM intervals**
- **The amount of identified savings is very expressive**

END OF LIFE ASSET MANAGEMENT

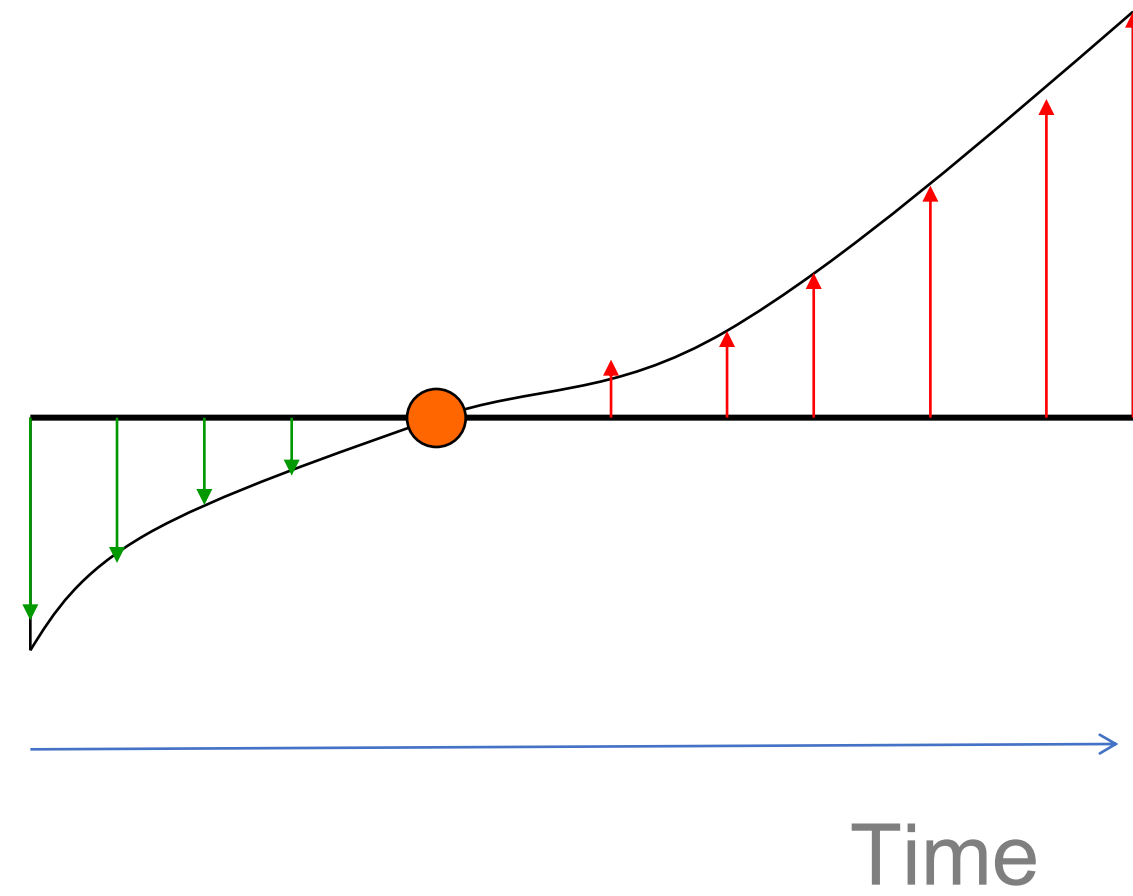
The proportion of end-of-life assets is growing

Criticality-based Ranking

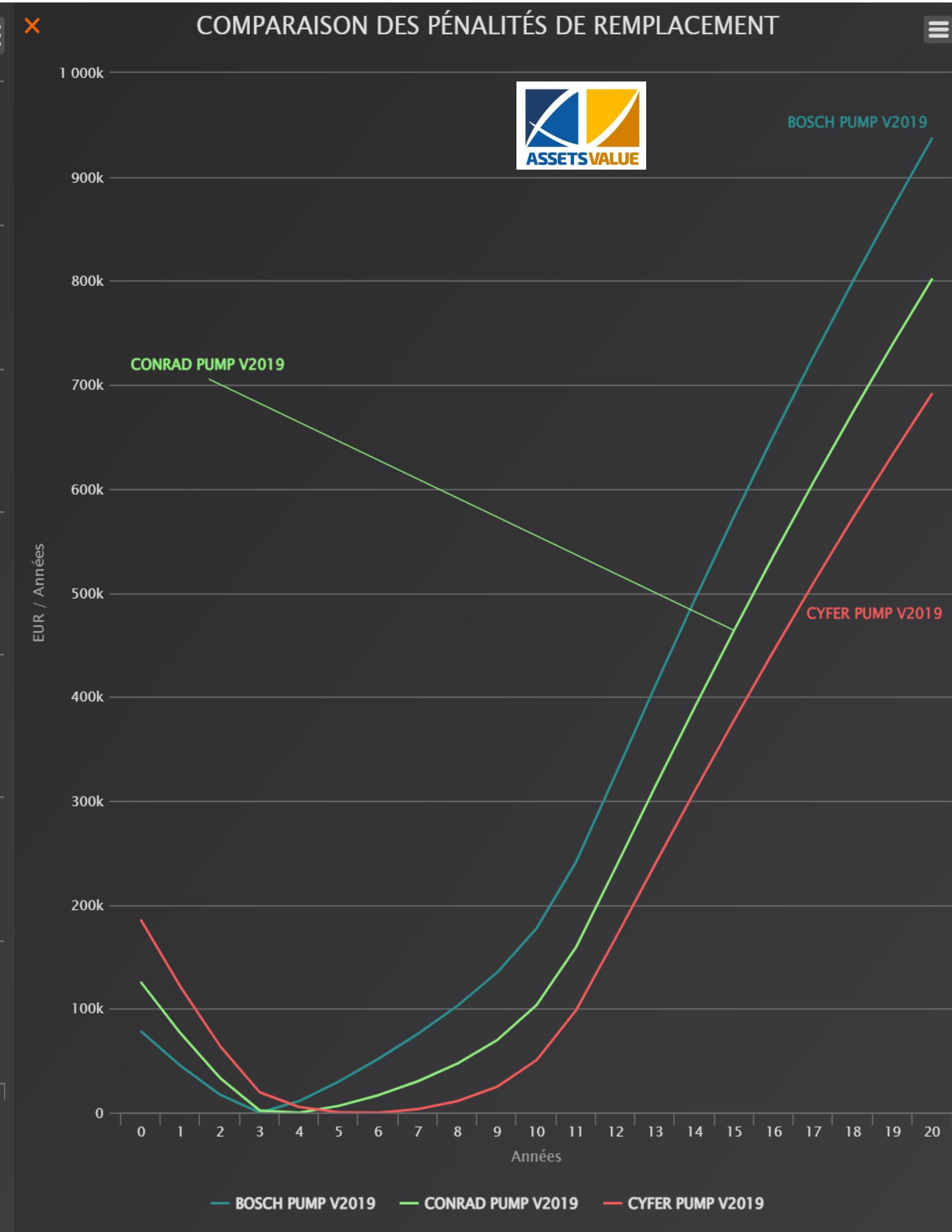
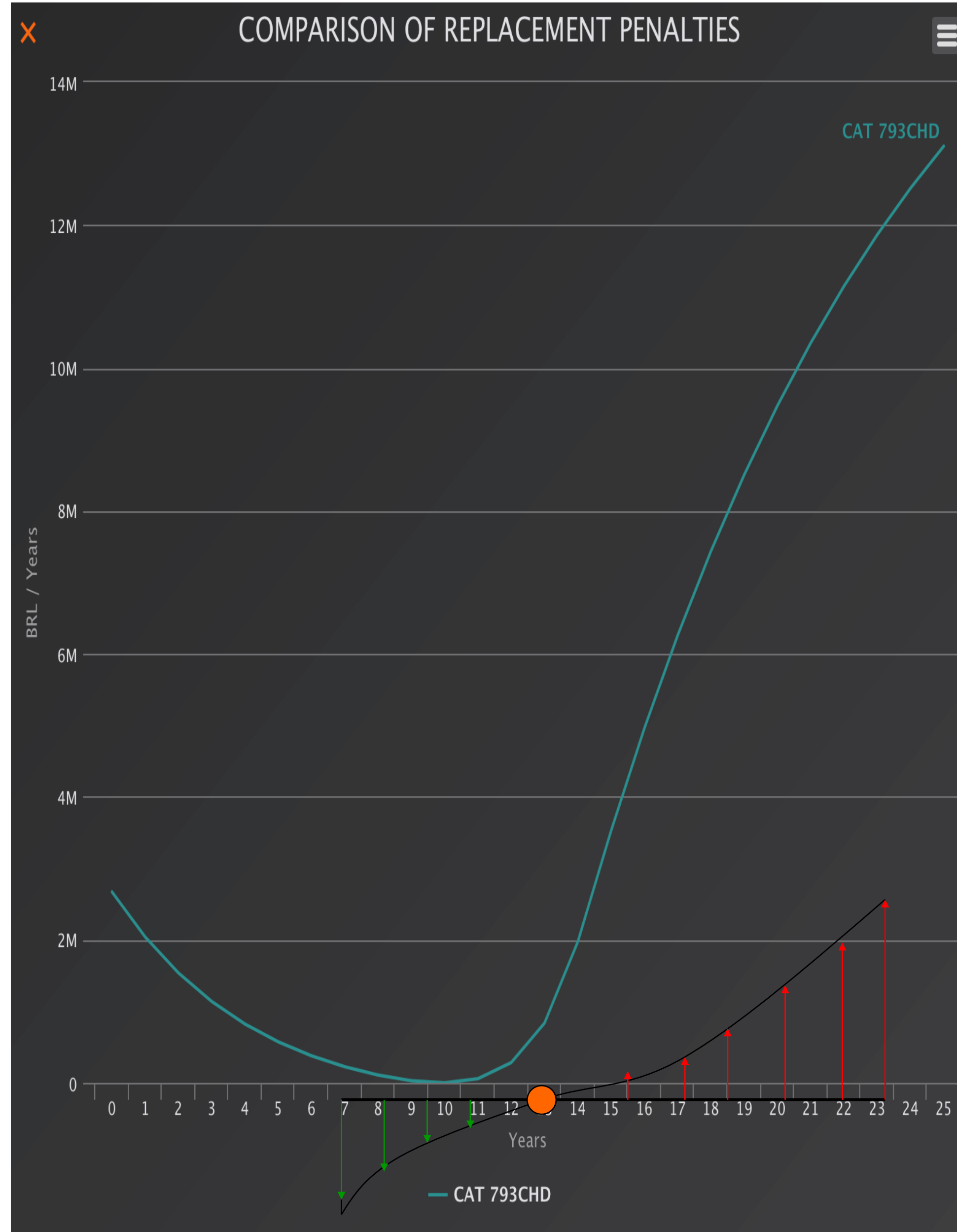


Source : IAM

Principle of the algorithm for determining the optimal moment of replacement



OPTIMUM MOMENT OF REPLACEMENT



ASSETS IN MATURE LIFE PHASE

- The decision-making scenarios based on the trade off Capex/Opex approach surprise intuition as well
- The optimal moment of replacement comes from the LCC of the future assets
- Assets replaced in arrears at the optimal time have an economic impact on companies at a rate greater than 20%/year of Capex!
"Bow wave effect"



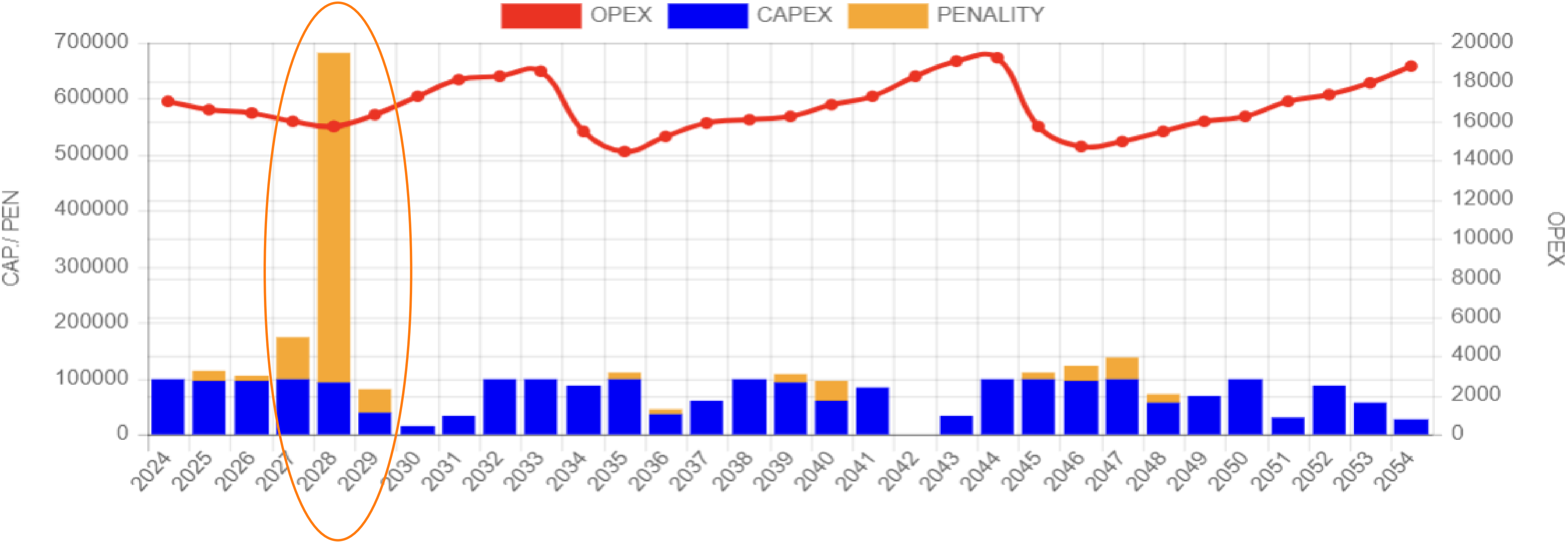
PROOF OF CONCEPT

Among the tests carried out, the POC (Proof Of Concept) that we selected with the best results is the following:

- **A capital-intensive rail system with 2,800 assets**
- **With 3,896 PM Tasks for its Asset Base**
- **From which we selected 216 assets considered “core business”,**
- **and their corresponding 318 PM Tasks**
- **and a Capex Budget of 100,000 Euros/year**

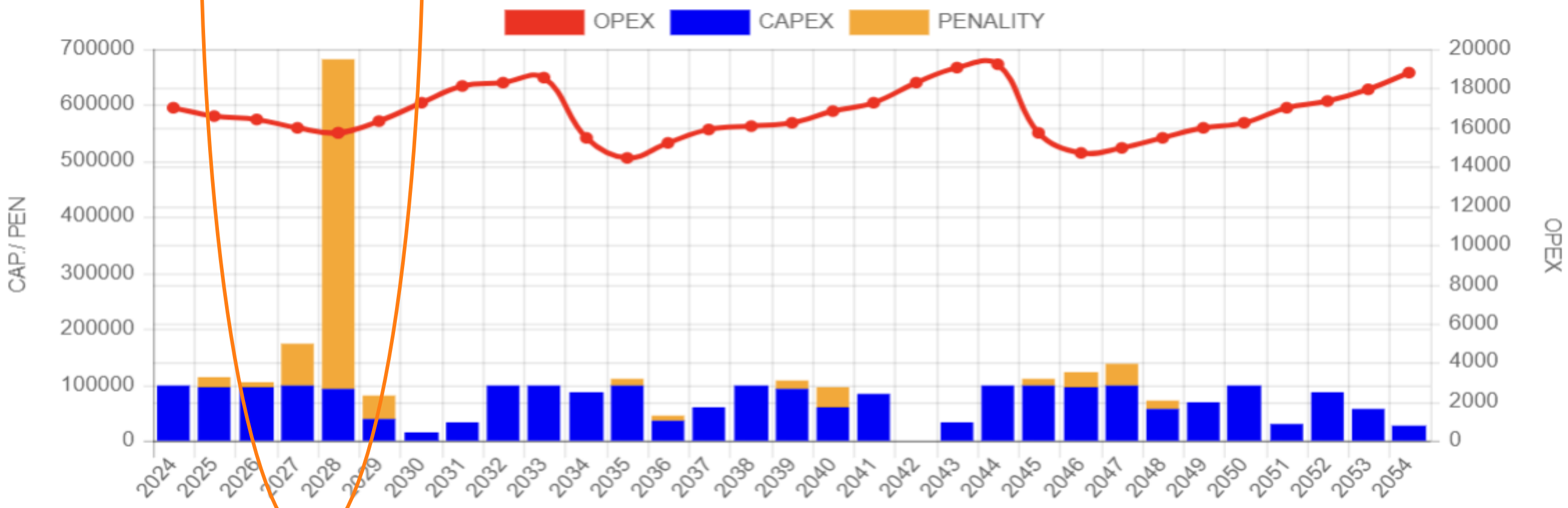
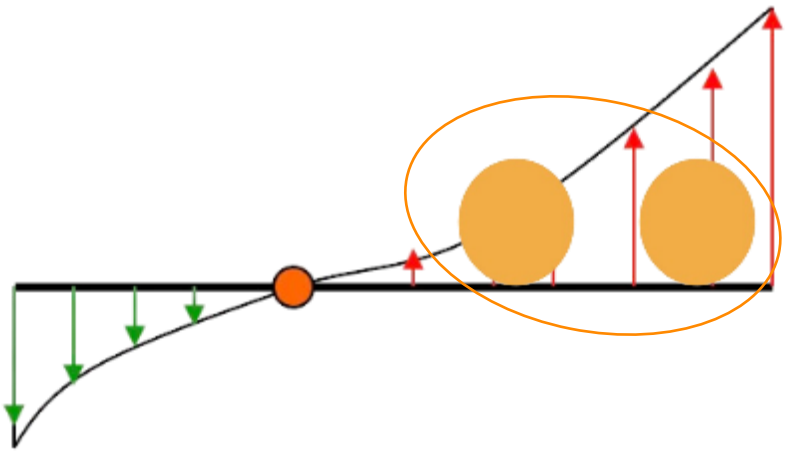
1st STEP:
ESTIMATION OF PENALTIES FROM CAPEX DELAY
(« GRAY DEBT »)

With a Capex Budget restriction of 100,000 Euros/year, we have:



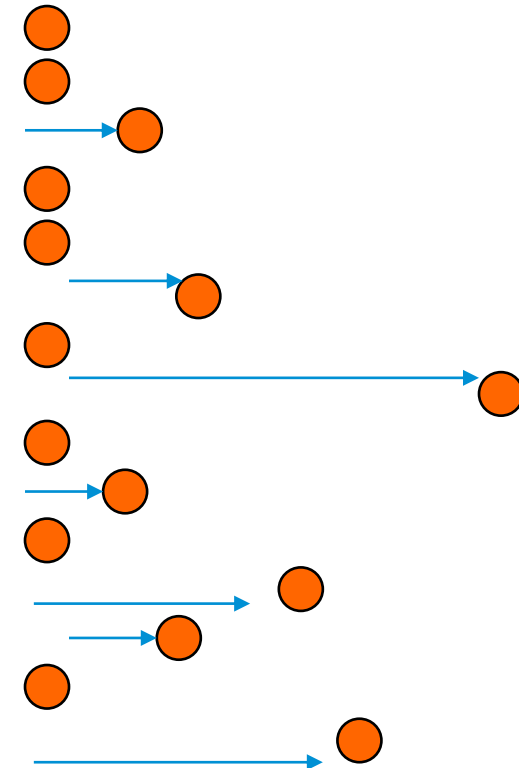
GENERATION OF PENALTIES UNDER BUDGET CONSTRAINTS

22PP-08(Pompe)	22PP-08(Pompe)	6	10K	3.1K 188	881 200	0 213	7.6K 88	48.9K 100	185.5K 113	363.6K 125	536.5K 138	704.1K 150	0 88	7.6K 100	48.9K 113	185.5K 125	363.6K 138	536.5K 150	0 163
22VAR-04(Variateur de vitesse)	22VAR-04(Variateur de vitesse)	6	4K	1.4K 74	532 80	0 86	1.8K 91	12.6K 34	49K 40	96.6K 46	142.8K 51	187.6K 57	231K 63	0 69	1.8K 34	12.6K 40	49K 46	96.6K 51	142.8K 57
22ON-04(Onduleurs)	22ON-04(Onduleurs)	6	15K	5.4K 279	1.9K 300	0 129	8.1K 150	55.8K 171	215K 193	423K 214	624.9K 236	0 129	8.1K 150	55.8K 171	215K 193	423K 214	624.9K 236	0 129	8.1K 150
22AG-04(Agitateur)	22AG-04(Agitateur)	9	7K	0 145	42 151	3K 65	9.9K 70	21.5K 75	33.2K 81	60.2K 86	87.5K 92	119.9K 97	156.8K 102	197K 108	0 113	42 65	3K 70	9.9K 75	21.5K 81



Grey Dept for Capex Budget of 100,000 Euros/year
721,600 Euros in few years

Global costs of the strategy at 100,000 Euros/year
3.7 Millions Euros over 30y



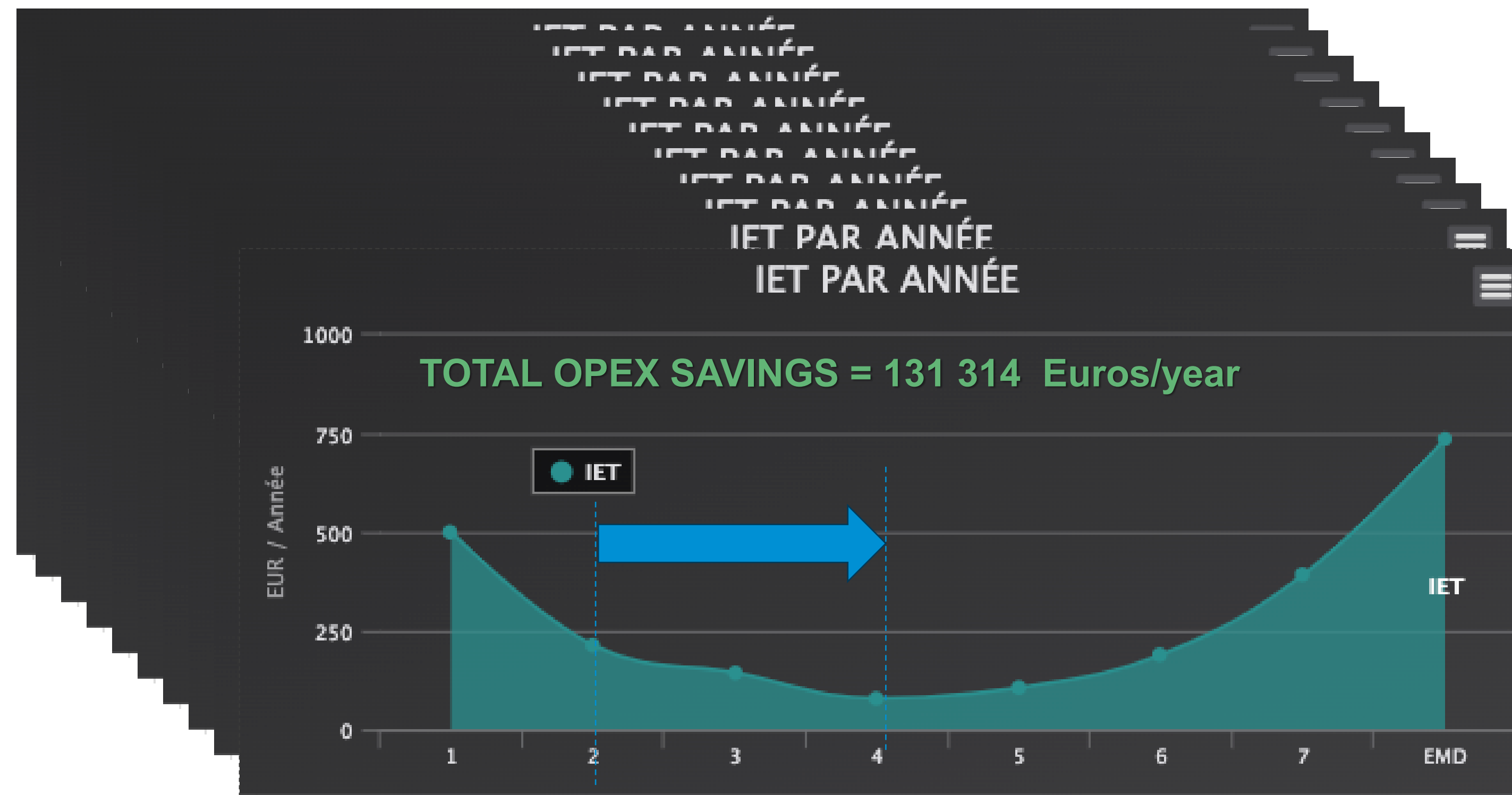
Ideal Scenario

Real Scenario

22PP-08(Pompe)		22PP-08(Pompe)		6	10K	3.1K 188	881 200	0 213	7.6K 88	49.9K 100	185.5K 113	363.6K 125	536.5K 138	704.1K 150	0 88	7.6K 100	48.9K 113	185.5K 125	363.6K 138	536.5K 150	0 163
22VAR-04(Variateur de vitesse)		22VAR-04(Variateur de vitesse)		6	4K	1.4K 74	532 80	0 86	1.8K 91	12.6K 34	49K 40	96.6K 46	142.8K 51	187.6K 57	231K 63	0 69	1.8K 34	12.6K 40	49K 46	96.6K 51	142.8K 57
22ON-04(Onduleurs)		22ON-04(Onduleurs)		6	15K	5.4K 279	1.9K 300	0 129	8.1K 150	55.8K 171	215K 193	423K 214	624.9K 236	0 129	8.1K 150	55.8K 171	215K 193	423K 214	624.9K 236	0 129	8.1K 150
22AG-04(Agitateur)		22AG-04(Agitateur)		9	7K	0 145	42 151	3K 65	9.9K 70	21.5K 75	38.2K 81	60.2K 86	87.5K 92	119.9K 97	156.8K 102	197K 108	0 113	42 65	3K 70	9.9K 75	21.5K 81
22MV-04(Vanne de sectionnement)		22MV-04(Vanne de sectionnement)		9	3K	421 58	0 60	478 62	73K 64	39.7K 28	144.5K 30	280.8K 32	413.1K 34	541.3K 35	665.4K 37	785.3K 39	0.9M 41	1M 42	0 28	478 30	73K 32
22ZV-04(Capteurs de vibration turbine)		22ZV-04(Capteurs de vibration turbine)		6	6K	1.5K 113	190 120	0 127	7.1K 133	43.2K 53	161.6K 60	315.8K 67	465.4K 73	610.4K 80	750.8K 87	0 53	7.1K 60	43.2K 67	161.6K 73	315.8K 80	465.4K 87
22CH-04(Brûleur Chaudière)		22CH-04(Brûleur Chaudière)		5	4K	0 84	2.3K 36	12.5K 40	33.3K 44	66.6K 47	113.6K 51	0 36	2.3K 40	12.5K 44	33.3K 47	66.6K 51	0 55	2.3K 36	12.5K 40	33.3K 44	66.6K 47
22RG-04(Système de régulation Turbine)		22RG-04(Système de régulation Turbine)		3	10K	120 225	0 75	9.9K 100	33.4K 125	0 150	9.9K 75	33.4K 100	72.9K 125	0 75	9.9K 100	33.4K 125	0 75	9.9K 100	33.4K 125	0 75	9.9K 100
				Années(s)		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
						0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
				CAPEX (K€an)		100K	95K	96K	100K	93K	40K	16K	32K	100K	100K	87K	100K	37K	59K	100K	94K
				PÉNALITÉS		0	18.7K	10.1K	75.1K	589.7K	39.8K	0	0	0	0	0	12.3K	9.5K	0	0	14K
				OPEX		17K	16.6K	16.4K	16K	15.8K	16.4K	17.3K	18.1K	18.3K	18.5K	15.5K	14.5K	15.2K	15.9K	16.1K	16.3K
				CAPEX + PÉNALITÉS		100K	113.7K	106.1K	175.1K	682.7K	79.8K	16K	32K	100K	100K	87K	112.3K	46.5K	59K	100K	108K
				CAPEX + PÉNALITÉS + OPEX		117K	130.3K	122.5K	191.1K	698.5K	96.1K	33.3K	50.1K	118.3K	118.5K	102.5K	126.6K	61.7K	74.9K	116.1K	124K
				CÔÛT SUR 30 ANS		3.7M															

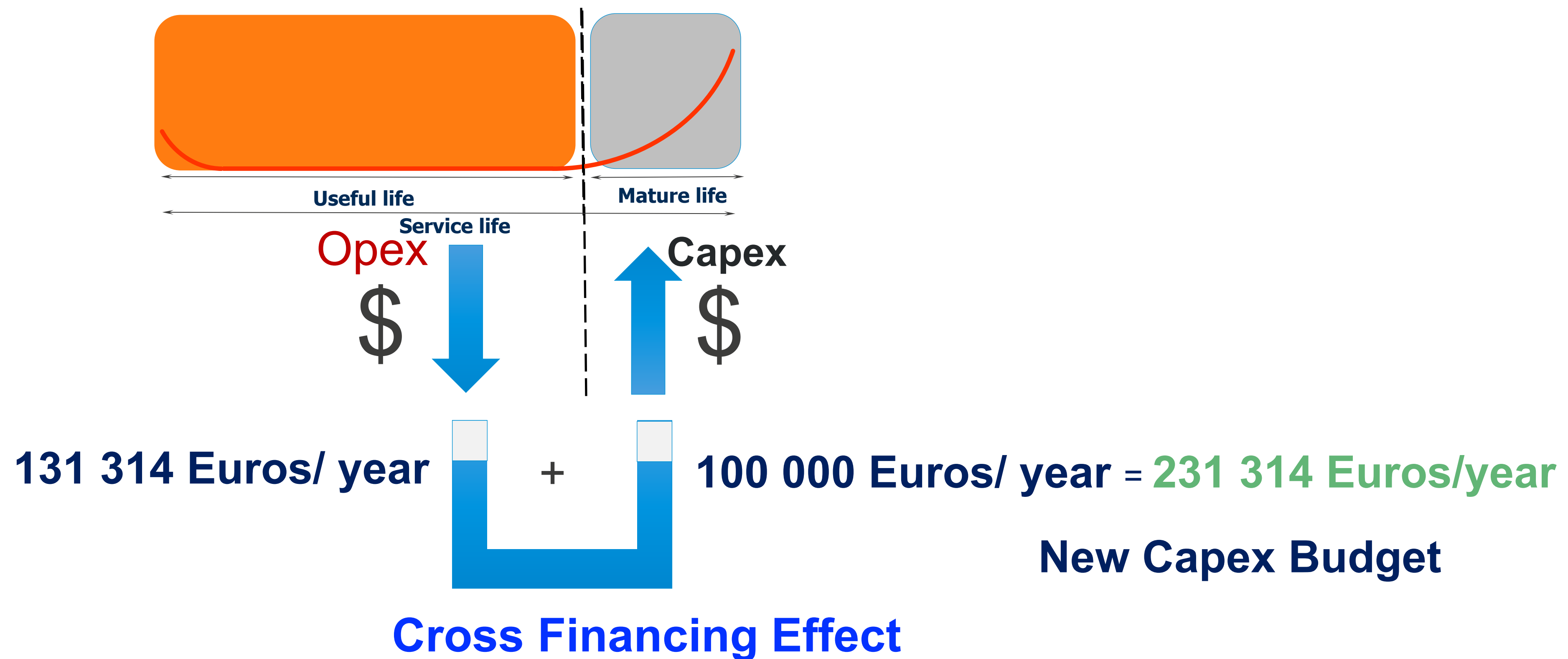
2nd STEP: OPEX SAVINGS FROM PM MAINTENANCE TASKS POSTPONED

Increased PM intervals over **318 PM tasks** due to low elasticities between periodicities and their economic impact



3th STEP: AMONT OF CROSS FUNDING EFFECT

Maintenance & Asset Management



FINAL STEP: SELF-FINANCING RESULTS

NEW CAPEX BUDGET

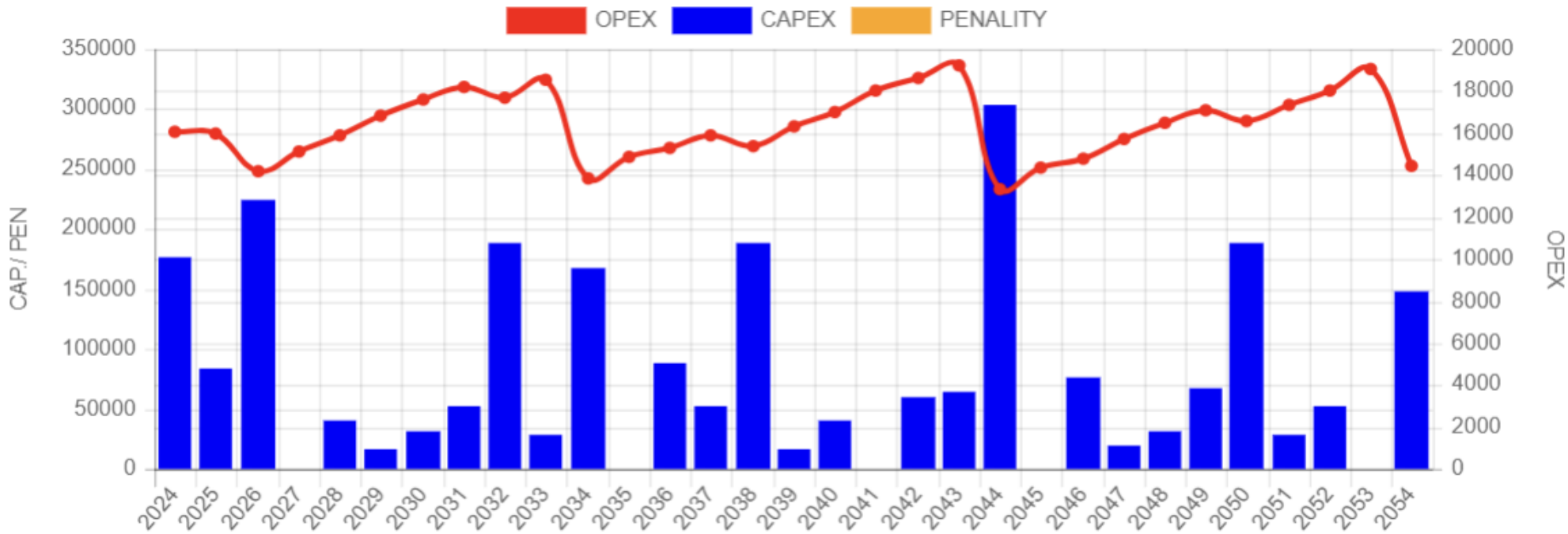
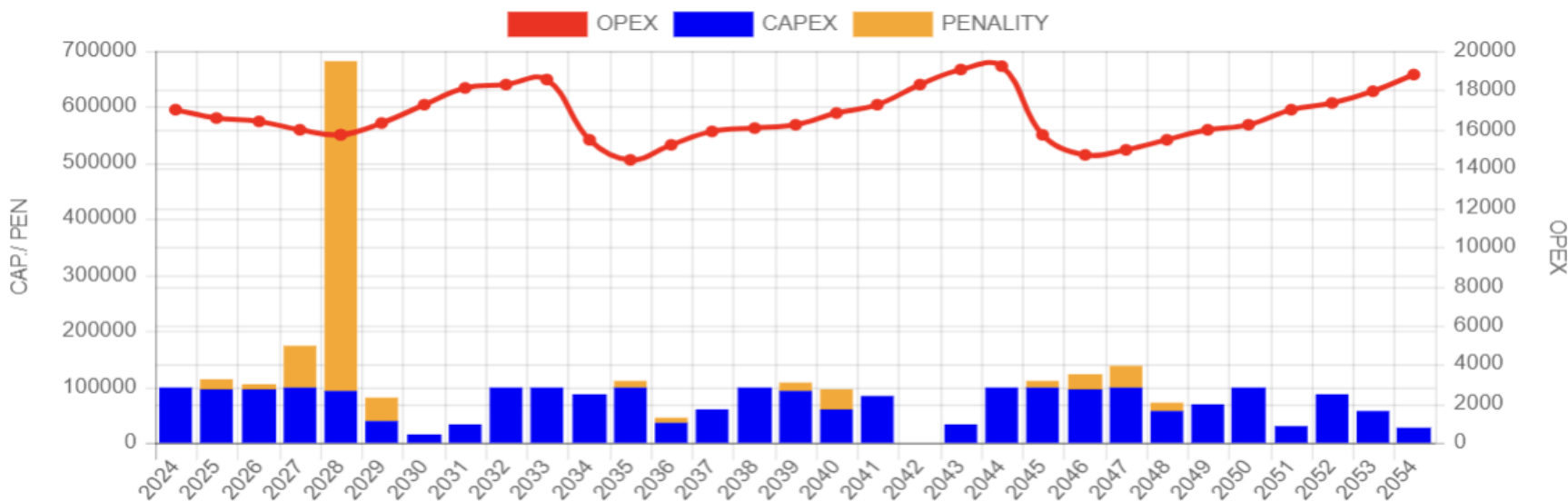
131,314 + 100,000 = 231 314 €/year

NEW GREY DEPT = « ZERO »

Global cost of the strategy at 231,314 Euros/year
2.9 Millions Euros in few years

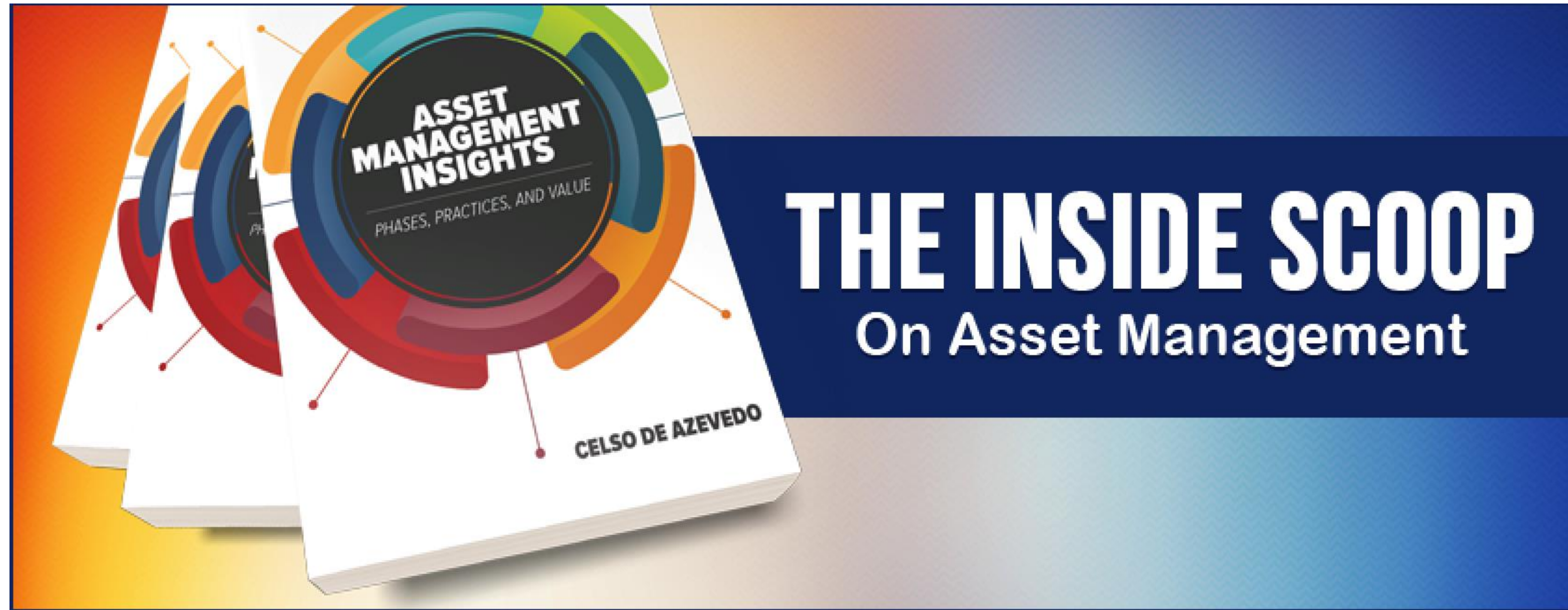
= 800,000 Euros in
Loss of earning avoided

22PP-08(Pompe)	22PP-08(Pompe)	6	10K	3.1K 188	881 200	0 88	7.6K 100	48.9K 113	185.5K 125	363.6K 138	536.5K 150	0 88	7.6K 100	48.9K 113	185.5K 125	363.6K 138	536.5K 150	0 88	7.6K 100
22VAR-04(Variateur de vitesse)	22VAR-04(Variateur de vitesse)	6	4K	1.4K 74	532 80	0 34	1.8K 40	12.6K 46	49K 51	96.6K 57	142.8K 63	0 34	1.8K 40	12.6K 46	49K 51	96.6K 57	142.8K 63	0 34	1.8K 40
22ON-04(Onduleurs)	22ON-04(Onduleurs)	6	15K	5.4K 279	1.9K 300	0 129	8.1K 150	55.8K 171	215K 193	423K 214	624.9K 236	0 129	8.1K 150	55.8K 171	215K 193	423K 214	624.9K 236	0 129	8.1K 150
22AG-04(Agitateur)	22AG-04(Agitateur)	9	7K	0 65	42 70	3K 75	9.9K 81	21.5K 86	38.2K 92	60.2K 97	87.5K 102	119.9K 108	0 65	42 70	3K 75	9.9K 81	21.5K 86	38.2K 92	60.2K 97
22MV-04(Vanne de sectionnement)	22MV-04(Vanne de sectionnement)	9	3K	421 58	0 28	478 30	7.3K 32	39.7K 34	144.5K 35	280.8K 37	413.1K 39	541.3K 41	665.4K 42	0 28	478 30	7.3K 32	39.7K 34	144.5K 35	280.8K 37
22ZV-04(Capteurs de vibration turbine)	22ZV-04(Capteurs de vibration turbine)	6	6K	1.5K 113	190 120	0 53	7.1K 60	43.2K 67	161.6K 73	315.8K 80	465.4K 87	0 53	7.1K 60	43.2K 67	161.6K 73	315.8K 80	465.4K 87	0 53	7.1K 60
22CH-04(Bruteur Chaudière)	22CH-04(Bruteur Chaudière)	5	4K	0 36	2.3K 40	12.5K 44	33.3K 47	66.6K 51	0 36	2.3K 40	12.5K 44	33.3K 47	66.6K 51	0 36	2.3K 40	12.5K 44	33.3K 47	66.6K 51	0 36
22RG-04(Système de régulation Turbine)	22RG-04(Système de régulation Turbine)	3	10K	120 225	0 75	9.9K 100	33.4K 125	0 75	9.9K 100	33.4K 125	0 75	9.9K 100	33.4K 125	0 75	9.9K 100	33.4K 125	0 75	9.9K 100	33.4K 125
			Année(s)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
				0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
			CAPEX (€/an)	176K	84K	224K	0	40K	16K	32K	52K	188K	28K	168K	0	88K	52K	188K	16K
			PÉNALITÉS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			OPEX	16.1K	15.9K	14.2K	15.2K	15.9K	16.8K	17.6K	18.2K	17.7K	18.5K	13.9K	14.9K	15.3K	15.9K	15.4K	16.3K
			CAPEX + PÉNALITÉS	176K	84K	224K	0	40K	16K	32K	52K	188K	28K	168K	0	88K	52K	188K	16K
			CAPEX + PÉNALITÉS + OPEX	192.1K	99.9K	238.2K	15.2K	55.9K	32.8K	49.6K	70.2K	205.7K	46.5K	181.9K	14.9K	103.3K	67.9K	203.4K	32.3K
			COÛT SUR 30 ANS	2.9M															



CONCLUSIONS

- **Maintenance strategies from an Asset Management perspective have seen notable evolutions in approach**
- **The distinction between Useful life and Mature life in the asset life cycle is a success factor in extracting more value from assets (2nd generation of decision-making support in asset management)**
- **The cross-financing effect between Opex and Capex budgets is the result of this distinction, thanks to:**
 - **Tangible savings in O&M phases**
 - **Mitigation of delays in Capex (“Gray Dept”)**



Grazie
Thank you
Merci

cazevedo@assetsman.com

Session 2: Strategy and Performance Q&A



INTERNATIONAL UNION
OF RAILWAYS

THANK YOU FOR YOUR ATTENTION

Celso de Azevedo
cazevedo@assetsman.com

ASSET MANAGEMENT
Working Group



INTERNATIONAL UNION
OF RAILWAYS

Asset Management Seminar

Pietrarsa, Naples – 2 October 2025

From values to actionable strategy

Developing an expandable prognosis approach for strategic asset management based on
a single point of truth

• **Christian Blättler & Alison Cowley**

ASSET MANAGEMENT
Working Group

Aging assets, network expansions, and increased pressure on finances are shared challenges in railway infrastructure asset management

DIFFERENT INFRASTRUCTURE MANAGERS AND OUR CONTRIBUTIONS

SHARED CHALLENGES

Austria, ÖBB-Infrastruktur

Germany, DB InfraGO

Norway, Bane NOR

Switzerland, SBB Infrastruktur

- Supporting condition reporting, needs forecasting and cost/target simulation for 10+ years
- Introduced network condition evaluation and prognosis
- Helped secure 40 bn EUR investment programme

- Introduced data driven strategic asset management
- Contributed to 50% increase in TOTEX

- Supported network condition reporting and strategic asset management for 10+ years

Aging assets – Rising costs
 Infrastructure is aging, major assets are increasingly approaching renewal age. At the same time, cost are increasing.

