2023 TRANSW Symposium

Towards a Capability Improvement Framework for Information Requirements Management on Rail Infrastructure Projects

Presented by: Yu CHEN

Principle Supervisor: A/Prof. Julie Jupp

Co-supervisor: Prof. Shankar Sankaran

University of Technology Sydney

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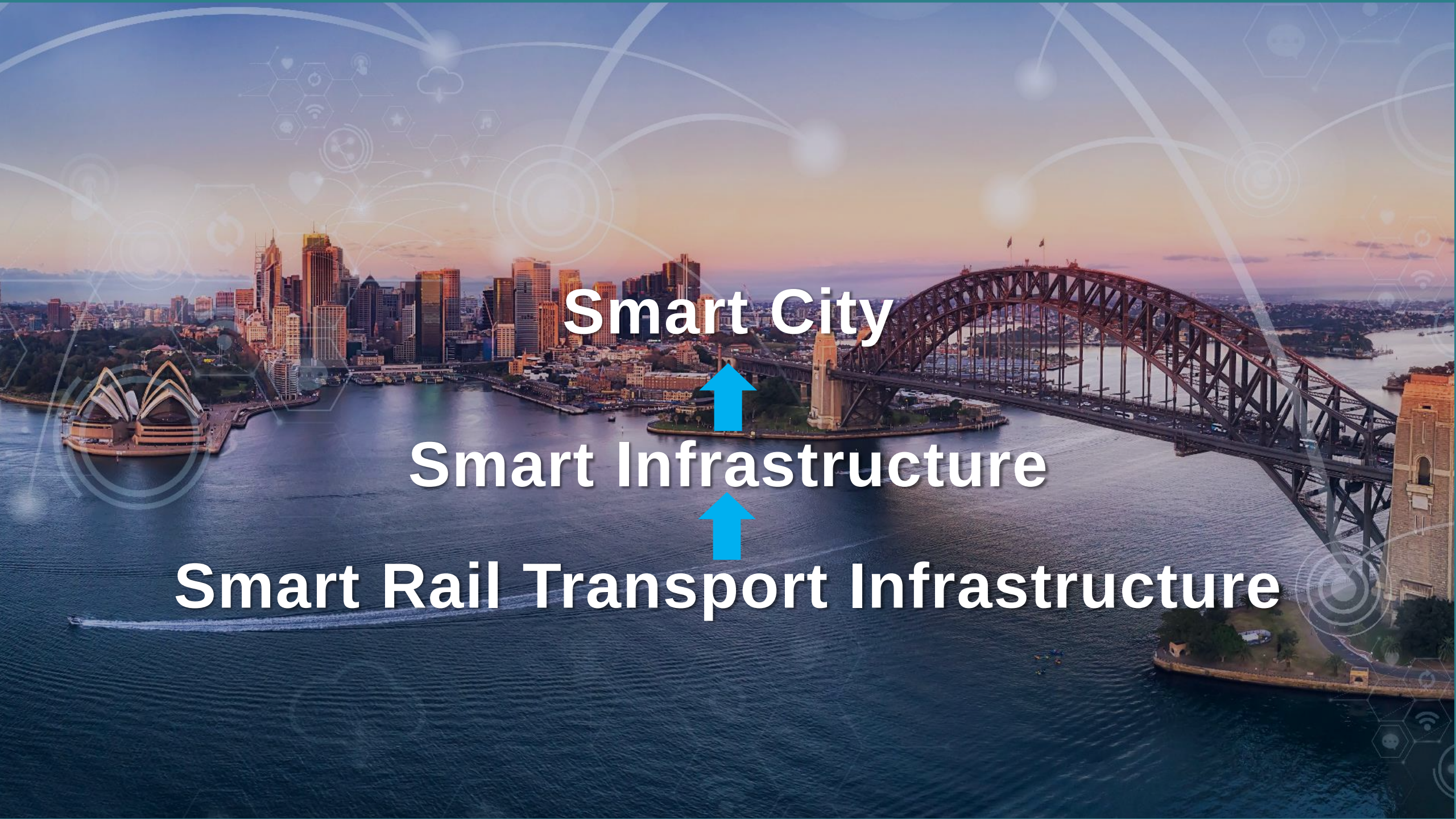
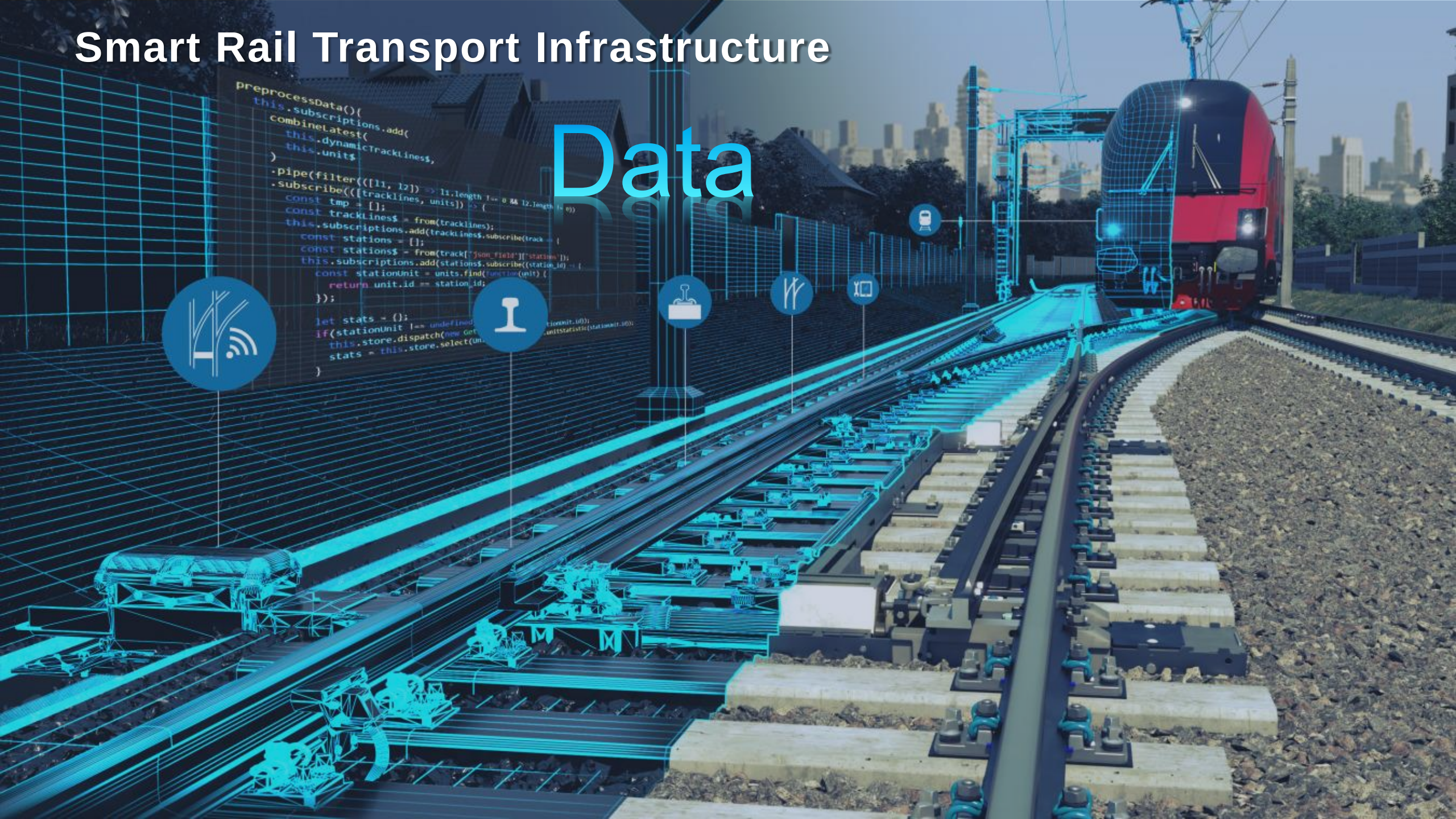

