Asset resolutions
PROCESSING RISK

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THE ASSET MANAGEMENT PROCESS REFERENCE MODEL FOR INFRASTRUCTURE

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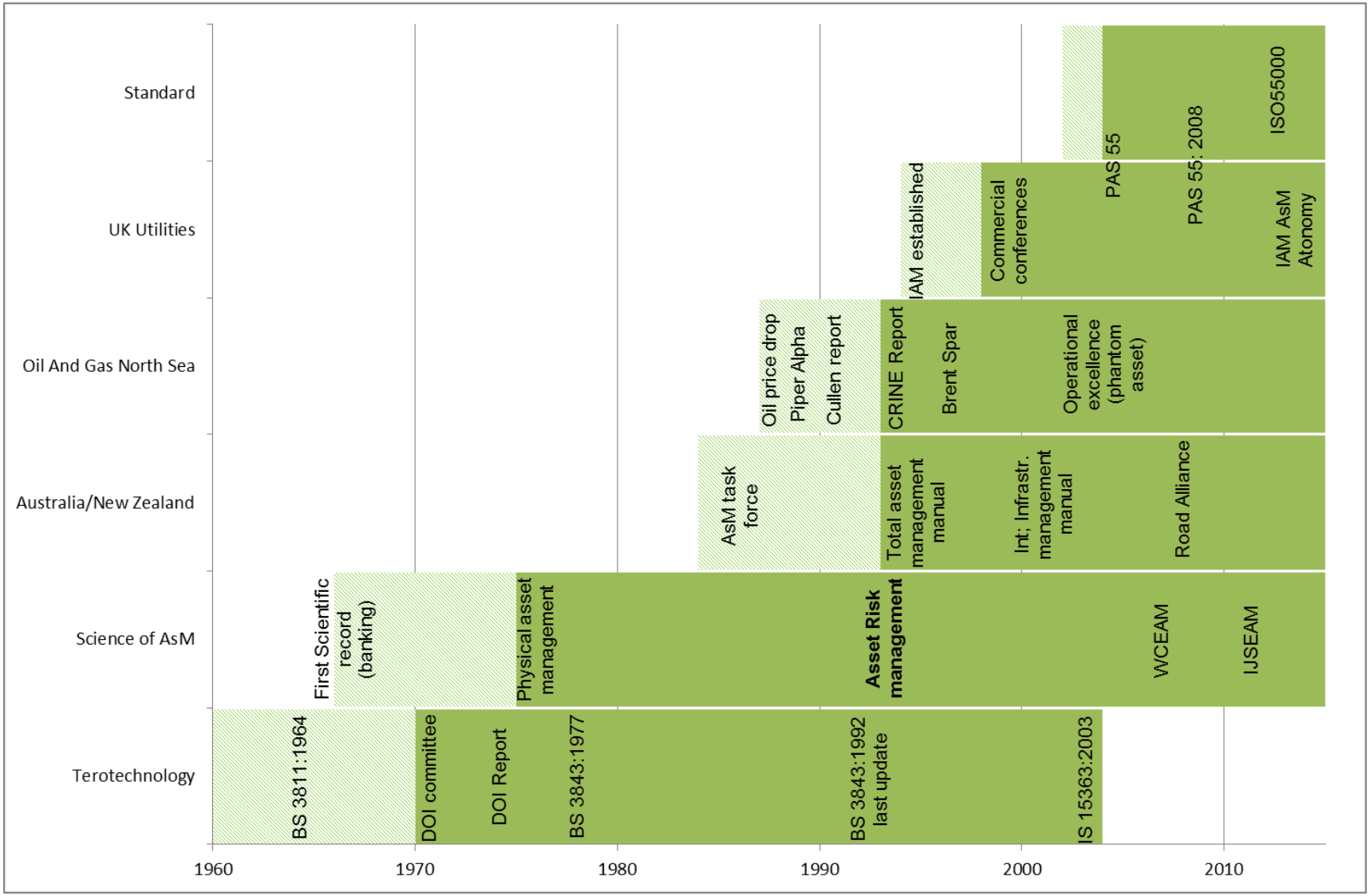
The development of asset management