Expanding networks and more traffic – More to Maintain
 Growth supports mobility and sustainability but increases long-term obligations-

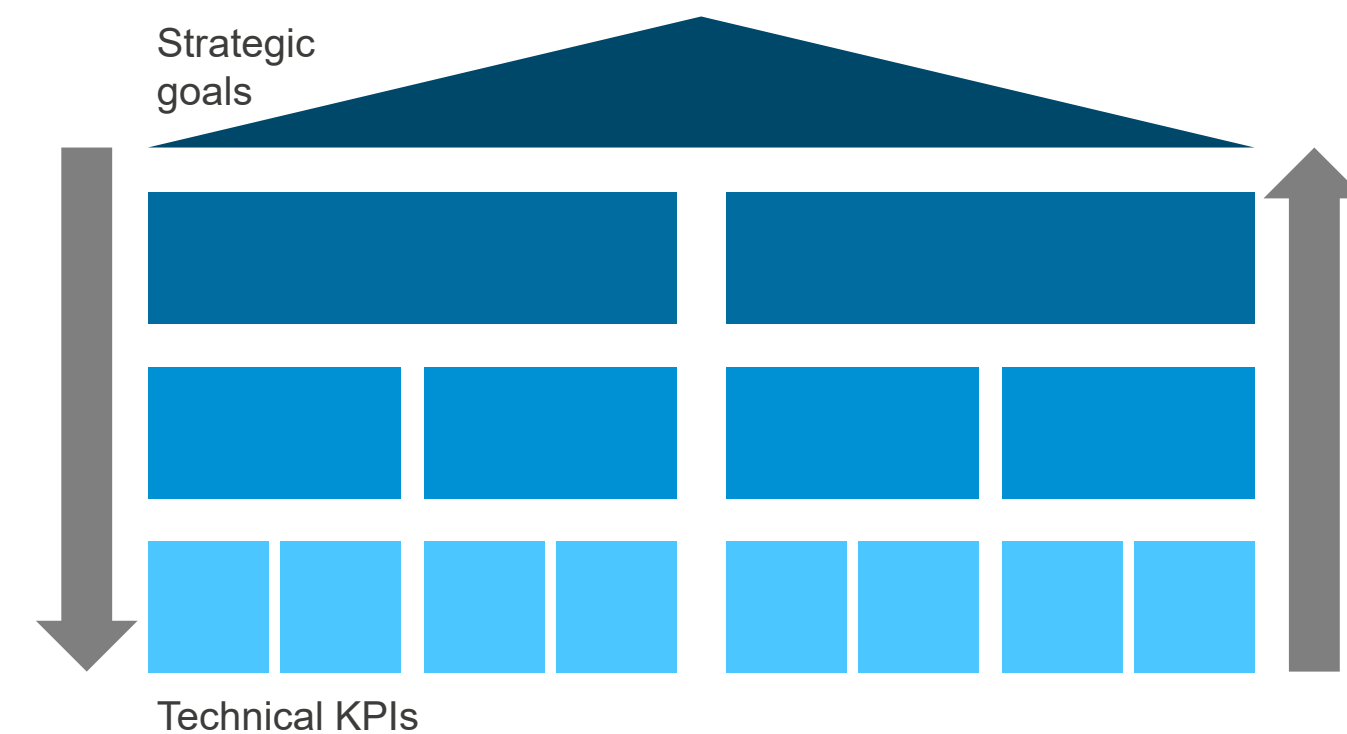
Funding pressure and allocation decisions
 Funding for renewal and maintenance is under pressure. More transparency, evidence-based argumentation as well as target-focused actions are required-

Using a transparent, data driven approach with full drill-down capability to assets and needs drivers and tangible “what-if” scenarios gets funding agencies on board, securing financial commitment

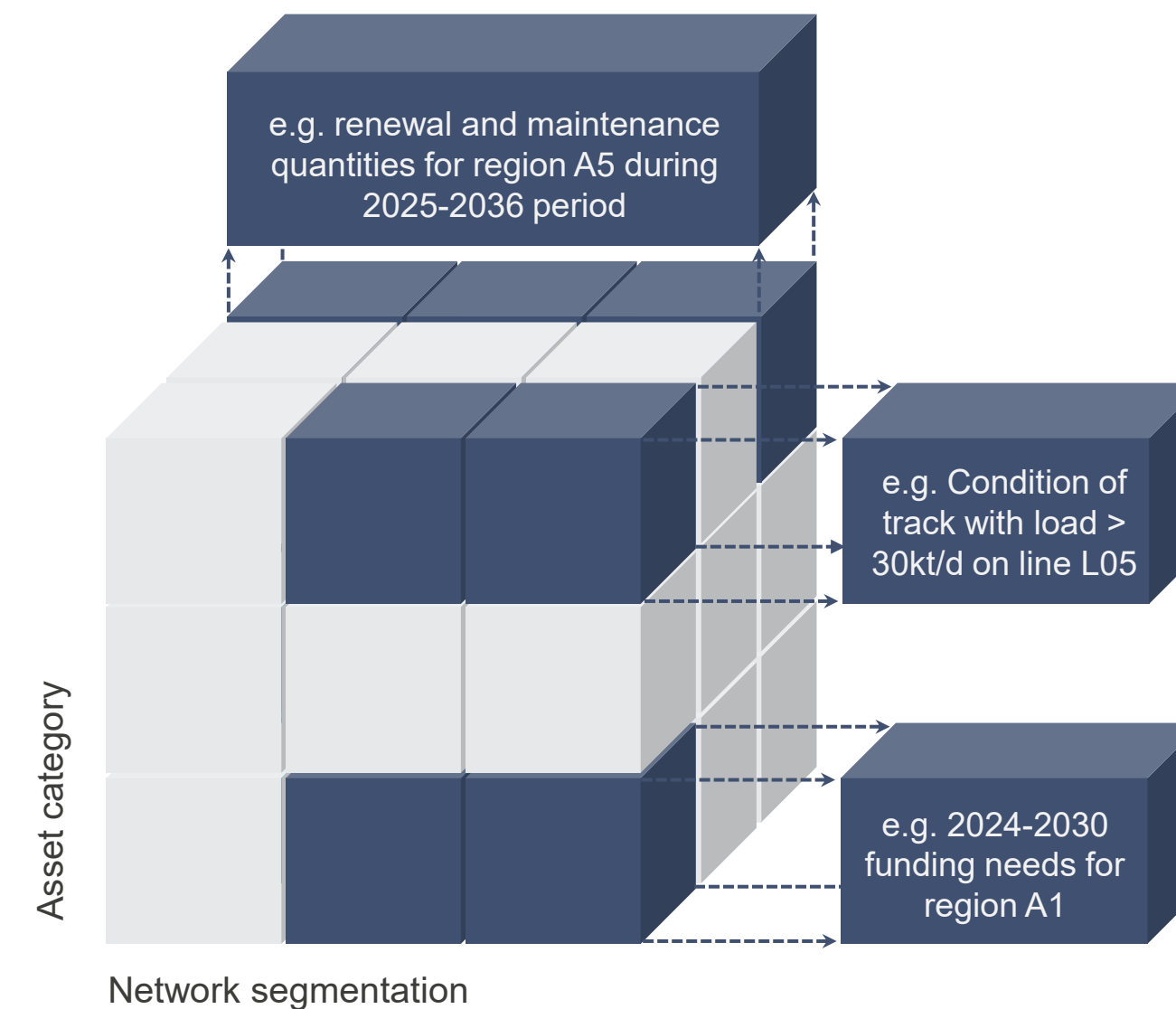
COMMON SUCCESSES

The right control/evaluation KPIs in the right data structure enable transparent and results driven asset strategy

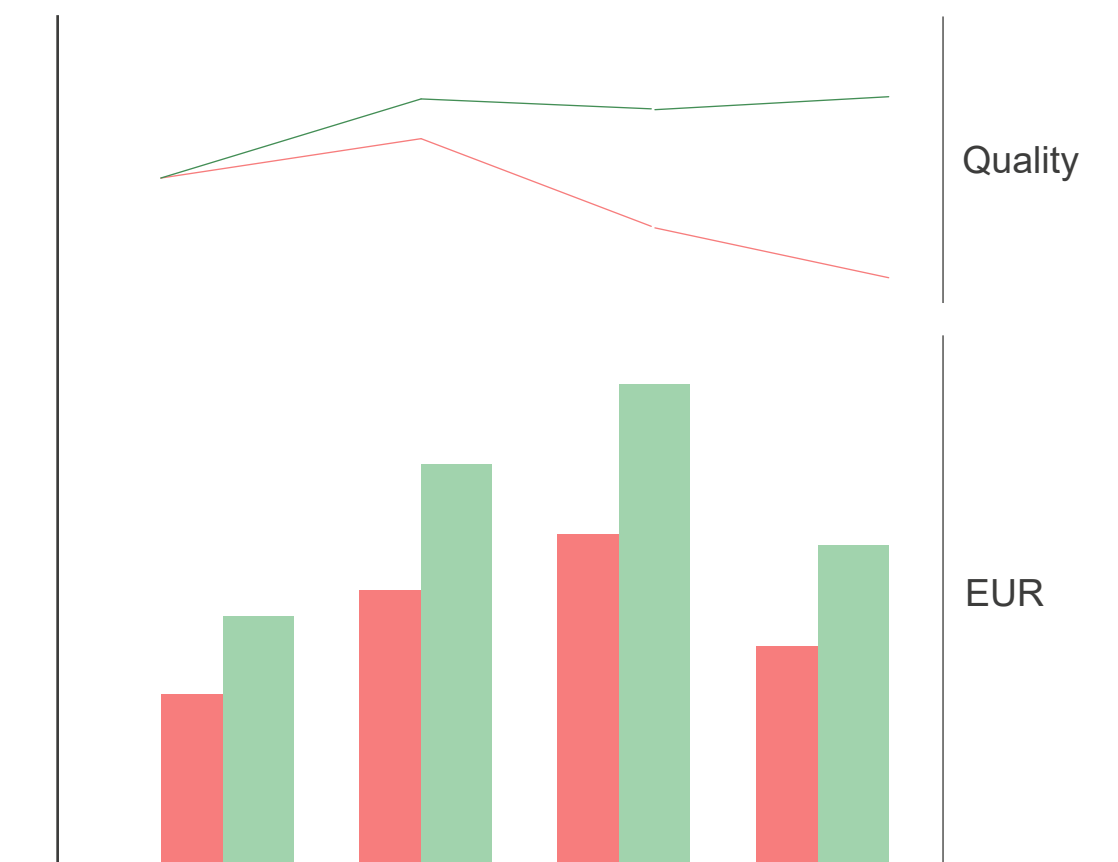
1 Map strategic goals to tangibly measurable and controllable KPIs driven by asset data



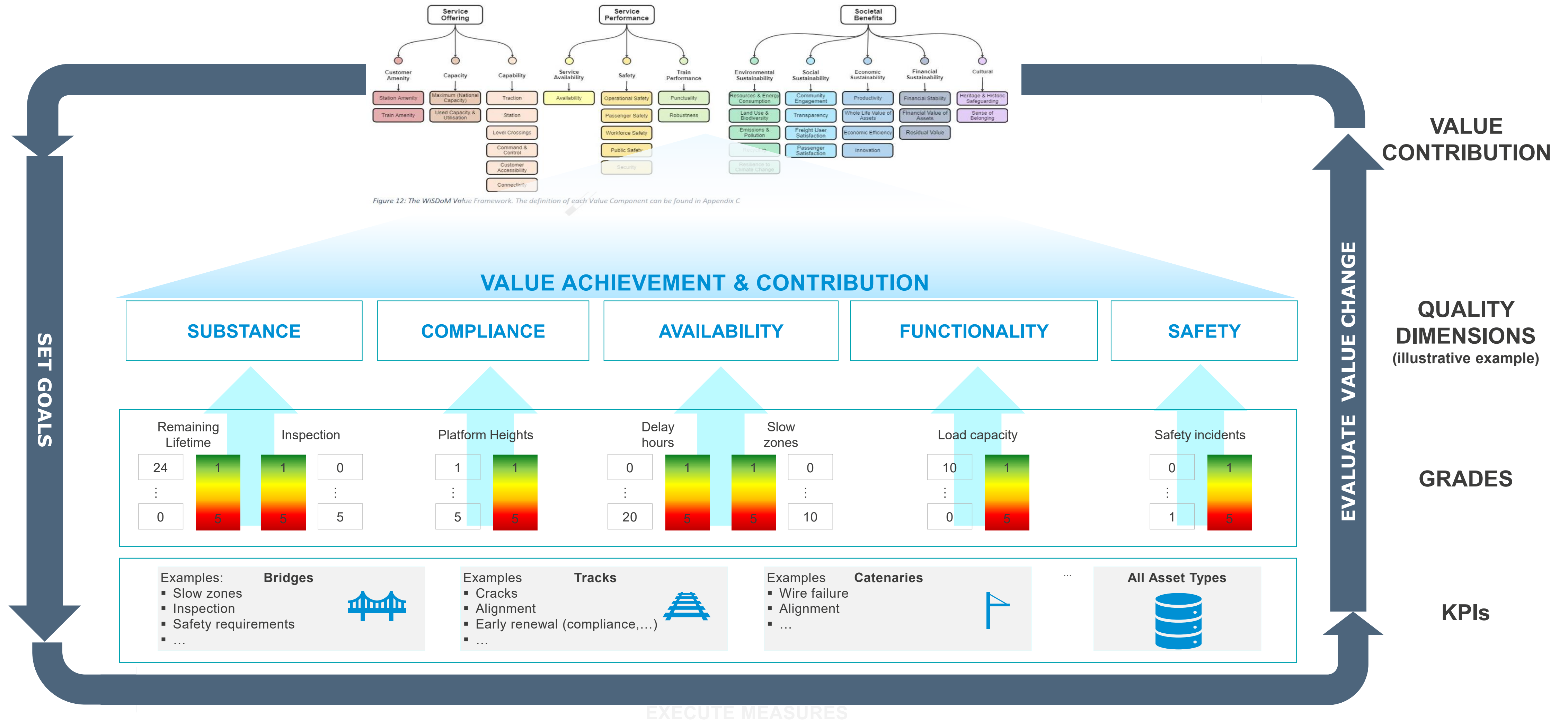
2 Structure asset and evaluation data to enable integrated analyses at all levels



3 Simulate funding, asset strategy and quality interactions to enable concrete and actionable planning

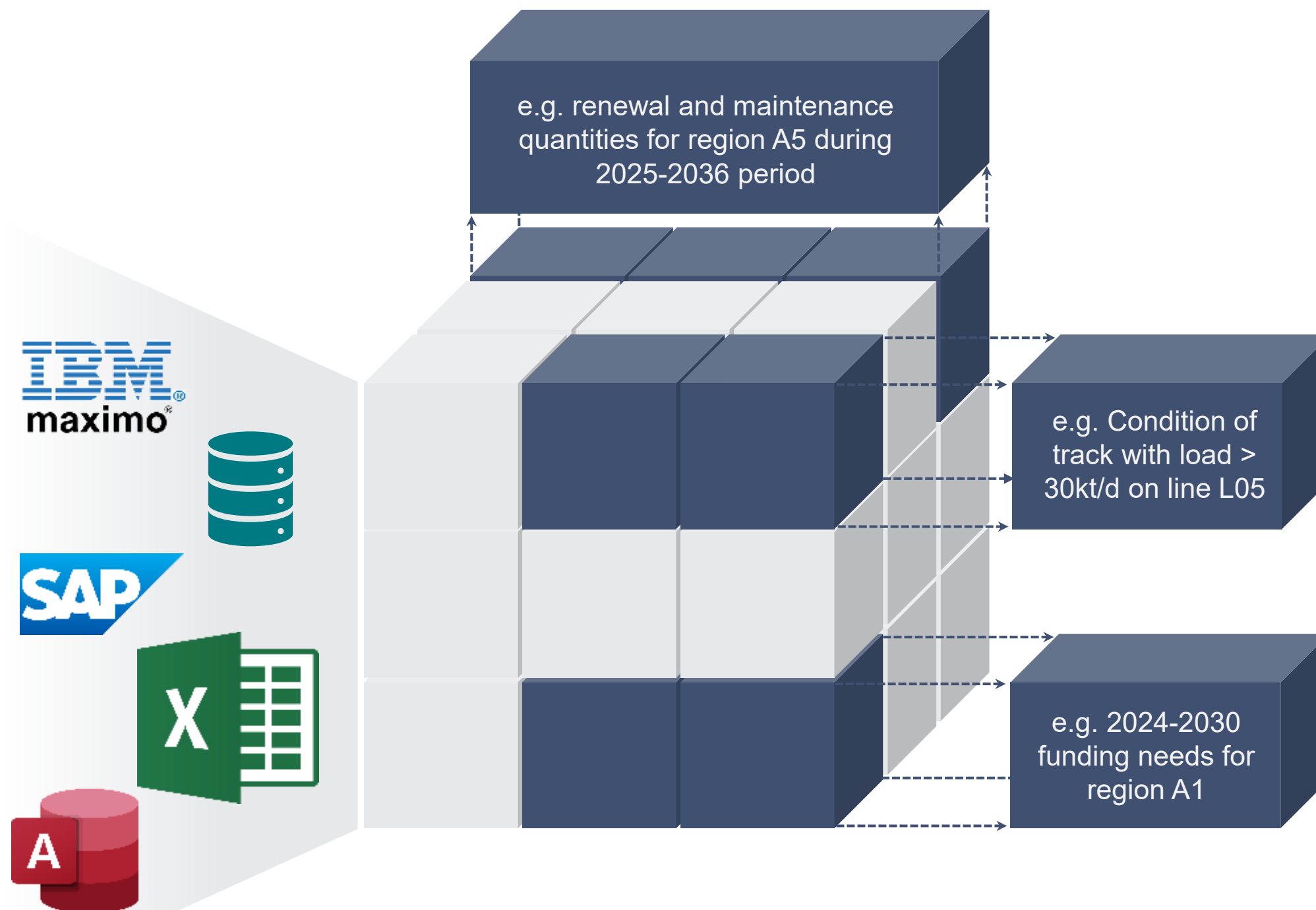


1 Evaluating existing and presently used KPIs in the context of strategic goals and values enables direct success review, control and simulation

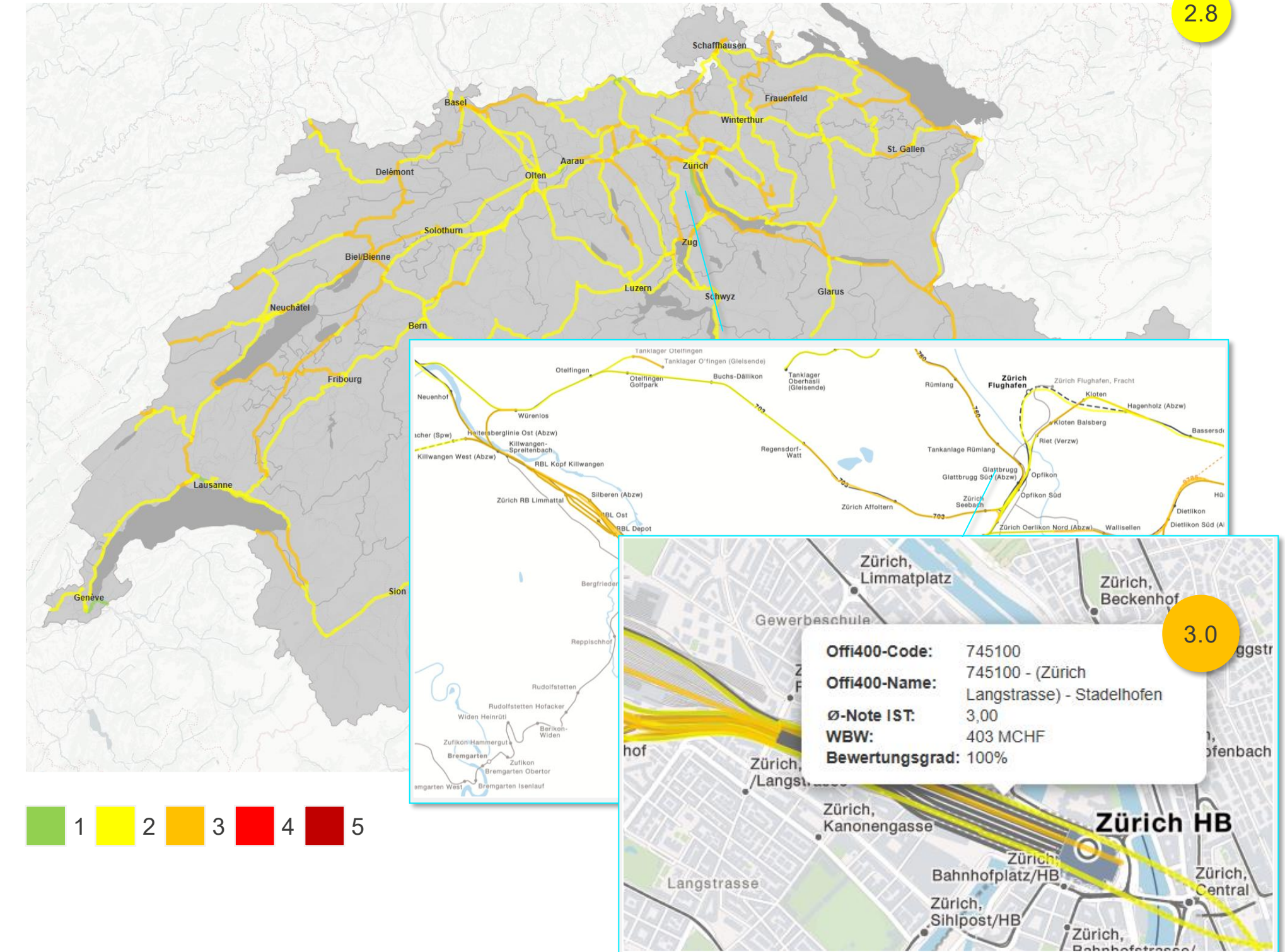


2

Data structured along key hierarchies enables transparent, target-oriented assessment, needs identification and drill-down at any level or subset



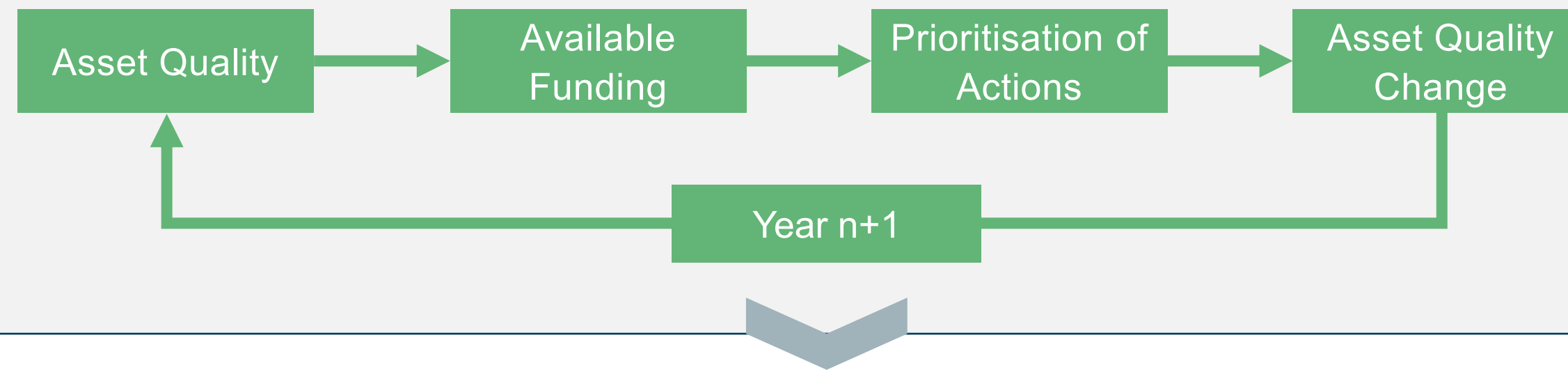
- **Structure of data** relevant for steering and strategy that is **consistent** and **comprehensive** across asset types and organizational or topological hierarchies
- Enable **drill-down** and slicing to any subset of the entire asset portfolio



- Assess **current condition**, regarding substance, availability, etc.
- Review differentiated **target conditions**
- Assess **target gap** for any segment or asset type to identify and transparently explain action needs – often not meaningful for single assets

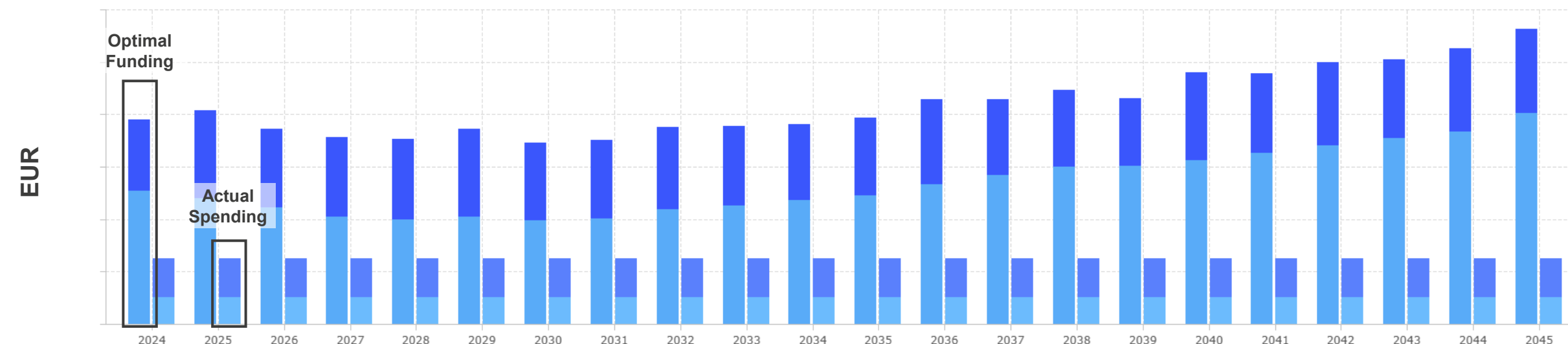
3

Current condition drives action needs. Available funding levels and prioritisation of action needs result in condition development.



- Condition determines needs
- Actions prioritised based on condition, traffic impact risk, expected improvement and value alignment
- Actions lead to updated condition

SPENDING & NEEDS



- **How much funding is needed**, where, when, why?
- **Bottom up approach**, being reliable on statistically big enough set of assets
- Needs based on current **strategy** per asset cluster
- Available funding in contrast to optimal funding
- Development of **backlog**

RESULTING QUALITY

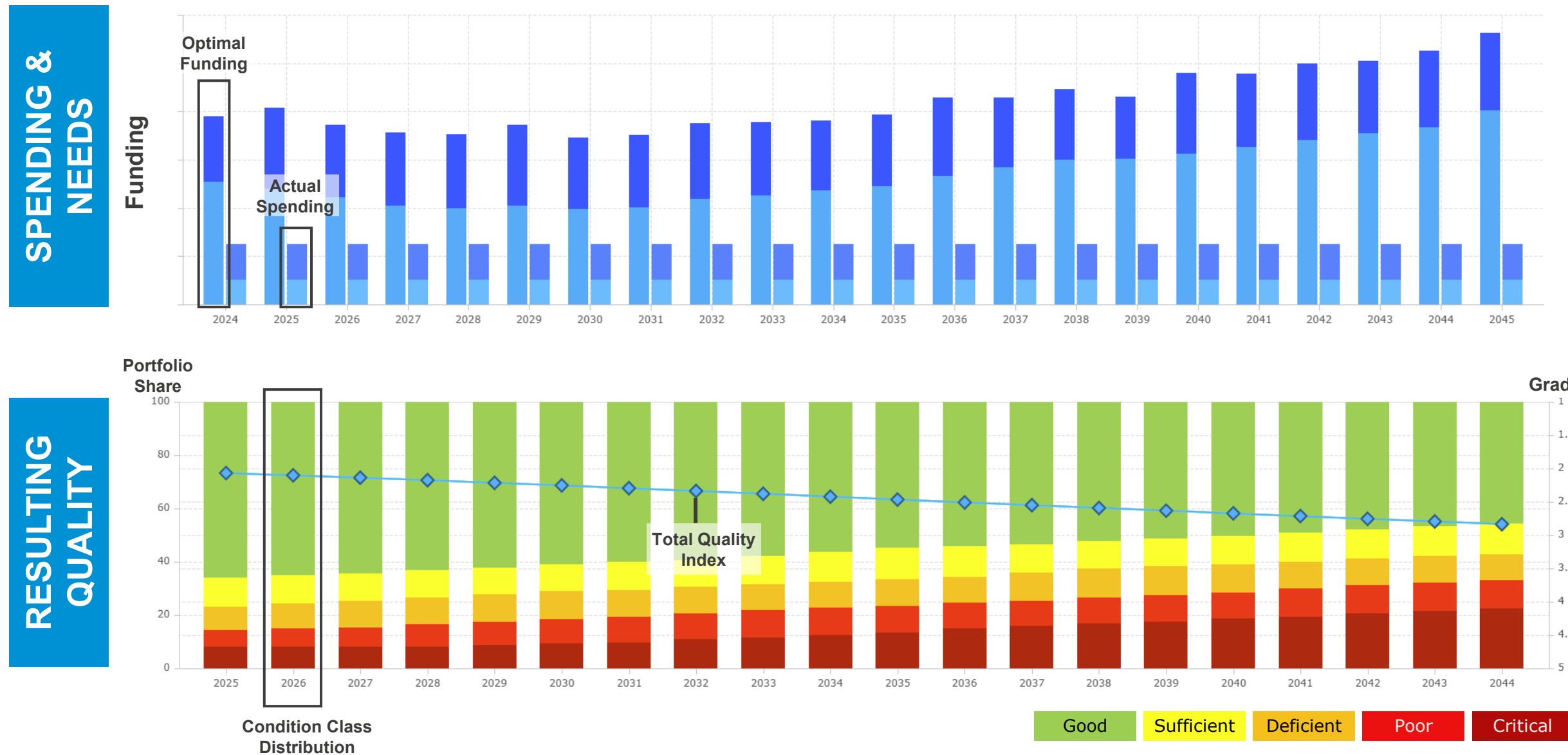


- Quality distribution and trends in the portfolio
- **Overall view for top level** and stakeholder communication, **drilldown for differentiated strategy** development with e.g. lines and regions
- **Explaining needs**: Where, why, when is CAPEX/OPEX need triggered?

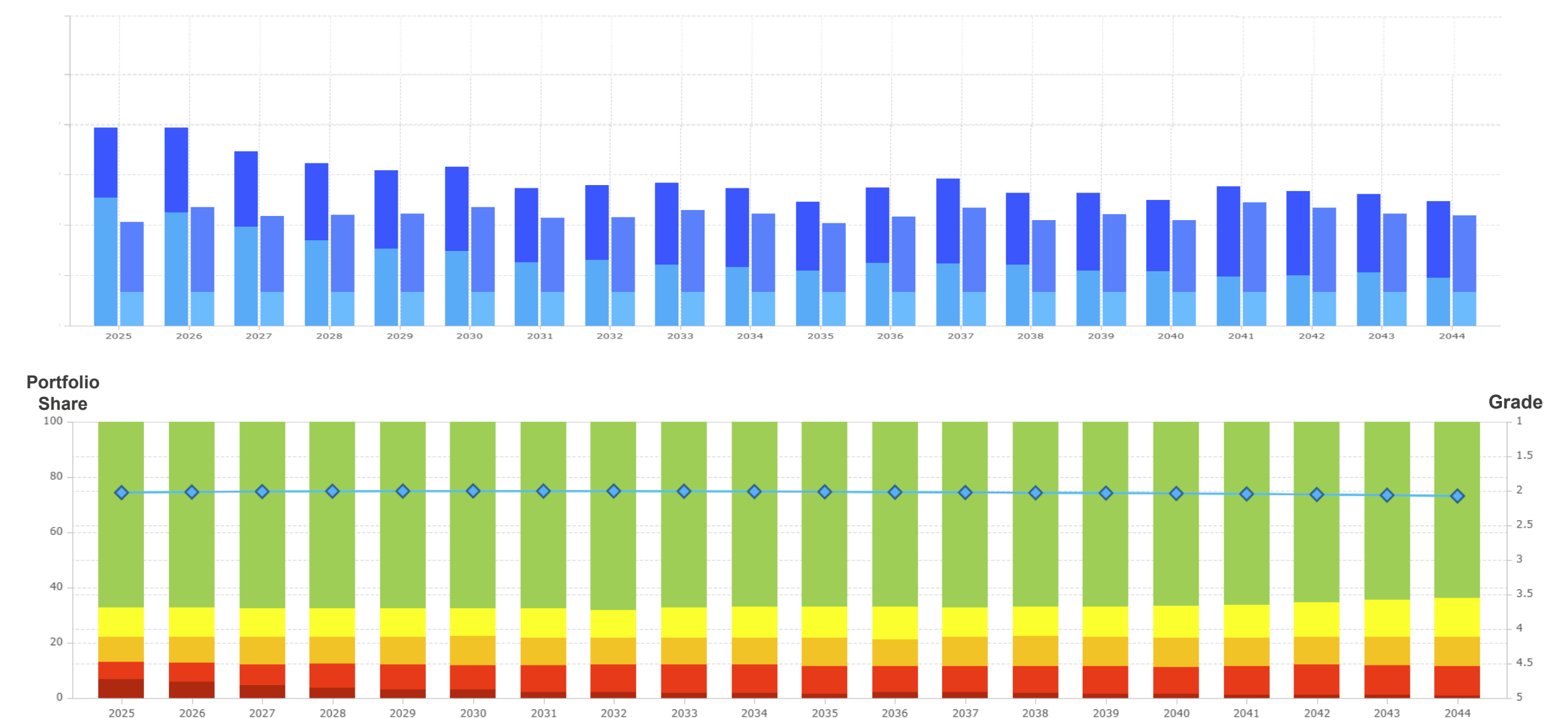
3

Quality/Cost simulation that is integrated from asset level actions to top level decision making ensures alignment and transparent communication

FUNDING CUTS



STABLE FUNDING



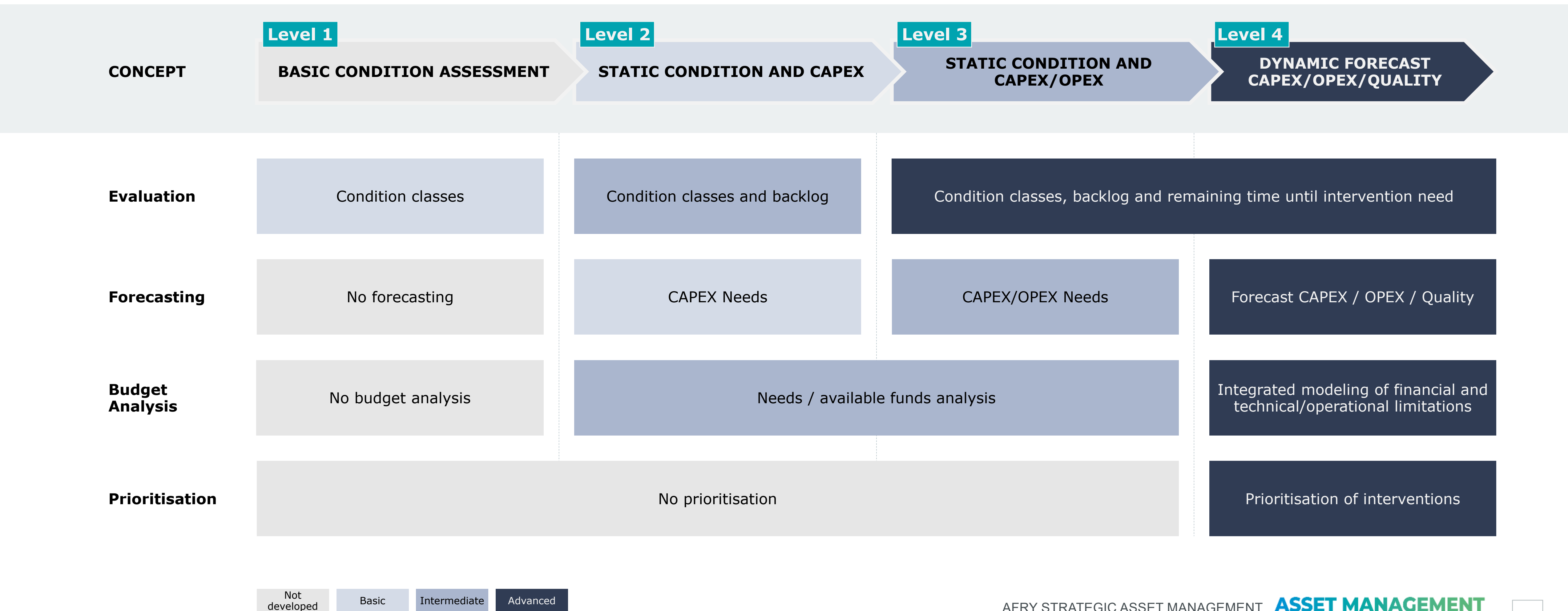
- Increasing needs accumulate and cause rising funding backlog
- Deterioration of total quality
- Rising share of overaged assets, decreasing share of good assets

- Stable funding ensures needs are met and do not accumulate backlog
- Total quality remains stable
- Stable share of ~70% good assets, acceptable low percentage of overaged assets

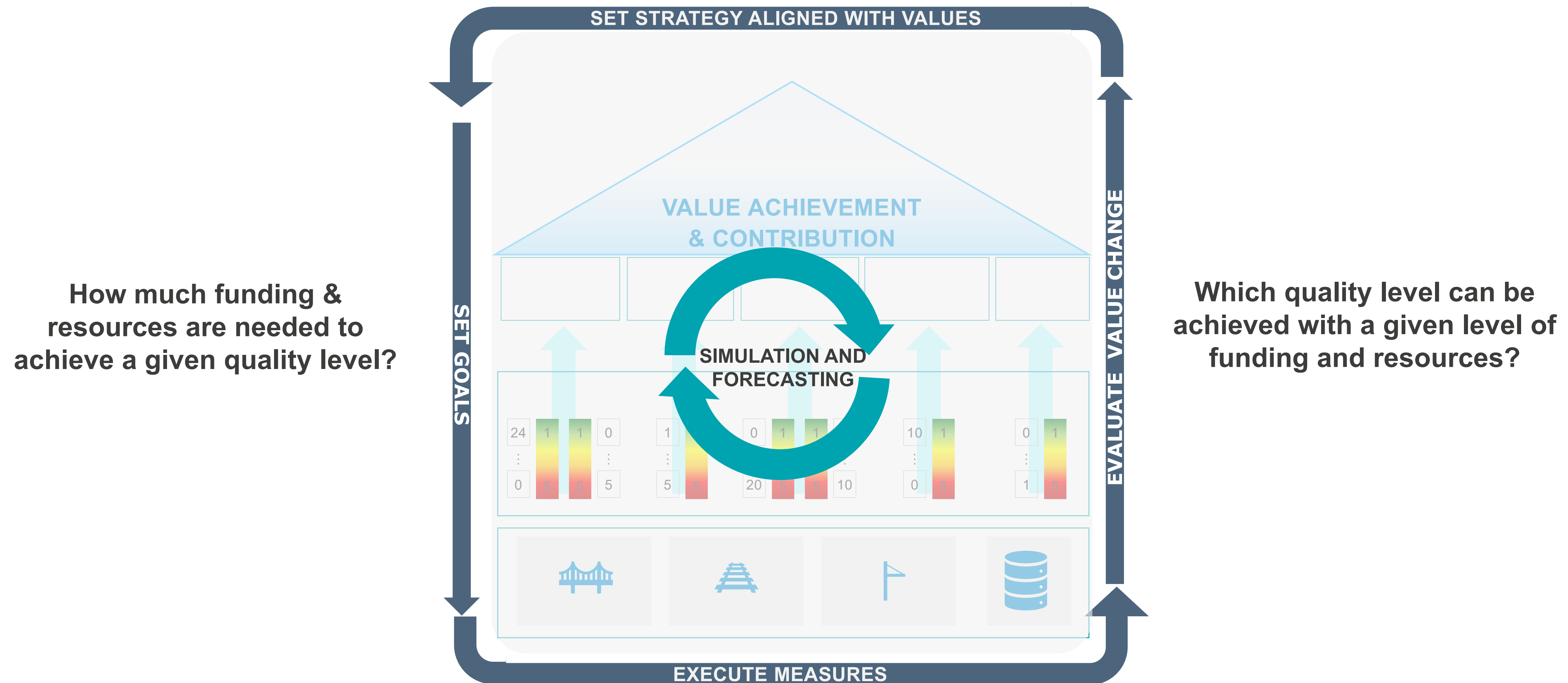
INTEGRATED STEERING AND COMMUNICATION

- For top management alignment and government negotiation: Abstract view of “what quality for what price?”
- For actionable and differentiated strategy: End-to-end integration from top level to region/line/asset level views
- Define how much funding needed to achieve a certain quality level (iterative process)

The prognosis skill level depends on current maturity of organisation, actual needs in strategic asset management and learning curves



Integrated simulation directly connects funding and quality, enabling results-driven approaches to strategy and goals aligned with resources



Session 2: Strategy and Performance Q&A



INTERNATIONAL UNION
OF RAILWAYS

THANK YOU FOR YOUR ATTENTION

Christian Blättler & Alison Cowley

christian.blaettler@afry.com, alison.cowley@afry.com

AFRY STRATEGIC ASSET MANAGEMENT

ASSET MANAGEMENT
Working Group



INTERNATIONAL UNION
OF RAILWAYS

Asset Management Seminar

Pietrarsa, Naples – 2 October 2025

SSG 13 Systems Engineering
Grame Hind
AMCL

ASSET MANAGEMENT
Working Group

What is Systems Engineering?