Smart City
Smart Infrastructure
Smart Rail Transport Infrastructure


Smart Rail Transport Infrastructure
Data

Spatial Model

Geometrical

GIS, 3D BIM model
As-built model of the asset

Asset Information

Non-geometrical

Specifications of asset performance, uptime, pressure ratings, operating temperature, manufacturer, asset tag numbers, operating limits and costs.

Real-time Data

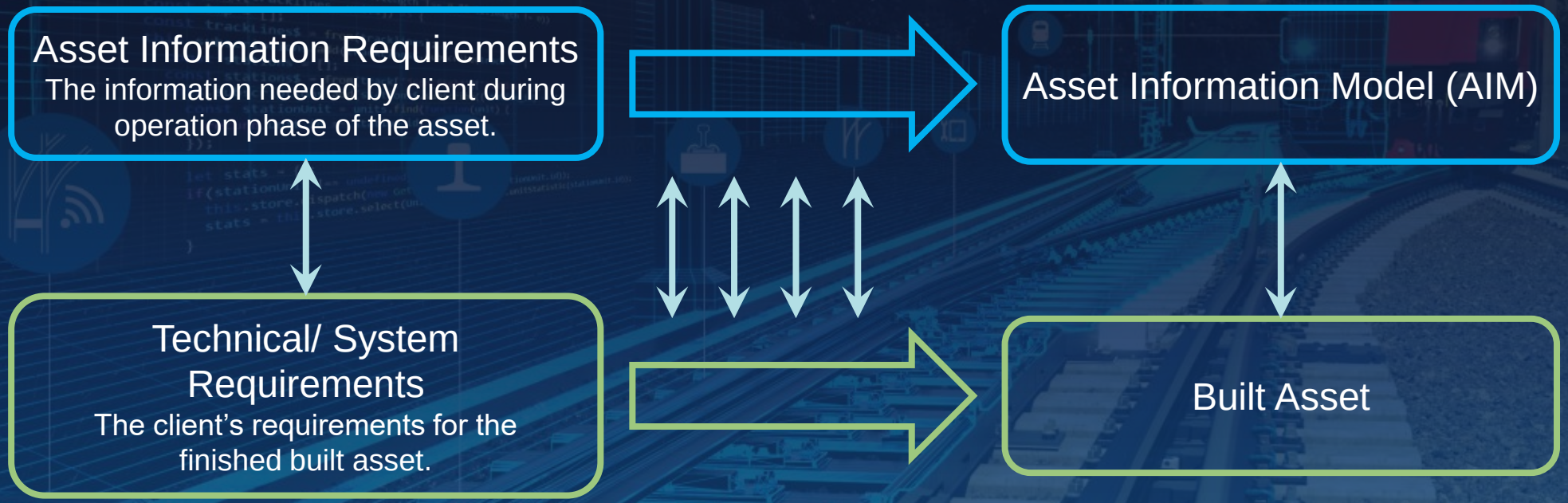
Operational data

Sensor data, IoT

Project Delivery Phases

Operation Phases

Physical System Requirements vs. Asset Information Requirements

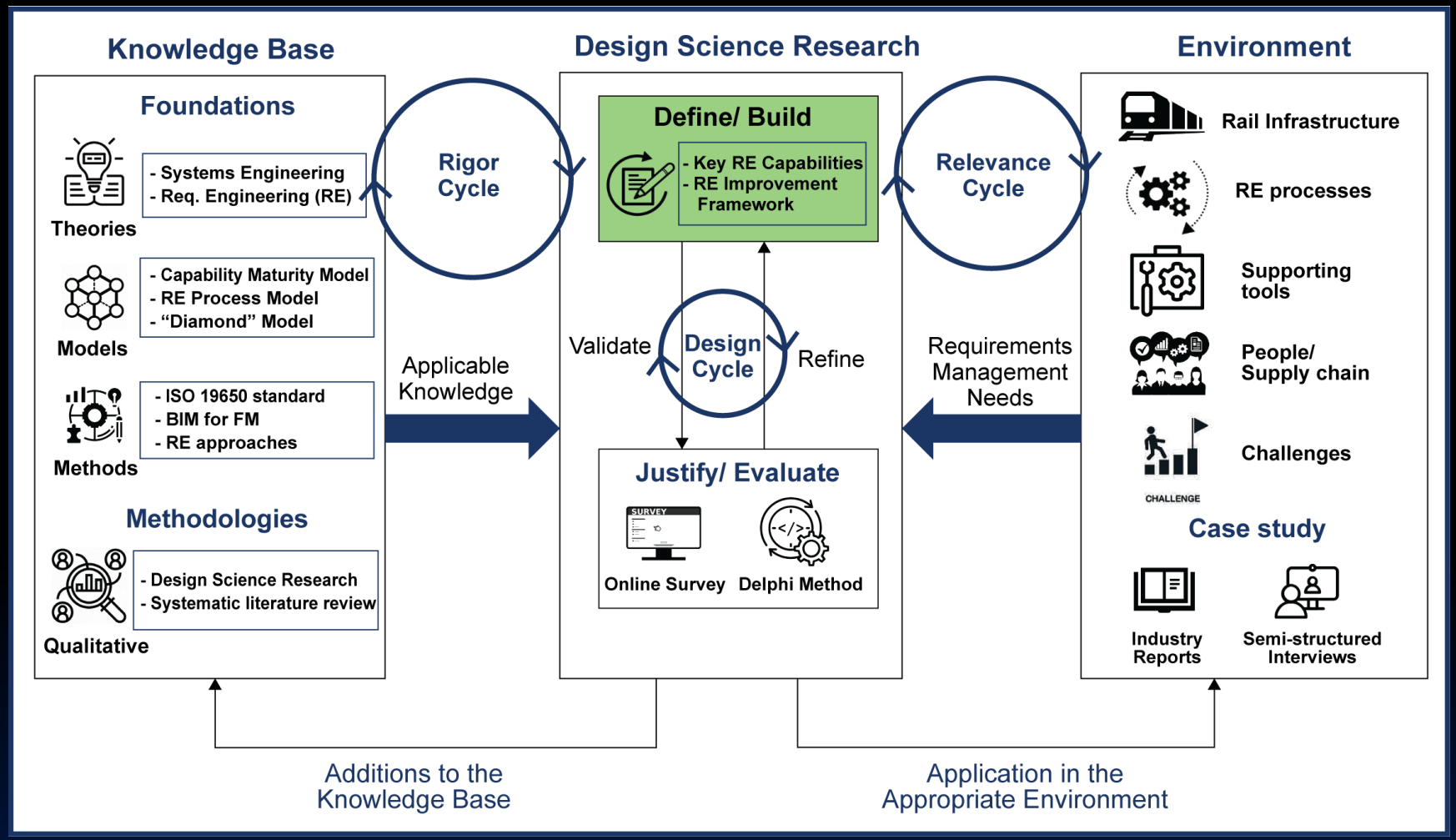


Parallel delivery of built asset and asset data
Sources: https://bim.natspec.org/documents/abab-air-guide

The research aim is to develop a Capability Improvement Framework for information requirements management on complex rail infrastructure projects in order to support an effective management of technical/ systems requirements (for physical deliverables) and information requirements (for digital deliverables) .