Over the years, the concept was generalized

- From physical infrastructure assets to all types of assets
- Increasing attention for aligning asset risk management with general risk management
- Alignment with other management systems

Asset management is now regarded as an integral part of the organization

However, not all assets require the same management over their lifecycle

	Lifecycle phase					
Asset Class	**Concept**	**Design**	**Construction**	**Operation**	**Maintenance**	**Decommissioning**
Single use 	🟢	🟢	🟢	🟡	🔴	🟢
Rotating/moving 	🟡	🟢	🟢	🟢	🟢	🟢
Cables/pipelines 	🟡	🟢	🟢	🔴	🔴	🟢
Constructions  	🟢	🟢	🟢	🔴	🟡	🟢
Earth structures 	🟢	🟢	🟢	🔴	🟡	🔴

Generalization of the concept => less specific guidance

Especially infrastructure managers lost guidance

- Infrastructure asset management revolves around risk management
- Risk management was a challenge under PAS55
- The abstraction of ISO 55000 requires more interpretation

Pas55	ISO 55001
Physical infrastructure assets	All types of assets
Specification of risk: • Asset failure • Operational • Natural events • External risks • Stakeholder expectations • Life cycle risks	Definition of the concept of risk: • The impact of uncertainty on objectives
Risk management methodology • Proportionate to the risk level • Scope, nature and timing=> proactive • Consider change of risk over time • Classification and prioritization of risk • Consistent with organizational capability • Monitoring of actions	Reference to ISO31000

Infrastructure Asset Managers need additional guidance documents!

Why is infrastructure asset management special?

Aspect	Consequence for asset management
The assets provide routes between users, Owners/managers are not the users	Functioning assets provide value to third parties
Monopolistic	Little opportunities for growth, often heavily regulated
Very long lifespan	Loss of information over time
In the public domain	Failures very visible
Networked	No natural hierarchy in assets
Evolutionary	No grand design behind portfolio
Mainly cables/pipelines and constructions (passive assets)	No opportunities for improving performance

Infrastructure asset management is much more about risk than about performance and opportunities

Why is risk management so challenging?

- No agreement on the concept of risk:
  - Impact of uncertainty on objectives (ISO55k),
  - Probability times effect
  - Event with undesired consequences

- No agreement on methods for:
  - Capturing the risk position
  - Risk prioritization
  - Decision making on mitigations

- No agreement on truth of risk assessment
  - Objective
  - Subjective
  - Constructive

No single view works for all risks. For infrastructures this lack of consistency cannot be hidden behind performance and opportunities

It helps to regard risk itself as a process…

Deliberate damage
Terrorism, vandalism, activism
Accidents
Excavation works, crashes
Acts of God
storm, ice rain, earth quake, volcano, flooding
Systemic faults
Common cause, coincidence, normal accidents
Asset flaws
Wear and tear, ageing, material flaws, construction flaws
Operational errors
Switching errors, design errors, parameter setting errors
Changes in physical environment
Reconstructions, city development, infrastructure development
Changes in institutional environment
Norms, requirements, standards, regulation
Changes in requirements
New users, demand growth, flow reversal (distributed generation)

Transmission
Cables, lines, pipes, poles, towers
Transformation
Power Transformer, Pressure regulator
Primary control
Switchgear, Splitter, Grounder, Valve
Secondary control
Current transformer, voltage transformer, protection relays, SCADA, pressure gauge,
Facilities
Sites, buildings, fences,
Rights
Access rights, safety zone, routes, noise contour

Structural
Vibration, crack, leakage (incl. voltage leaks), get stuck, open failure, closed failure
Loss of control
Spontaneous switching, Not switching, slow/delayed switching, erroneous signal
Failure during operation
Electrocution, explode, burn, choke
Procedural failure
Misdemeanor: operating outside permit, norms, guidelines, rules of thumb, practices

Financial
Damage/ loss of assets, third party damage, fines, lost revenue
Quality of supply
Outage, Voltage dip, flicker, asymmetry, harmonics
Safety
Casualties, injuries, near misses
Environment
Emissions of dangerous substances, toxic waste, greenhouse effect, EM radiation, noise
Reputation
Negative reports in media, political attention, damaged relations with stakeholders like consent providers
Regulation
Fines, processes, Directives