- Multi-disciplinary approach to complex systems
- Manages technical, operational & organisational interfaces
- Ensures the "right system" is built, and it's built "right"
- System engineering is simple holistic total system engineering

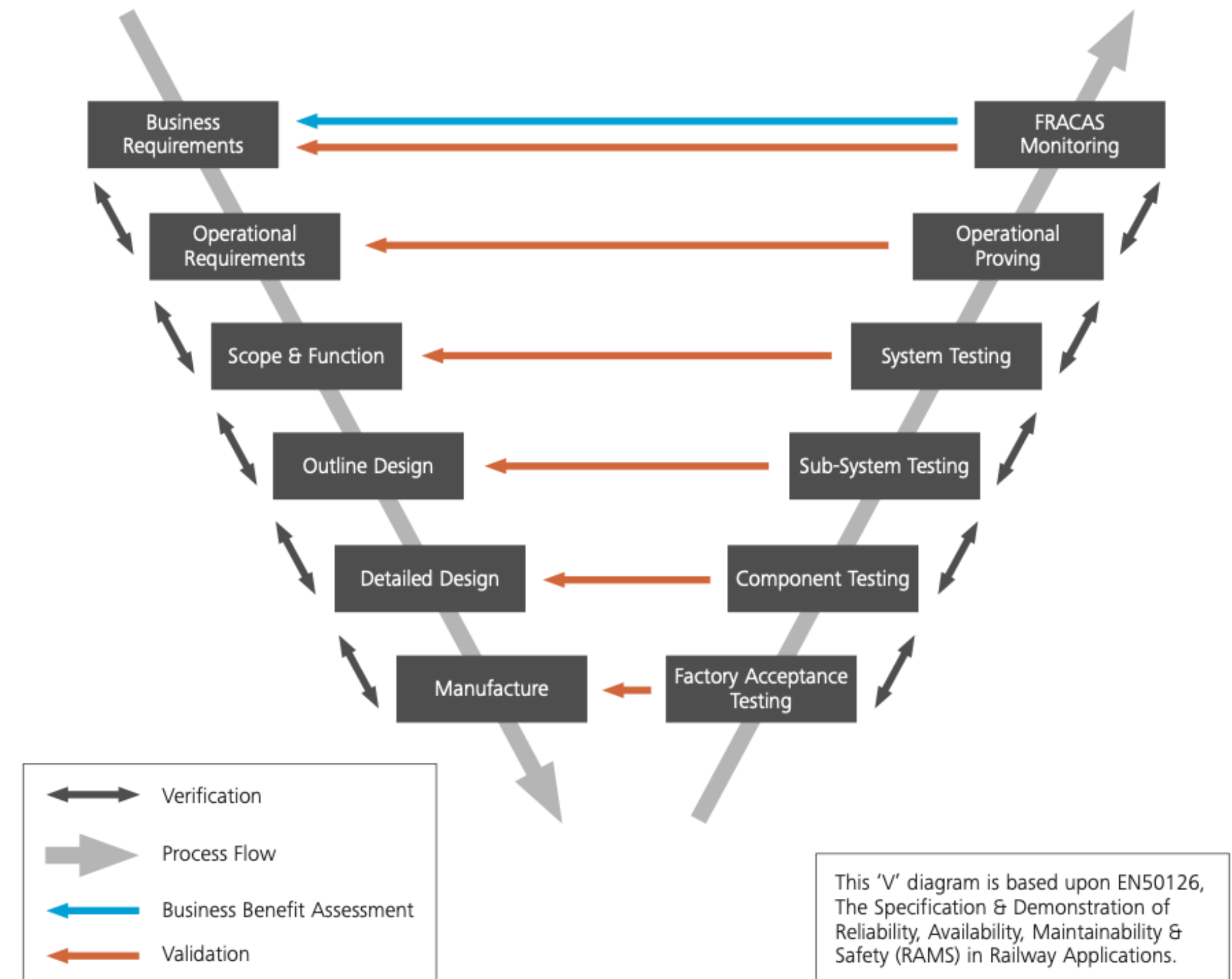


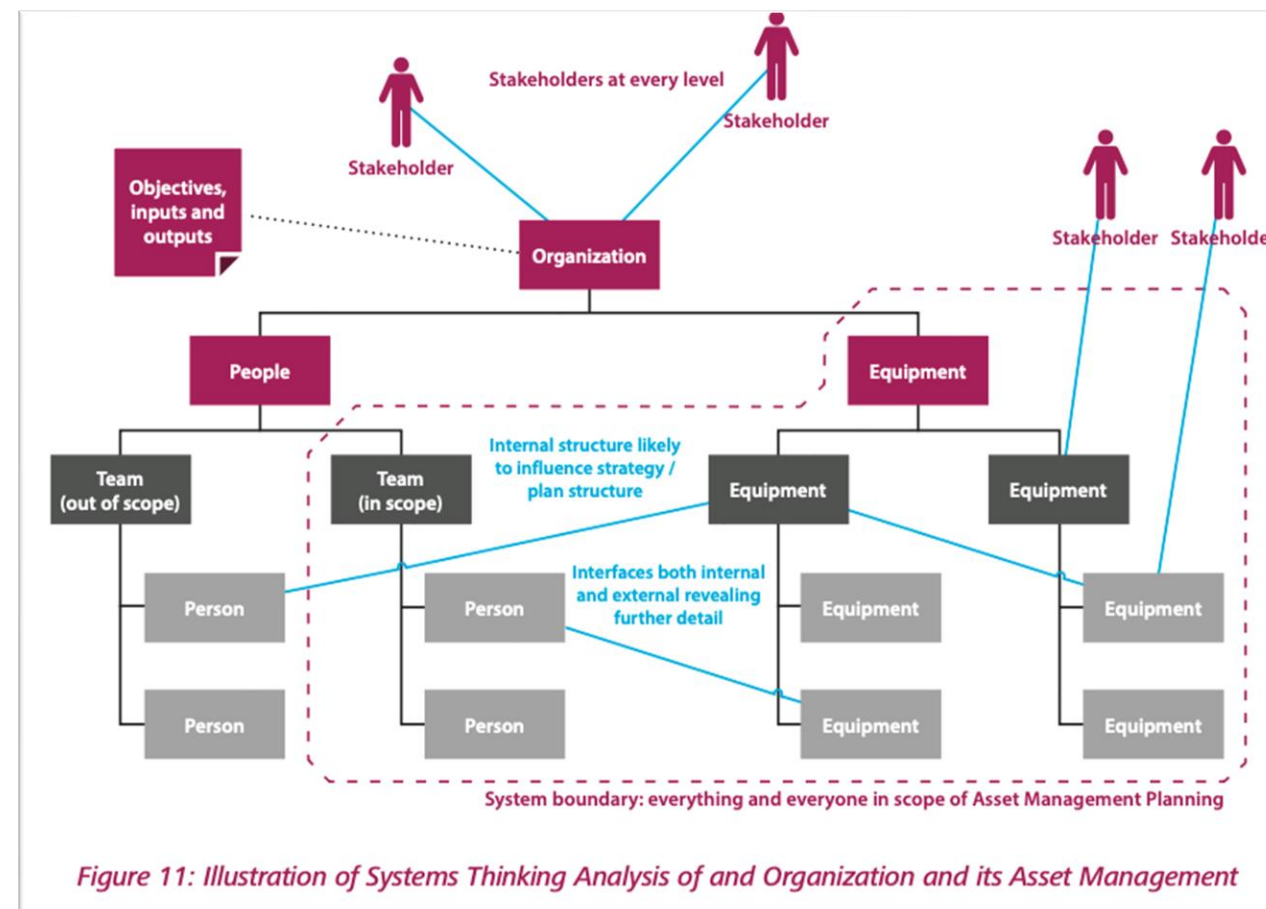
Figure 4: 'V' diagram from RAMS in Railway Applications EN50126

Why it Matters?

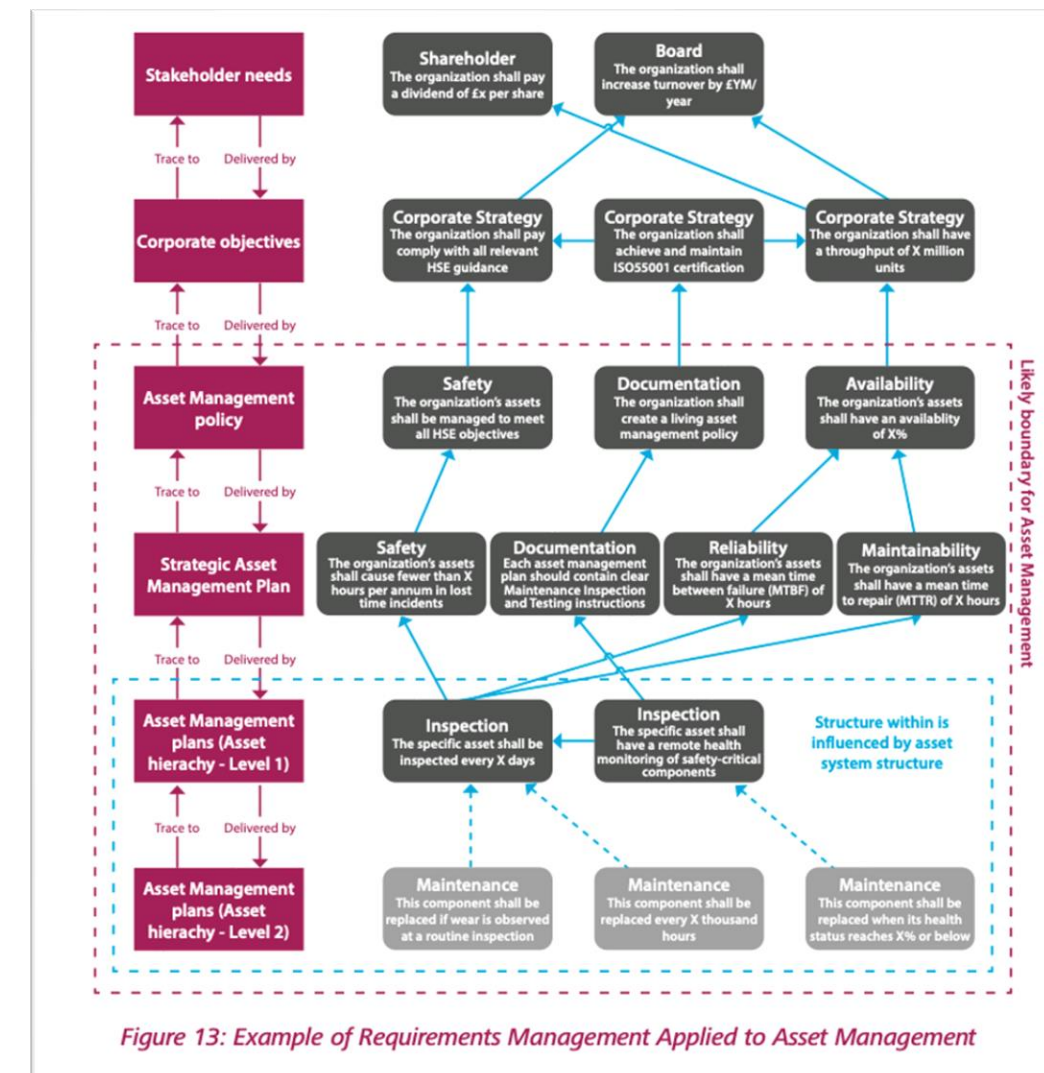
Asset Management Objective	How System Engineering thinking supports
Value Delivery	Ensures the system meets stakeholder needs and delivers intended outcomes across the lifecycle.
Risk Management	Identifies, traces, and mitigates risks early through structured requirements and assurance processes
Lifecycle Cost Optimisation	Enables informed trade-offs and whole-life decision-making through integrated planning and feedback loops.
Performance & Reliability	Embeds RAMS principles and progressive validation to assure system performance.
Sustainability & Resilience	Supports long-term thinking, adaptability, and integration of environmental and social factors.
Compliance & Governance	Provides traceability, documentation, and assurance aligned with regulatory and organizational standards.
Stakeholder Engagement	Facilitates clear communication, shared understanding, and alignment across disciplines and teams.

- Improves performance & reliability
- Reduces lifecycle cost & risk
- Aligns strategy with delivery
- Supports compliance & assurance

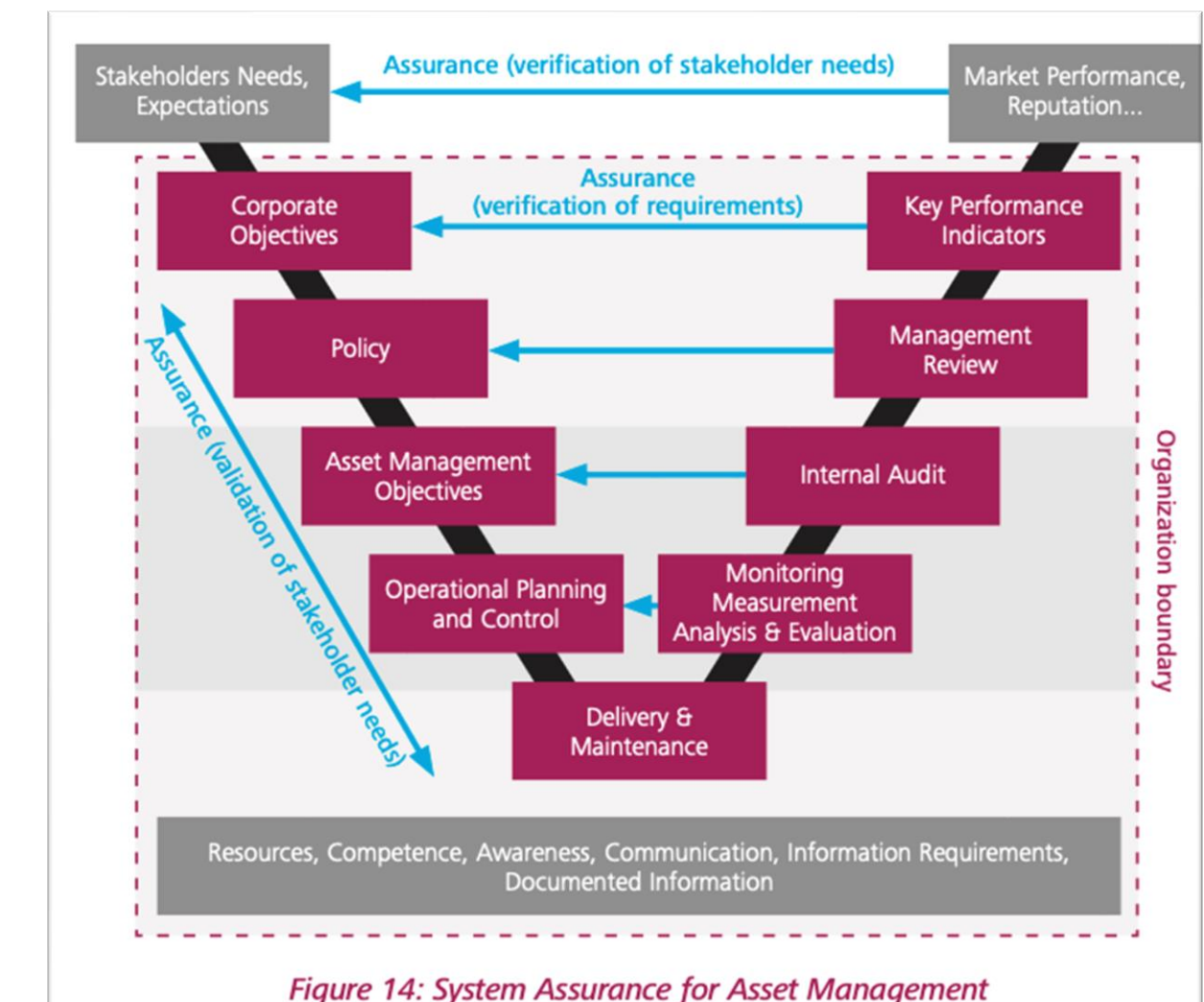
Core Themes



Systems Thinking
holistic, context-aware,
interface-driven



Requirements Management
traceable, prioritised,
lifecycle-managed



System Assurance
progressive verification
& validation, RAMS
focus

Factors for Success

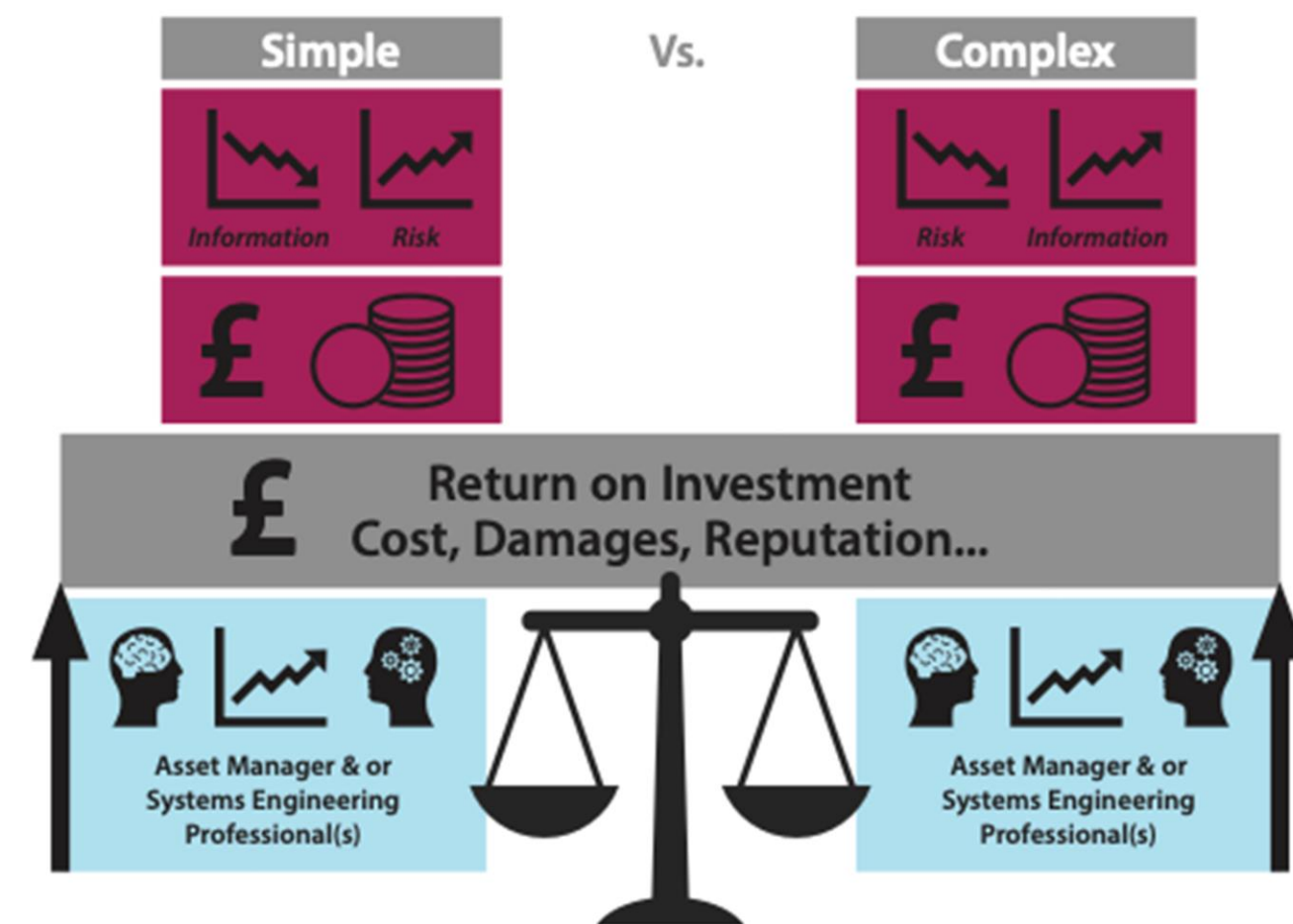


Figure 8: Return on Investment

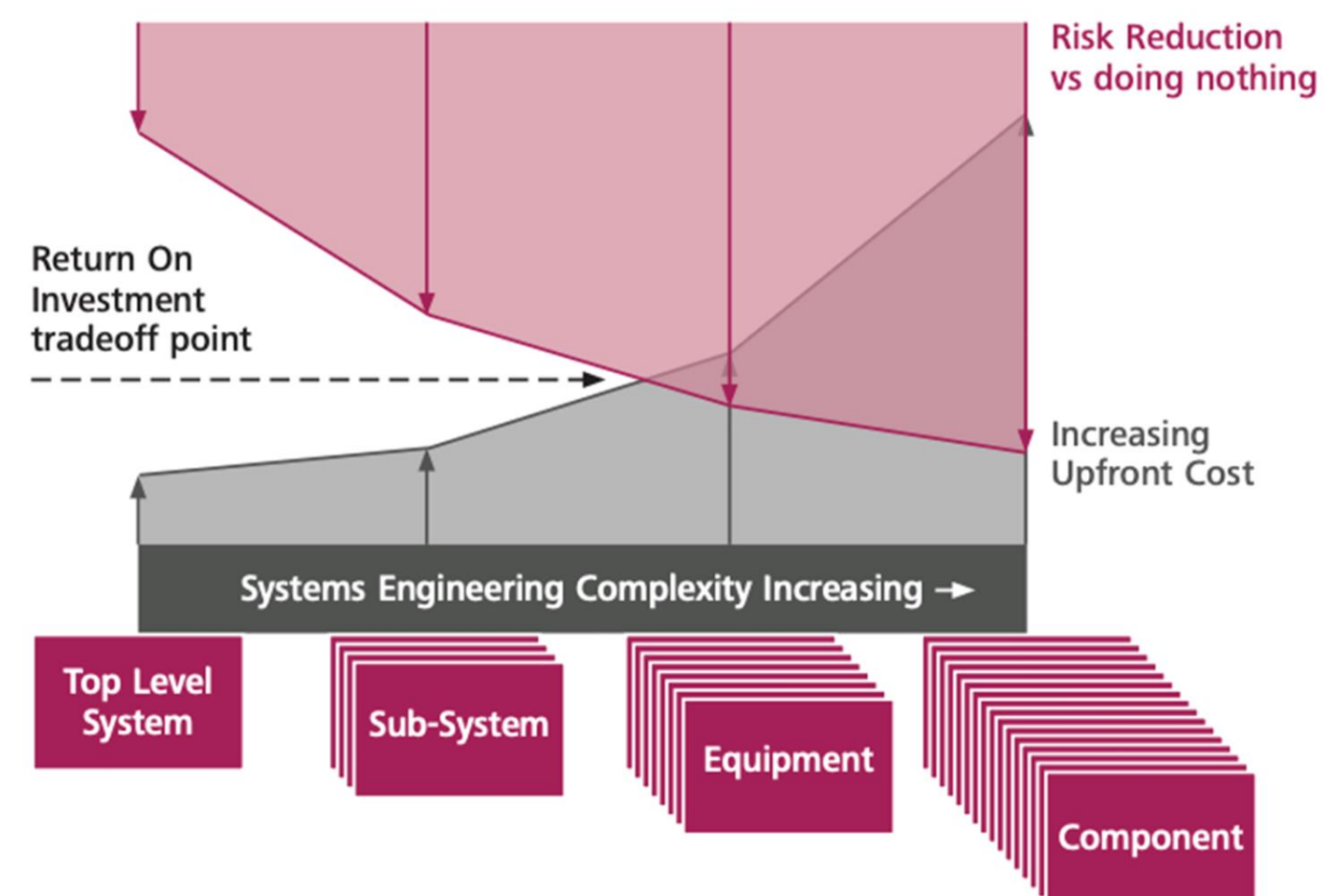


Figure 7: Cost vs Depth of Implementation Diagram

- Match approach to system complexity & organisational maturity
- Maintain clear line of sight from strategy to delivery
- Apply progressive assurance throughout the lifecycle
- Invest in skilled people & adequate resources

Lifecycle Application

- Acquire → Operate & Maintain → Dispose
- Extended V-Model with feedback loops
- Asset information as a lifecycle asset (DIKW model)
- Continuous improvement through lessons learned

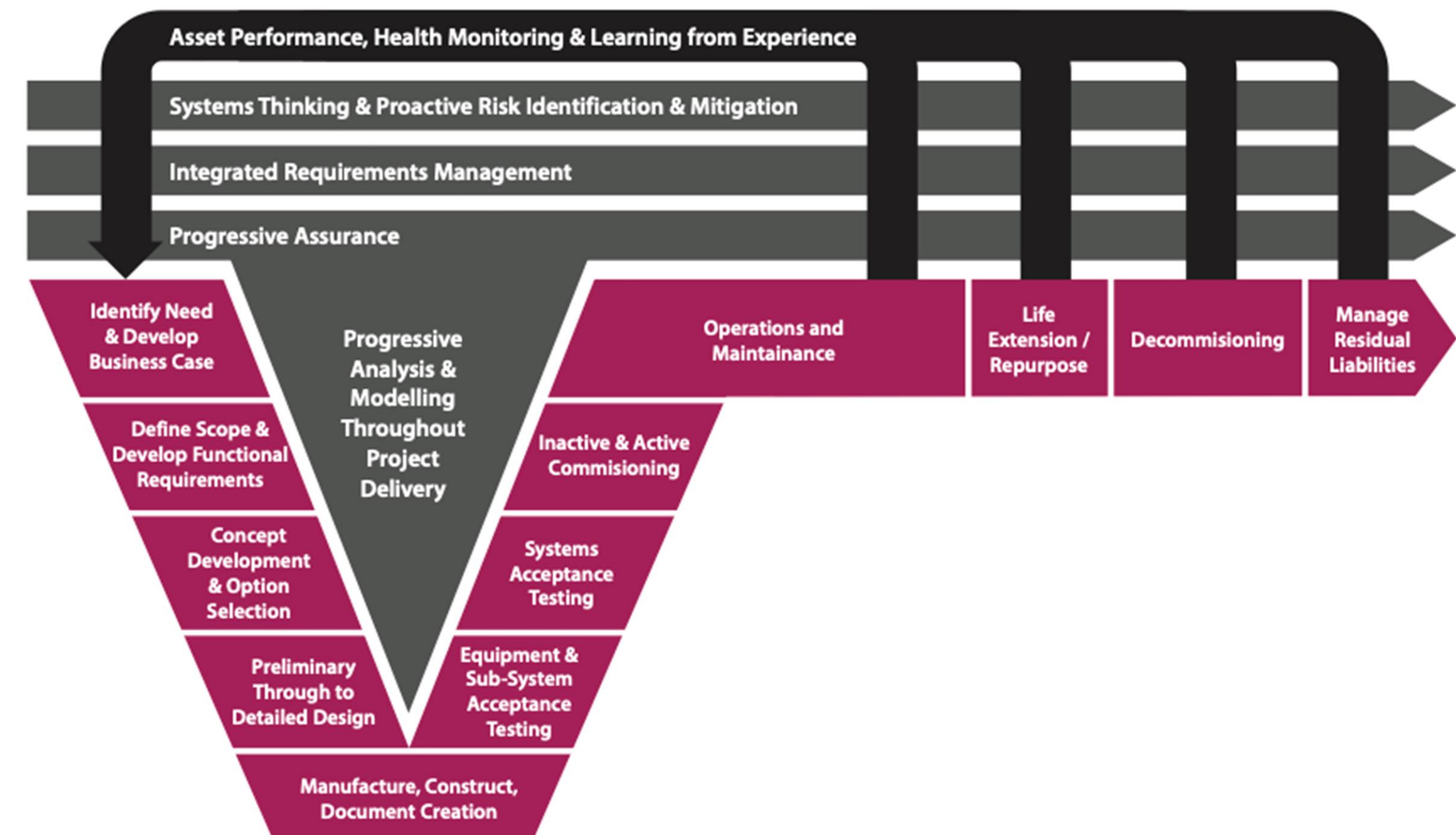


Figure 20: Extended V Cycle for Life Cycle Delivery

Rail-Specific Drivers

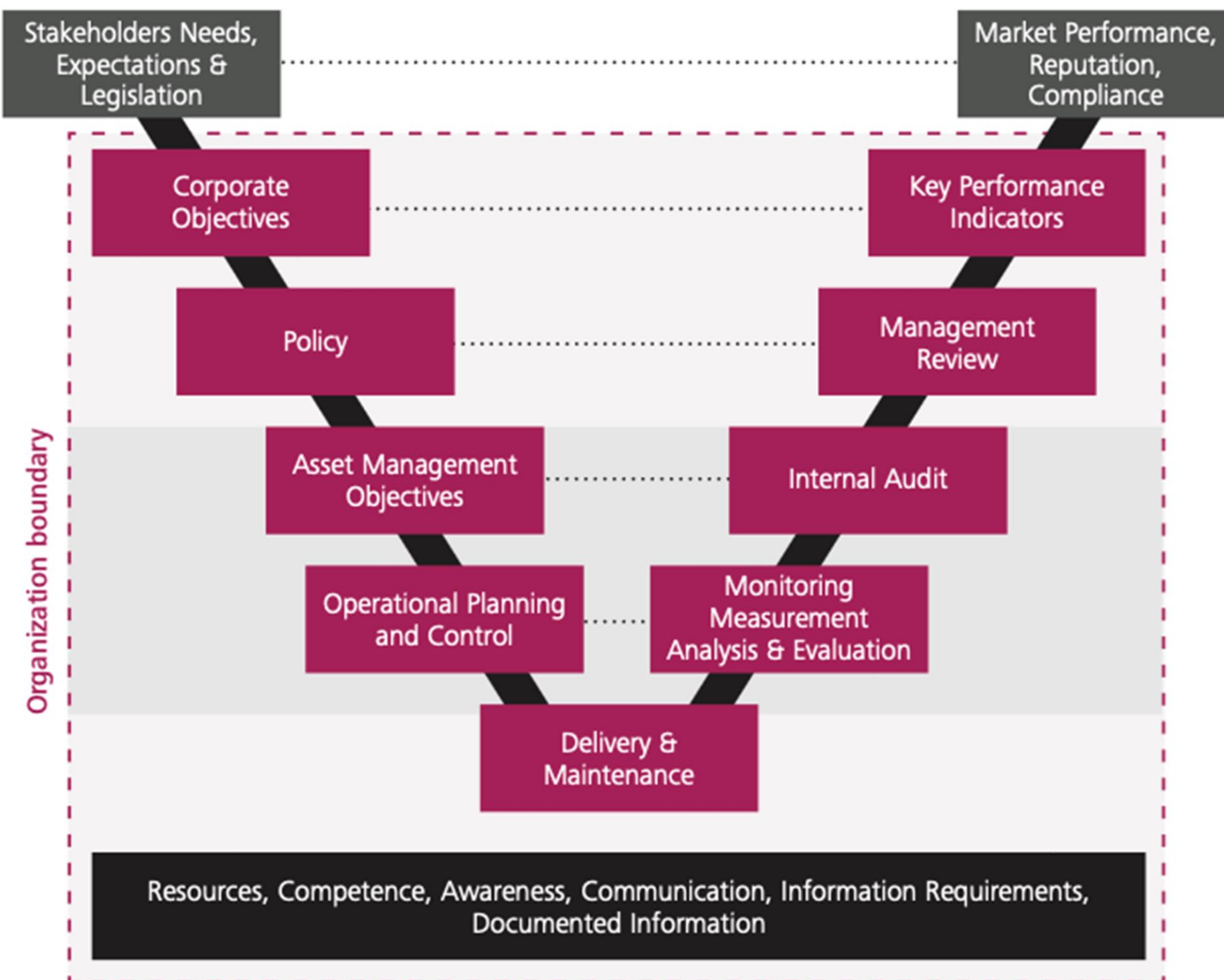


Figure 5: Systems Engineering for the wider organization

- EN50126 RAMS compliance
- Cross-border interoperability (ERTMS, TSI)
- Climate resilience & sustainability targets
- Digital transformation & data integration

What This Means for UIC Members

- Strategic: Align with EU Green Deal & TEN-T priorities
- Operational: Reduce lifecycle cost, improve availability
- Collaborative: Common language for multi-country projects
- Assurance: Demonstrable compliance to regulators & investors/financing

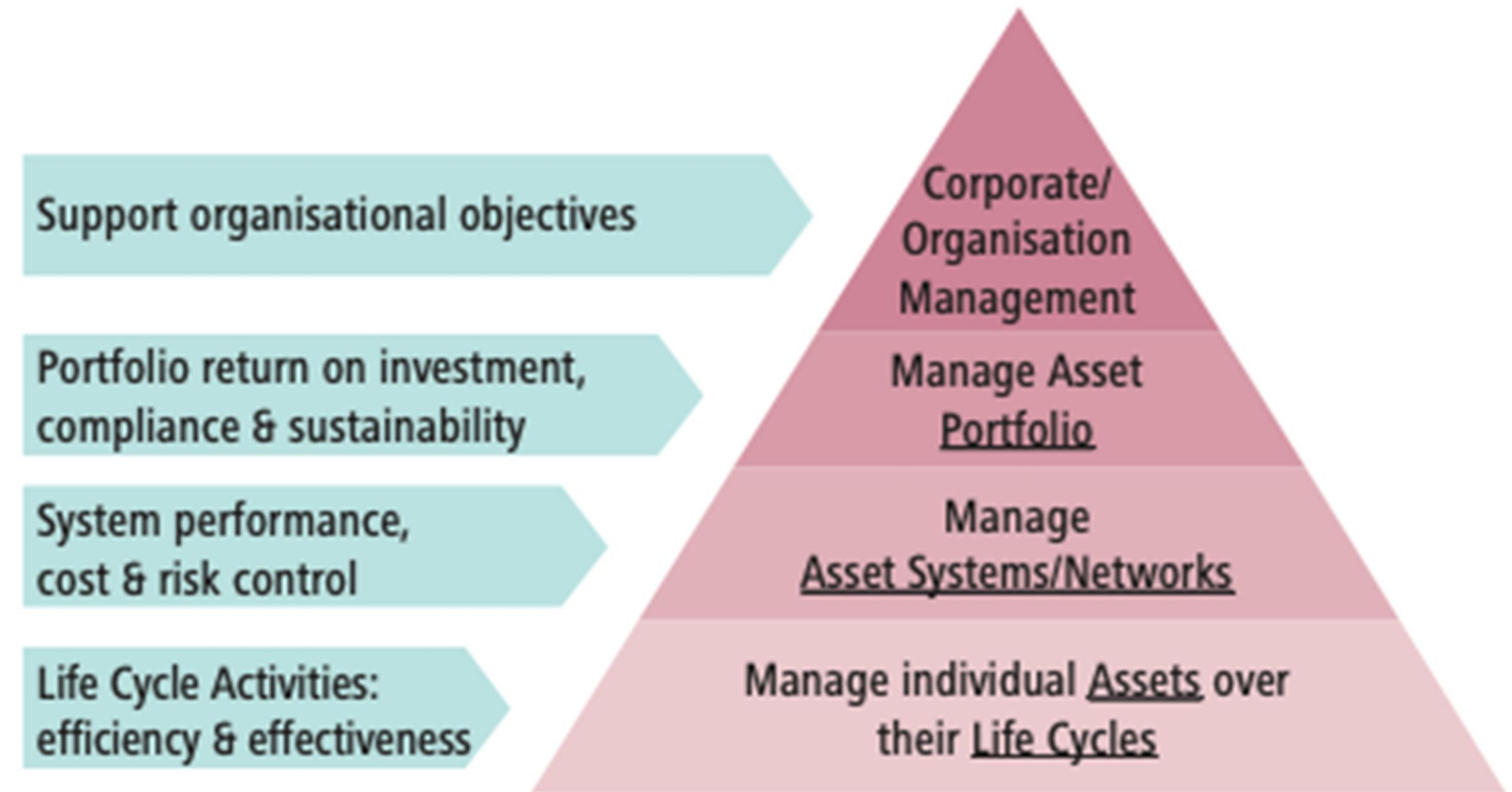


Figure 9: Hierarchy of Assets within an Integrated Management System

Call to Action

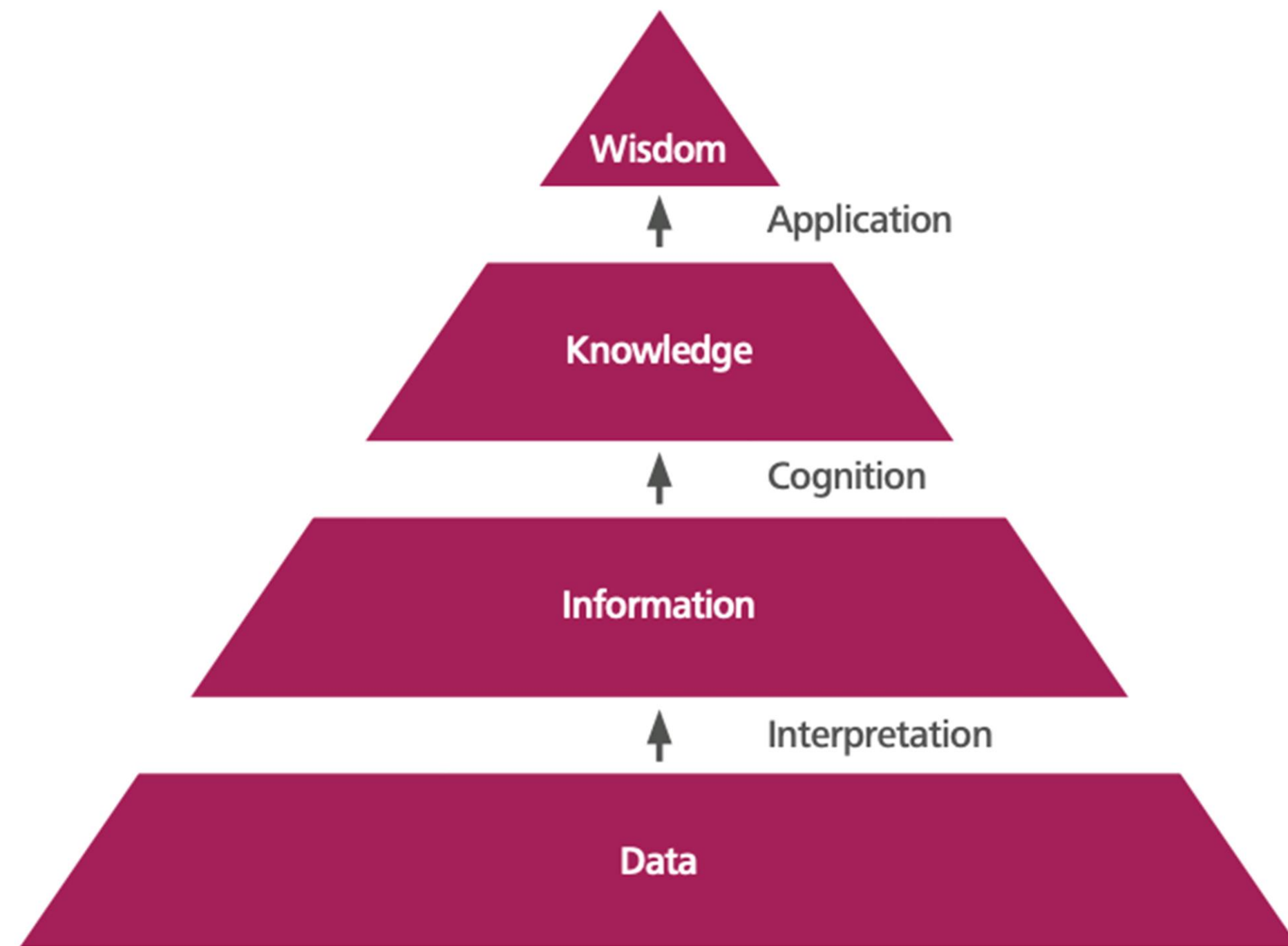


Figure 26: Data, Information, Knowledge and Wisdom (DIKW) Conceptual Model

- Embed Systems Engineering early in project lifecycles
- Use requirements traceability to manage complexity
- Share models, data & lessons learned across borders
- Build SE capability within teams & extended supply chains

Q&A

Where could SE deliver the biggest gains in your network?

How can UIC facilitate shared SE practices?

What barriers exist to wider adoption?

Session 2: Strategy and Performance Q&A



INTERNATIONAL UNION
OF RAILWAYS

THANK YOU FOR YOUR ATTENTION

Grame Hind
grame.hind@amcl.com

ASSET MANAGEMENT
Working Group



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Session 3

Decision Making



Cristiano Martincigh
(IFS Copperleaf)



Roberto Pinto
(Bergamo University)



Adalberto Polenghi
(Politecnico Milano)

Working Group

ASSET MANAGEMENT
Working Group



INTERNATIONAL UNION
OF RAILWAYS

Asset Management Seminar

Pietrarsa, Naples – 2 October 2025

**Strategic Investment Planning through
Value-based Decision Making**

Cristiano Martincigh
VP of Sales – Southern Europe



Asset Investment Planning for Rail

Copperleaf helps organisations decide how and where to invest in their business to maximize value with available resources.

Making the right investments at the right time to cost effectively manage risk, deliver on performance targets, and execute strategy.

New imperatives and challenges.

Balancing competing investment needs and targets is difficult.