- Better **understanding of the current maturity level** of information requirements management capabilities of an organisation or a project team, and
- **Recognising a potential pathway for improvement**.

Design Science Research Methodology



50+ Systematic Literature review

13 Interviewees across

6 Companies

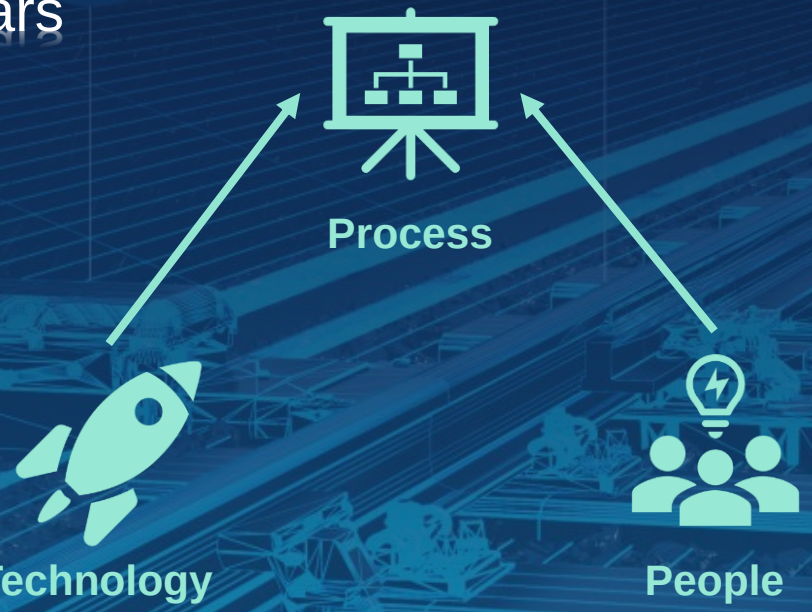
36 (50%) Valid Survey Responses

3 Feedback Workshops

How Mature is Your Capability to Info. Requirements Management ?