Risks are flows through this process: During excavation works (cause) a cable (asset) is hit and broken (reaction), resulting in an outage of power for the customers (consequence). Mitigations are barriers in this risk process

…And to consider several levels of aggregation

Problem

Violations

Whole system performance (kpi score for a year) is not (may not be) adequate: below target, not as agreed (hence violation)

Risks

Generalized type of issue. If a risk materializes it becomes a localized problem

Issues (bottlenecks)

A localized problem: a point in the grid is not adequate: capacity shortage, asset deterioration, asset failure, third party request

Response

Strategy

Coherent set of policies and programs to bring the performance up to expectations/ agreement

Policy/program

Guideline how to deal with issues if they arise
Plan to resolve a number of issues

Project

List of activities to resolve the issue on a specific location

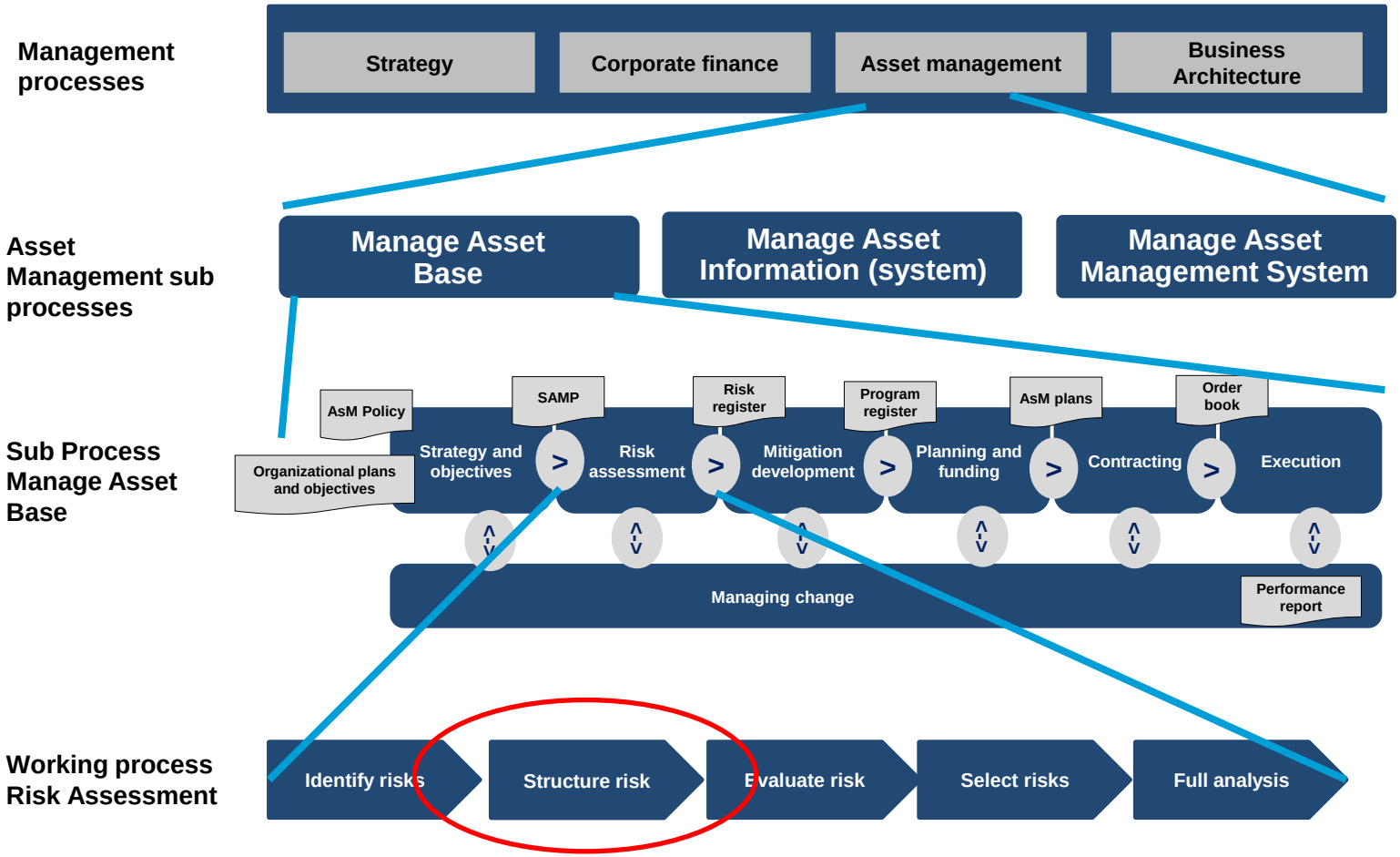
Many of the challenges in risk management result from framing risk in different phases and at different levels of aggregation