Value



Train
Performance



Safety

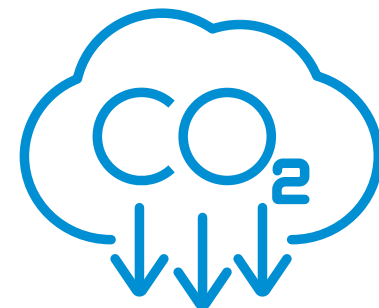


Economic
Sustainability

Value



Social
Sustainability



Environmental
Sustainability



Train
Performance



Safety



Economic
Sustainability



Passenger
Satisfaction



Availability

Asset Investment Planning (AIP)

Single, Integrated, end-to-end Planning Solution

Core
Solution
Principals

Create
Value

Proactively Manage
Performance / Risk

Execute Strategy

Enable Business
Agility



Key
Planning
Steps

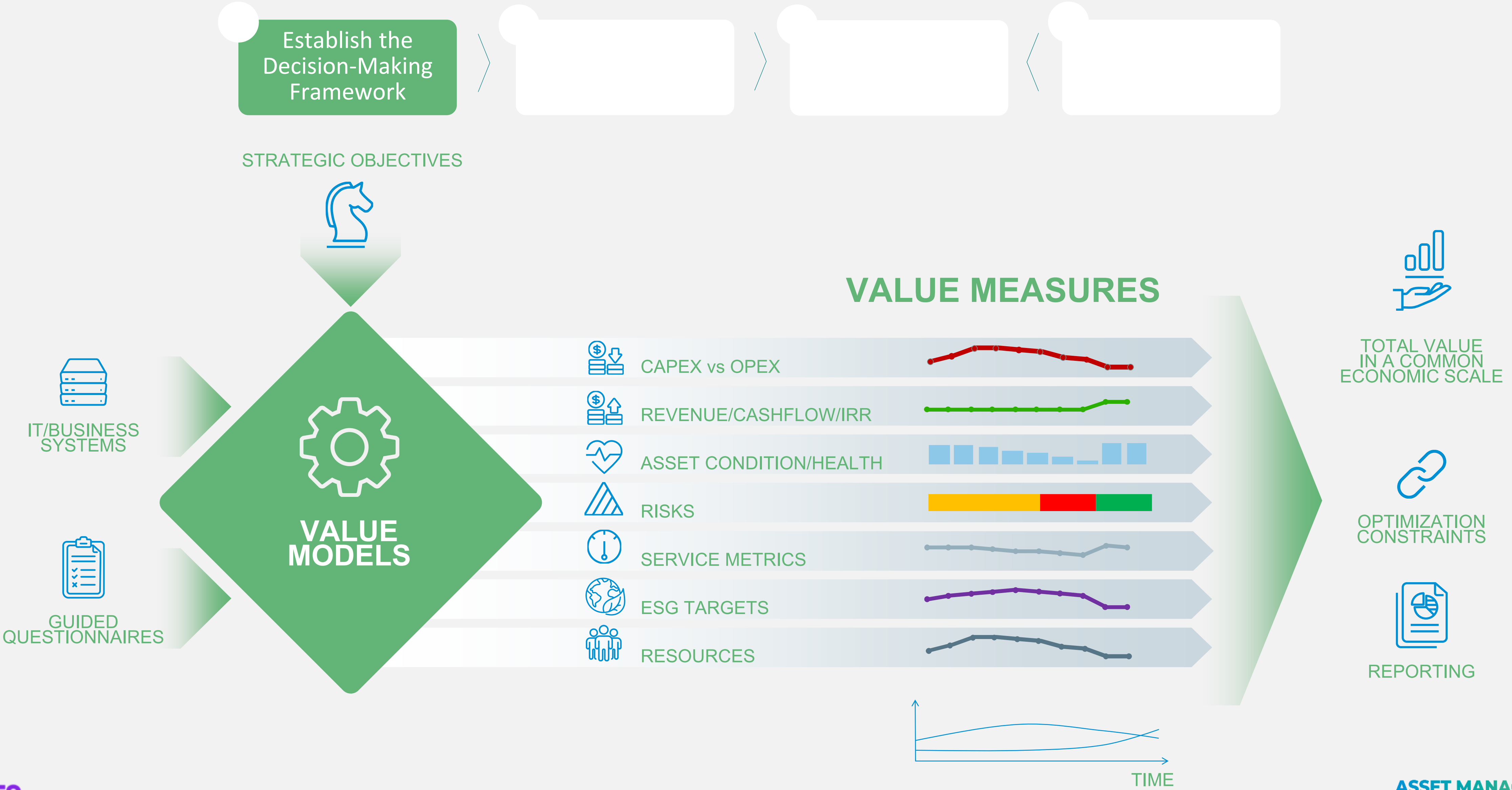
Establish the
Decision-Making
Framework

Evaluate Candidate
Investments

Optimize the
Investment Portfolio

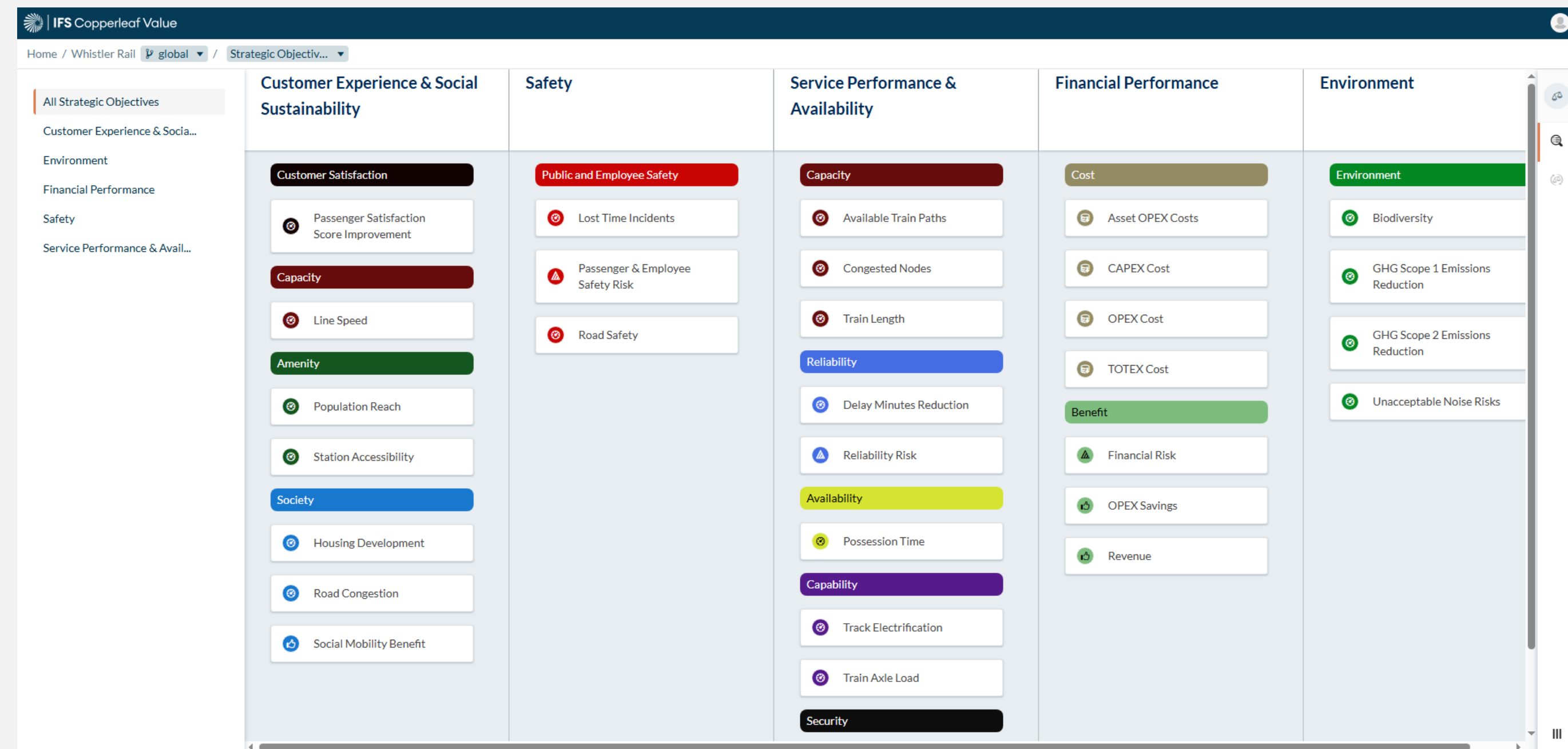
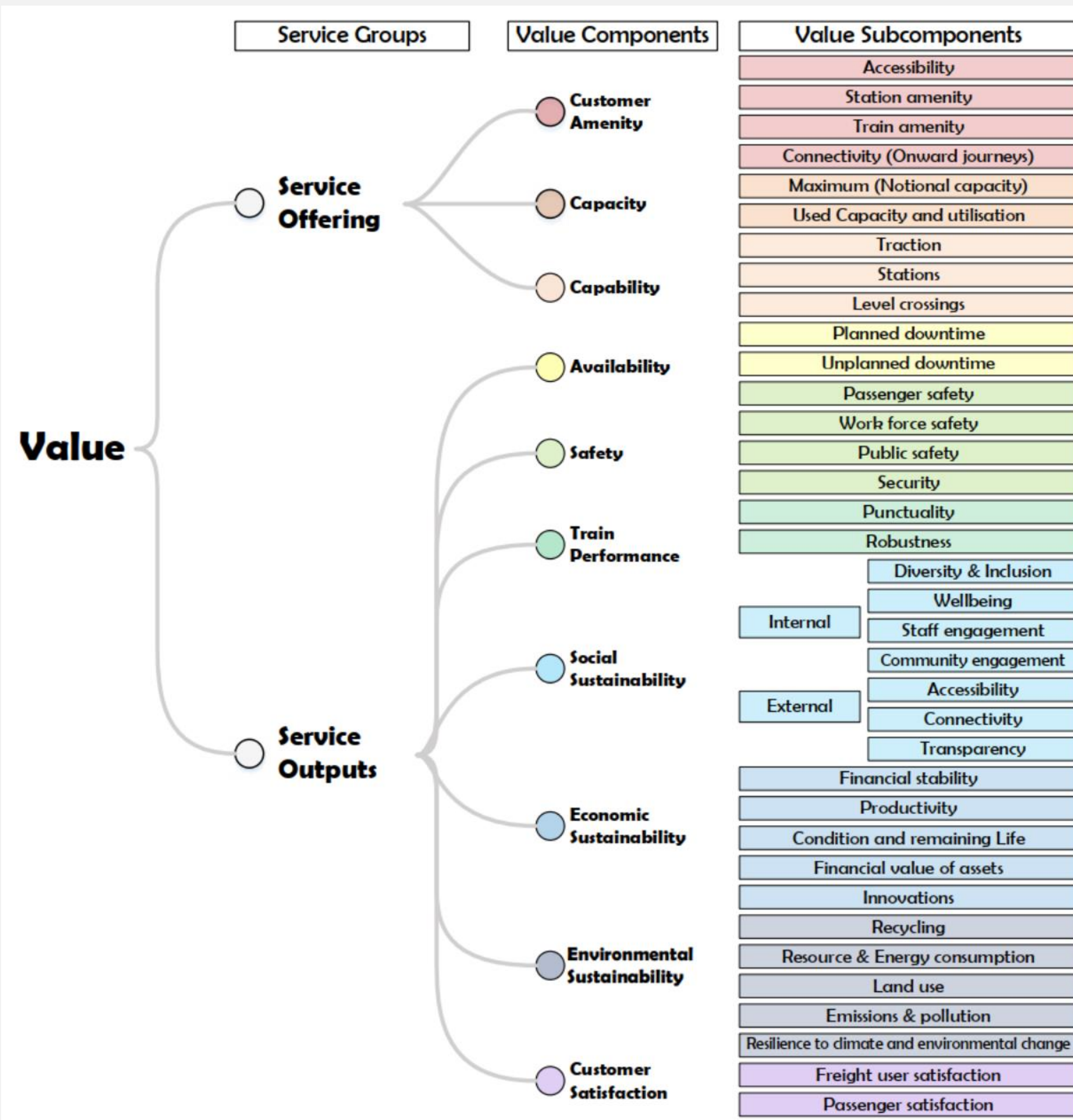
Continuously Manage
the Plan

Value Framework



Value Framework

Making best practices operational



Evaluating Candidate Projects



CANDIDATE INVESTMENTS



Asset Sustainment



Capacity Expansion



Safety / Performance
Improvements



Sustainability Programs

Evaluating Candidate Projects

Evaluate Candidate Investments

CANDIDATE INESTMENTS



Asset Sustainment



Capacity Expansion



Safety / Performance Improvements



Sustainability Programs

Asset Types

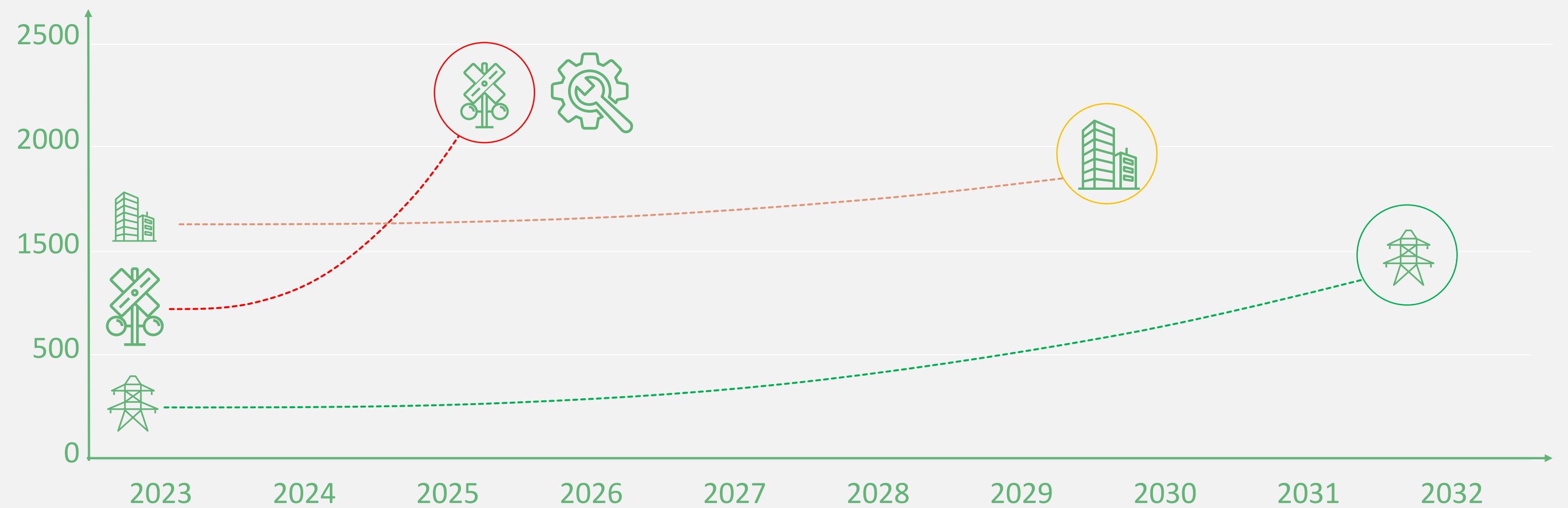
Station Assets (Escalators, Fire Suppression Systems)

Power Systems (Track Power Supply, Current Protection)

Revenue Systems (Rolling Stock, Etc.)

Risk Forecast

(Reliability, Passenger Satisfaction, Safety)



Evaluating Candidate Projects



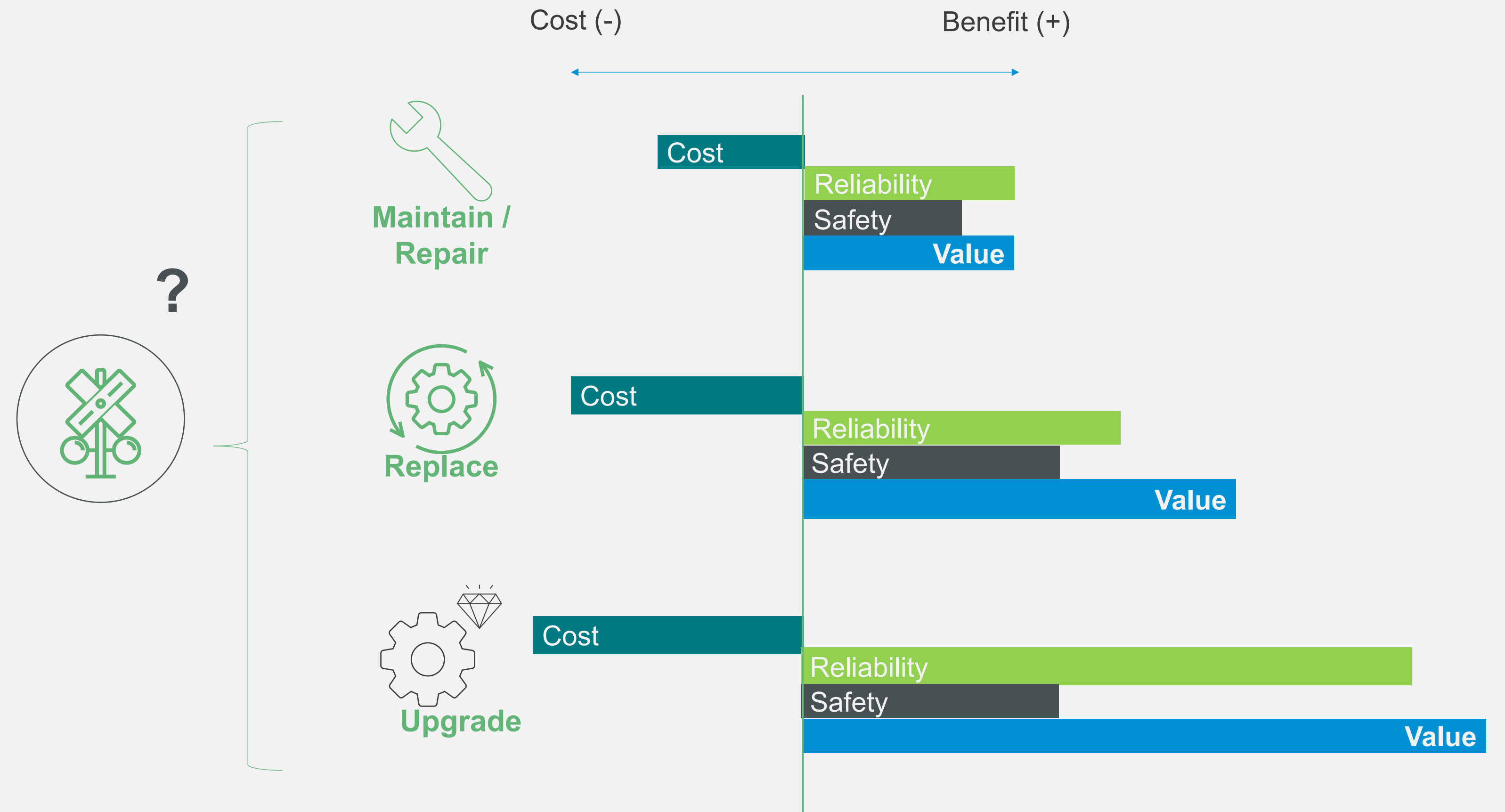
CANDIDATE INESTMENTS

Asset Sustainment

Capacity Expansion

Safety / Performance Improvements

Sustainability Programs



Evaluating Candidate Projects



CANDIDATE INVESTMENTS



Asset Sustainment



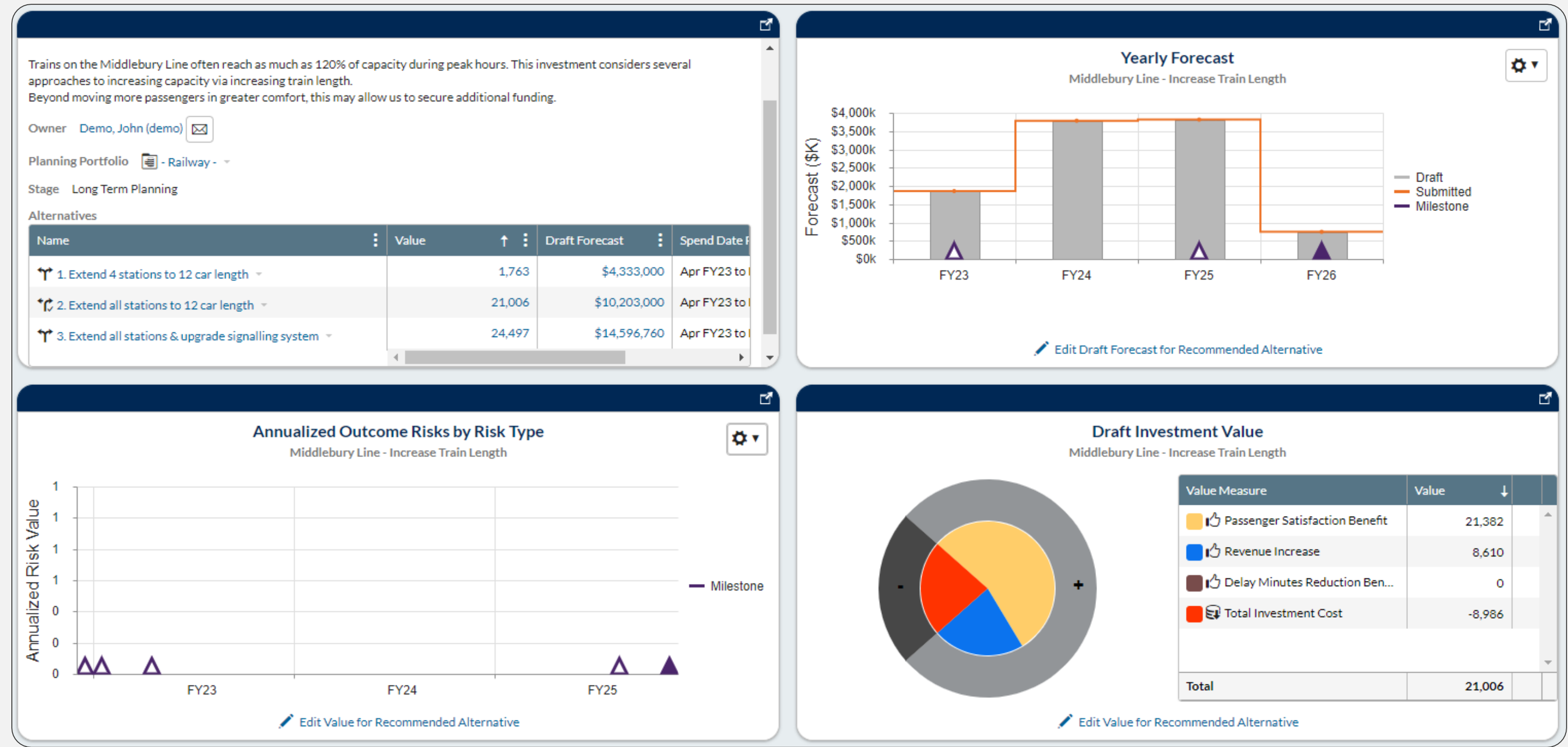
Capacity Expansion



Safety / Performance Improvements



Sustainability Programs



Portfolio Optimization & Scenario Analysis

Optimize the Investment Portfolio

PROJECTS

Costs, Resources, Benefits



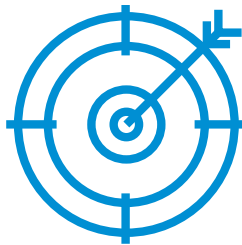
CONSTRAINTS

Financial, Resources, Operational

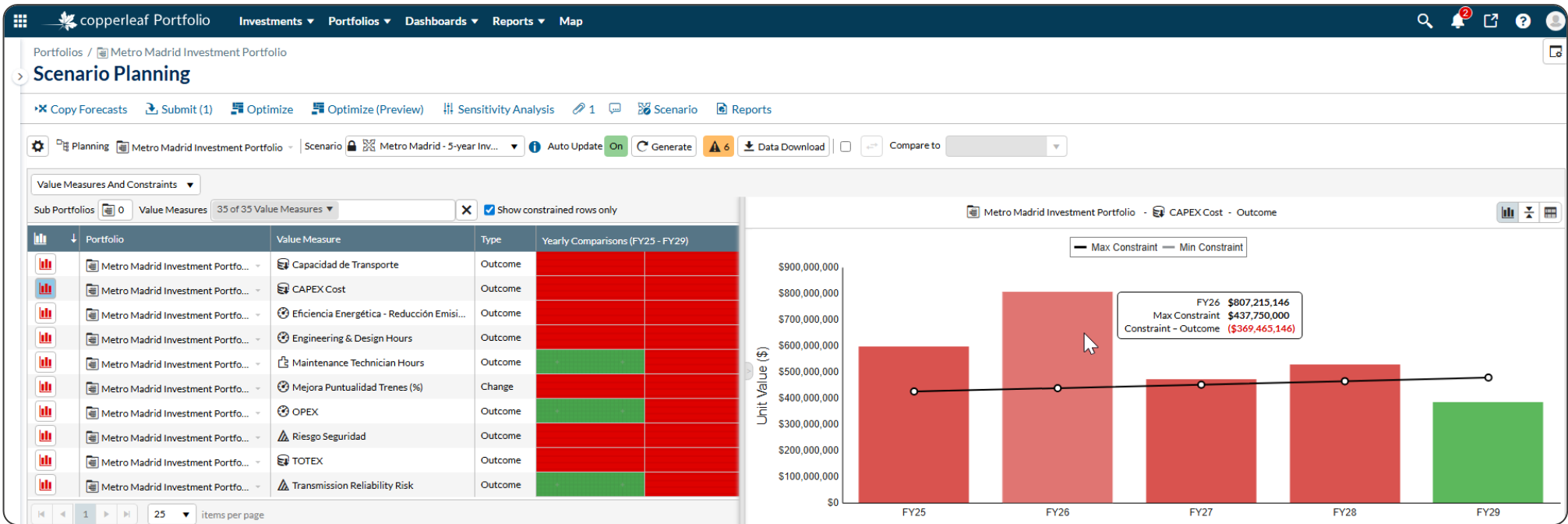
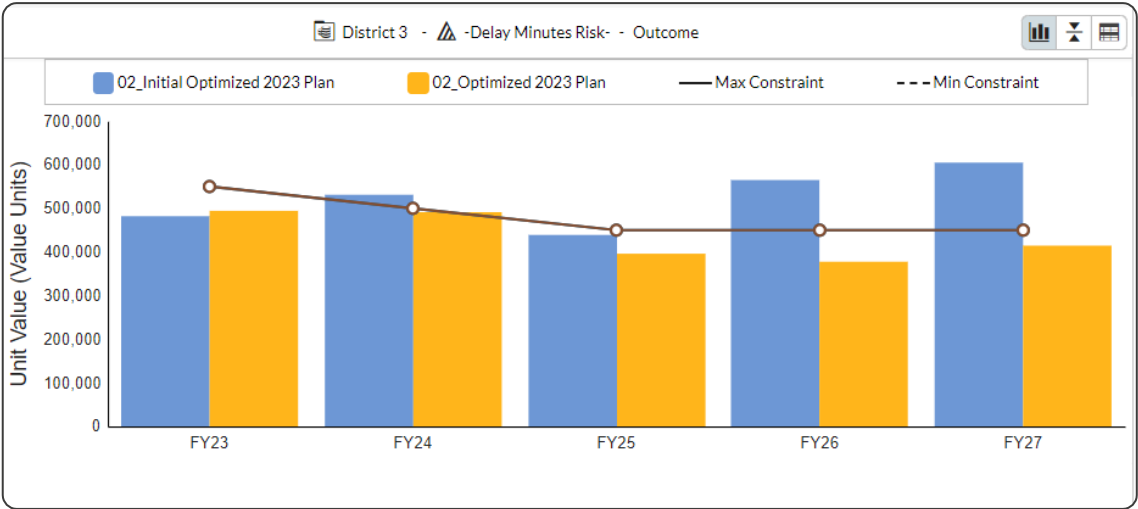


TARGETS

Risk, Performance, Emissions



OPTIMIZE



Portfolio	Value Measure	Type	Yearly Comparisons (FY25 - FY29)
Metro Madrid Investment Portfolio	Capacidad de Transporte	Outcome	
Metro Madrid Investment Portfolio	CAPEX Cost	Outcome	
Metro Madrid Investment Portfolio	Eficiencia Energética - Reducción Emisiones	Outcome	
Metro Madrid Investment Portfolio	Engineering & Design Hours	Outcome	
Metro Madrid Investment Portfolio	Maintenance Technician Hours	Outcome	
Metro Madrid Investment Portfolio	Mejora Puntualidad Trenes (%)	Change	
Metro Madrid Investment Portfolio	OPEX	Outcome	
Metro Madrid Investment Portfolio	Riesgo Seguridad	Outcome	
Metro Madrid Investment Portfolio	TOTEX	Outcome	
Metro Madrid Investment Portfolio	Transmission Reliability Risk	Outcome	

Portfolio Optimization & Scenario Analysis

Optimize the
Investment
Portfolio

PROJECTS

Costs, Resources, Benefits



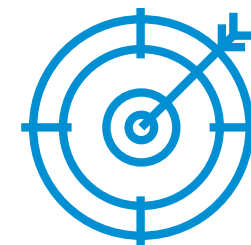
CONSTRAINTS

Financial, Resources, Operational

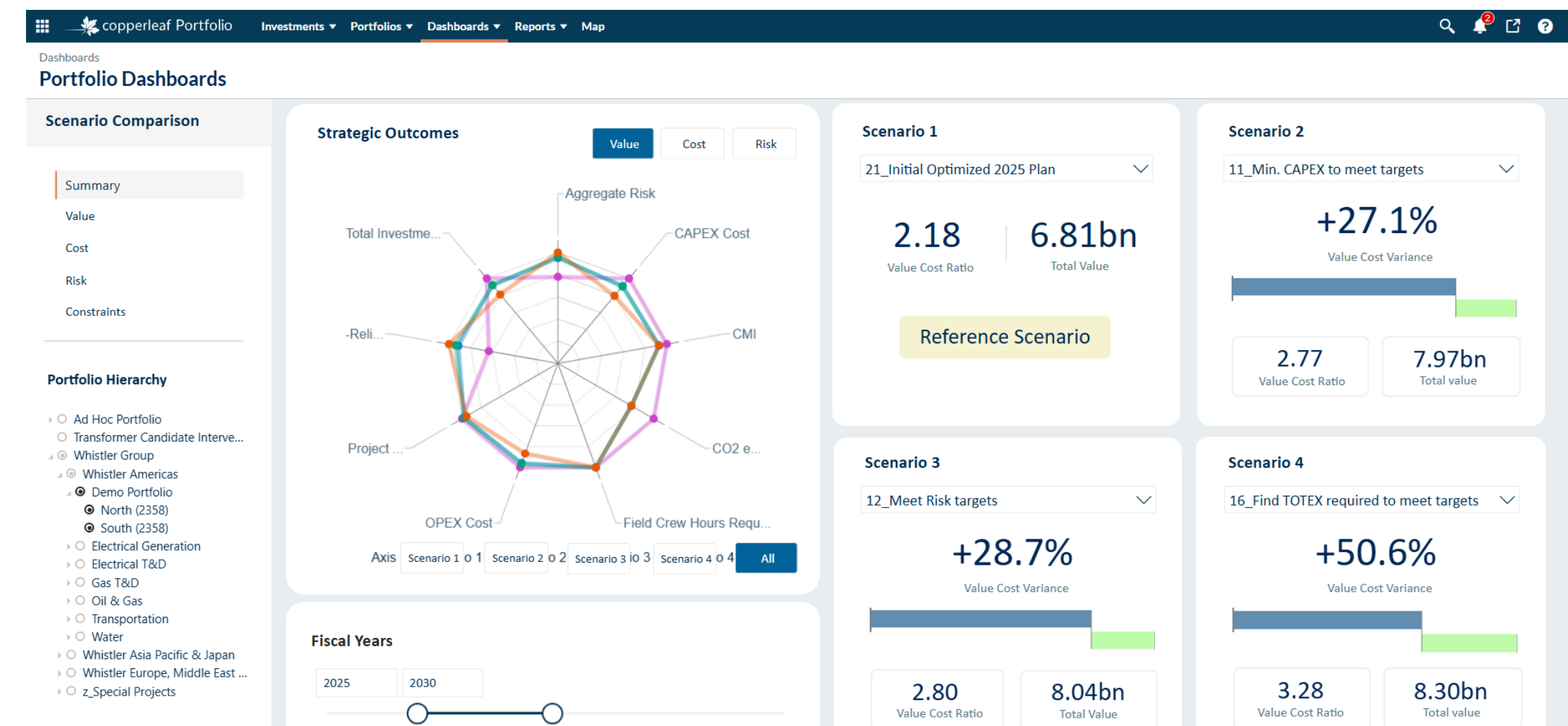
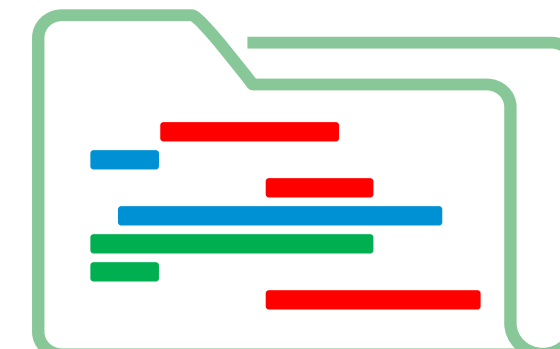
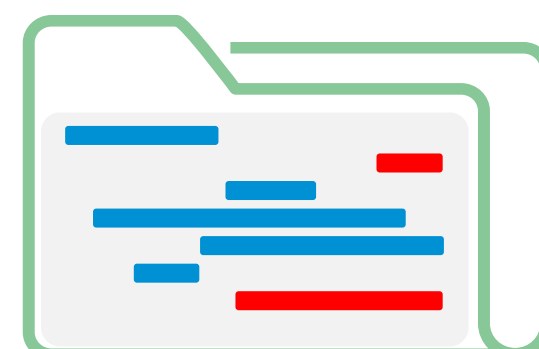


TARGETS

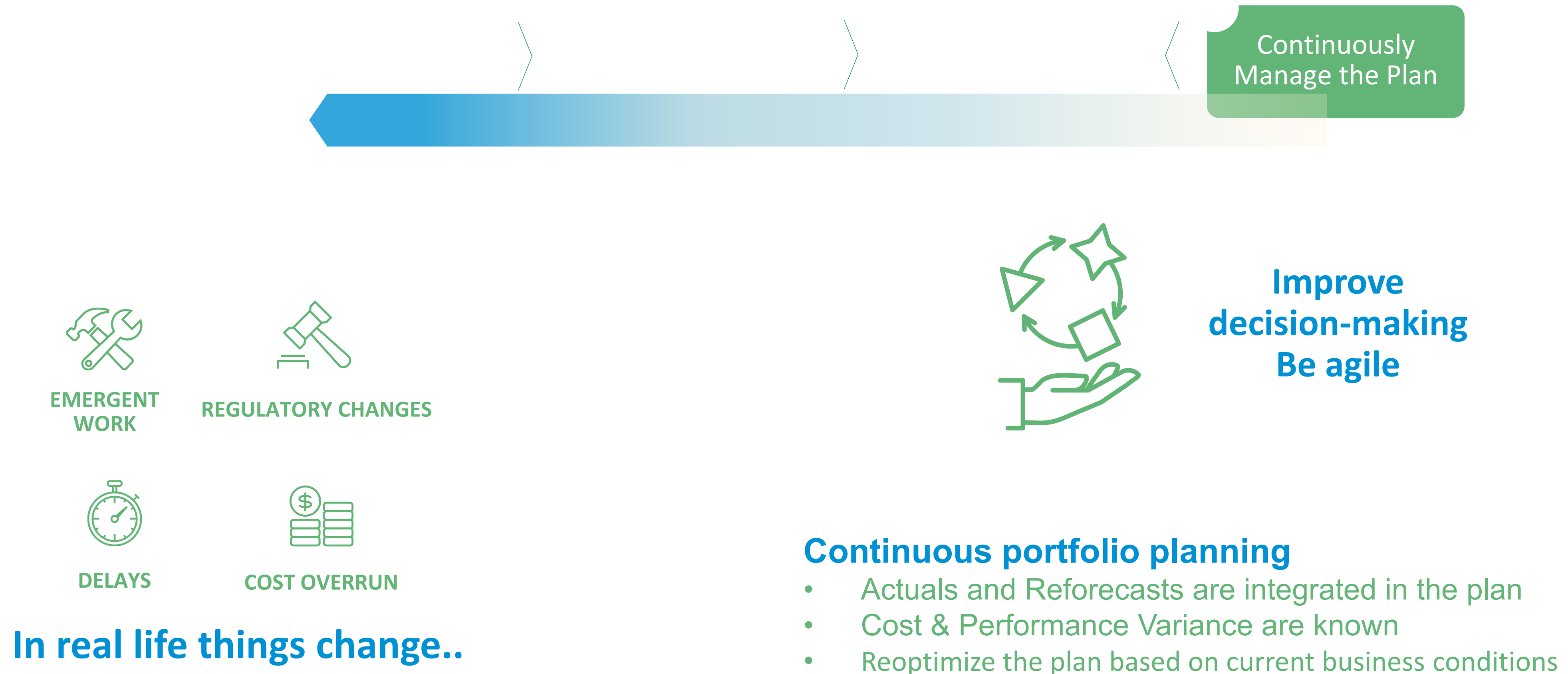
Risk, Performance, Emissions



‘What-if’?