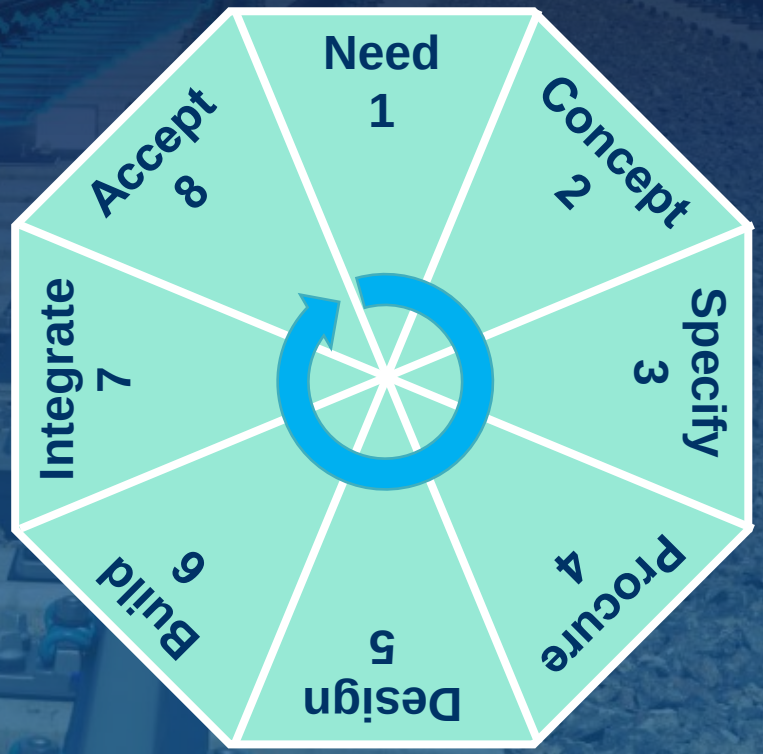
3

Pillars



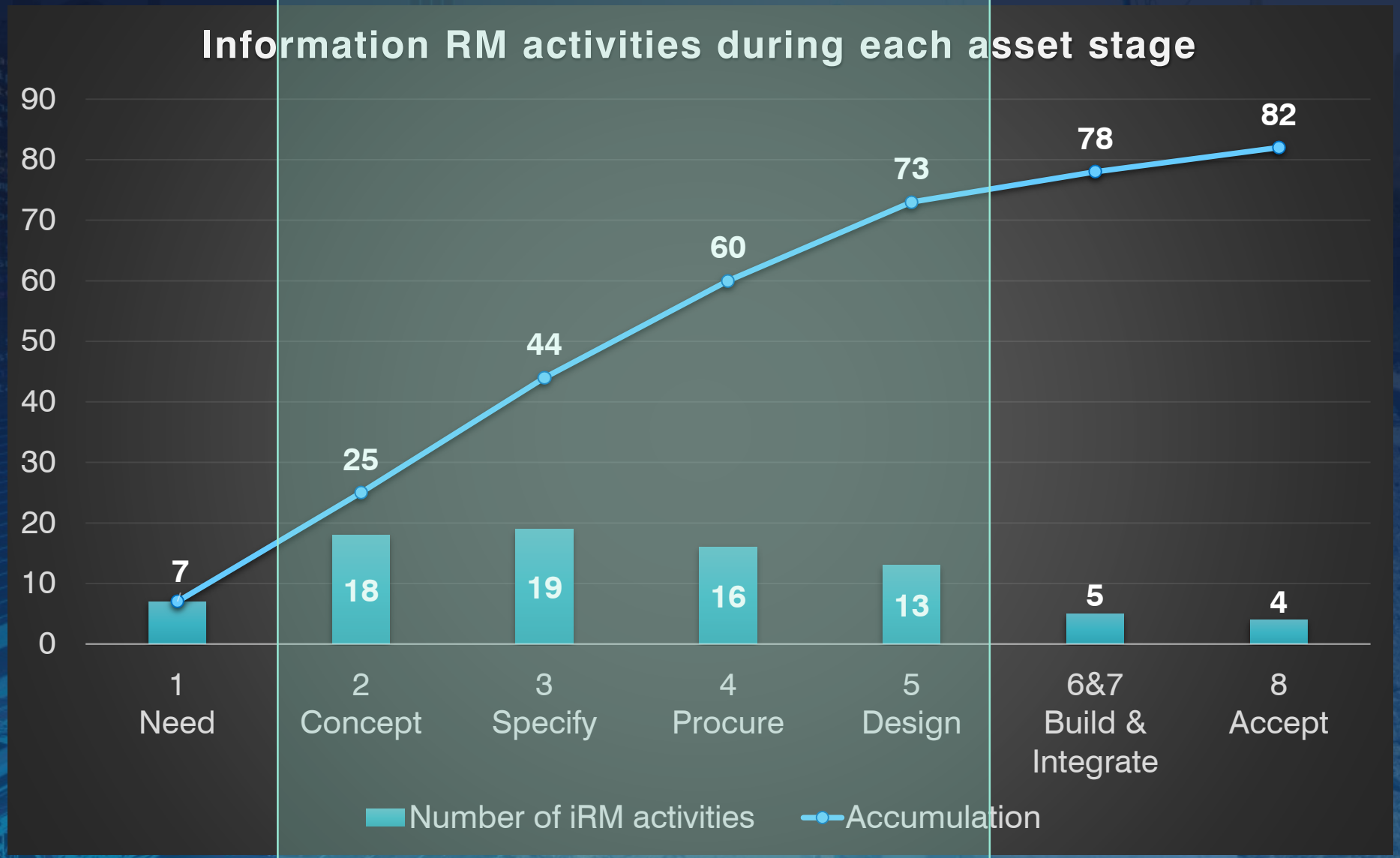
8

Asset development stages



82

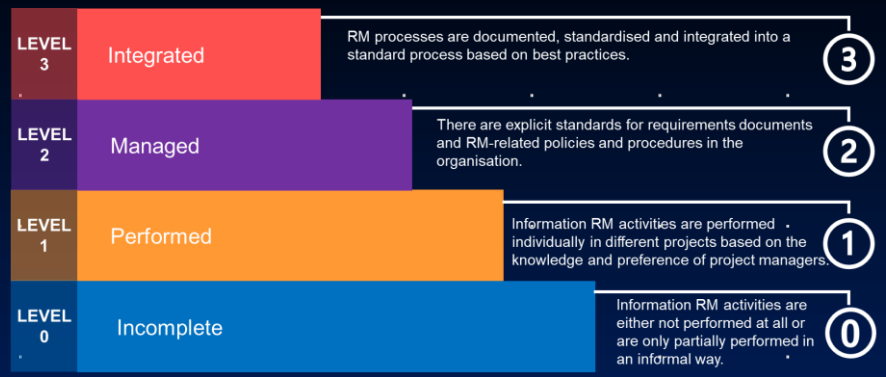
Information RM activities

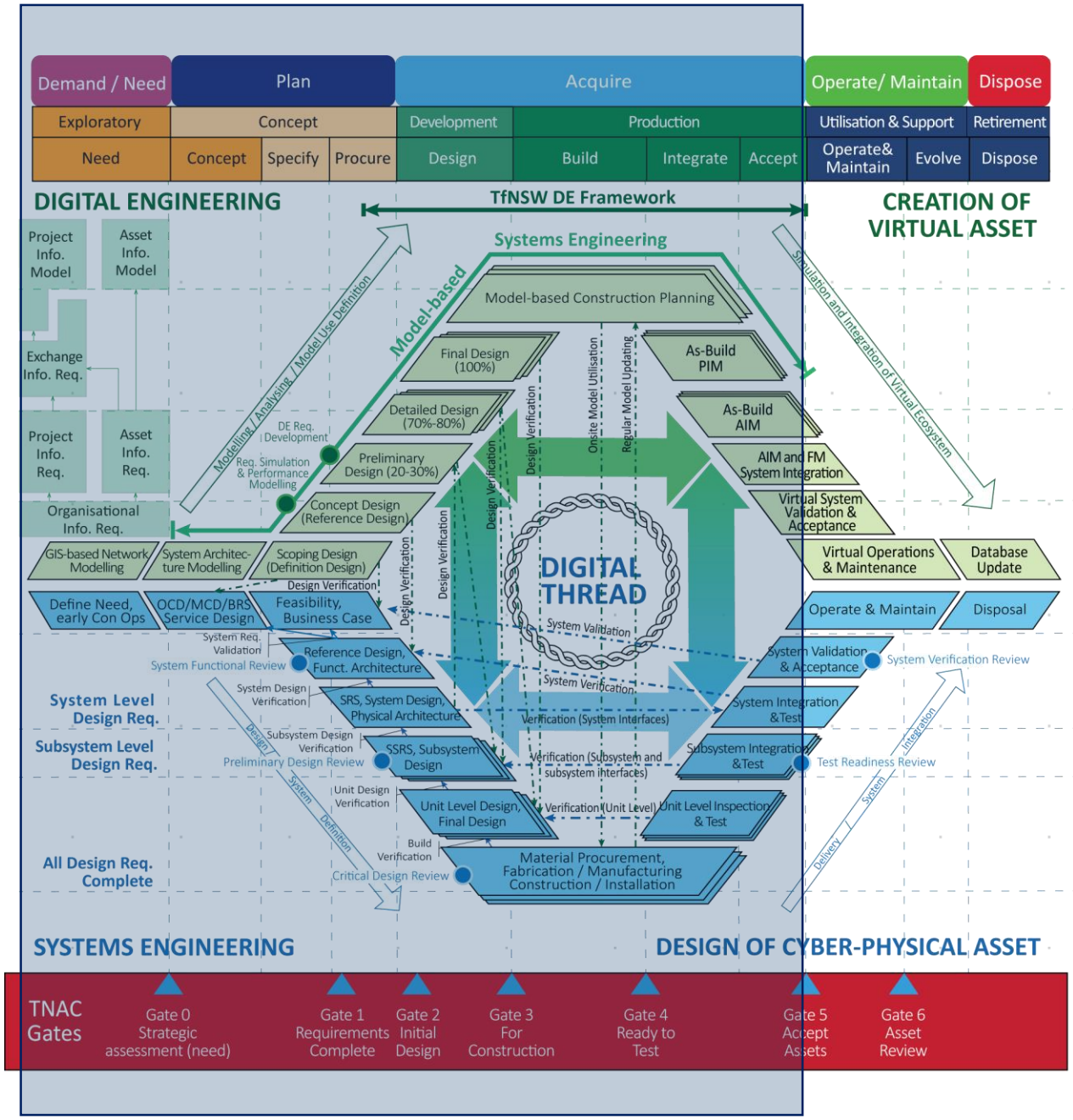


Organisation Level

At organisational level implementation of the framework, the checklist of 82 information RM activities