ISO 55001 poses several types of requirements

Area	ISO55001 Requirement
Documents	Asset Management Policy
	Strategic Asset Management Plan and objectives
	Asset Management Plans
	Evidence of processes in control (e.g. Risk register, Program register, Order book, performance report)
Processes	Risk and opportunity management
	Information management
	Potential asset failure identification
Behavior	Evidence of desired behavior

All types of requirements can be fulfilled with a process reference model

The process reference model is risk based

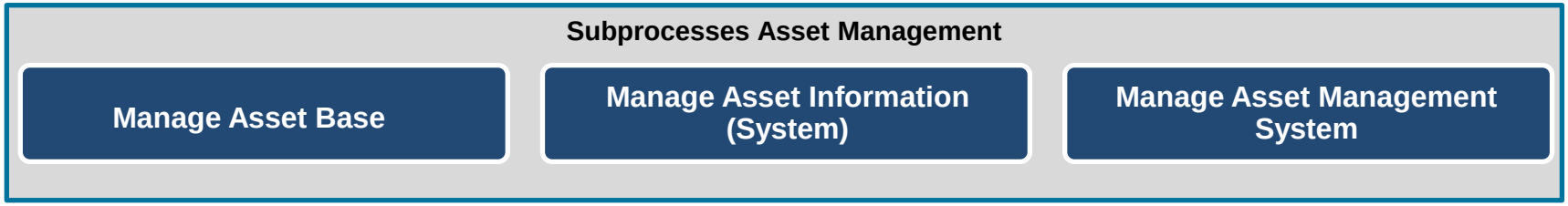


Risk management is integral part of the asset management process, with structuring risk as an essential step

This reference model fulfills all requirements

Area	Requirement	Captured in working process
Documents	Asset Management Policy	Input for Strategy and objectives
	Strategic Asset Management Plan and objectives	Output of Strategy and objectives
	Asset Management Plans	Planning and funding
	Evidence of processes in control (e.g. Risk register, Program register, Order book, performance report)	Risk assessment, Mitigation development, Contracting, Execution and change
Processes	Risk and opportunity management	Risk assessment
	Information management	Separate sub process and working processes (working processes not in figure above)
	Potential asset failure identification	Risk assessment
Behavior	Evidence	Documented process and outputs as stated above

Plotting the requirements against the model



	Fraction of requirements of ISO55001	23%	18%	59%	100%
Chapter	**Title**	**Manage Asset Base**	**Manage Asset Information (System)**	**Manage Asset Management System**	**Total**
4	Context of the organization	35%	3%	63%	100%
5	Leadership	11%	5%	84%	100%
6	Planning	48%	4%	48%	100%
7	Support	5%	53%	42%	100%
8	Operation	37%	23%	39%	100%
9	Evaluation	11%	10%	79%	100%
10	Improvement	32%	8%	59%	100%

Most of ISO 55k is about managing the system and not about managing the assets

Conclusion

- Asset management developed from a collection of ideas into a coherent concept
- Standards formalized the requirements for asset management covering (eventually) all assets, though direct applicability is not a focus of these standards
- Many asset managers struggle with this abstraction, especially with regard to risk
- Good experiences exist with a risk based process reference model for infrastructure asset management as more specific guidance
- Most of this model is not specific for infrastructure but about managing asset management
- Adaptation to other sectors therefore may be limited to the core process of managing the asset base

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Thank you

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