Respond to Rapidly Changing Business Environments



Client Case Study: Network Rail

Centralizing high-value asset investment decisions

Challenges

- ▶ Complex funding, regulatory & operating environment
- ▶ High costs and administrative overhead for planning and modeling solutions
- ▶ Difficulty comparing investment strategies across asset classes

Solution Overview

- ▶ Off-the-shelf solution for integrated investment planning & modeling
- ▶ Centralized enterprise-wide system to support diverse asset base
- ▶ Common approach to valuation across the organization aligned to strategic goals
- ▶ Optimization & scenario analysis to meet performance targets and balance sustainment with growth

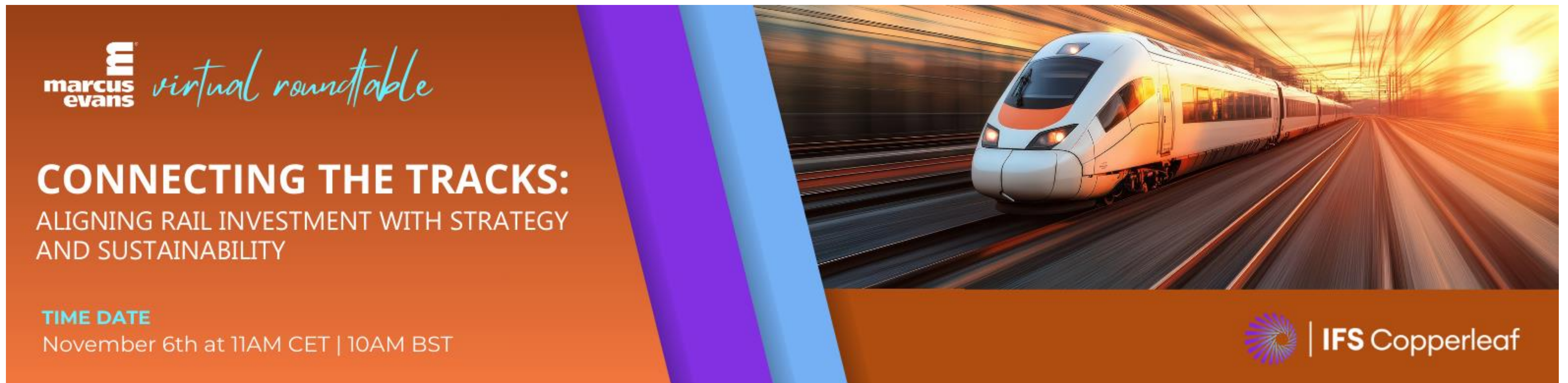
Outcomes

- ▶ Create **optimal & executable programs amidst constraints** such as: timing, cost, staff availability, salaries, access requirements, materials, technology, and more
- ▶ Enhanced planning **transparency, efficiency, and productivity**
- ▶ Improved **agility to plan & re-plan** quickly given changing requirements



Join our upcoming Virtual Roundtable

November 6th, 11:00 AM
Online



marcus evans *virtual roundtable*

CONNECTING THE TRACKS:
ALIGNING RAIL INVESTMENT WITH STRATEGY
AND SUSTAINABILITY

TIME DATE
November 6th at 11AM CET | 10AM BST

 | **IFS Copperleaf**

www.copperleaf.com/events/

Find out more



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www.copperleaf.com

Session 3: Decision Making Q&A



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THANK YOU FOR YOUR ATTENTION

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ASSET MANAGEMENT
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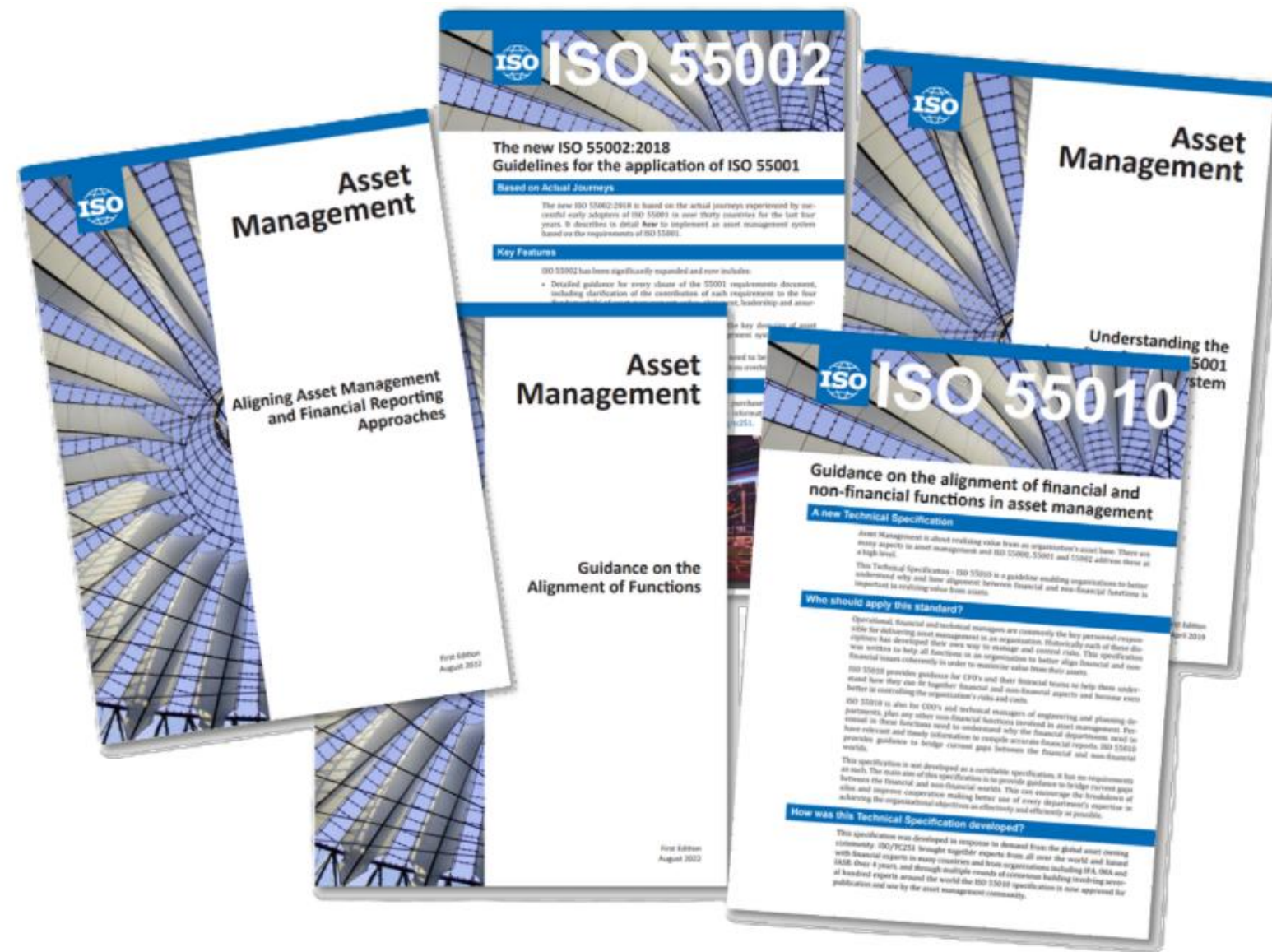
Asset Management Seminar

Pietrarsa, Naples – 2 October 2025

A TCO model for complex assets: lessons learnt
from a real world case

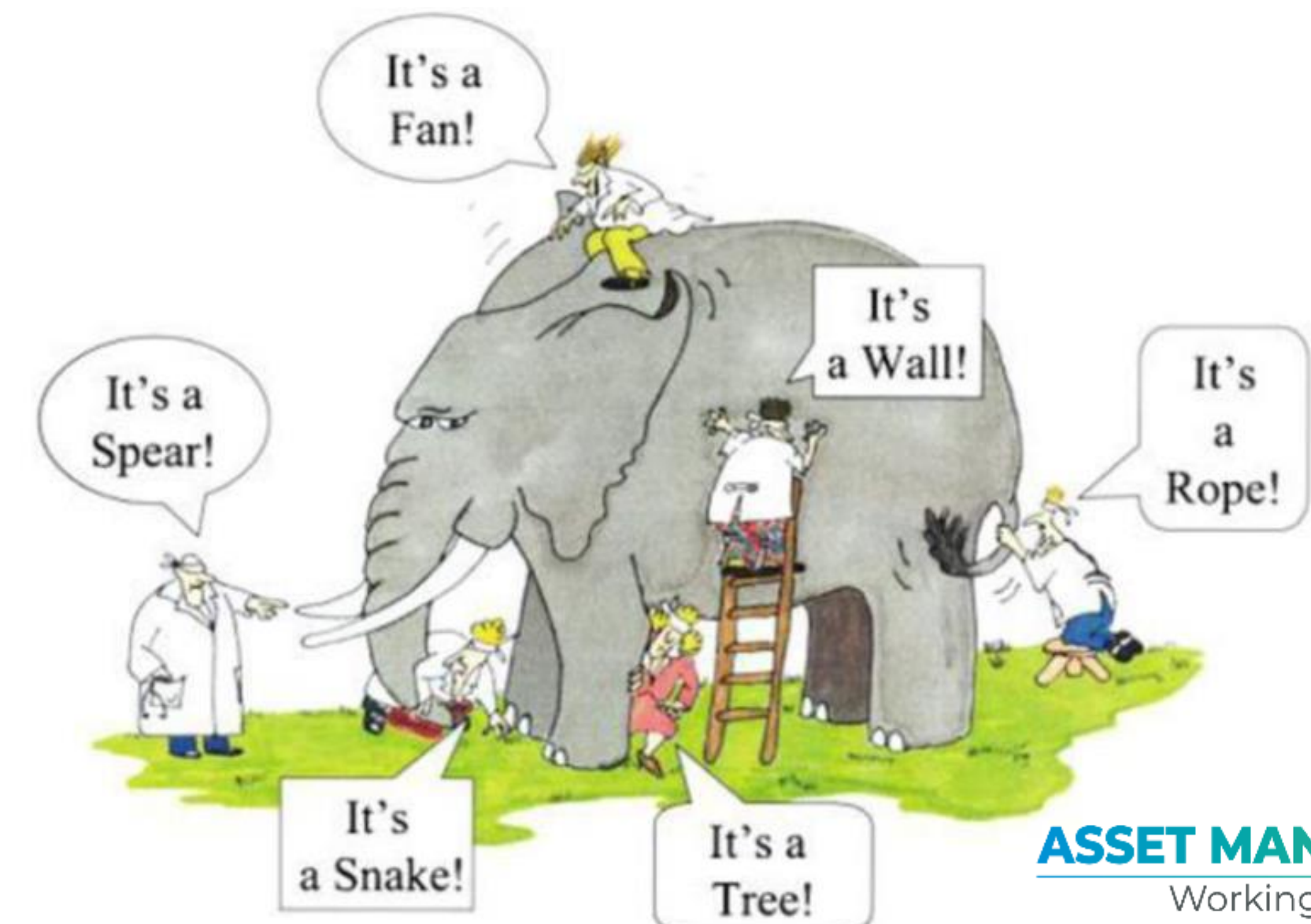
Roberto Pinto

Asset Management in RFI



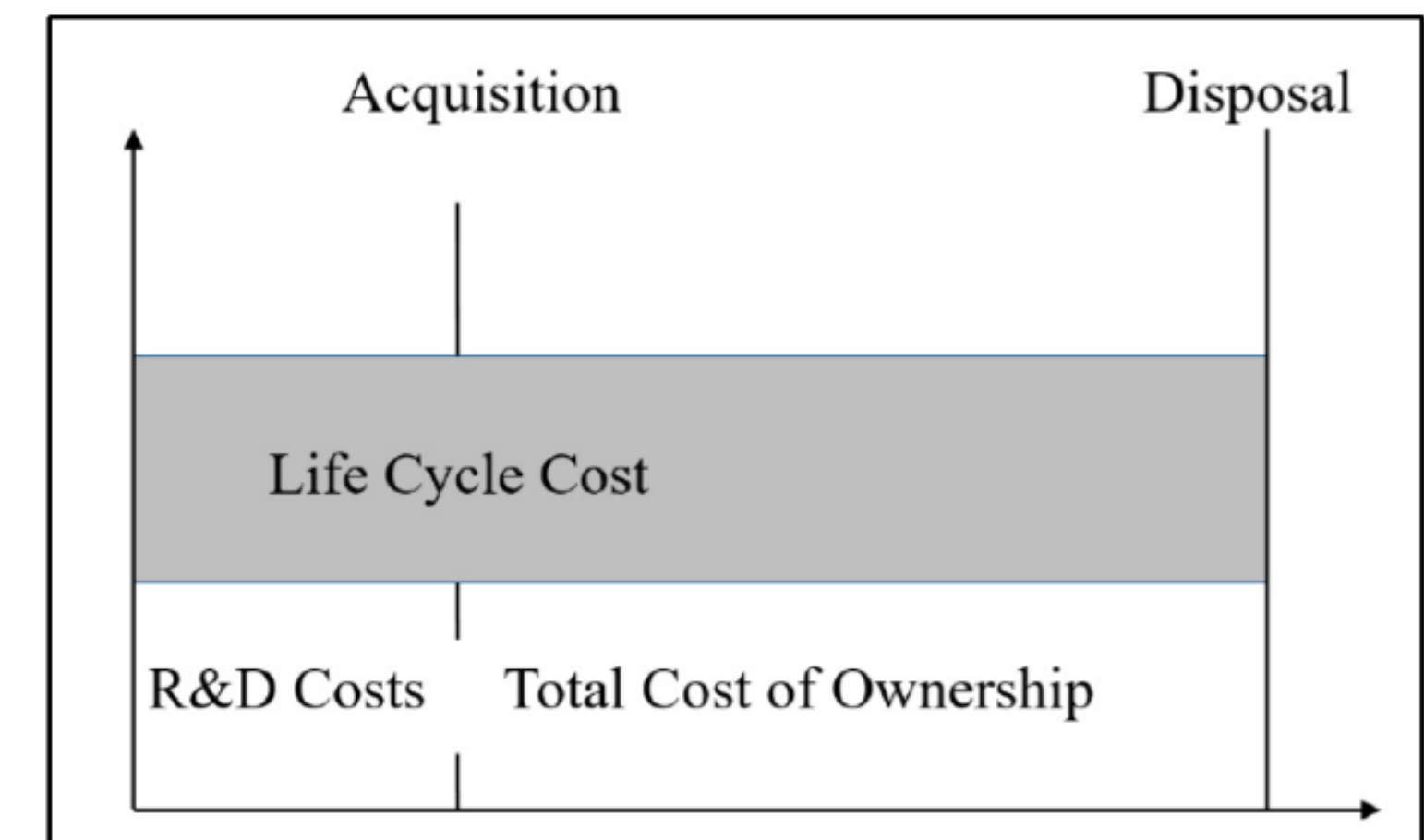
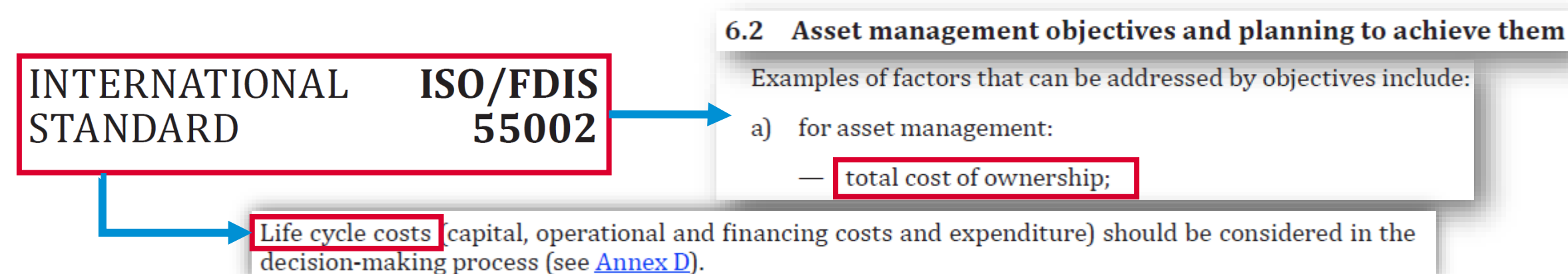
- Disseminates within RFI the principles of Asset Management in **compliance** with international ISO 5500X standards.
- Interacts with other railway infrastructure managers and **universities** to better interpret the standards.
- Introduces **innovative methodologies** related to the ISO 5500X framework.

- Ensures the **development** and updating of RFI's Asset Management System (AMS).
- Analyzes the **key components** of RFI's AMS.
- Pursues a **systemic approach** to overcome siloed perspectives.



TCO

Total Cost of Ownership (TCO) is an evaluation method that considers **all costs** associated with the acquisition, use, maintenance, and disposal of an asset or service during its **entire lifecycle**. It is not limited to the purchase price but also includes operational costs, maintenance, training, upgrades, energy consumption, and other indirect costs.



Steffen Landscheidt and Mirka Klans / Procedia CIRP 57 (2016) 746 – 751

In the Asset Management context, TCO helps to:

- Support strategic and investment **decisions**;
- Assess the **economic efficiency** of an asset over time;
- Optimize the **asset management** and maintenance plan.

TCO

The goal of RFI's Asset Management is to **introduce** the TCO **methodology into the company**: develop a model for calculating and evaluating Total Cost of Ownership to provide RFI's different departments with a tool that supports strategic, tactical, and operational **decision-making**.

Specifically, the model should be:

- **comprehensive**, covering all possible cost items;
- **IT-based**, with a system that implements the methodology and integrates with other corporate IT systems;
- **structured**, so the TCO methodology can be shared across the entire company.



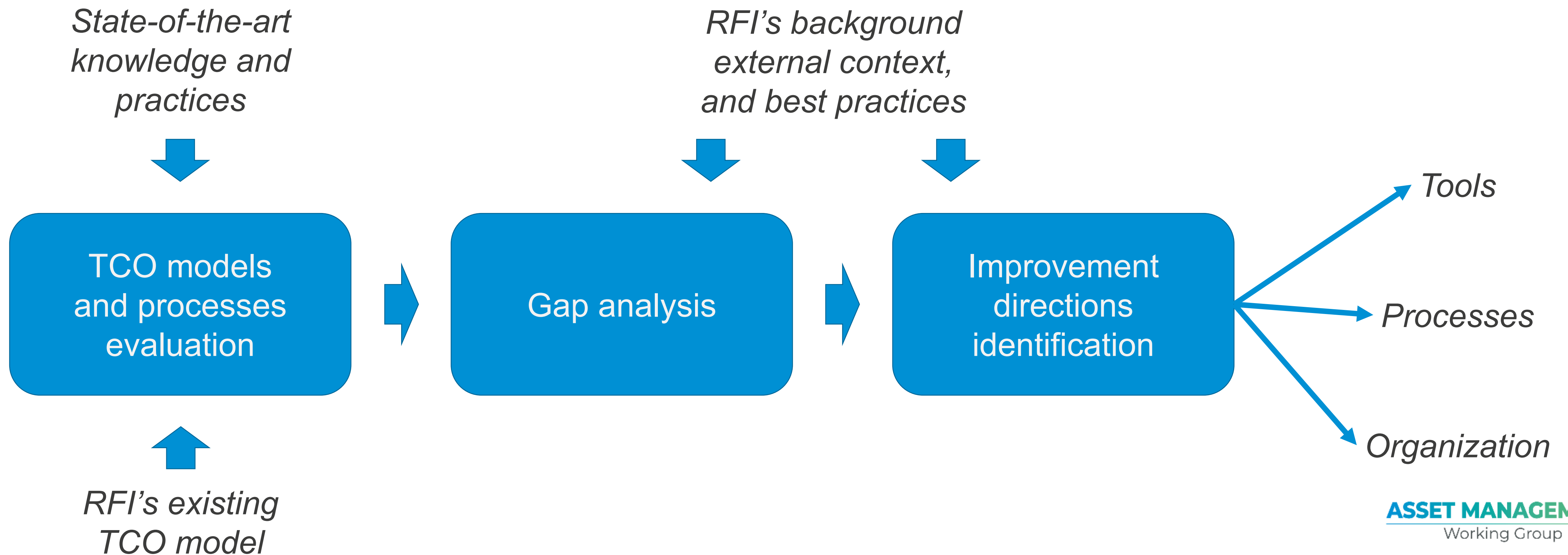
RFI had already launched this study in 2017 with PoliMI, which provided an initial version of the model.

Over time, the need to update the methodology arose, and for this purpose **UniBG** was engaged.

The project foundations

A complex system that works is invariably found to have evolved from a simple system that worked.

Gall's law

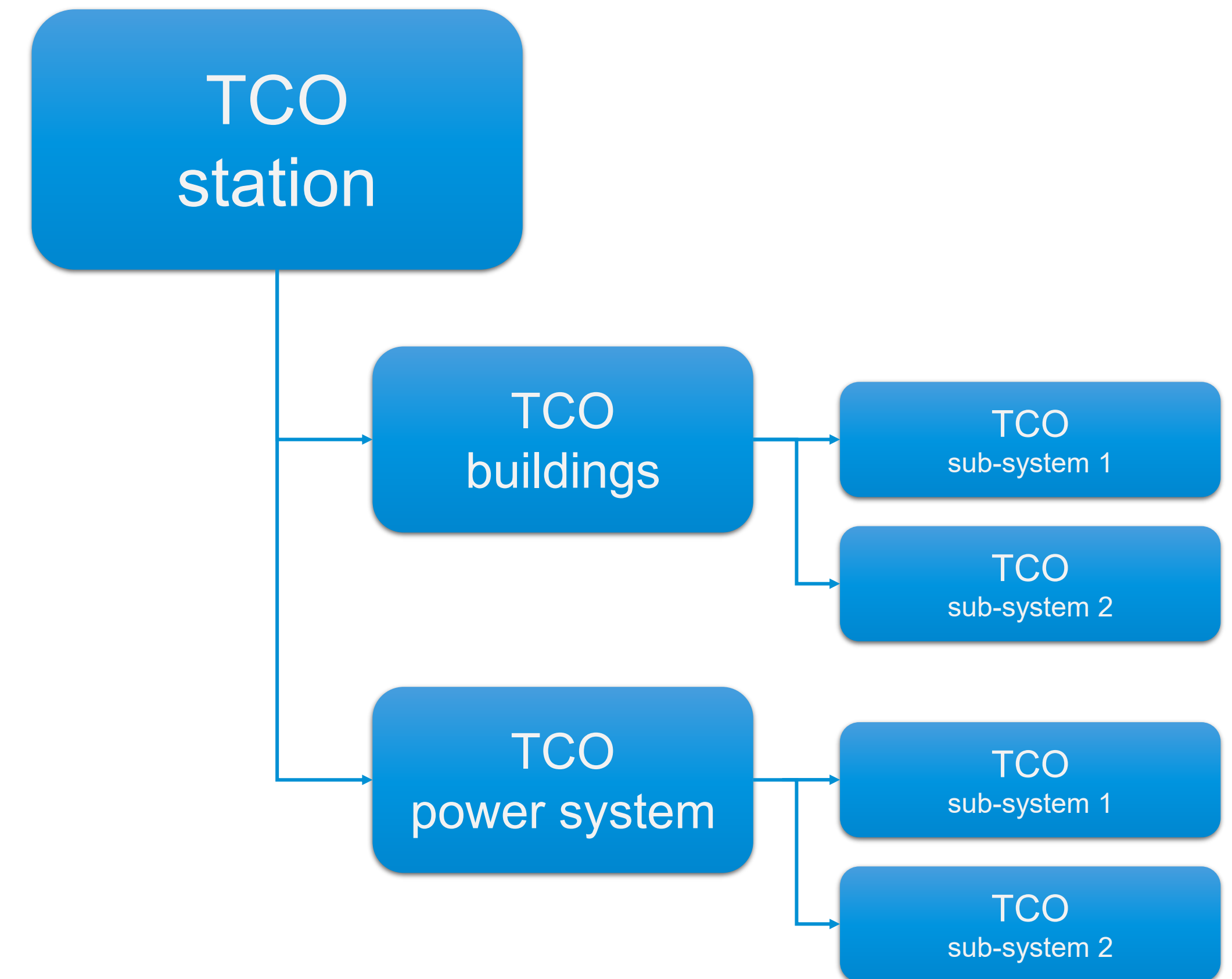


LL1 – Not all assets are created equal

Complex asset = an asset composed of several sub-assets, which in turn may be composed of other sub-assets

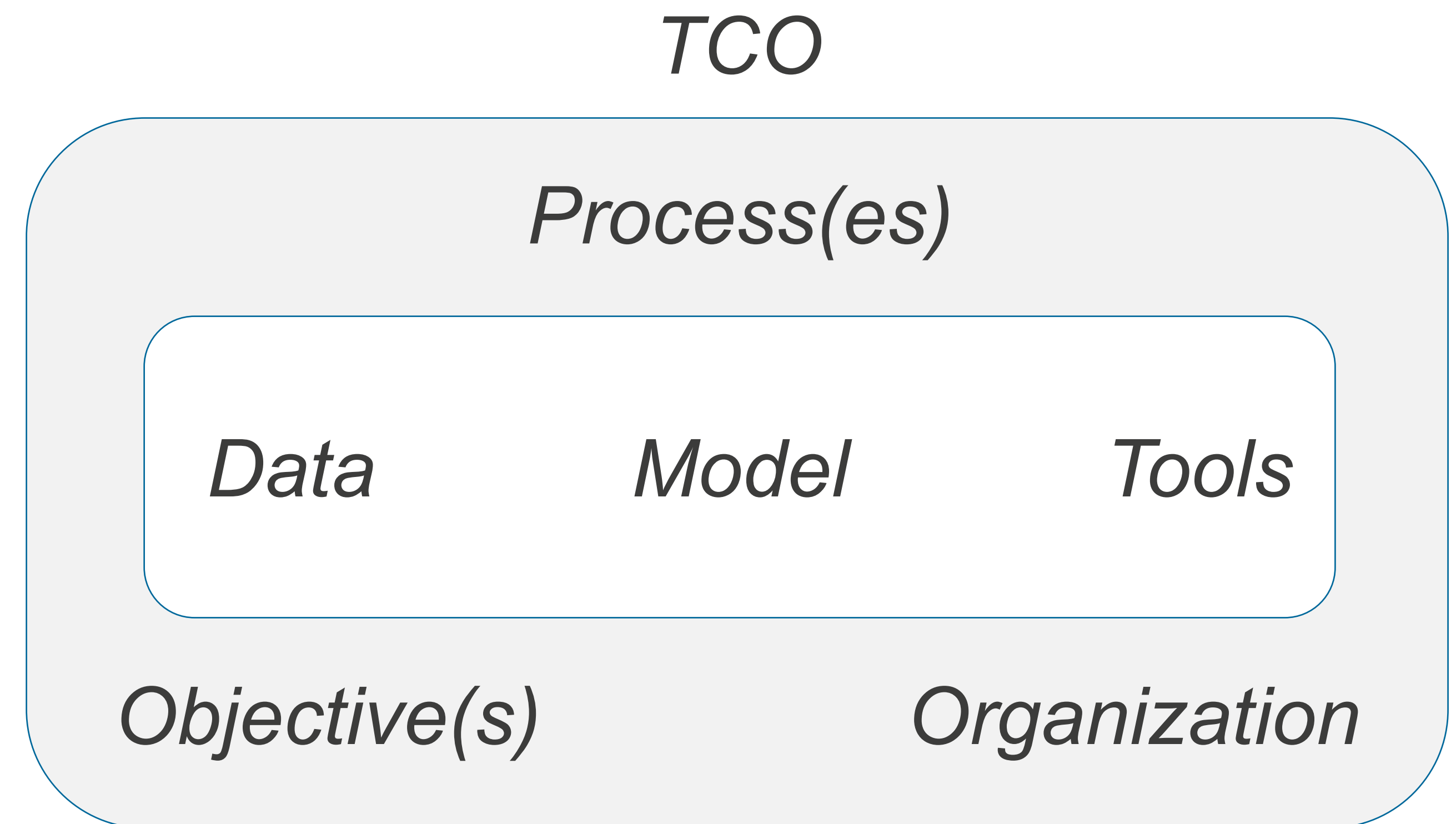
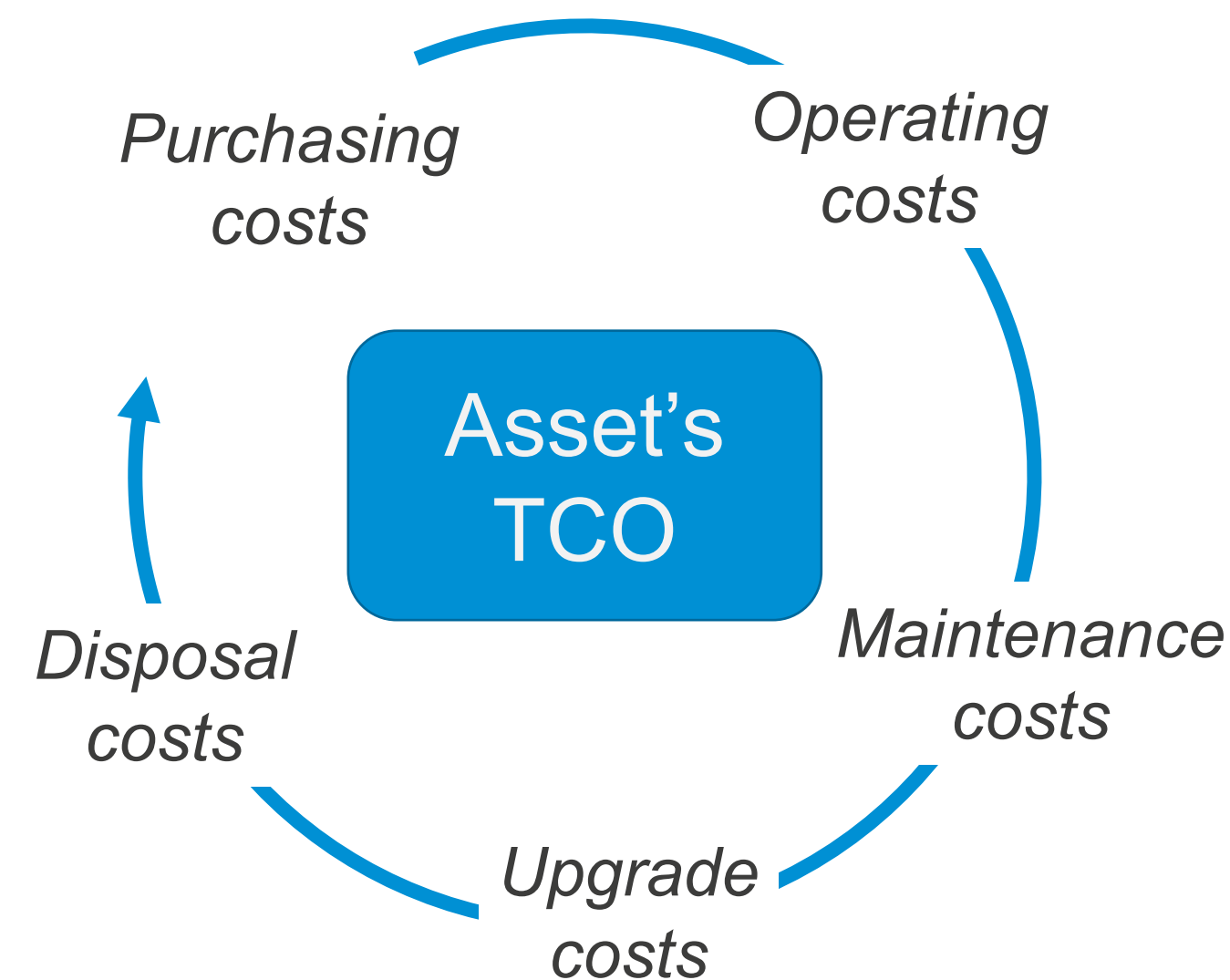
Example of complex assets: a train station, a portion of tracks, an infrastructure...

In this case, the TCO evaluation is more complex



LL2 – There is more than meets the eye

The TCO is the **sum of all costs** tied to an asset along its entire lifecycle (BoL, MoL, EoL)



Interlude – The role of the model

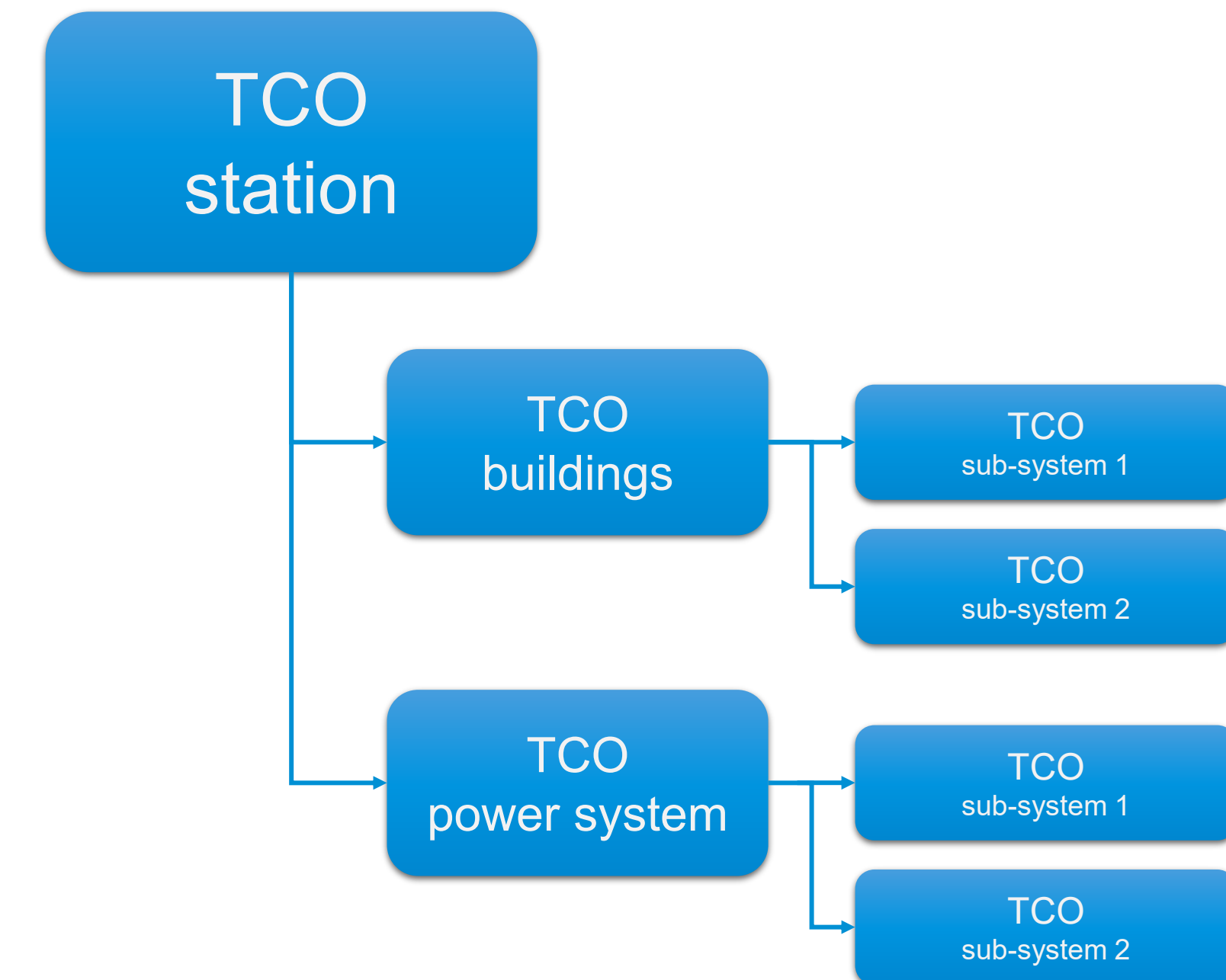
The model is meant to represent the relevant elements and their mutual relationships in the definition of the TCO

- **Operating logic:** the rules and processes that the model follows to process input data and generate output.
- **Scope of validity:** defines the situations in which the model can be successfully applied and its generalizability.
- **Level of accuracy:** the level of approximation of the results due to simplifications and generalizations in the model and operating logic, as well as the data considered.

Interlude – The role of the model

We proposed a **modular** and **hierarchical** model:

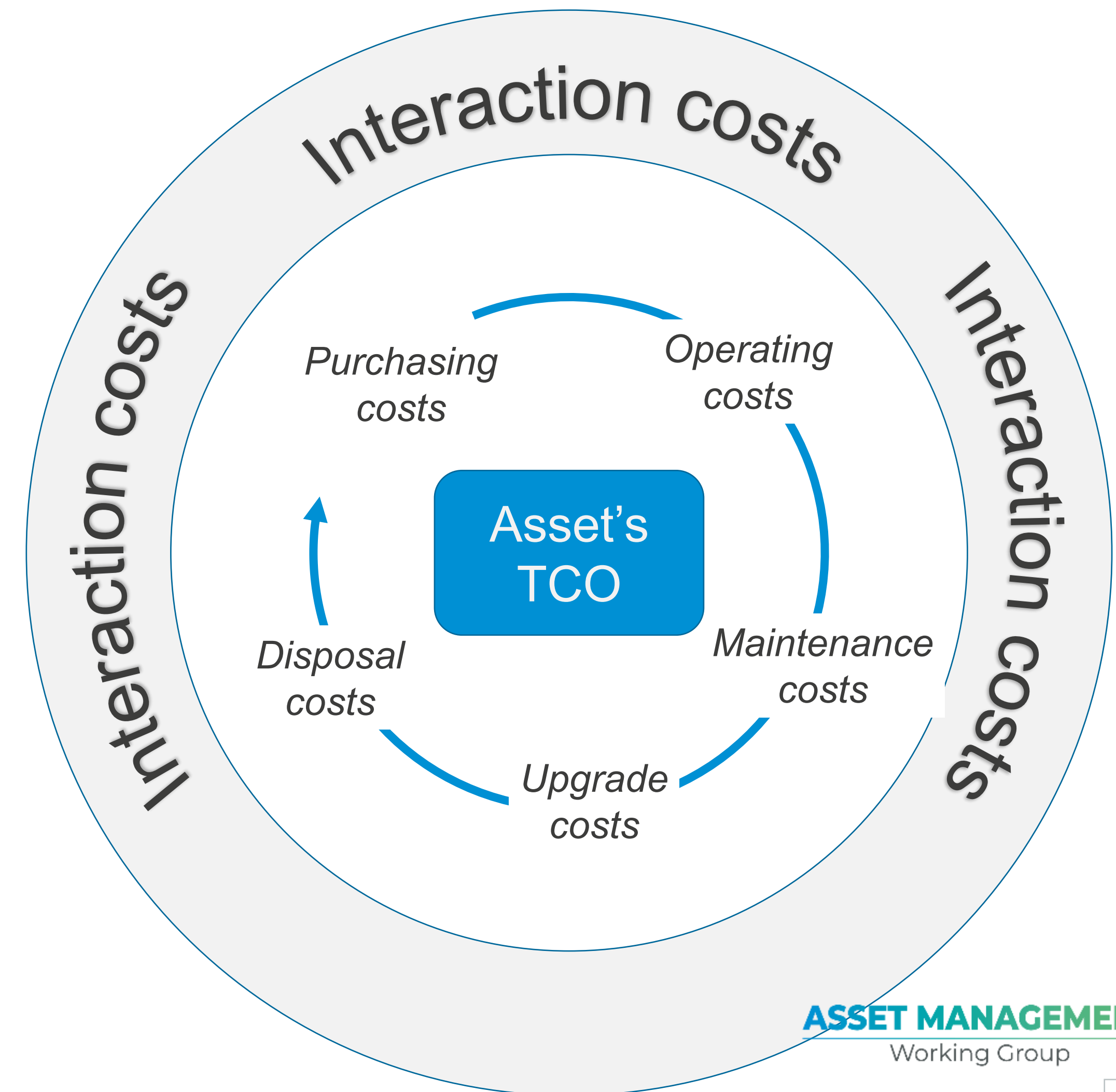
- It allows both top-down and bottom-up approaches
- It stimulates “reasoning” about the asset
- It allows the level of detail to be defined during the work
- It allows the calculation modelling to be divided among multiple actors so that they can proceed in parallel (*separation of concerns*)
- Extremely flexible and adaptable



LL3 – The whole is greater than the sum of its parts

The TCO includes factors related to all the assets/sub-assets involved, as well as other factor connected to their mutual **interactions**:

- Integration costs
- Synchronization costs
- Cascading costs
- Scaling inefficiencies costs



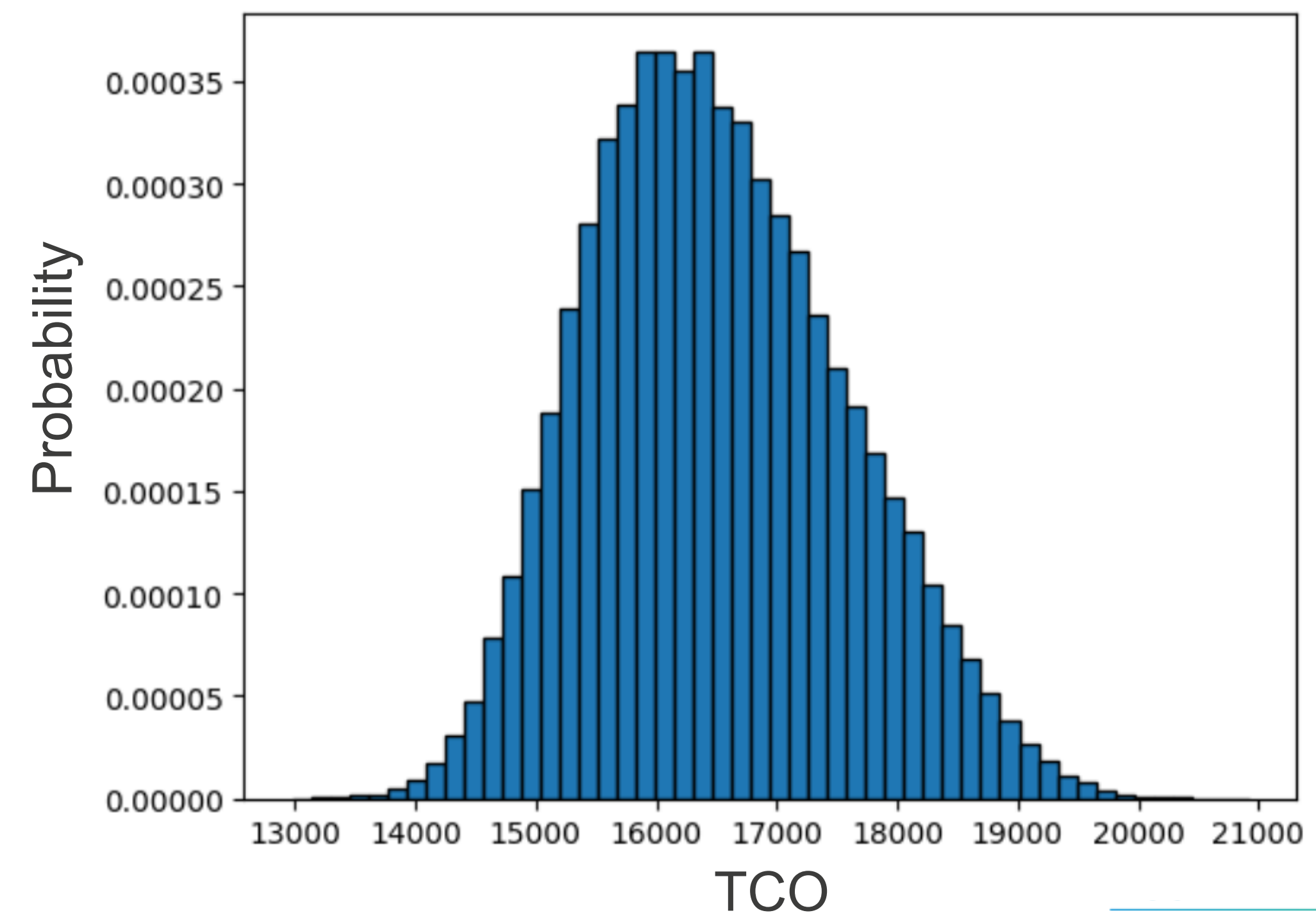
LL4 – Looking through a different lens

Assets operate across:

- Several years
- Different conditions

It is necessary to deal with **uncertainty**

●
TCO

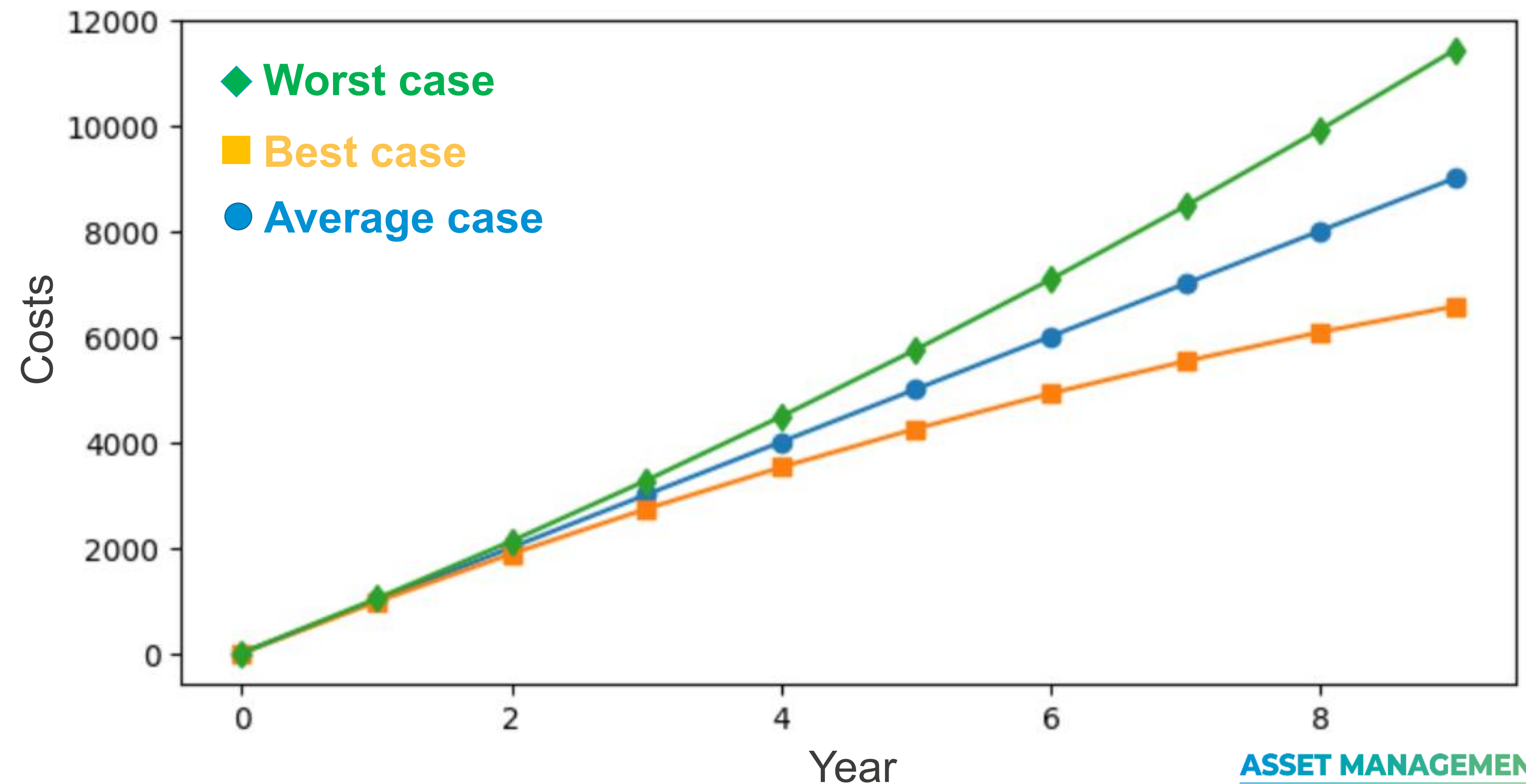


LL4 – Looking through a different lens

Assets operate across:

- Several years
- Different conditions

It is necessary to deal with **uncertainty**



TCO – Summary and conclusions

Main lessons learnt:

- Not all assets are created equal
- There is more than meets the eye
- The whole is greater than the sum of its parts
- Looking through a different lens

The main benefits of a well structured approach to TCO

- Complete, granular visibility into costs
- Data-driven decision making and investments
- Alignment and integration with other systems to enable structured, continuous monitoring
- Interdisciplinary collaboration inside and outside the organization
- Enables thinking differently about the asset (TCO uncertainty, asset composition)
- Elicit the progression of the company's maturity in strategic asset management

Session 3: Decision Making Q&A



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THANK YOU FOR YOUR TIME AND ATTENTION

UniBg Team

- Roberto Pinto
- Emanuele Dovere
- Giovanni Ruggeri
- Mattia Galimberti
- Enrico Cagnoni

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ASSET MANAGEMENT
Working Group



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Asset Management Seminar

Pietrarsa, Naples – 2 October 2025

WiSDoM –
Whole System Decision Making
Adalberto Polenghi

Agenda

- Project overview
- WiSDoM phase 1 summary
- WiSDoM phase 2 project
- Application to use cases
- Conclusions

Background and objectives

Traditionally, the railways have been organised according to what would now be recognized as **business silos**. Historically a **highly effective** model based on functional hierarchies and geographical spans of control, with fast decision-making and clear accountabilities.