should be scored according to the ways they are implemented in the organisation. There are 4 scenario of implementation:

1) Standardised. Score = 3.
2) Normal use (not mandatory). Score = 2.
3) Used at discretion of project manager. Score = 1.
4) Never. Score = 0.





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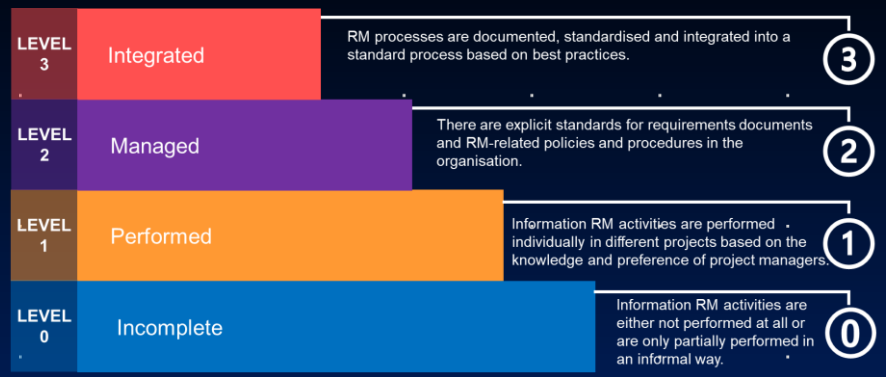

TfNSW Phases AS ISO 55001 Asset management - management systems - requirements approach	TfNSW Asset Life Cycle Stages	Scores	Information Requirements Management (iRM) Activities	Category of activity	RM capability area
Demand/Need	1 Need		1.1 *Enterprise Level:* Prepare or review existing data and information asset management policy/strategy/framework, and strategic asset management plan (align with ISO 55001)	Basic	Requirements elicitation
			1.2 *Enterprise Level:* Establish or review existing Organisational information requirements (OIR) based on asset management activities identified in the policy, strategy and plan	Basic	Requirements elicitation
			1.3 *Enterprise Level:* Identify asset/ facilities managers as primary stakeholders and support the delivery team in understanding the operational service needs.	Basic	Stakeholder involvement
			1.4 *Enterprise Level:* Understanding the asset managers' information requirements in the strategic and operational management of assets.	Basic	Requirements elicitation
			1.5 *Enterprise Level:* Establish or review existing **Concept of Operations (ConOps) or concept brief**	Basic	Requirements elicitation
			1.6 *Enterprise Level:* Establish configuration management baselines and review gates for milestone delivery	Basic	Configuration management
			1.7 *Enterprise Level:* Establish and maintain the plan for performing information requirements management process	Advanced	RM protocol and language
	2 Concept		2.1 *Project/ Capability Level:* When developing and completing **Operations Concept Definition (OCD) and Maintenance Concept Definition (MCD)**, ensure that O&M requirements are allocated to an appropriate system or asset, and asset location	Basic	Requirements allocation
			2.2 *Enterprise Level:* Develop/ update Master Classification Library (MCL)/ Common Data Dictionary based on identified system or asset and locations using common asset classification coding standard (e.g., Uniclass)	Advanced	RM protocol and language
			2.3 *Project/ Capability Level:* Establish the DE project strategy (approach to DE implementation)	Advanced	Senior management support
			2.4 *Enterprise Level:* Establish/ review data classification and referencing (include asset classification, asset references, location classification, location references - confirming the "**Common Data Model***" for the client/ asset owner based on the MCL.) Buildings = COBie/ Infrastructure Transport Data Building Blocks (Uniclass + Project / Contract Info + Legacy Asset classifications)	Advanced	RM protocol and language
			2.5 *Project/ Capability Level:* Based on DE project strategy and setup, establish the project data dictionary (Transport this equates to the Project Data Building Blocks (PDBB))	Advanced	RM protocol and language
			2.6 *Project/ Capability Level:* Aligning with the Project Management Plan (PMP), specify asset information required for O&M (based on DE Framework and PDBB or OIR), AKA asset information requirements **(AIR**)**	Basic	Requirements elicitation
			2.7 *Project/ Capability Level:* Generate Project Data Schemas (PDS) based on functional requirements and AIR, following the MCL (data dictionary) established in 2.4	Advanced	RM protocol and language
			2.8 *Enterprise Level:* Establish the Client-side Common Data Environment (CDE) which includes Enterprise Content Management, Scheduling Schemas, Cost Estimating Systems, etc.	Advanced	Integration/ Interoperability of tools
			2.9 *Project/ Capability Level:* Embed Project Data Schemas/ AIR in the tender document (relative to other DE requirements including scope, draft DEXP, draft project data schema)	Basic	Integration of RM protocols with PM protocols
			2.10 *Project/ Capability Level:* Support the delivery team's tender response (Ensure alignment between information requirements/ project data schemas, contract templates, technical disciplines and deliverables)	Basic	Integration of RM protocols with PM protocols
			2.11 *Project/ Capability Level:* When conducting tender evaluation, include the requirement for an information requirements management plan aligned to ISO 19650 (e.g., DEXP), and project data schema alignment in assessment criteria	Basic	Integration of RM protocols with PM protocols
			2.12 *Project/ Capability Level:* After awarding the contract, review and approve contractor's information requirements management plan which is included in DEXP against 2.9	Basic	Requirements change management
			2.13 *Project/ Capability Level:* After awarding the contract, review and approve contractor's final project data schemas against 2.9	Advanced	RM protocol and language
			2.14 *Project/ Capability Level:* After awarding the contract, support the establishment of contractor's CDE which should include RM tool, 2D CAD, 3D CAD, GIS, BIM (3D), Scheduling, cost accounting, cost estimating systems etc.	Advanced	Integration/ Interoperability of tools
			2.15 *Project/ Capability Level:* Update Project Data Schemas/ AIR to align with approved DEXP	Basic	Requirements change management
			2.16 *Project/ Capability Level:* Validate the DE data in Strategic Business Case (SBC) (establish RVTM) submitted by Contractor against updated Project Data Schemas/ AIR in 2.15	Basic	Requirements verification and validation
			2.17 *Project/ Capability Level:* Validate the DE data in Options Design Model submitted by Contractor against updated Project Data Schemas/ AIR in 2.15	Basic	Requirements verification and validation
			2.18 *Project/ Capability Level:* Model-based approaches are implemented to verify that Option Design deliverables are compliant with information requirements (AIR, PIR, EIR) by contractor via CDE	Advanced	Requirements verification and validation
			3.1 *Project/ Capability Level:* Elicit and analyse stakeholder information requirements with the support from asset and facilities management teams	Basic	Requirements elicitation Requirements analysis and prioritisation Stakeholder involvement
			3.2 *Project/ Capability Level:* Clarify existing or planned operating information management systems/ software, and identify legacy asset and location classification, and hierarchy requirements	Basic	Requirements analysis and prioritisation
			3.3 *Project/ Capability Level:* After the approval of SBC, review and update OIR and Project Data Schemas/ AIR against the context of the project (e.g., key decision points when information is required, level of information need, LOD, asset classification, asset location reference, asset attributes and data schemas, asset register, etc.)	Basic	Requirements change management
			3.4 *Project/ Capability Level:* Embed information requirements of the OCD and MCD in the Business Requirements Specification (BRS)	Basic	Requirements elicitation
			3.5 *Project/ Capability Level:* When performing the feasibility study assessment on the preferred		