While such organizational model is able to maintain the status quo and deal with incremental developments, it is **less effective in responding to major changes**.



Strategic decisions are:

- Long-term and uncertain
- Interdependent
- Not always quantifiable
- Dependent on trade-offs

*The overall objective for the project is to **establish and validate a methodology and framework for whole-system, value-based decision-making.***

WiSDoM Project Participants



Infrastructure Management companies



Standardisation body



Methodological experts



Project structure

Needs for support to
complex decision-making in
railway infrastructure
management

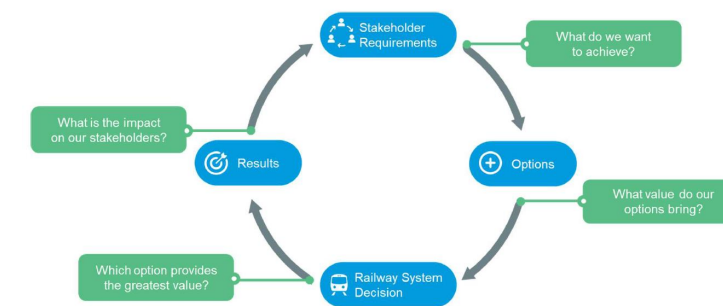
Phase 1

Objective

To define a decision-making framework able to accommodate specific feature for railway infrastructure managers

Result

Value-based decision-making cycle



Phase 2

Objective

To apply and refine the value-based decision-making cycle so as to validate the concept

Result

Decision-making support tool based on DEMATEL (MCDA)



POLITECNICO
MILANO 1863

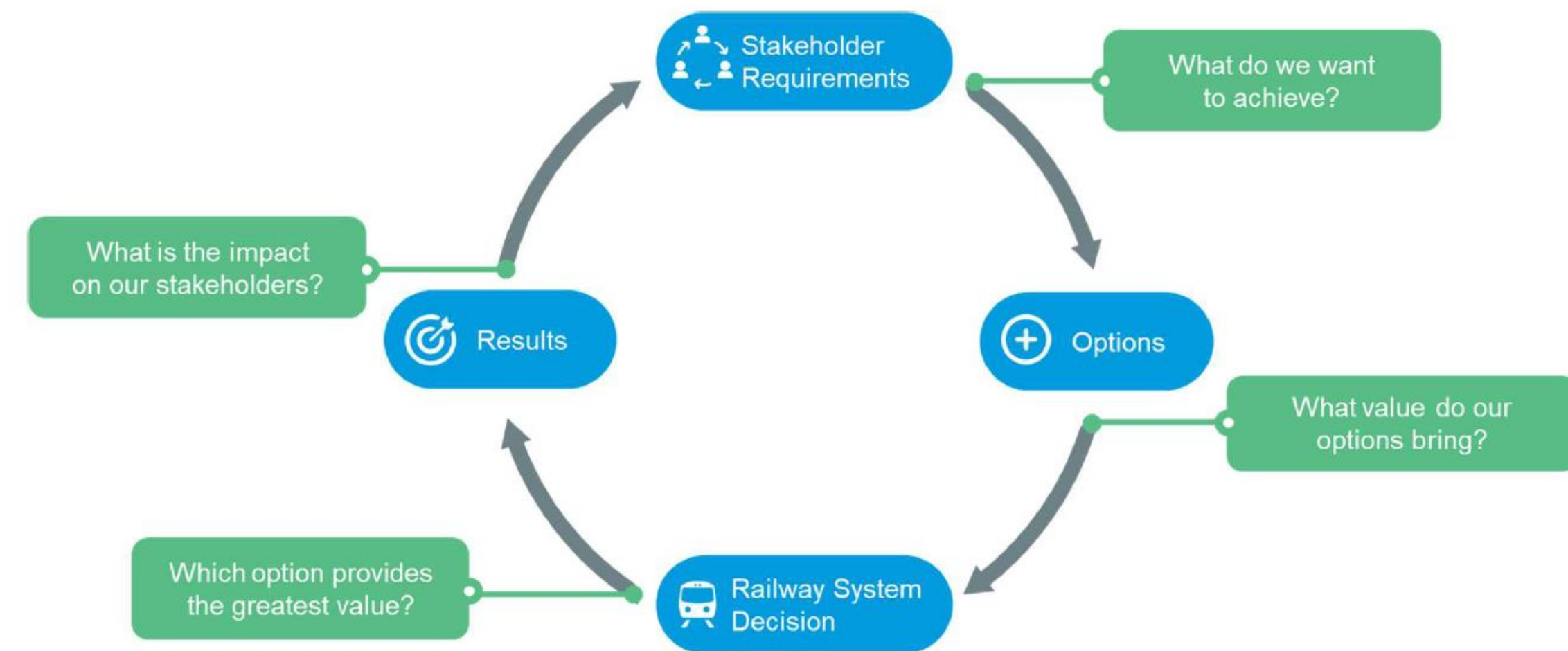


DEMATEL

10 USE CASES

Phase 1 / Features and characteristics

The value-based decision-making cycle is based on an iterative process that considers **system thinking** and **multi-criteria decision analysis (MCDA)** as a must-have in complex decisions, as the one in railway, from budget allocation to maintenance plan definition.



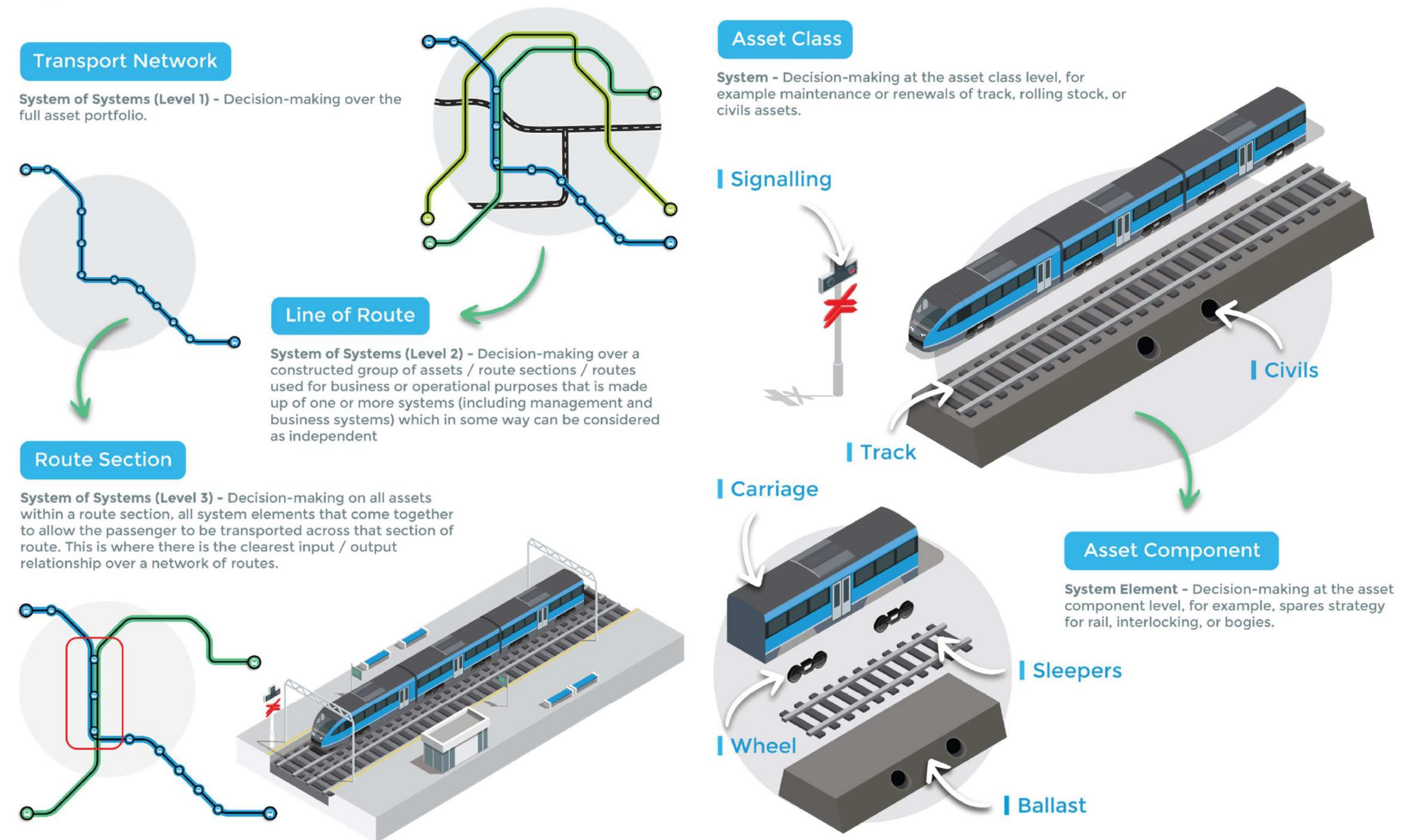
Value-based decision cycle

For this reason it is built on:

1. Analysis and formalisation of stakeholders requirements
2. Identification of options (within each decision, the options must be properly defined)
3. Prioritisation of options based on relative value generation
4. Evaluation of results and eventual revision

Phase 1 / Features and characteristics

As a consolidated basis for such decision-making cycle, a suitable and agreed-upon **system breakdown structure** must be present.

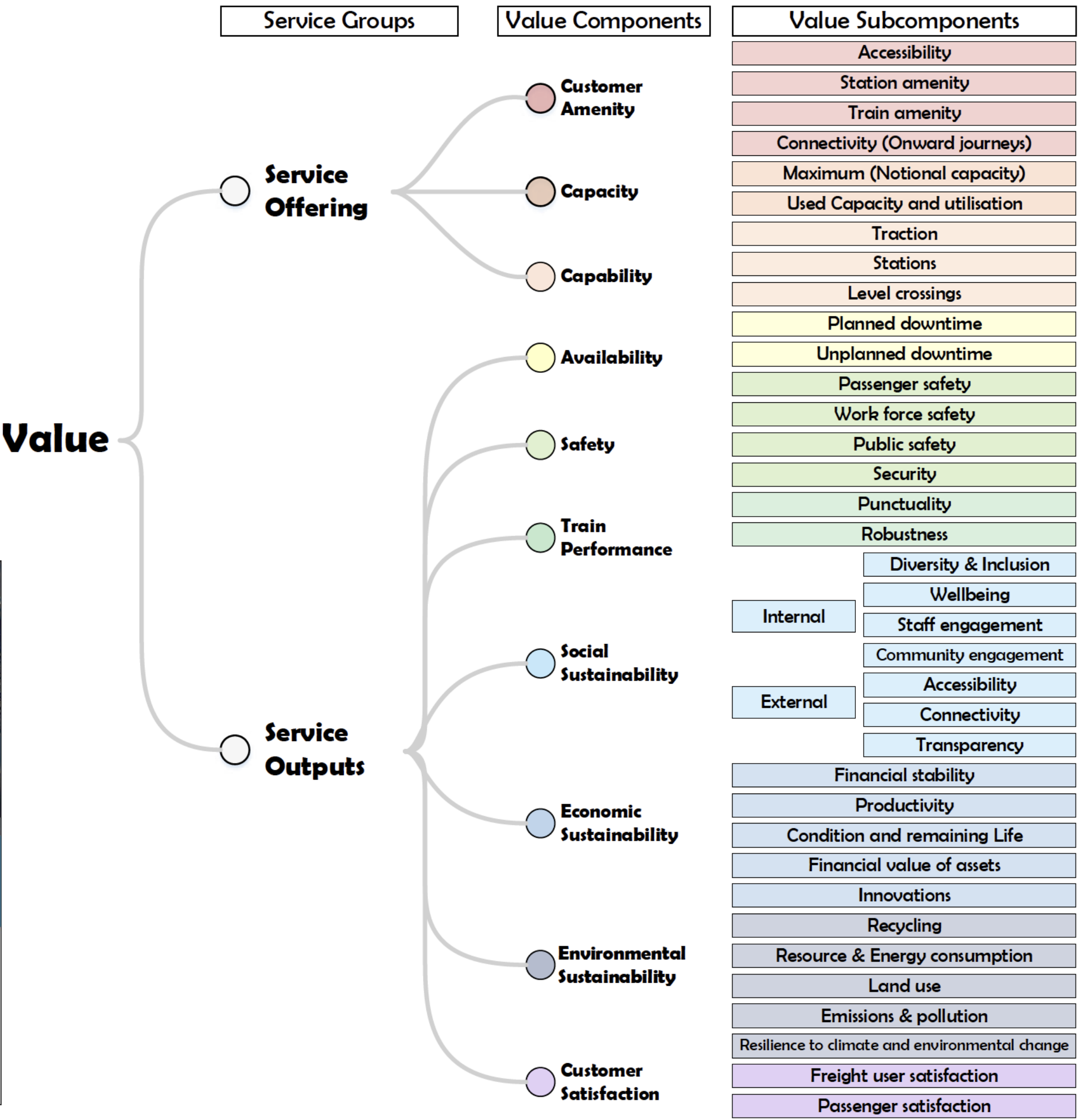
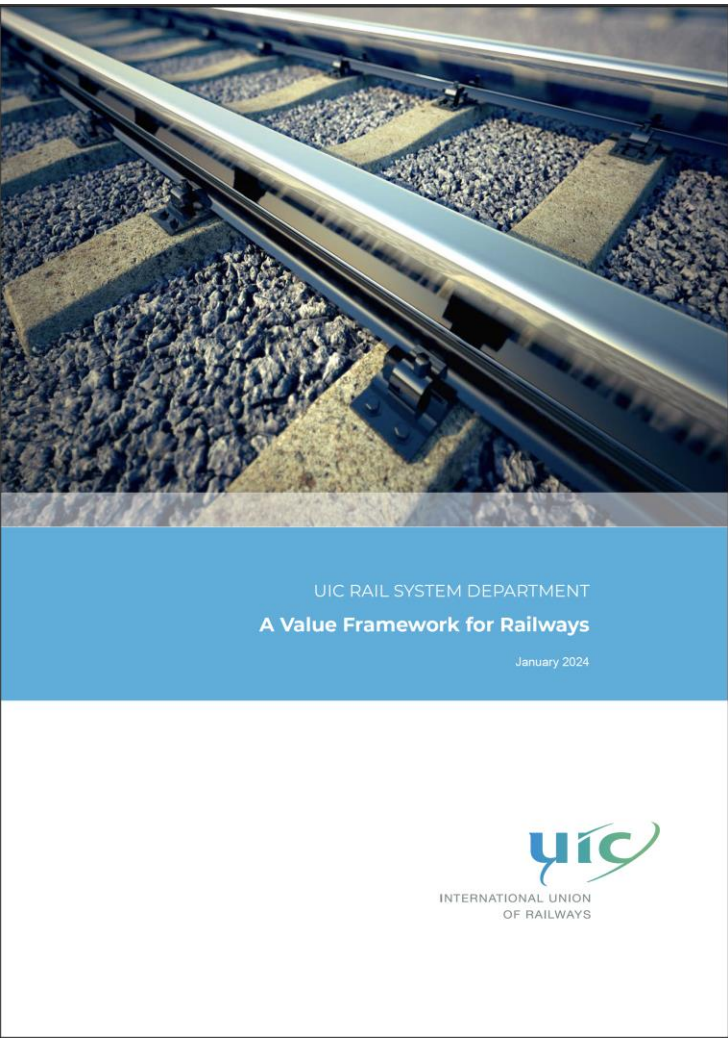


System breakdown structure

Phase 1 / Value framework

The value framework is meant to support **company-wise decision-makers** by guaranteeing alignment in terms of “values” considering while making trade-offs.

For each value component and subcomponent a **set of key metrics** are established so as to guaranteeing proper evaluation and assessment of the metric.



Value framework from UIC

Phase 2 / use cases

 	AM strategy and planning Rugby-Birmingham funding allocation Western Route train planning & catenary strategy
	Budget allocation optimization Budget allocation optimization
  	Asset reconfiguration Track renewal vs downgrade/closure Infrastructure upgrade optimization Signalling rationalization strategy
 	Maintenance strategy definition Transformer oil monitoring strategy Route maintenance strategy design
	Maintenance policy redefinition Criticality-based maintenance optimization
	Asset information management Railway digital twin of fingertips for trusted information

Focus on AM strategy and planning, mainly concerning funding and budget allocation as well as route-level train planning

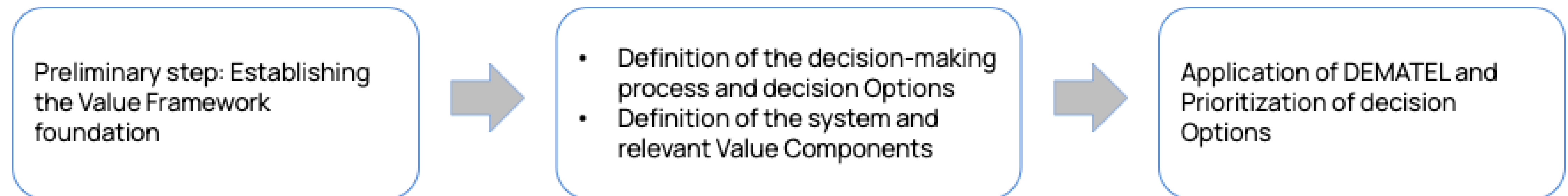
Focus on asset reconfiguration options via renewal, upgrading or standardisation

Focus on evaluation of maintenance strategy (re) definition for route sections or specific assets

Focus on improving information management and elaboration

Phase 2 / proposed MCDA-based methodology

To be fully usable and adaptable to **different decisions**, the value-based decision cycle has been revised so that it can **accommodate current IM (Infrastructure Management) organisations' needs** and then become a tool.



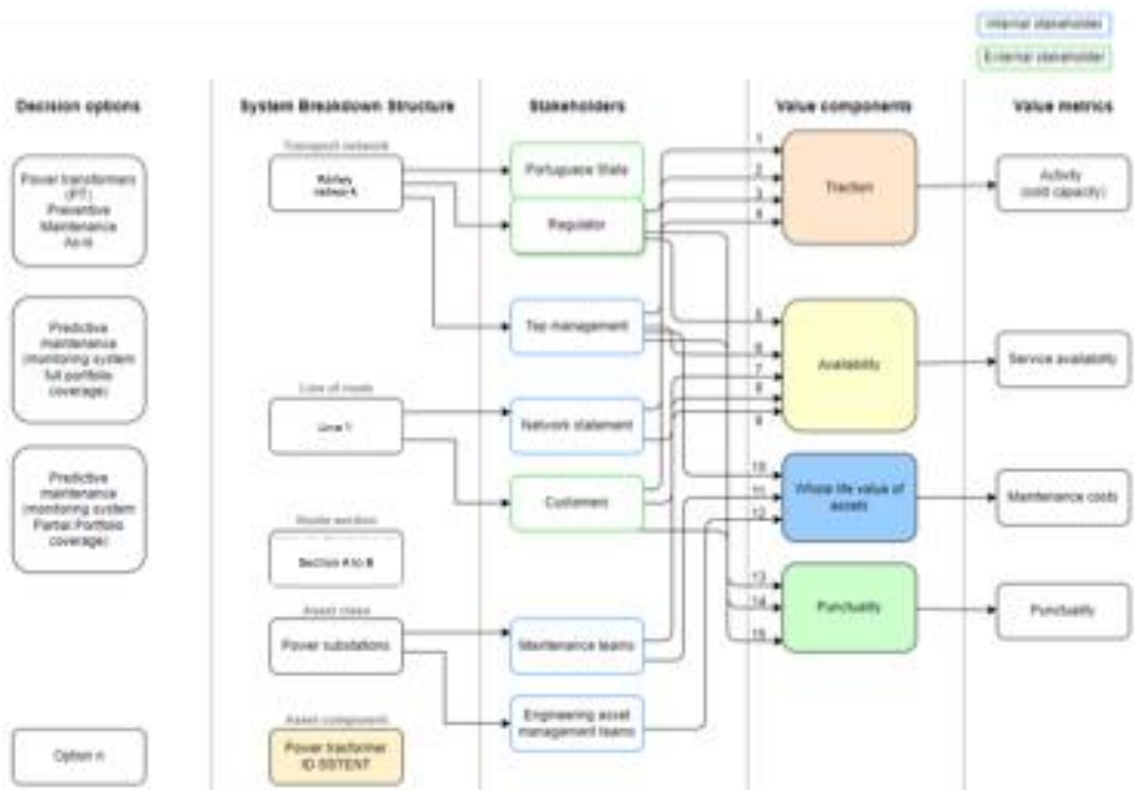
Phase 2 / proposed MCDA-based methodology

Supported by DEMATEL-based tool

Preliminary step: Establishing the Value Framework foundation

- Definition of the decision-making process and decision Options
- Definition of the system and relevant Value Components

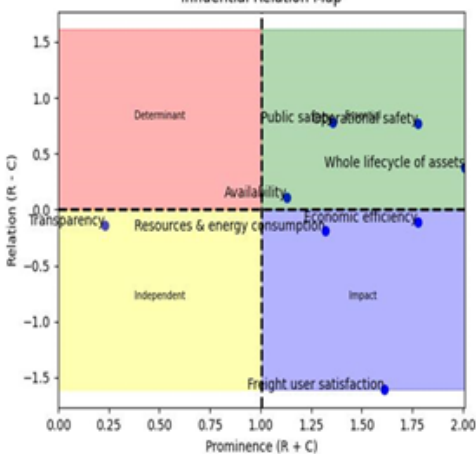
Application of DEMATEL and Prioritization of decision Options



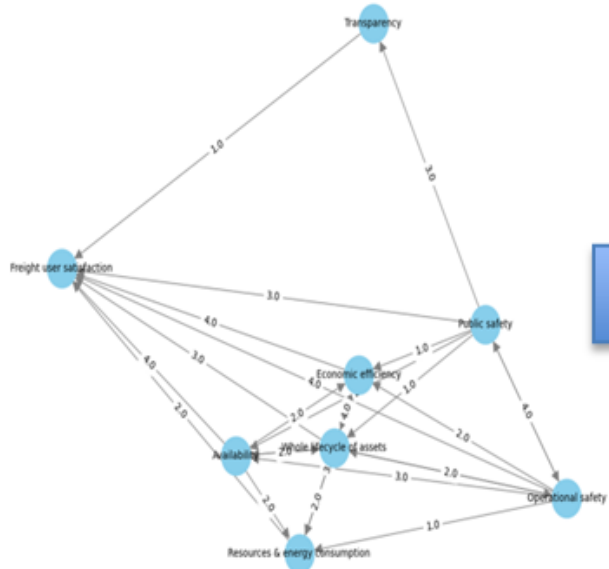
Direct influence matrix (DEMATEL)

	Transparency	Public safety	Availability	Freight user satisfaction	Economic efficiency	Whole lifecycle of assets	Operational safety	Resources & energy consumption
Transparency	0	0	0	1	0	0	0	0
Public safety	3	0	2	3	1	1	4	0
Availability	0	0	0	4	2	1	0	2
Freight user satisfaction	0	0	0	0	0	0	0	0
Economic efficiency	0	0	0	4	0	4	0	3
Whole lifecycle of assets	0	0	2	3	4	0	3	3
Operational safety	0	4	3	4	2	2	0	1
Resources & energy consumption	0	0	0	2	3	2	0	0

Influence Relationship Map (DEMATEL)



Graph



Value Components weights (Weighted PageRank centrality)

Value Component	Weighted PageRank Centrality
Operational safety	0.289689063
Public safety	0.219504504
Whole lifecycle of assets	0.196361313
Economic efficiency	0.110396594
Resources & energy consumption	0.077108684
Availability	0.068680913
Transparency	0.019508929
Freight user satisfaction	0.018750000

Impact of Options on Value Components

V_{mj}	VC 1	VC 2	VC 3	VC 4	...	...
Option 1	0	1	-2	2		
Option 2	3	-1	2	1		
Option 3	2	0	-3	3		
...						

Strategic Index

Option	Weighted Value
Option 1	0.8444
Option 2	-0.03

[Download csv file](#)

Phase 2 / multi criteria decision analysis

Multicriteria Decision Analysis is generally defined as a decision-aid and a mathematical tool allowing the **comparison of different alternatives or scenarios according to many criteria**, often conflicting, in order to guide the decision maker towards a judicious choice.

MCDA models analyze these different views to identify a set of criteria which are compared and used to assess the alternatives in order to obtain an objective clear judgment”.

Full name	Acronym	Description of the MCDA method
Technique for Order of Preference by Similarity to Ideal Solution	TOPSIS	TOPSIS is a method built on a simple principle: the selected best alternative should have the shortest (Euclidian) distance from the positive ideal solution in a geometrical sense while it has the longest distance from the negative ideal solution. [2]
Weighted Sum Model	WSM	Simple linear additive models, where weights are multiplied with the performance measure of an alternative to calculate final scores. The WSM based approaches use simple, ordinal scales (1-10 and typically Likert scale 1-5) for weight attribution. [2]
Decision-Making Trial and Evaluation Laboratory	DEMATEL	DEMATEL is an MCDA that allows for the study of the causal relationships among factors with the objective to find the total influence (direct and indirect) among them [3]
Analytic Hierarchy Process	AHP	The decision problem is structured within a hierarchy. At the top is the general objective (e.g., choice of technology or policy). Criteria are set below this goal and can be further decomposed into sub-criteria, alternatives are at the bottom of this hierarchy. Within AHP, stakeholders attribute an individual preference to each criterion by pairwise comparisons (in total $n(n-1)/2$). [2]
Analytic Network Process	ANP	ANP model is a generalization of the AHP for considering interdependence and feedback among the elements of a decision problem. The ANP presents decision-making problems as networks of criteria and alternatives (all called elements), grouped into clusters. All the elements in the network can be related in any possible way, such that, for example, a network can incorporate feedback effects and complex inter-relationships within and between clusters. [1]

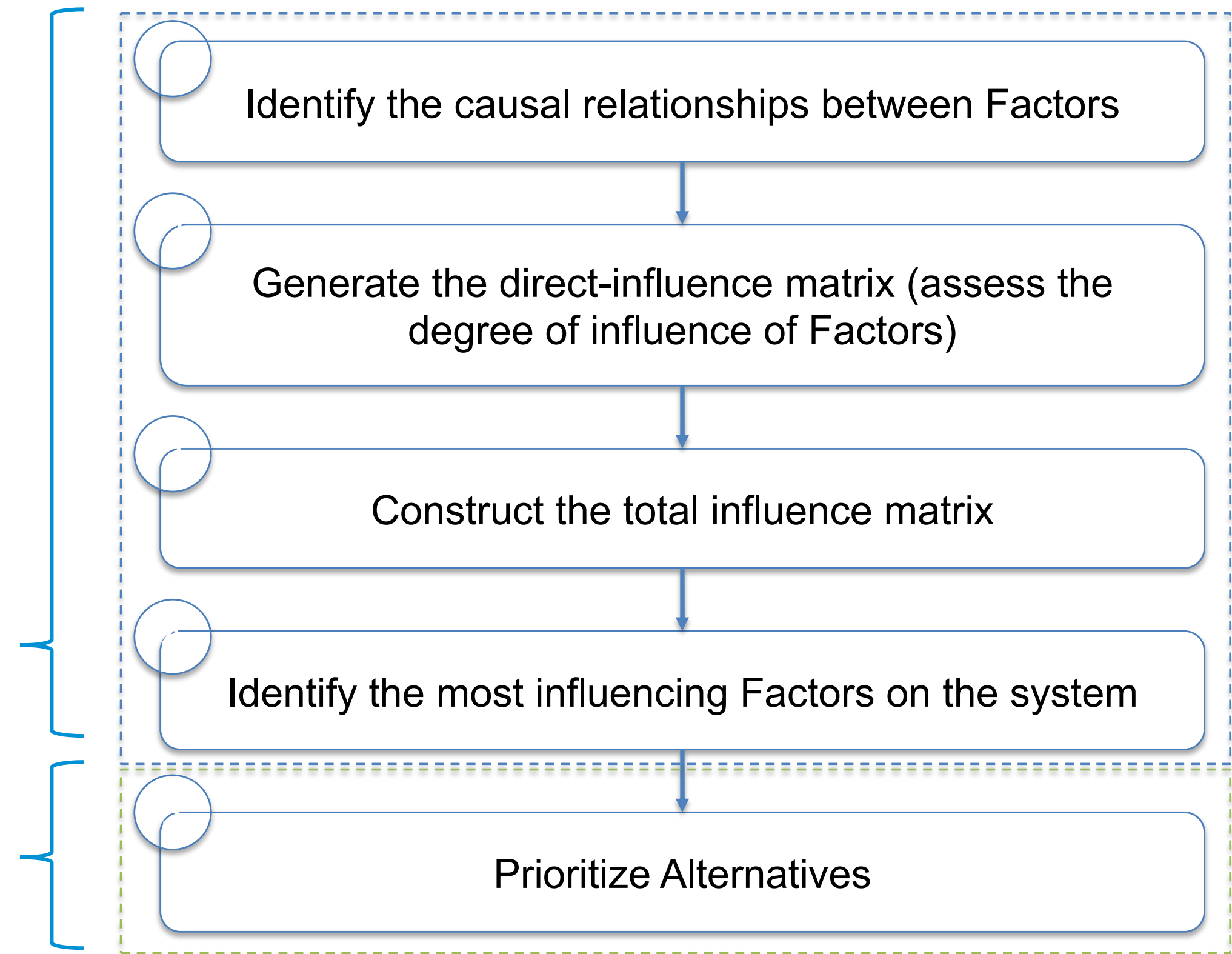
García-Melón, M., & Poveda-Bautista, R. (2015). Using the strategic relative alignment index for the selection of portfolio projects application to a public Venezuelan Power Corporation. International Journal of Production Economics, 170, 54-66.

Phase 2 / multi criteria decision analysis

DEMATEL was selected after a **careful review of scientific literature** on MCDA for railway and beyond. Also, DEMATEL is the simplest method to accommodate **relationships between factors**, thus relaxing independence assumptions of many MCDA.

Established steps for DEMATEL application

! Politecnico di Milano proposal to make DEMATEL suitable for options prioritisation

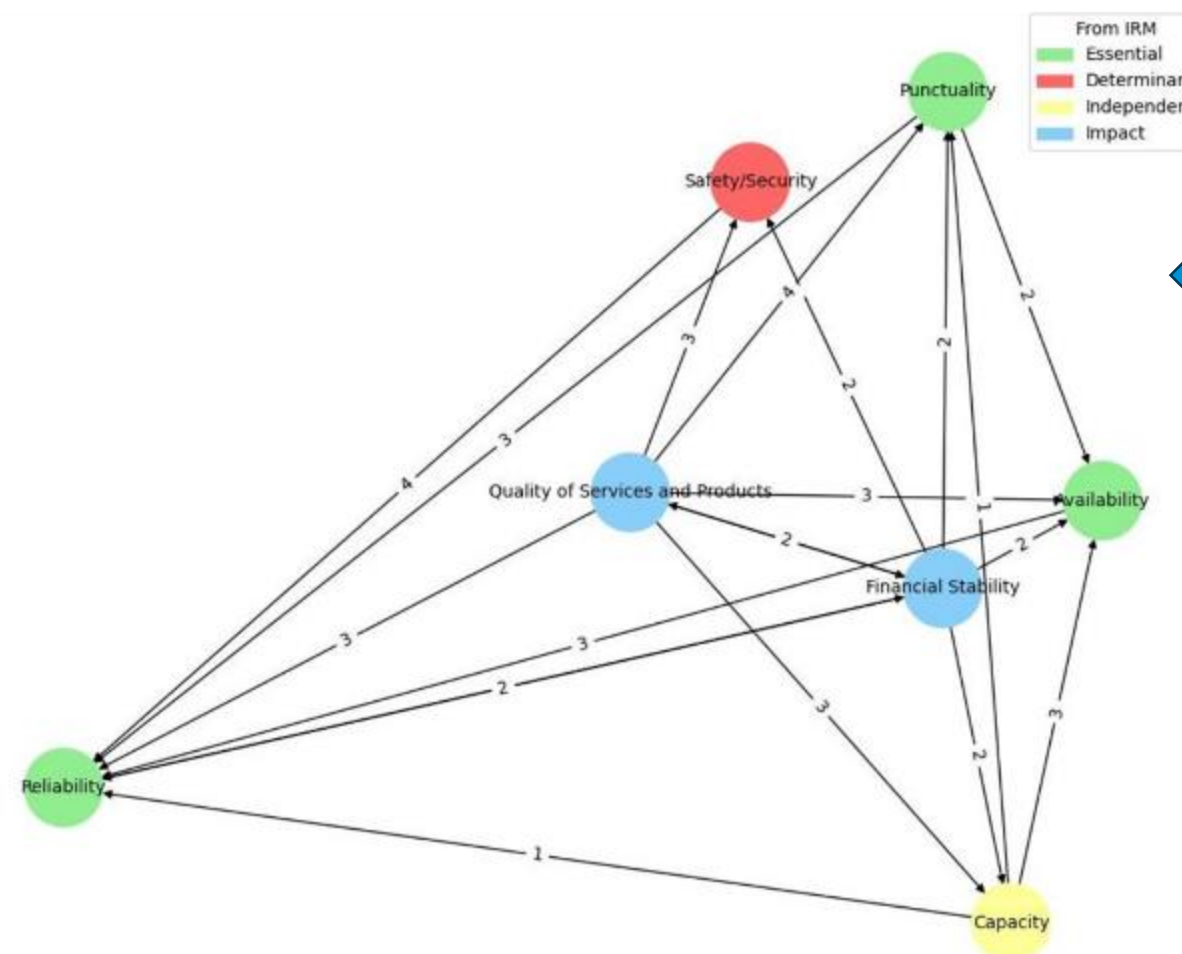


Si, S. L., You, X. Y., Liu, H. C., & Zhang, P. (2018). DEMATEL technique: a systematic review of the state-of-the-art literature on methodologies and applications. *Mathematical problems in Engineering*, 2018(1), 3696457.

Quezada, L. E., López-Ospina, H. A., Ortiz, C., Oddershede, A. M., Palominos, P. I., & Jofré, P. A. (2022). A DEMATEL-based method for prioritizing strategic projects using the perspectives of the Balanced Scorecard. *International Journal of Production Economics*, 249, 108518.

Phase 2 / strategic index & options prioritisation

The **graph** is realised leveraging the same matrix used for DEMATEL. Based on the graph theory, indeed, is also possible to define the **value components' weights** to be later used for the strategic index evaluation.



	Weighted PageRank Centrality
Reliability	0.2997
Financial Stability	0.2792
Availability	0.1348
Punctuality	0.0851
Capacity	0.0701
Safety/Security	0.0701
Quality of Services and Products	0.061

*Application of Weighted PageRank centrality
(centrality measure in graph theory)*

V_{vi}	Availability	Punctuality	Reliability	Capacity	Quality of Services and Products	Financial S tability	Safety/ Security
increase maintenance frequency	+1	+1	+1	0	+1	-1	+1
from preventive to predictive maintenance	+1	+1	+1	0	+1	-1	+1
technological increase of components	+1	+2	+2	0	+1	-2	+2
replacement with components that have same features	+1	+1	+1	0	+1	-1	+1
removal of level crossings	+3	+3	+3	+1	+2	-3	+3

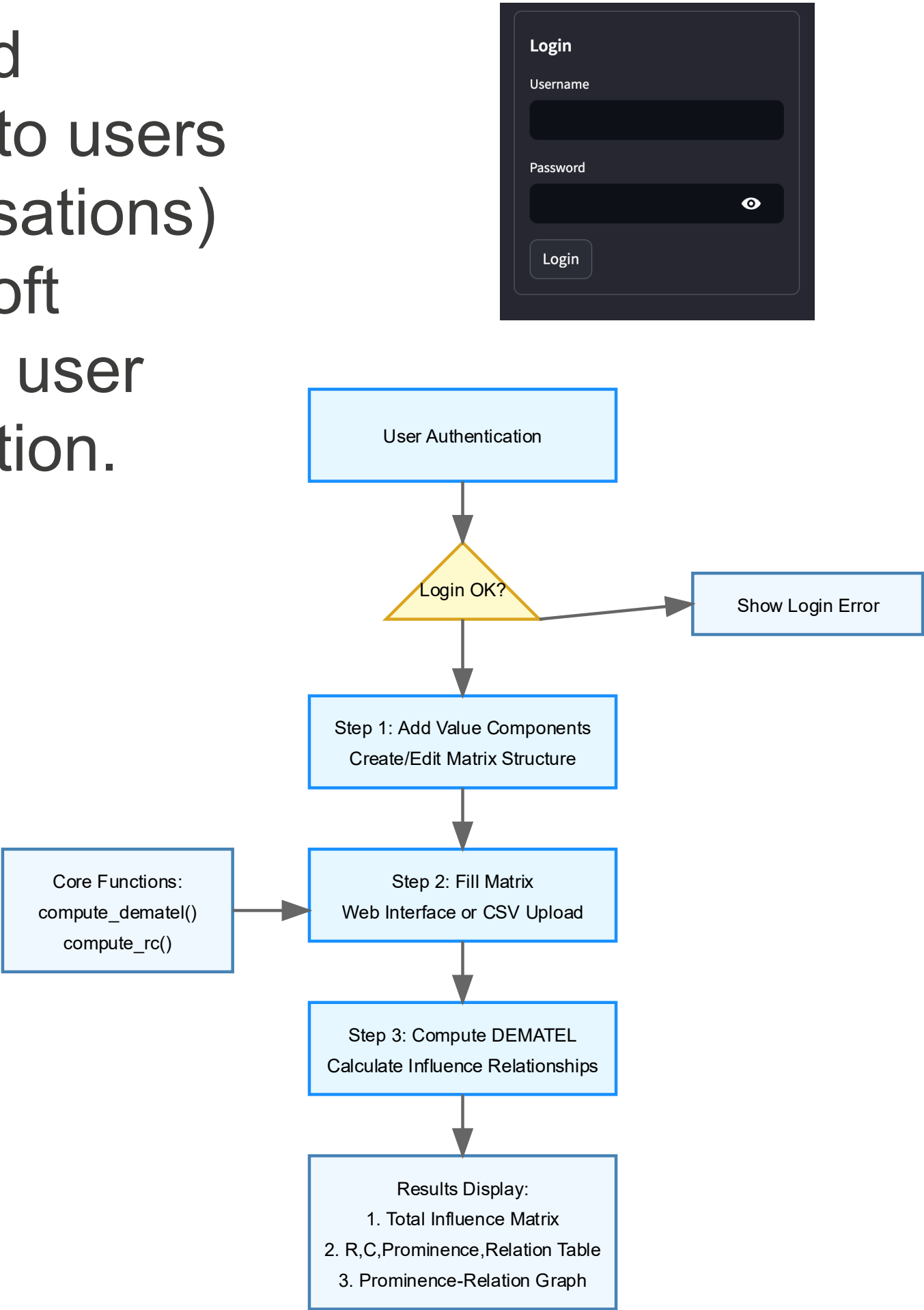
Wiegthed average for VC impact

Option	⋮	Weighted Value
increase maintenance frequency		0.3715
from preventive to predictive maintenance		0.3715
technological increase of components		0.5472
replacement with components that have same features		0.3715
removal of level crossings		1.1236

Strategic Index

Phase 2 / DEMATEL-based tool

The tool is developed in Python and devivered to users (IM organisations) via Microsoft Azure with user authentication.



DEMATEL App

1 Step 1: Add value components as factors to DEMATEL matrix

In this step, you should add useful value components for your use case. Please insert one value compinent at a time by writing it in the blank cell and then pressing Add value component button.

Insert a new value component:

Add value component

By clicking on Add value component, you will update the list of component and the matrix accordingly.

If you want to remove a value component, please deselect it from the list below (that will appear as soon as one value component will be inputted). If you want instead to remove all value components, please press the button Reset button below the checklist.

If you want to remove:

Reset

3 Step 3: Compute DEMATEL total influence matrix

In this step, you will compute the DEMATEL total influence matrix based on the filled DEMATEL matrix.Also, you will compute the R, C, Prominence and Relation for each value component that will allow further reflection on the generated value network.

5 Step 5: Options' strategic index evaluation

In this step, you can evaluate the value of different options based on the DEMATEL total influence matrix and the weighted directed graph.

Step 5.1: Input Option Names

Enter the names of the options you want to evaluate (e.g., 'preventive maintenance', 'corrective maintenance'). Each option will be a row in the evaluation table.

Insert a new option name:

Add option

Here is the list of options you have added so far:

No options added yet. Please add options to evaluate.

Reset options

Step 5.2: Evaluate Options

Fill in the evaluation table below. Rows are your options, columns are the value components (from previous steps).

You can enter negative numbers in the evaluation table to represent negative impacts.

Manual input of impact via Web interface

Do it by uploading a CSV file with impacts

Step 5.3: Strategic Index Calculation

Calculate strategic index

2 Step 2: Fill the DEMATEL matrix

In this step, you will fill the DEMATEL matrix by assigning the influence between the value components.You can do this in two ways: by entering the values manually via Web interface or by uploading a CSV file.

Choose the most convenient way for you to fill the DEMATEL matrix. If you will go for the Web version, remind to download the matrix for your own records. If you already have a compliant DEMATEL matrix, you can upload it and skip the web-based manual input.

If you like to use a free-rider mode, you can also upload the matrix by filling in the value components and influence value on your own and directly in a spreadsheet; the DEMATEL APP will just work as computational tool; however, you need to take care of the input.

Manual input via Web interface

Do it by uploading a CSV file

If you want, you can validate the matrix before launching, or getting help if the computation does not work out for numerical reasons related to input matrix

Validate matrix for DEMATEL

is highly recommended to do so. If you are sure of y to the computation of the DEMATEL total influence

4 Step 4: Calculate the weights of the value components and plot the graph

In this step, you will calculate the weights of the value components based on the DEMATEL total influence matrix and plot the weighted directed graph.

!! The plot of the graph will show complete results only if the previous steps have been completed successfully. If not, there will be no association with IRM results, but still the graph with VC relationships will be shown.

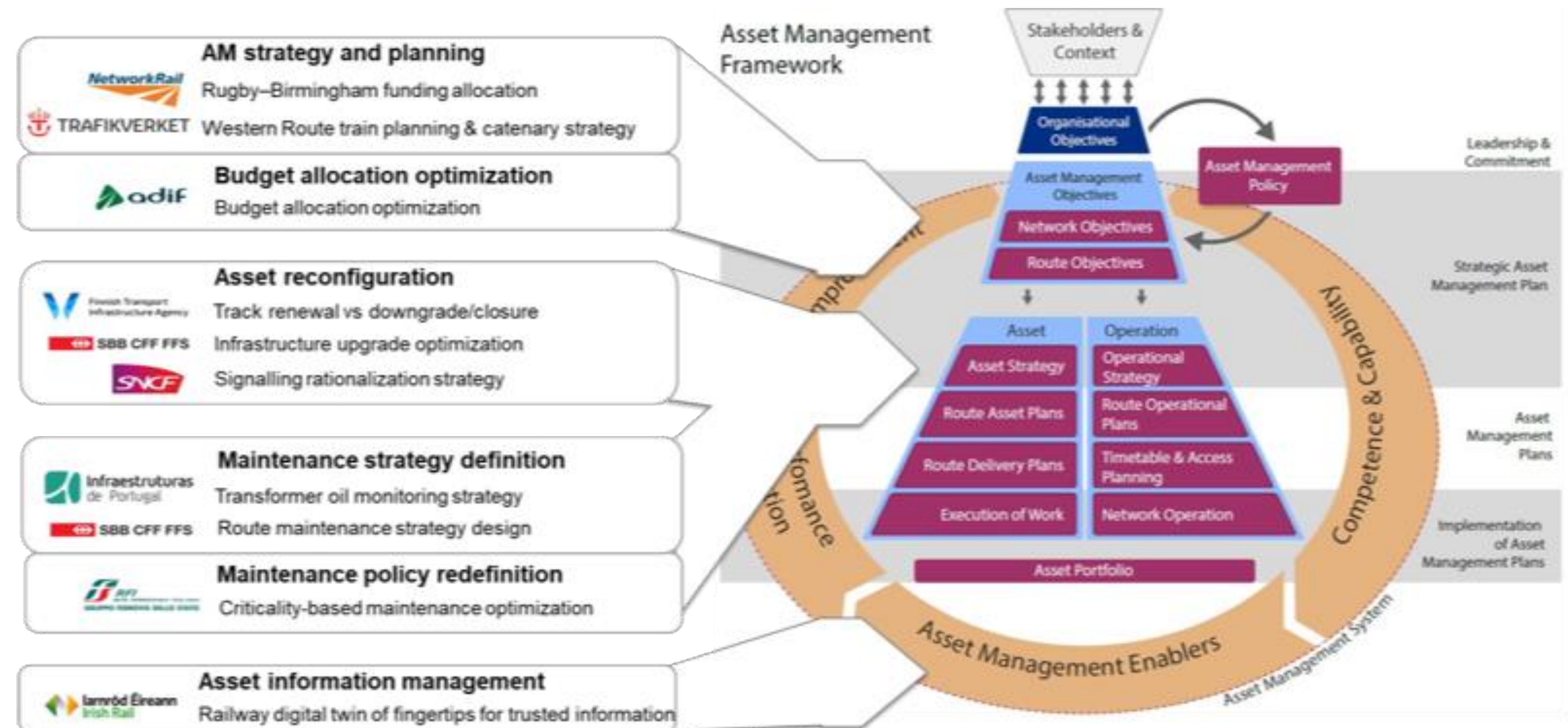
Calculate weights and plot graph

DEMATEL-based tool deployed on Azure

Phase 2 / Application to use cases overview

The methodology and related tool is able to accommodate various decisions.

As use cases, most of the decisions were strategic in nature.



Use cases mapped against UIC Asset Management framework

Phase 2 / Application to use cases lessons learnt

The application of the tool to 10 use cases via **action research** allowed to identify key lessons learnt that will become core to further improve the methodology and tool for a more **stable and clear use of it for IM decision making process** and its **position within the IM business decision chain**.

Decision options features

- **Multiple dimensions** (technical performance, resource allocation, system design)
- **Trade-off archetypes** (time horizon, min-max, continuity vs tranformation, allocation vs prioritisation)
- **Impact horizon** (now vs deferred impact)

Methodology and tool feedbacks and open points

Learning value

Visual tool
Standard decision-making
Transparency
Agreed-upon definitions

Data

Data availability
Metrics relevance
Subjective judgements
Data-driven culture

Uncertainty

VC weight uncertainty
VC impact uncertainty
Judgement calibration
Judgement scale

Complexity & Scalability

Numerous VCs
Diversified asset portfolio
Strategic index
interpretation

Use and Integration

Business processes fit
Organization structure
Commitment
MCDA-based tool

Adoption & Collaboration

Cross-function collab.
Stakeholders engagement
Broken silo approach
Roles and responsibilities

Conclusions

The WiSDoM Phase 2 project has been carried out over a period of **17 months**, involving **10 IM companies** developing **10 use cases** about **strategic decisions**.

The project leveraged an **action research** approach coordinated by Politecnico di Milano team, involving **co-design** sessions and **continuous interactive and discussion meetings as well as workshops** with IM companies.

The developed web-based tool implementing the **DEMATEL** as multi criteria decision analysis method and the **Strategic Index** as a novel synthetic indicator for options prioritisation enabled the IM decision-makers to evaluate **value generation** of different options.

Future work will build over the lessons learnt to extend and enrobust the methodology and related tool, especially **the integration of the tool within the business process and information systems** of IM organisations.

Thanks!



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We would like to thank all participants in the WiSDoM project Phase 2.

These include the UIC and the infrastructure managers from Austria (ÖBB), Belgium (Infrabel), Finland (Väylävirasto), France (SNCF), Ireland (Irish Rail), Portugal (IP), Spain (Adif), Sweden (Trafikverket), Switzerland (SBB), UK (Network Rail, RSSB).

Session 3: Decision Making Q&A



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THANK YOU FOR YOUR ATTENTION

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ASSET MANAGEMENT
Working Group



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Session 4

Maintenance / Asset Portfolio



Vesa Männistö
(FTIA)



Jude Carey
(Irish Rail)



Alfonso Perna
(ACCA Software)



INTERNATIONAL UNION
OF RAILWAYS

Asset Management Seminar

Pietrarsa, Naples – 2 October 2025

Railway Maintenance Backlog
Vesa Männistö

Finnish Transport Infrastructure Agency

ASSET MANAGEMENT
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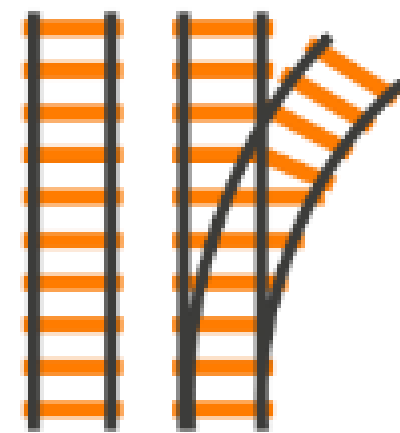
Topics

- Finnish Transport Infrastructure Agency
- Maintenance backlog – why and how?
- How to use maintenance backlog information?
- Conclusions



Finnish Transport Infrastructure Agency

Key Figures: Railway Network



5 915 km

**Finnish Railway
Network**

88 %

Single track

3 626 km

**Electrified track
(61%)**

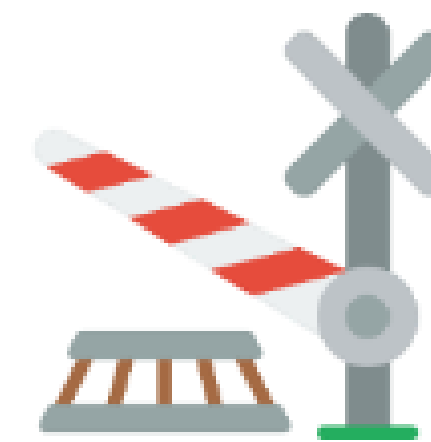


82

Million Journeys Passenger
transport

27

Million Tonnes
Freight transport



2 400

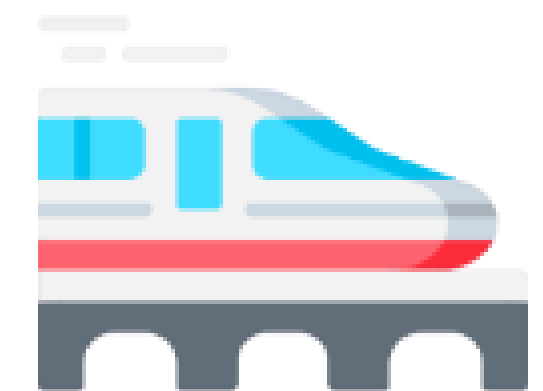
Level Crossings

46

Tunnels

308

Traffic Operating Points



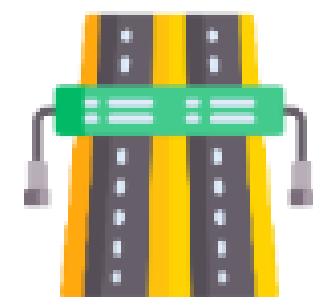
**160+
km/h**

High-speed Railway
Network

1120 km

High-speed Track

Key Figures: Road Network



79 000 km

Public Roads



90 %

of Passenger Transport



232 Mt

Goods Carried
Annually by Lorries



26 000 km

Street Network

948 km

Motorways

73 %

of Freight Transport

352 M

Journeys by Bus

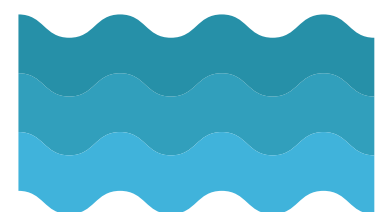
350 000 km

Private Roads

6 100 km

Pedestrian and
Bicycle lanes

Key Figures: Waterways



4 000 km

Maritime Trade Routes

8 300 km

Coastal Routes

8 000 km

Inland Waterways



30

Ports Open Year-Round

10 Largest Ports Handle

80 %

Freight Transport



25 600

Maritime Aides to Navigation

- Beacons
- Buoys
- Signs



94 %

of Exports and

96 %

of Imports use Ports

Maintenance backlog

Why and how?

Why to calculate maintenance backlog ?

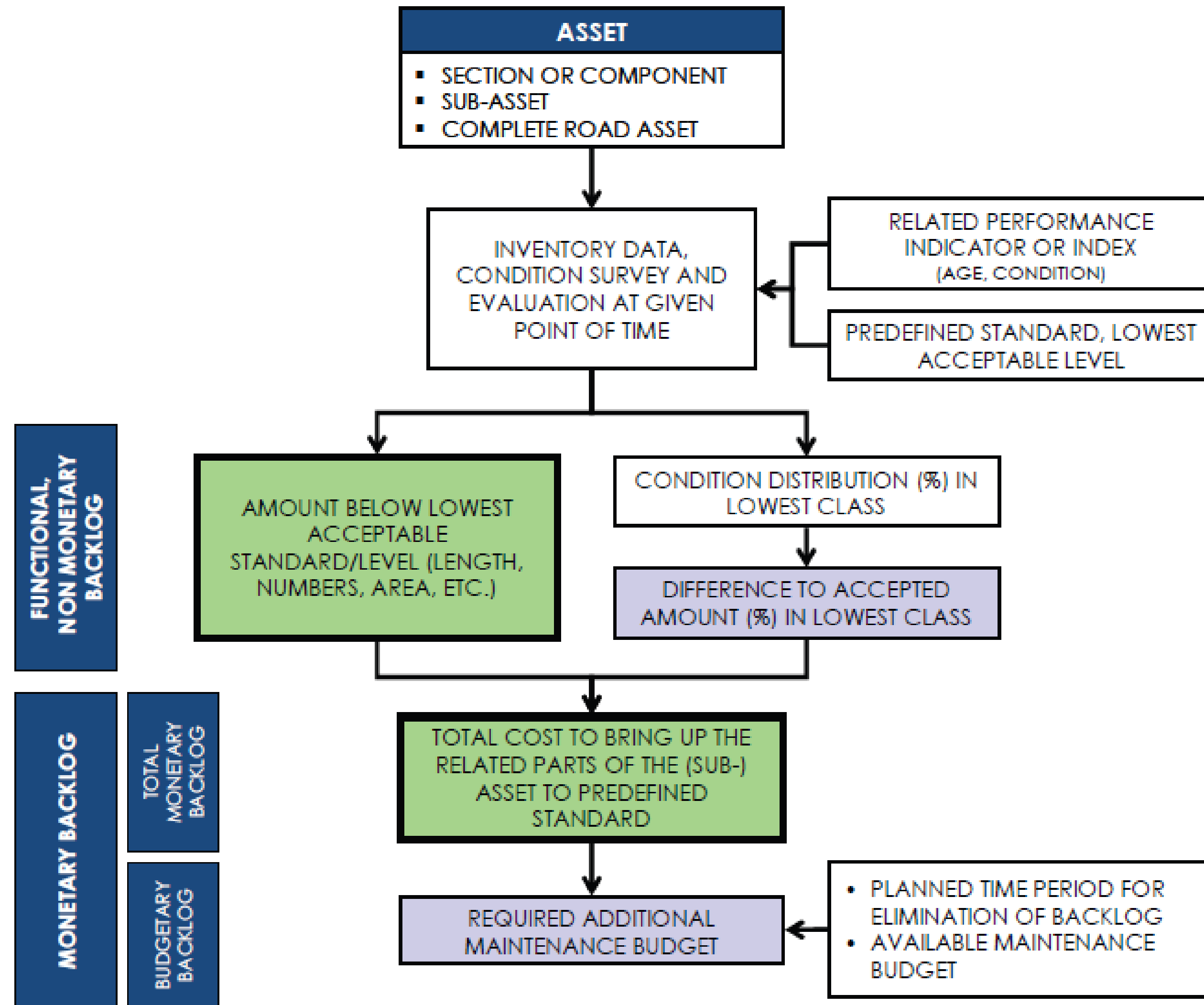
- Scarce resources for infrastructure management
- Justification of funding getting more challenging
- Decision makers understand only money
- Need to compare railways, roads and waterways
- Media needs tools to discuss state of the infrastructure



Definition of maintenance backlog

- Maintenance backlog of the rail infrastructure is the number of unfulfilled demands at a given point of time in explicit reference to the predefined standards to be achieved.
- Maintenance backlog can be expressed in functional (non-monetary) or monetary terms, and it refers to single components, sub-asset or to the whole road infrastructure asset of a given rail network".
- Developed by Weninger-Vycudil et al., 2009 (ERANET)

How to calculate maintenance backlog ?



CHALLENGES

- Condition data
- Threshold values
- Unit costs

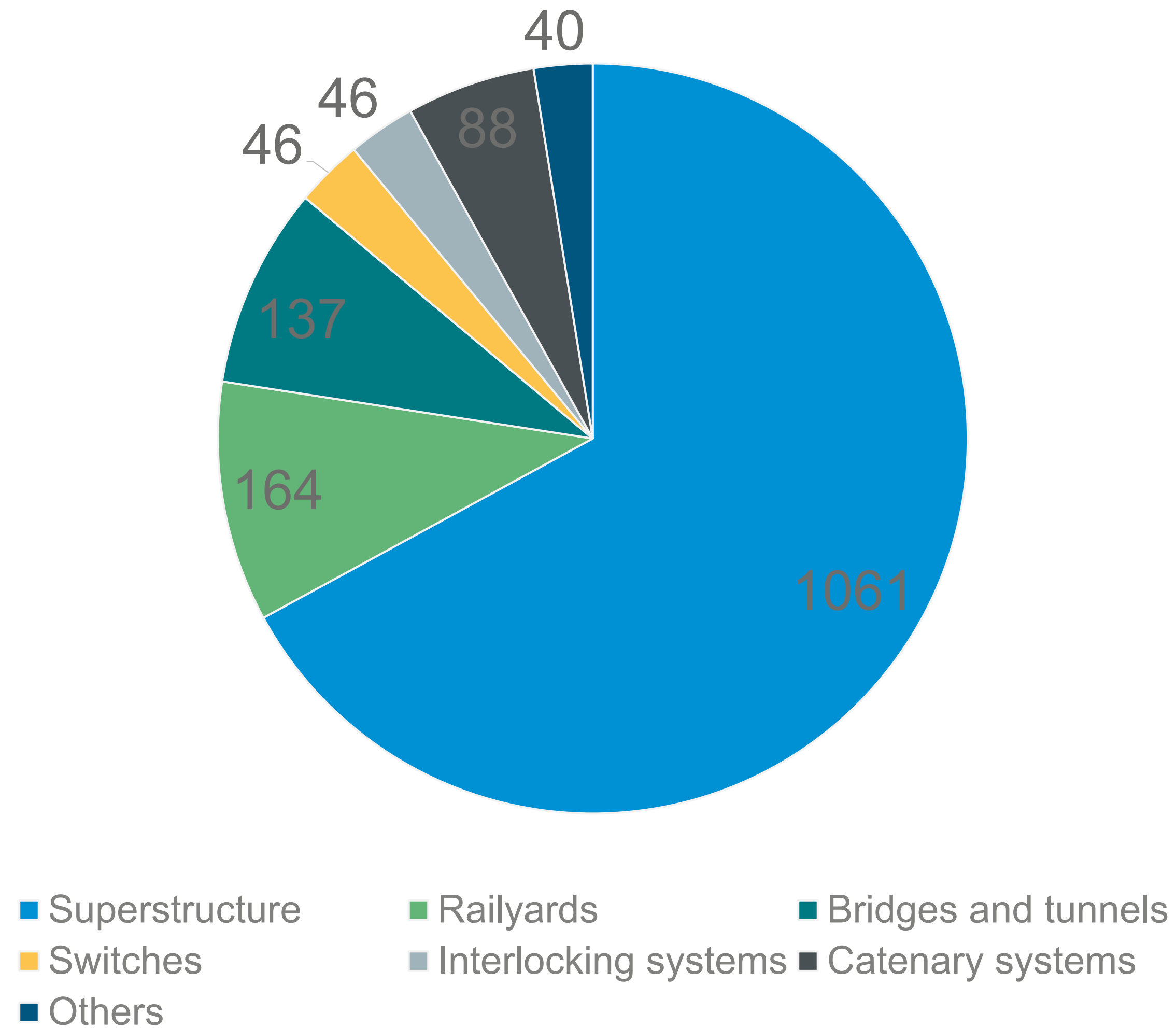
Alternative definitions

- Maintenance not done when scheduled
- Assets, where residual value is below XX percent of price of new assets
- Gap between existing and needed budget
- Infrastructure Backlog Ratio
 - $\text{Cost to Bring to Satisfactory Standard} / \text{Total Written Down Value of Asset Portfolio}$

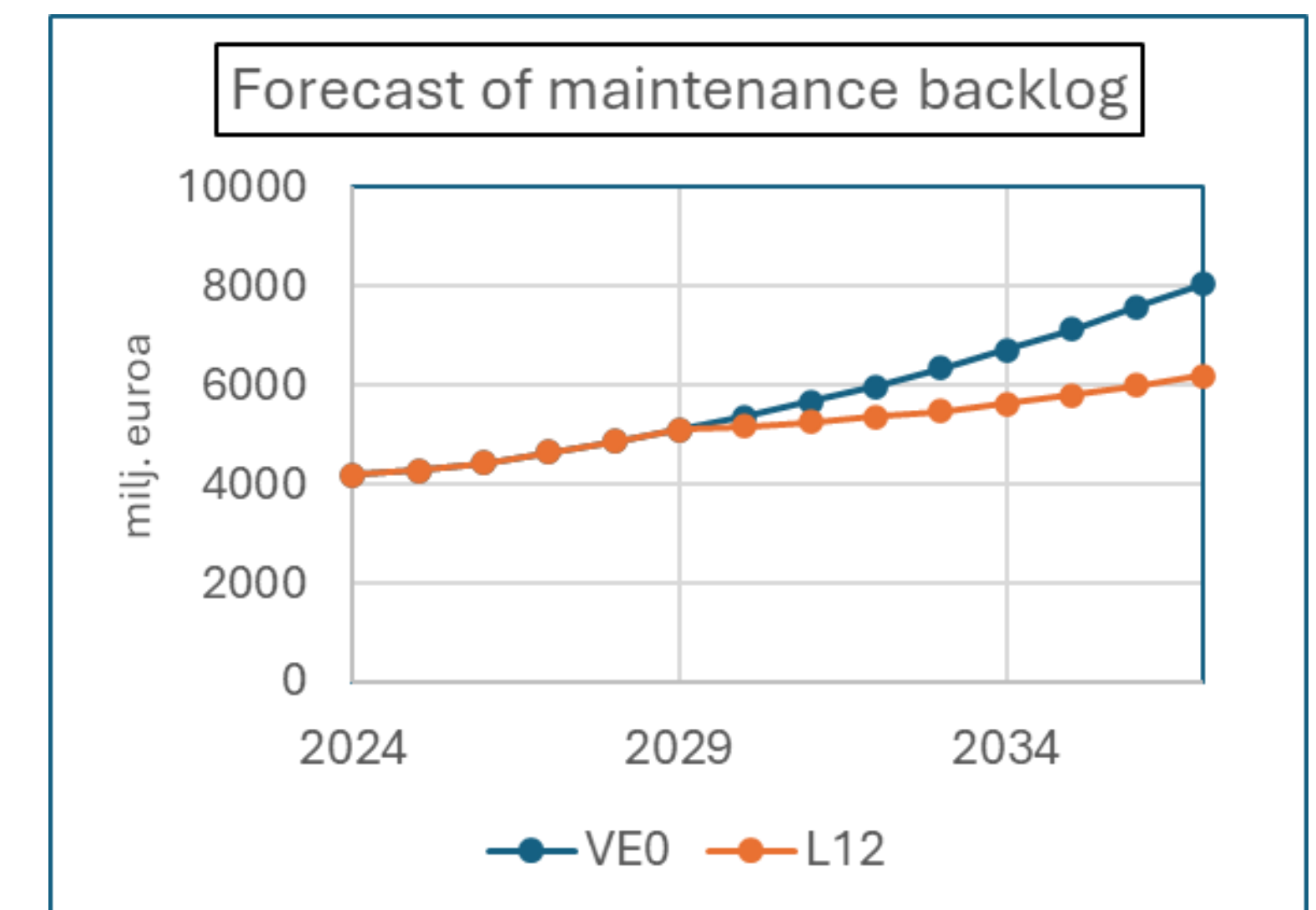


How to use maintenance backlog information?

Railway maintenance backlog 1.1.2025



Backlog	Mill. euros
Roads	2562
Railways	1583
Waterways	29



Use of maintenance backlog information

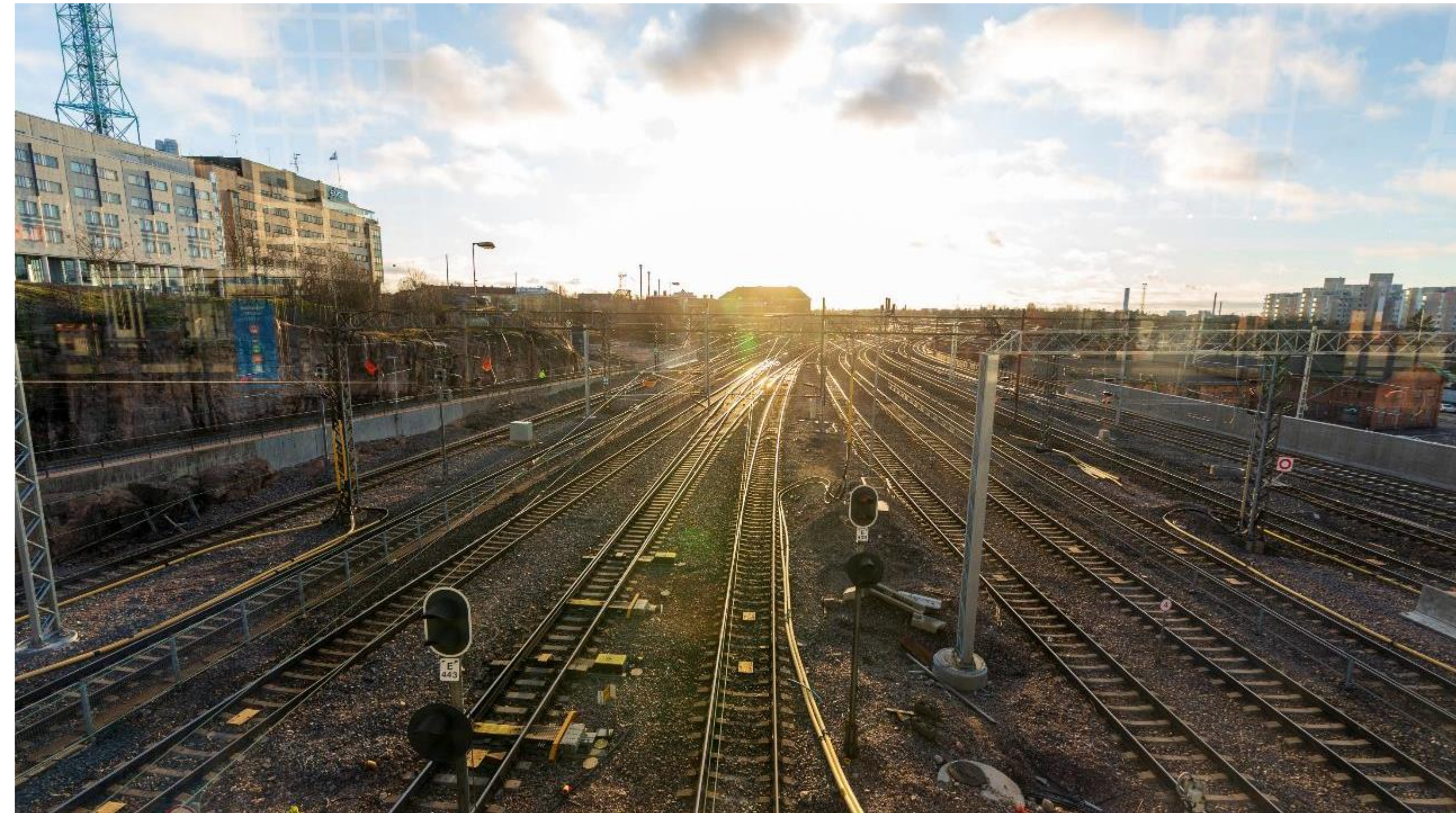
- Typically, a lump sum of the total MB
 - Usually "big numbers", with no explicit reference
- Utilised only in strategic level documentation
- Often required by stakeholders and media
- Comparison between countries and/or organisations



Conclusions

Expériences of maintenance backlog

- A valid key performance indicator in informing and justification of funding needs for road maintenance
- Should not be used as the only indicator in decision-making
- Some skepticism risen in modern asset management



Challenges

- Big numbers are not easy to understand nor compare
- Pumping of high excess of funding to maintenance is not easy – no dramatic improvement can be gained as quick wins
- Optimal level of maintenance backlog
 - If we are happy to the current state, is there any backlog?
 - Should it be totally nulled?



Session 4: Maintenance/Asset Portfolio Q&A



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[Männistö \(2023\)](#) (article on road maintenance
backlog)

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Asset Management Seminar

Pietrarsa, Naples – 2 October 2025

Trusted Information at your Fingertips
Jude Carey

**Our AM Vision is to deliver
“Trusted Information at your
fingertips”**



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Asset Management Transformation Strategy Set the Scene



Customers are at
the heart of
our business

Value Framework
System of System

Major
investments in
infrastructure

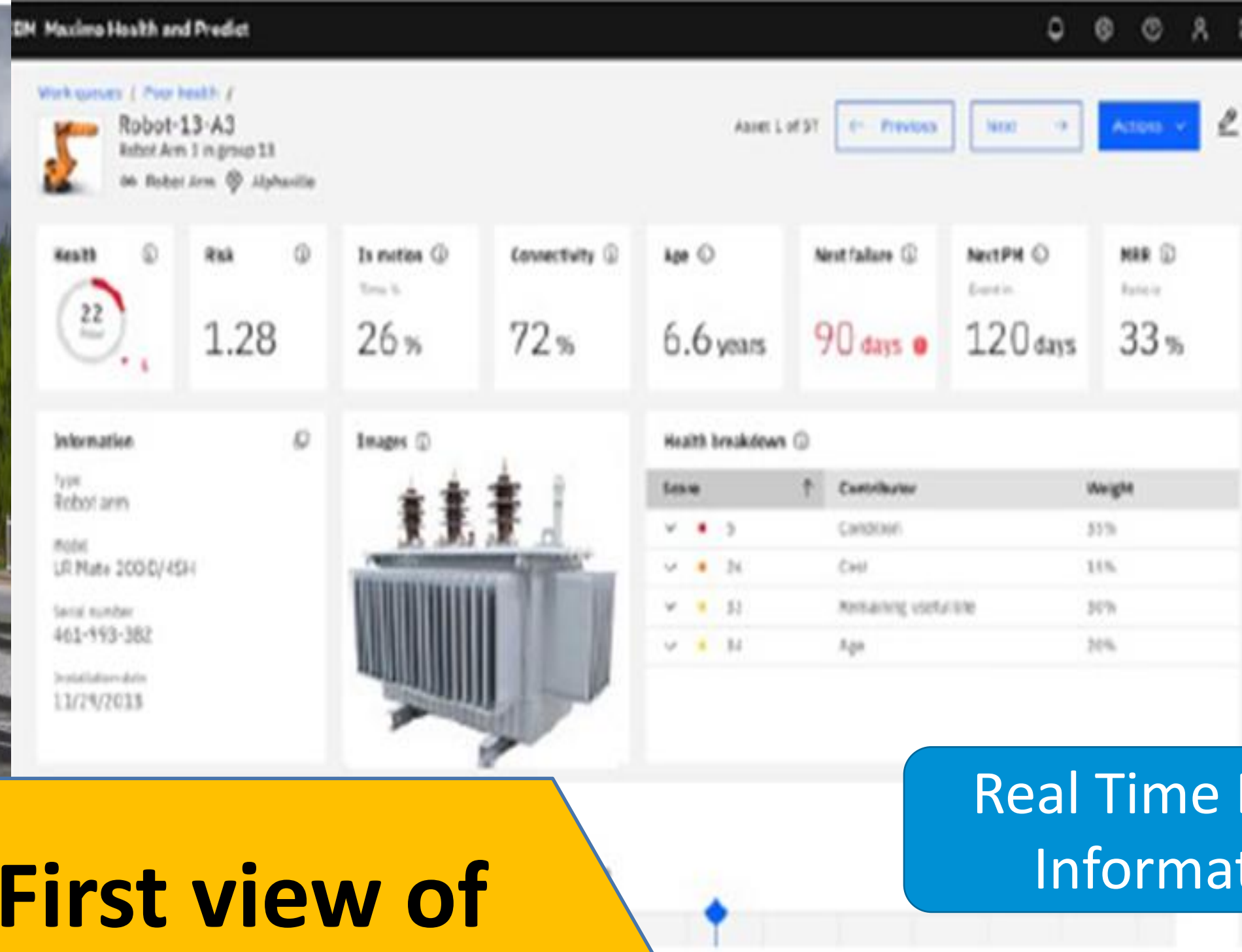
Ambitious Growth -
Passenger journey
double

Rail2050
Potentially
invest €35bn

*“Best railway in
Europe for
customer
experience”*



Digital Twin
Railway



Real Time Digital
Information



Buried
Cables

First view of
Digital Twin
2022

IÉ Board
October 2022



NTCC & BIM



Bentley®

233

Our AM Digital Vision is to deliver “Trusted Information at your fingertips”

“Trusted”

There will be underlying data frameworks and metrics that are aligned to our organisational structure, reporting and processes. Therefore, our users can trust that the information provided is timely, accurate and relevant.

“Information”

To effectively manage our assets and optimally deliver services to our customers, users need tailored insights to empower them to make the right decisions about our assets.

“Fingertips”

The user insights and information should be readily available with the use of dashboard and mobile solutions. Users should no longer have to extract and manipulate large data sets to access information.

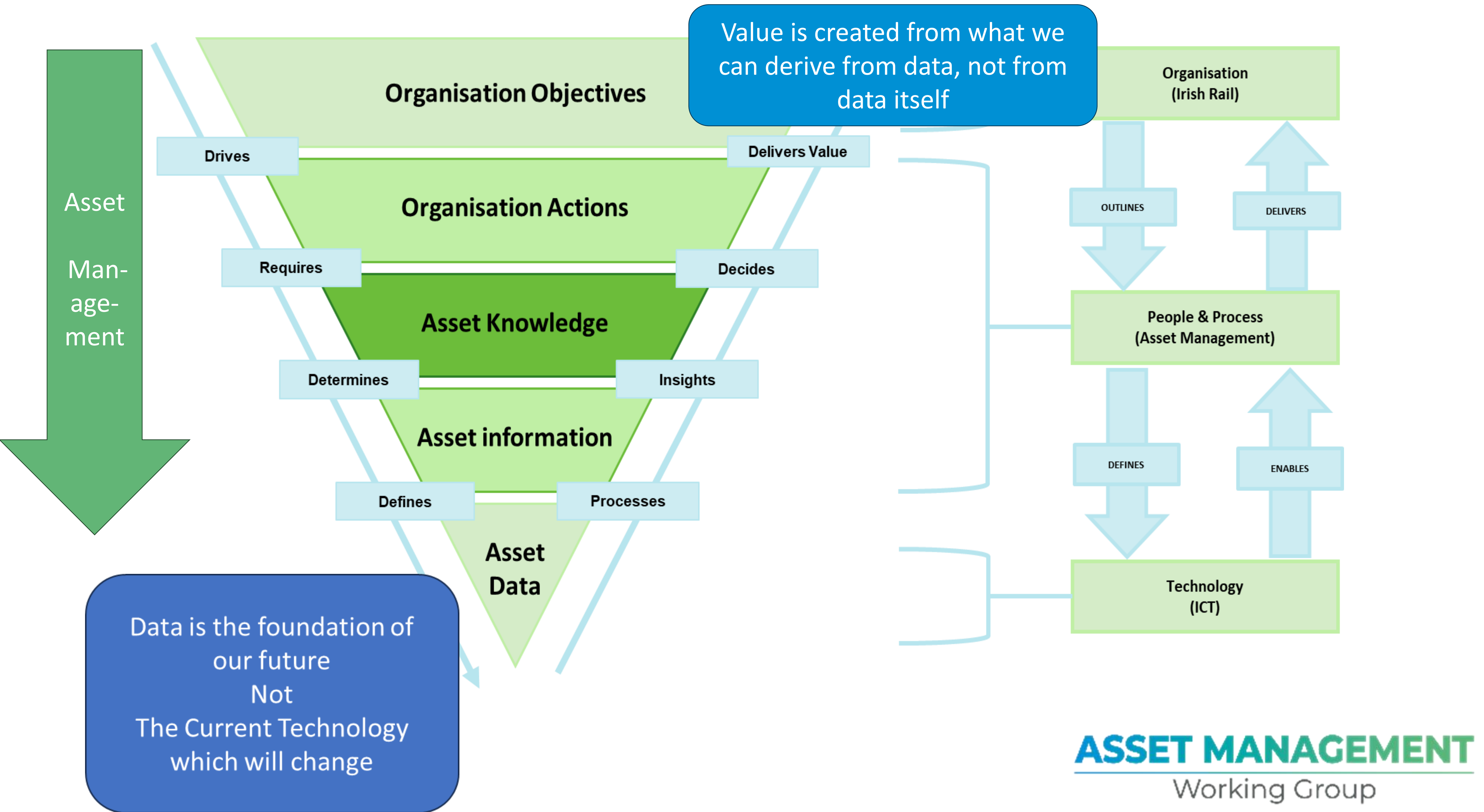
AM VISION STATEMENT

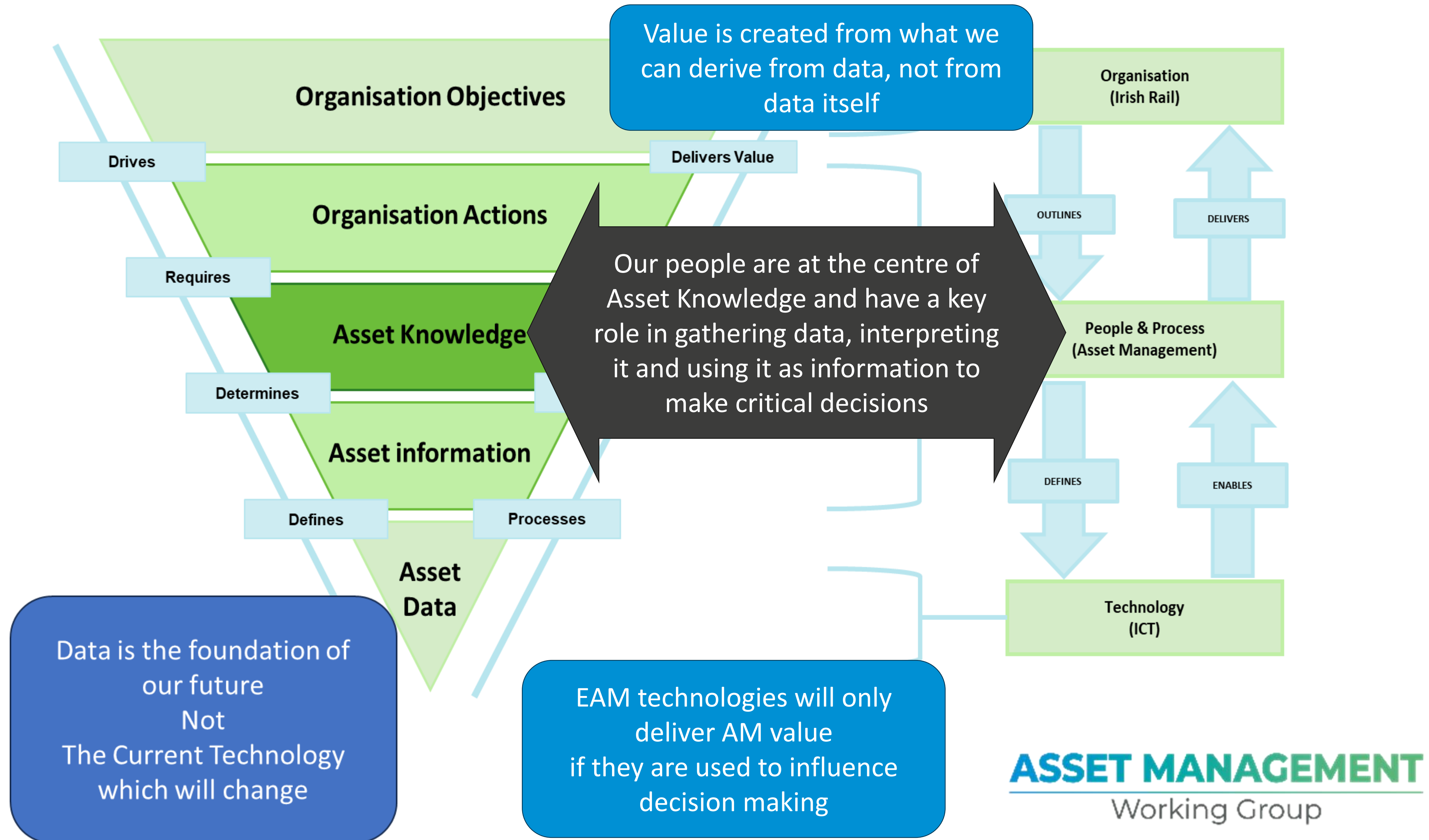
***Establish an Asset Management outcome-
focussed culture, empowered by information,
whilst delivering a
safe, secure and sustainable service,
with effective use of funding***

TRANSFORMATION VISION STATEMENT

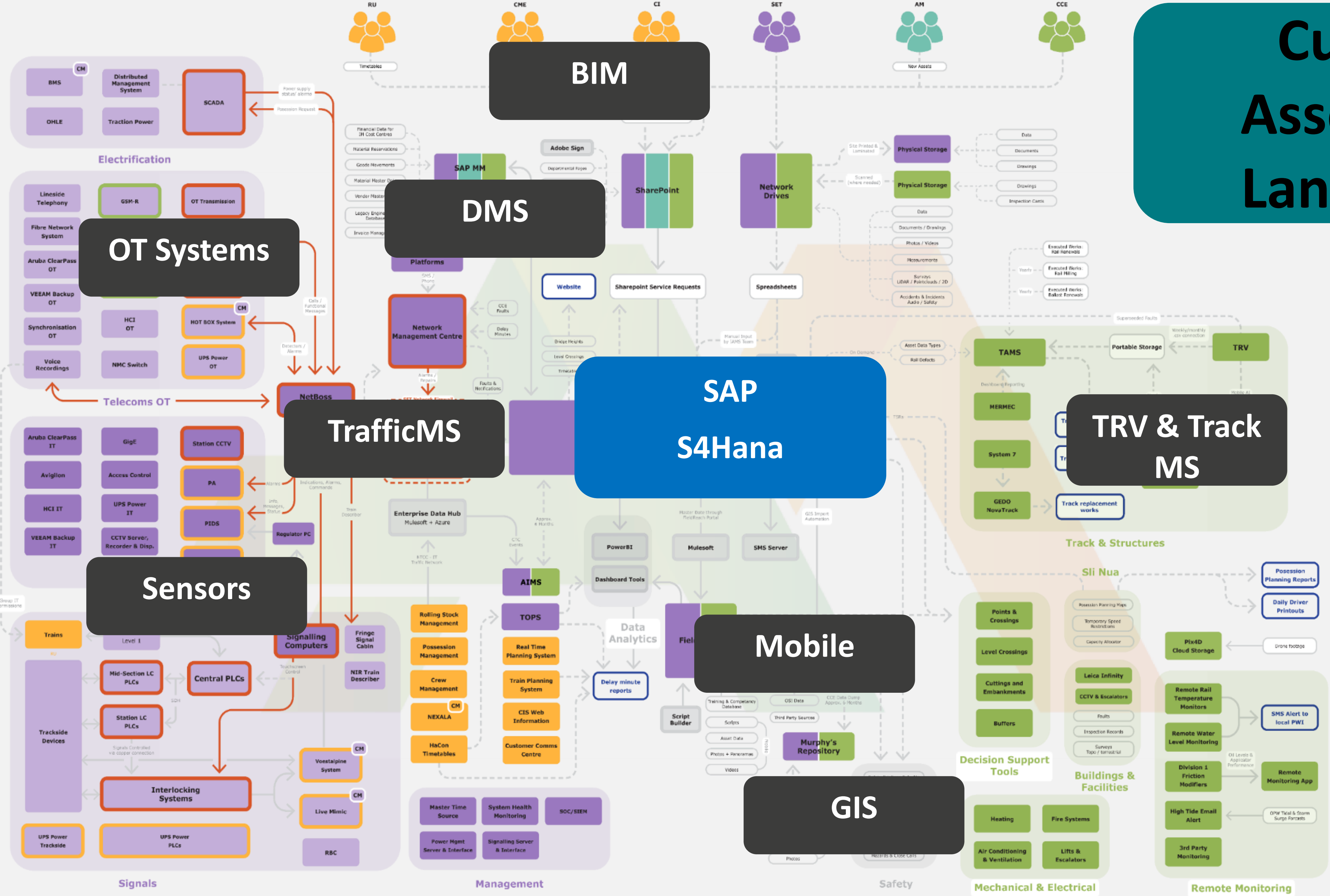
***“Implement an ecosystem of people, process
and digital solutions that delivers
‘Trusted information at our fingertips’***

Our AM Vision is to “deliver trusted
information at our fingertips”





Current Asset data Landscape



- Systems Users:**
NB. All systems subject to cyber security requirements
- Chief Civil Engineers
 - Signals, Electricals, Telecomms
 - Asset Management
 - Stakeholders
 - Operational / Non-Operation Tech
 - Reports / Outputs
 - Data Types
 - Systems Extensions
 - Cyber Security Critical
 - Cyber Security Desirable
 - Cyber Security Resilient
 - Systems Link
 - Human / Manual Process
 - Condition Monitoring



User Stories P&C Inspector

SAP / IAMS	Mobility	Share Point	Eng DMS	Geo Spatial Viewer	Geo Spatial Authoring	Visualisation	Digital Model Viewing	AIMS	Other	TAMS & Dashboards and Reporting	TRV (Track Recording)
X	X	X	X	X	X	X	X	Possibly	P/WI? (issues noted by Patrolmen)	X	X

As a CCE P&C Inspector

I want to see key information to enable me to prepare for and complete my Points & Crossings inspection

So that I am equipped with the information required to complete my inspection as efficiently and thoroughly as possible.