Information Requirements Management activities in 'Need' stage

Asset Life Cycle Stages (Transport for NSW, 2019)	Information Requirements Management (iRM) Activities	Category of activity	RM capability area
1 Need	1.1 *Enterprise Level:* Prepare or review existing data and information asset management policy/strategy/framework, and strategic asset management plan (align with ISO 55001)	Basic	Requirements elicitation
	1.2 *Enterprise Level:* Establish or review existing Organisational information requirements (OIR) based on asset management activities identified in the policy, strategy and plan	Basic	Requirements elicitation
	1.3 *Enterprise Level:* Identify asset/ facilities managers as primary stakeholders and support the delivery team in understanding the operational service needs.	Basic	Stakeholder involvement
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	1.5 *Enterprise Level:* Establish or review existing Concept of Operations (ConOps) or concept brief	Basic	Requirements elicitation
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	1.7 *Enterprise Level:* Establish and maintain the plan for performing information requirements management process	Advanced	RM protocol and language

Information Requirements Management activities in 'Concept' stage

Asset Life Cycle Stages (Transport for NSW, 2019)	Information Requirements Management (iRM) Activities	Category of activity	RM capability area
2 Concept	2.1 *Project/ Capability Level:* When developing and completing Operations Concept Definition (OCD) and Maintenance Concept Definition (MCD), ensure that O&M requirements are allocated to an appropriate system or asset, and asset location	Basic	Requirements allocation
	2.2 *Enterprise Level:* Develop/ update Master Classification Library (MCL)/ Common Data Dictionary based on identified system or asset and locations using common asset classification coding standard (e.g., Uniclass)	Advanced	RM protocol and language
	2.3 *Project/ Capability Level:* Establish the DE project strategy (approach to DE implementation)	Advanced	Senior management support
	2.4 *Enterprise Level:* Establish/ review data classification and referencing (include asset classification, asset references, location classification, location references - confirming the "**Common Data Model**" for the client/ asset owner based on the MCL.) Buildings = COBie/ Infrastructure Transport Data Building Blocks (Uniclass + Project / Contract Info + Legacy Asset classifications)	Advanced	RM protocol and language
	2.5 *Project/ Capability Level:* Based on DE project strategy and setup, establish the project data dictionary (Transport this equates to the Project Data Building Blocks (PDBB))	Advanced	RM protocol and language
	2.6 *Project/ Capability Level:* Aligning with the Project Management Plan (PMP), specify asset information required for O&M (based on DE Framework and PDBB or OIR), AKA asset information requirements (AIR)	Basic	Requirements elicitation
	...		

How Mature is Your Capability to Info. Requirements Management ?

LEVEL 3	Integrated	RM processes are documented, standardised and integrated into a standard process based on best practices.	3
LEVEL 2	Managed	There are explicit standards for requirements documents and RM-related policies and procedures in the organisation.	2
LEVEL 1	Performed	Information RM activities are performed individually in different projects based on the knowledge and preference of project managers.	1
LEVEL 0	Incomplete	Information RM activities are either not performed at all or are only partially performed in an informal way.	0

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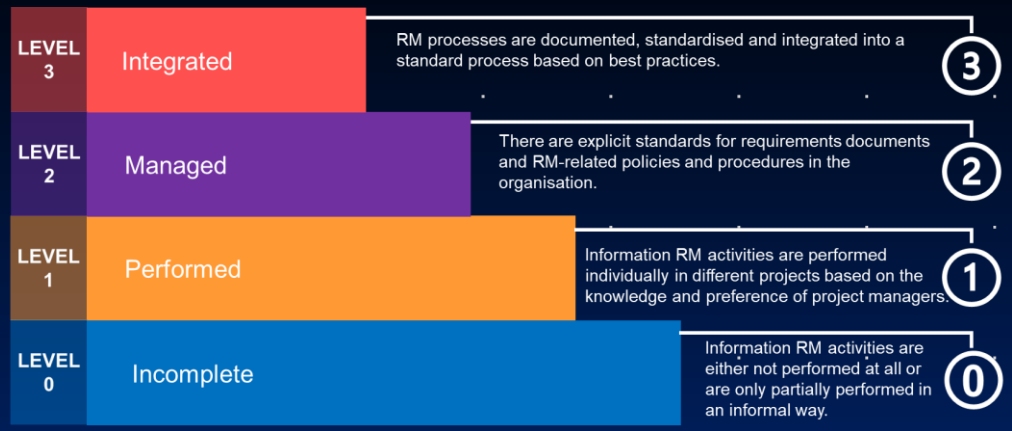

Project Level

At project level implementation of the framework, the checklist of 82 information RM activities provide guidance to the project team for effective and efficient information RM before and during project set-up.

The checklist should be adapted according to the contextual factors.

The checklist helps the project team to identify resources required to support information RM practices.


Thanks for your attention!
Q&A