Also, so that I can continue to coordinate with other parties (e.g. signalmen) as needed and prepare special requirements (e.g. signal protection, lookouts for safety).

Also, so that I can co-ordinate and get "T3 possession" in some situations.

- When I select the asset I need to visit..**
- Then I can should be able to see all the information available about the asset I am going to inspect. This could include:**
- Key drawings/documents
 - Asset Location information & any access issues
 - Asset inspection script
 - Asset inspection history
 - Condition History & Ratings
 - Maintenance history
 - Relevant applicable standards and guidelines
 - Latest info from TRV including defects and issues raised by TRV
 - Renewal plans
 - all relevant notifications for this asset
 - Any "local asset issues" noted
 - Any information required for possession planning
 - Issues reported by patrolmen on their weekly checks
 - Information required to ensure a "best possible safe system of work" for inspectors. This could include zone info, and / or whether a "lookout" is required to ensure safety (e.g. red zones always need lookouts). Info re safe hours of working etc.
 - Information should be visible in a data and geographic context

User Stories

X 160



I want to see the **TAMS and Track Maintenance & Renewal Plan Dashboard** for my section of track. I want to see information in a **drillable dashboard and in a GIS / map context.**

I want to understand the **true Age Profile of my assets** which includes the ages of the component elements/parts of this asset and associated risks.
(For example **a lift car could be 20 years old, but its controller could be only 2 years or and its doors might be 5 years old** and different systems/teams/contractors/supplier s would be involved in each component)

I want to see information regarding **welding and repair reports** for my P&C assets

So that I can use this information to better inform, plan, coordinate and execute my inspections and recommendations. **Number of welds done** can indicate the level of wear.

I want to understand recent **accidents and incidents** that have happened near the asset(s) I'm inspecting (e.g. trespass)

I want to manage **Track Geometry Trolley (TGT) Data** including TGT Measurements, GIS road location data, TRV Survey history

I want a centralized dashboard that **visually tracks equipment, geofences, and safety measures** across all sites

I want to understand which are the **most recent IEIM / IE standards and processes** apply to my project management tasks.

I want to see a report summarising **the state of track assets** according to the Track Quality Index (TQI) & DCD data (based on findings gathered during inspections)

I want to see information gathered in **video recordings** for a section(s) of track.
Including - TRV Videos
- Video from across a vast array of captured data e.g. Driver view cameras, **Fleet Footage, Drones (Incl 3D point cloud data), PLPR ((Plane line pattern recognition), Chest cams etc**
- AI, machine learning vision inspection platform.

I want to see if there are any **risks associated with my asset(s)** or within x metres of my asset(s)

User Stories X 160

I want
to see key information
related to my assets and my
activities on the network
in a single view and
accessible
while I am on site.

So that
“In the future, there will be greater demand for more
passengers on trains which will extend train operations
and put more pressure on field engineers to be effective
when undertaking their jobs.

These information initiatives will help ensure that
maintenance is efficient and accurate, which in turn
reduces failures/ delays and increase network
efficiency.

And this is the true value to the business.

Furthermore efficiency of public transport is a key
requirement in the government's plan and these are the
tools we need to be efficient"

I want to understand the true Age Profile of my assets which includes the ages of the component elements/parts of this asset and associated risks.
(For example a lift car could be 20

I want to understand recent accidents and incidents that have happened near the asset(s) I'm inspecting (e.g. trespass)

I want to manage Geometry Trolley (G including TGT Measure GIS road location data Survey history

Business aspirations from technology capabilities

Digital Asset Management



Emerging themes

Intuitive UI and
workflow

Self Service
reporting and
dashboards

Trusted near
Realtime decision
support data

Asset Visualisation

Controlled 3rd
party access

Single view and
source of truth

iTRAK Digital Capabilities to be delivered



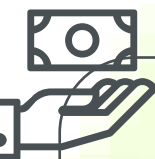
INTELLIGENT ASSET MANAGEMENT

Asset lifecycle support with the use of decision support tools, value management tools, Asset intelligence data analytics, predictive maintenance, and Asset information and systems strategy for lifecycle planning and delivery.



MOBILITY

The ability to access, track, and manage assets remotely, using mobile devices and other technologies (e.g. GPS tracking, real-time data analytics) to enable to efficient movement of Assets, people and information.



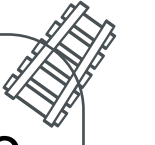
ASSET INVESTMENT PLANNING

Use of systems and tools to capture, analyse and understand data in relation to IE's asset base (i.e. current condition, performance, and expected lifespan). This data is used to develop investment scenarios and evaluate their potential impact on the organisation's funding allocation, risk profile, and service delivery.



PORTFOLIO & PROJECT MANAGEMENT

Prioritisation of Asset interventions with effective management of resources, risks, dependencies and budgets to optimally deliver IE corporate and AM strategic objectives and strategy.



LINEAR ASSET MANAGEMENT

The use of leading practice tools and processes to provide users with an intuitive and interactive graphical representation of linear assets and network. The technology will enable users to better identify Assets and related maintenance activated more accurately, and thus improving data capture and analysis to support informed decision-making.



ENVIRONMENTAL, HEALTH & SAFETY

Data, processes and technology that support IE to ensure that Assets are managed in a way that minimises negative impacts on the environment and protects the health and safety of employees and the public.



ASSET PERFORMANCE MANAGEMENT

The use of tools and technologies (e.g. IoT, sensors, data analytics, and machine learning) to collect, analyse and benchmark data on Asset performance (e.g. asset utilization, availability, reliability, and maintenance needs) to identify opportunities for improvement and to inform investment decisions.



DIGITAL TWIN

The use of technology (e.g. IoT, sensors, GIS, BIM etc.) to create an interactive, virtual representation of the physical Assets and Network which can be used to simulate, monitor, and optimize the performance of the asset in real-time and as a modelling tool.



iTRAK Demo



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ITRAK

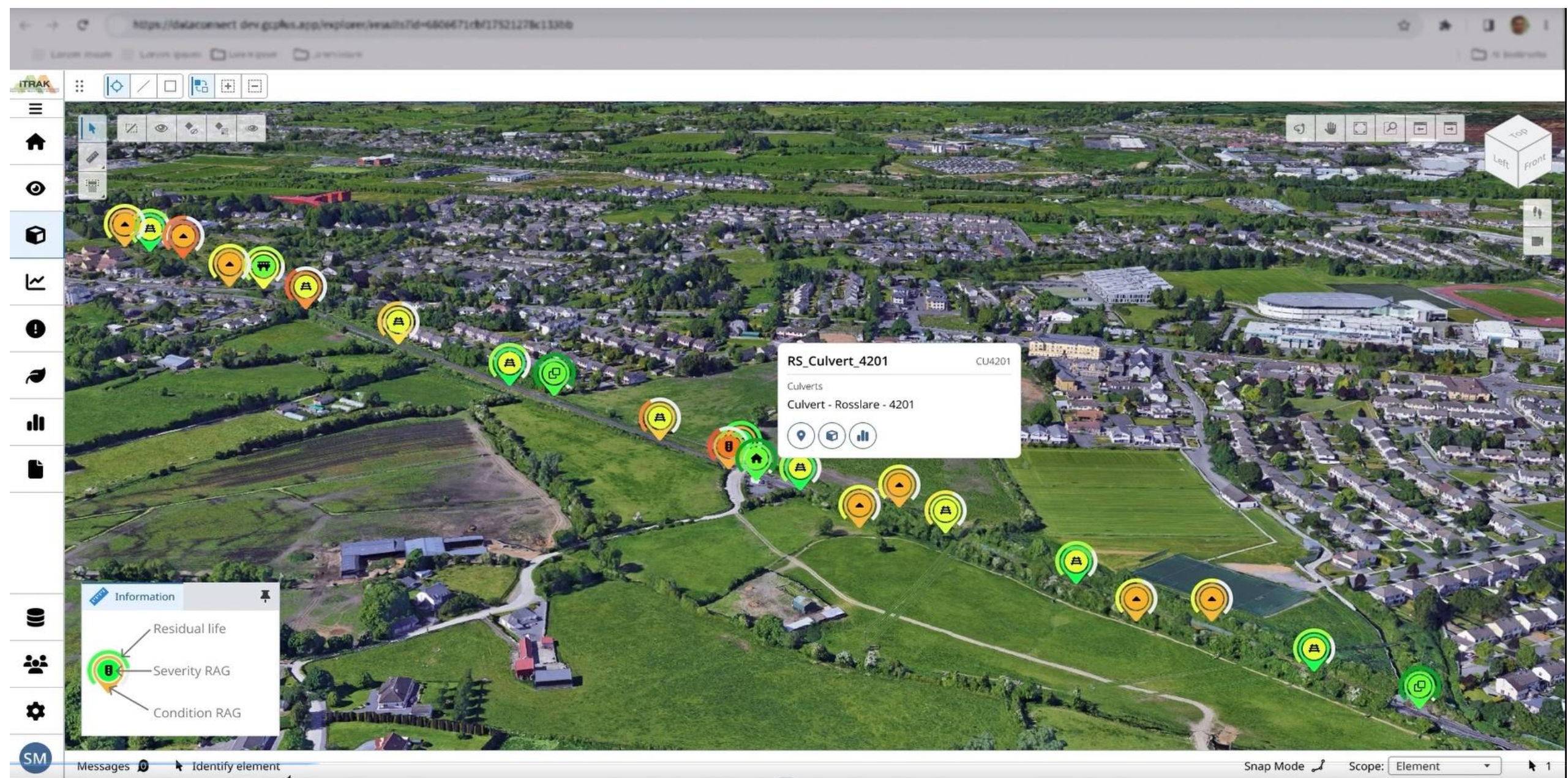
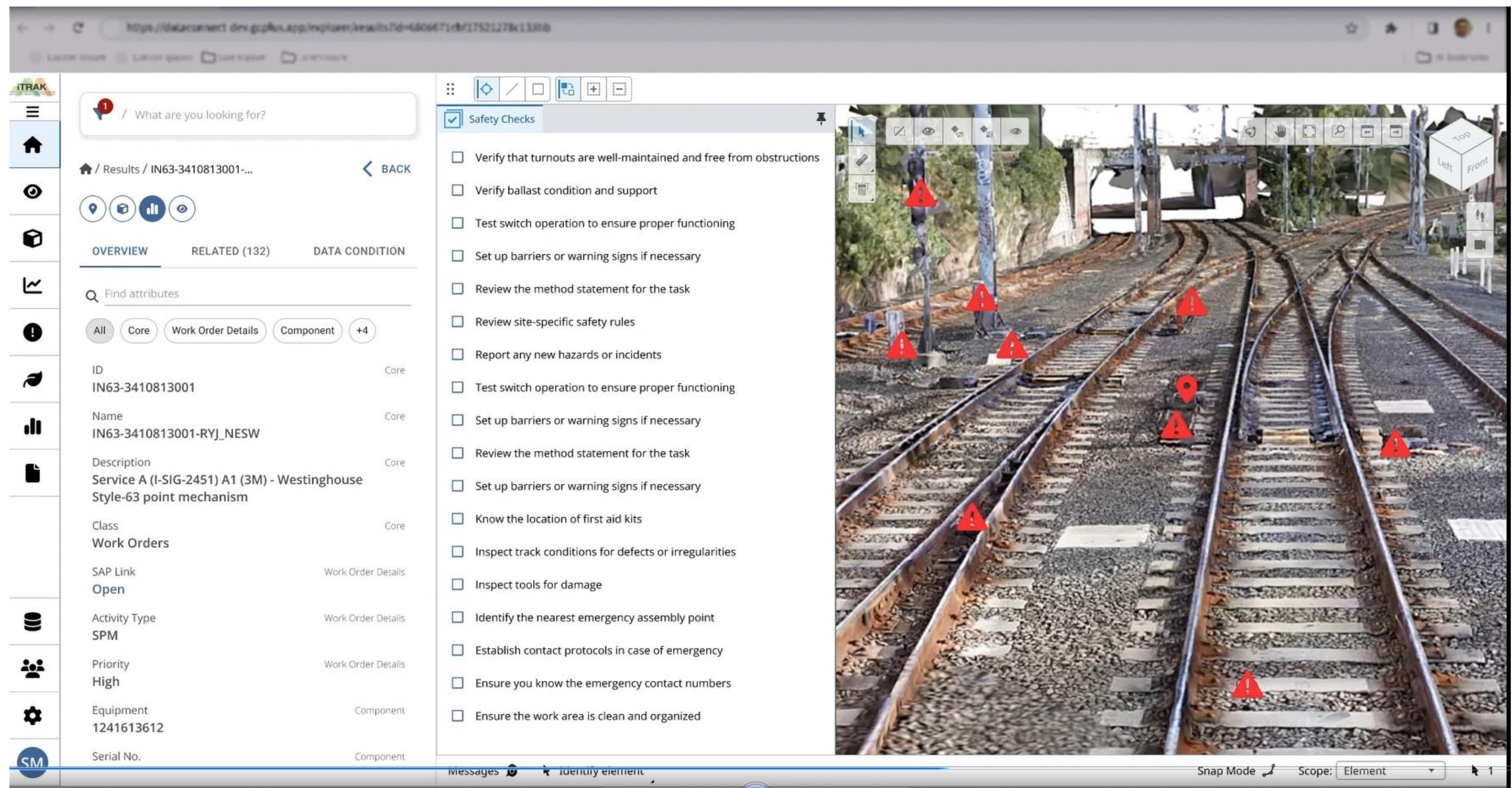
INSIGHTS FROM **TRUSTED** ASSET KNOWLEDGE



Iarnród Éireann iTRAK Capability Vision

Delivering trusted information at your fingertips

**Our AM Vision is to deliver
“Trusted Information at your
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Session 4: Maintenance/Asset Portfolio Q&A



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THANK YOU FOR YOUR ATTENTION

Jude Carey
Jude.Carey@irishrail.ie

ASSET MANAGEMENT
Working Group



INTERNATIONAL UNION
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Asset Management Seminar

Pietrarsa, Naples – 2 October 2025

**Manage real estate and infrastructure assets with
geospatial digital twins**

Alfonso Perna

ACCA software S.p.A.

ASSET MANAGEMENT
Working Group

ACCA software : main numbers & figures

ACCA provides software solutions exclusively for the AECO sector.



100

Software solutions and services



280

Employees



35

Average Employee Age



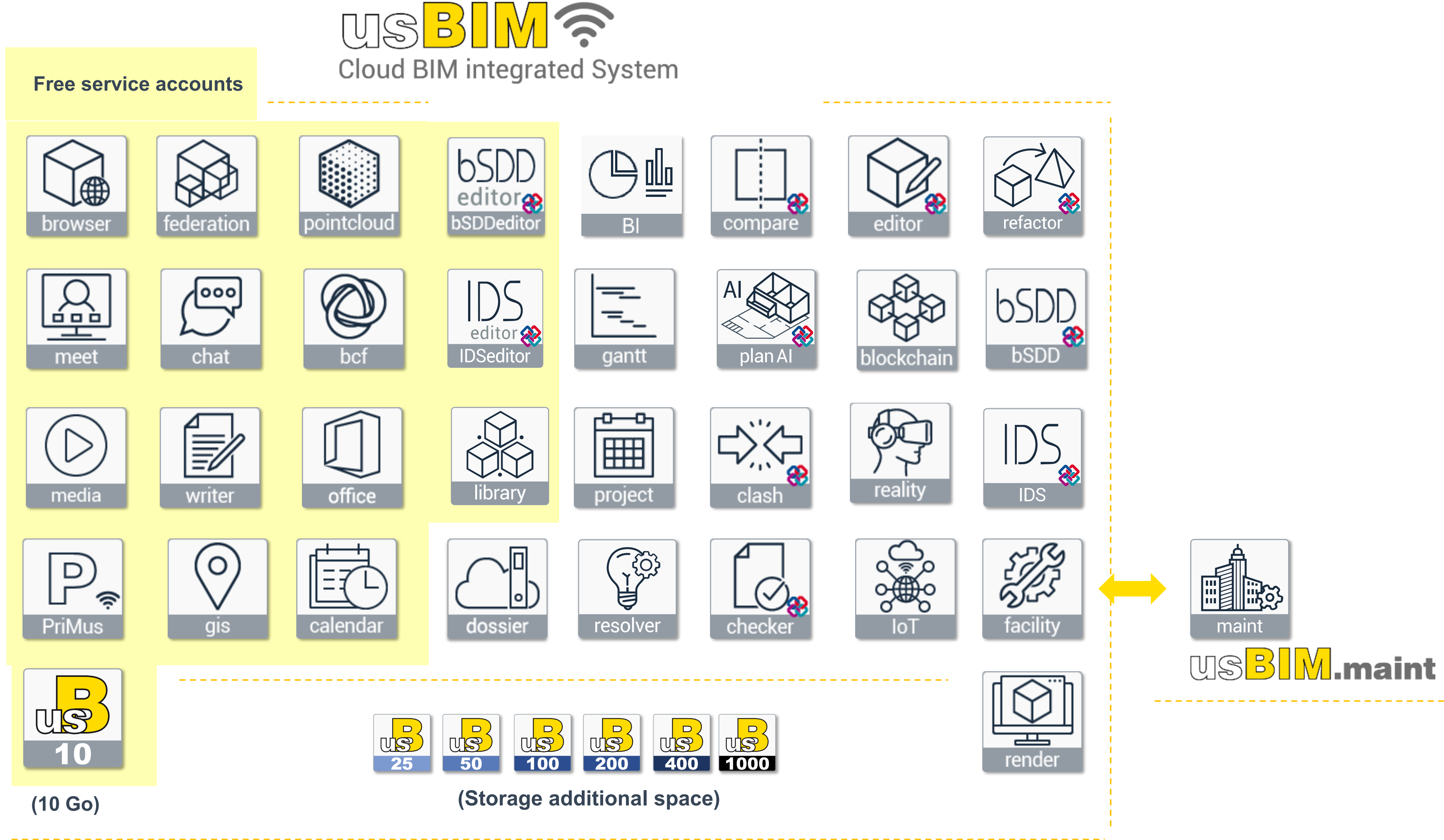
esri

Partner Network
Bronze



Headquarters:
Bagnoli Irpino (AV)
South Italy
Europe

usBIM : BIM Management system modularity (SaaS or On-Prem)



usBIM.geotwin
openBIMGIS
TECHNOLOGY 


usBIM.platform
CDE
platform

Open BIM + GIS: One data and 3D seamless environment

US **BIM**.geotwin



3D and
geodata seamless
integration

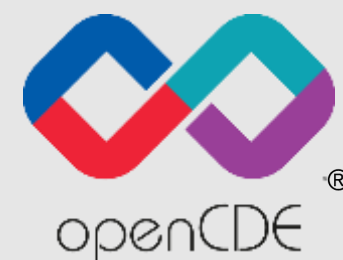


US **BIM**

UsBIM international standards compliance



International
Organization for
Standardization



usBIM.geotwin use cases

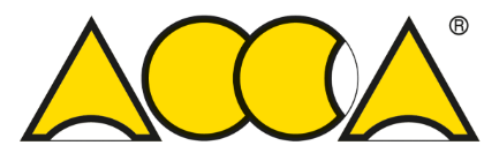
usBIM.geotwin
Geospatial Digital Twin

openBIMGIS 
TECHNOLOGY

GIS + openBIM® + AI
Geospatial Digital Twin & Smart City

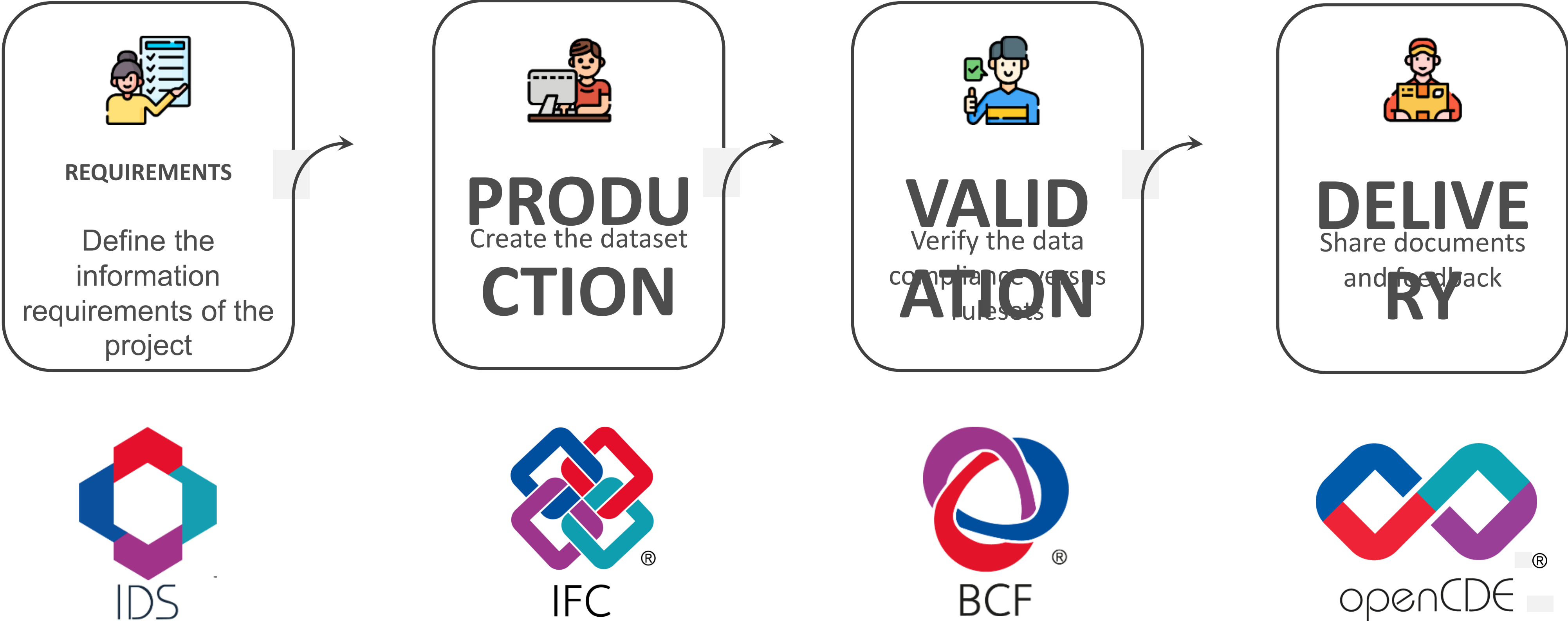
versione 880a


ACCA SOFTWARE


ACCA SOFTWARE

ASSET MANAGEMENT
Working Group

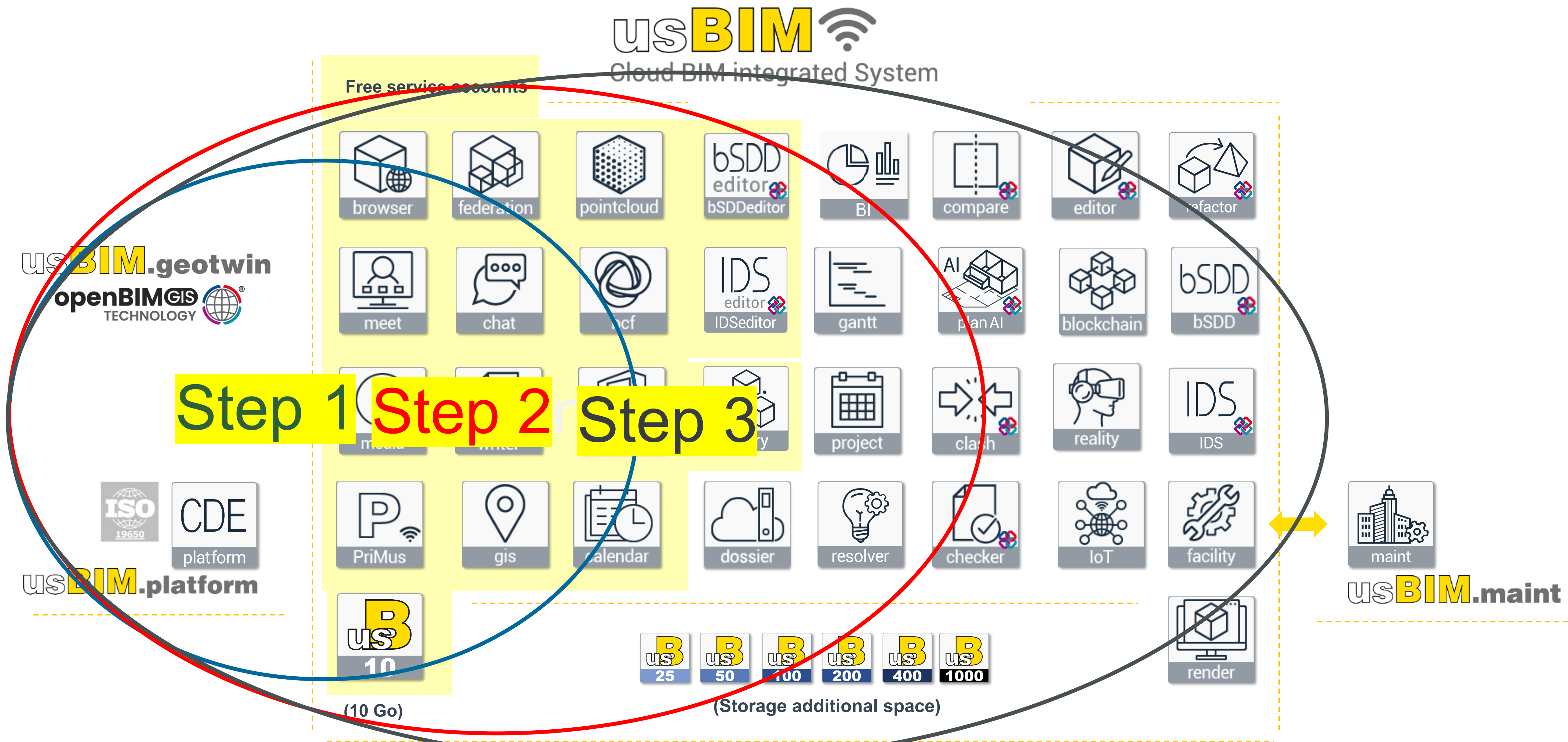
Open BIM standards and usBIM modules



Data formats processed directly and accessible by simple browser

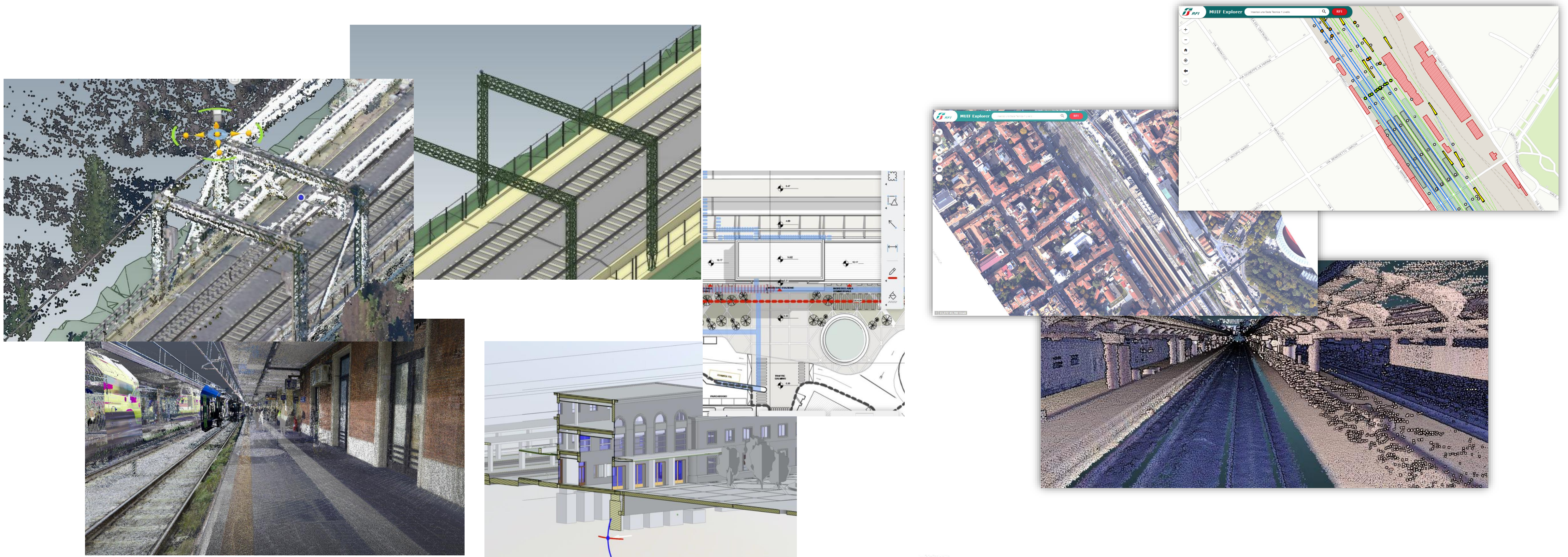


BIM Management system : customer roadmap and steps (1-2-3) startegy

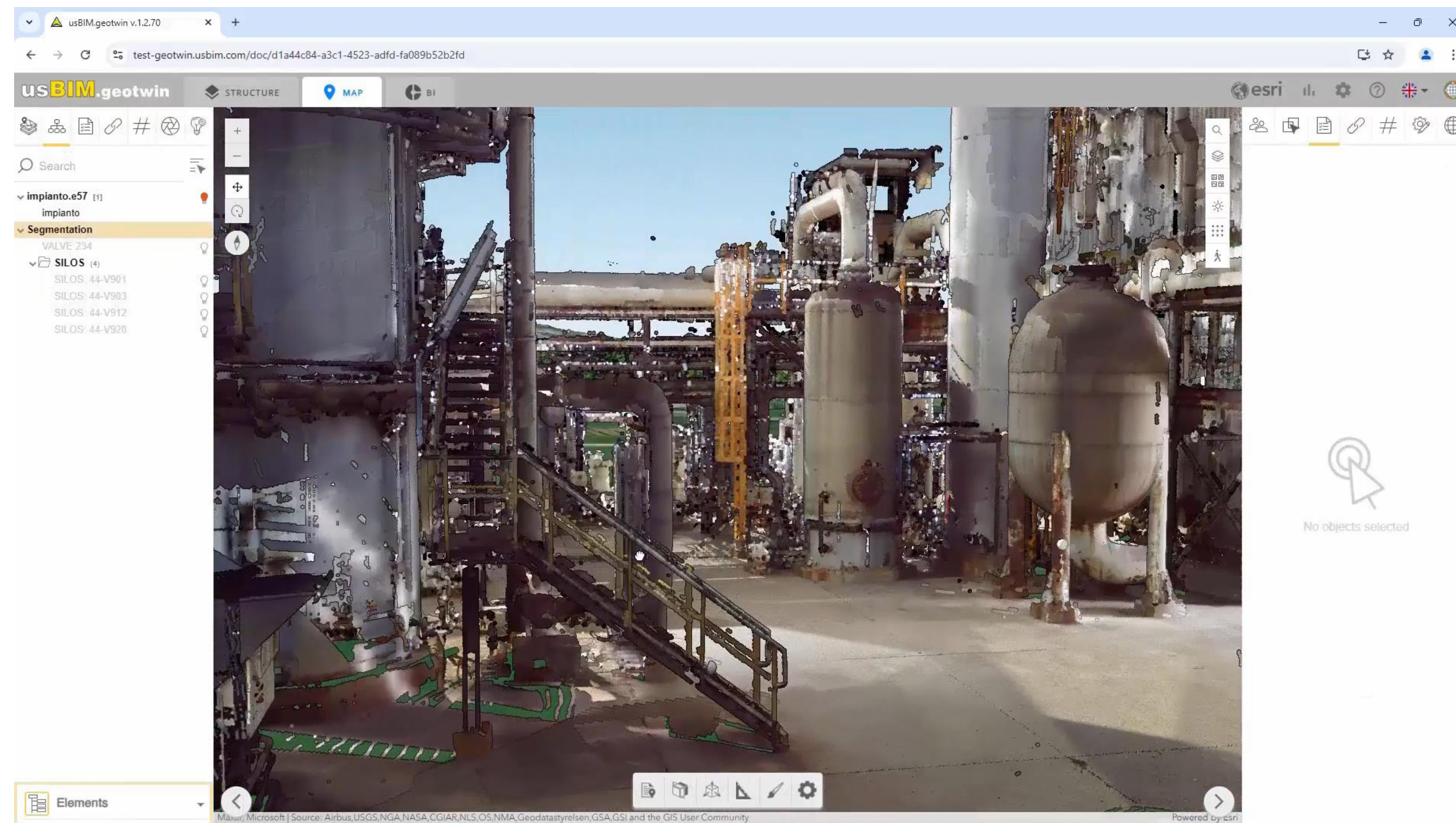


GIS and open BIM : one seamless 3D navigation

From LOD 0 to LOD 400 : An open BIM CDE starting from infra and buildings BIM models or from simple **point cloud** surveys or towards 3D high level of detail digital twins



If 3D models are missing, ...point clouds are valuable too!



Technological solutions | Big picture

Software as a Service

Common Data Environment

Visualizzatore

Modifica e gestione delle informazioni

Clash Detection

Collaborative Working

Real Time Rendering

BIM 4D

Model Checking

Virtual Reality

Transmittal

Task Management

BIM Object Library

BCF

bSDD

IDS

IFC 2x3

IFC 4.0

IFC 4.3

openCDE



Connectors and Integrations



Esri ArcGIS

Microsoft Active Directory

Document Management Systems

Facility Management

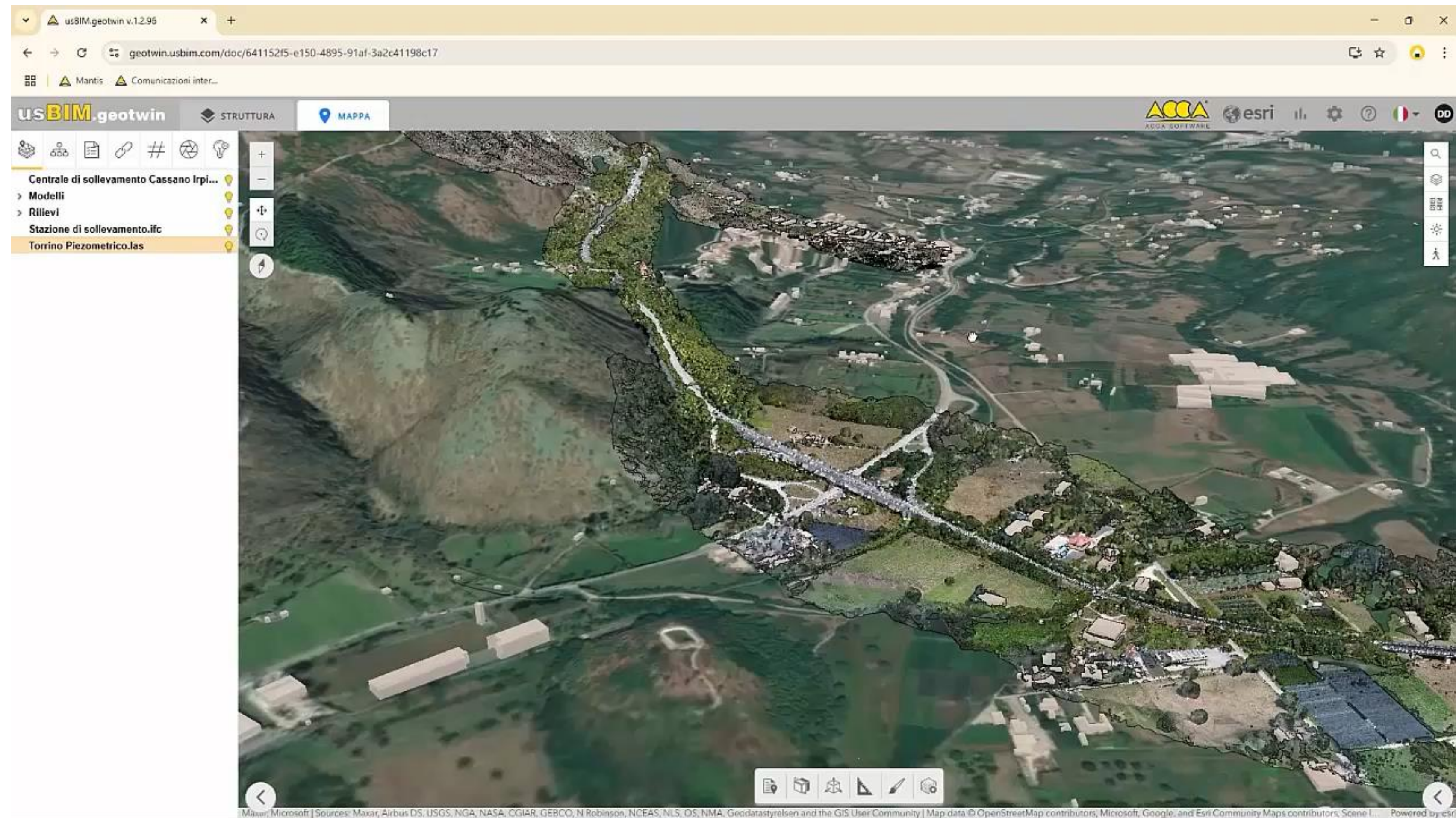
IoT

Other connectors via API REST

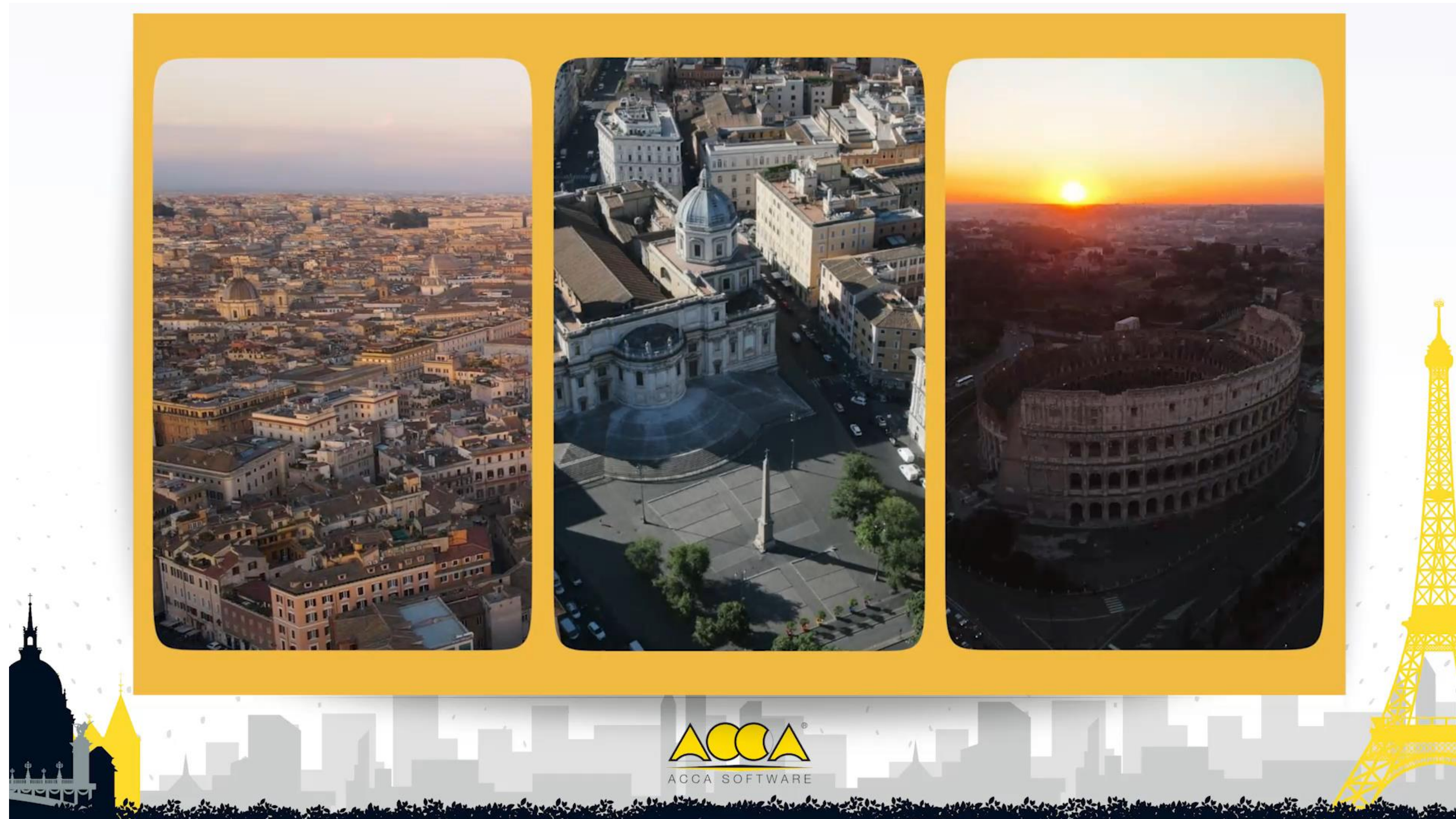
Success Case: Bridge Management



Success Case: Water utilities



Success Case: City of Rome Urban Development



Session 4: Maintenance/Asset Portfolio Q&A



INTERNATIONAL UNION
OF RAILWAYS

THANK YOU FOR YOUR ATTENTION

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