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'Right-Sizing' Systems Engineering for New Zealand Projects

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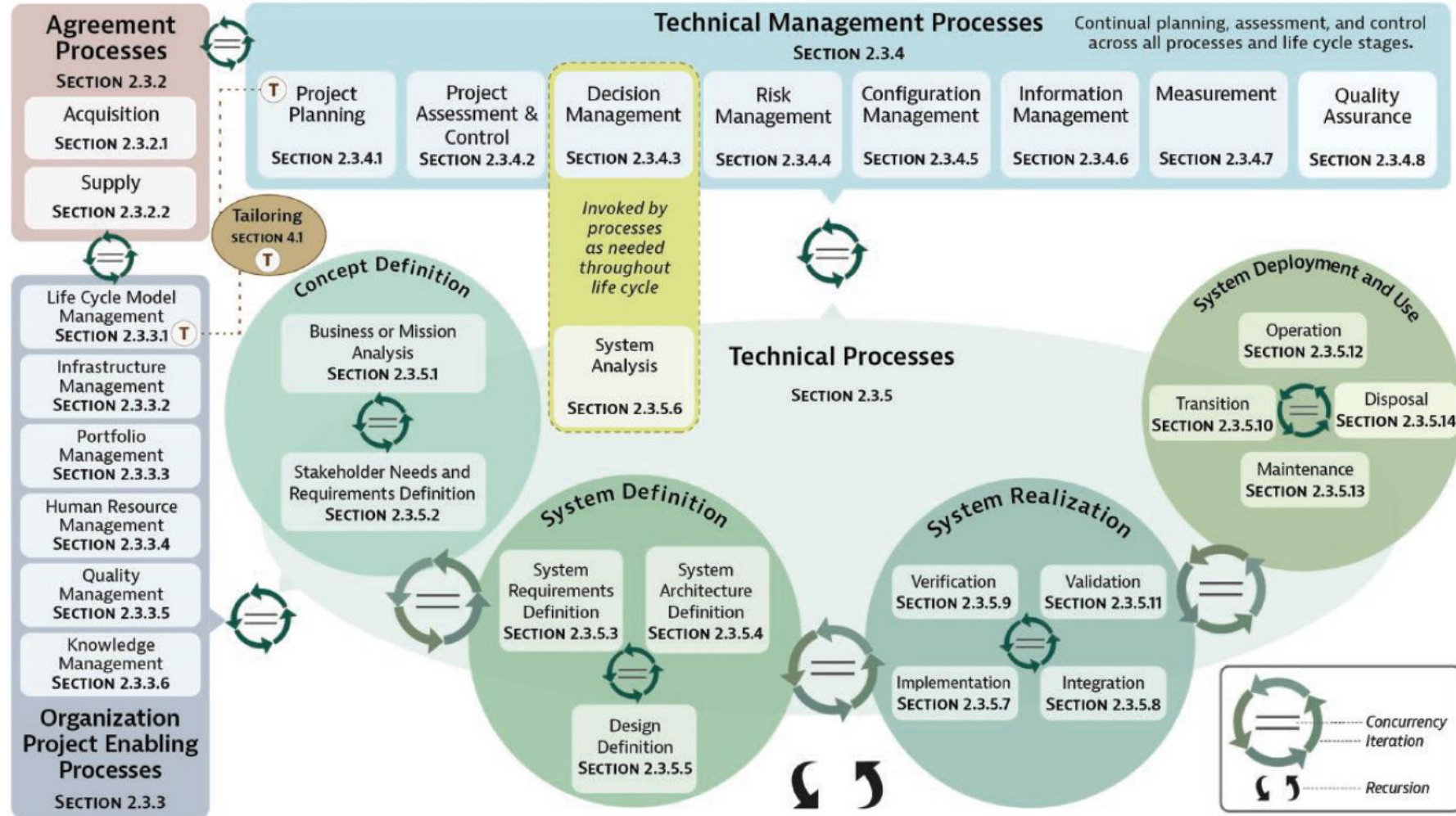
Introduction

- Large New Zealand transport and infrastructure projects are becoming more complex, both in terms of functionality and their interfaces to existing systems.
- There has been a positive uptake of the use of SE in NZ transport projects over the last ~5 years, but not across all processes and outputs defined in ISO 15288 and the INCOSE Handbook.
- Purpose of this presentation
 - Where is SE being used well in NZ transport projects?
 - Where are the opportunities for improvement or increased uptake?
 - Case Study: Interisland Resilient Connection (iReX) project
- Outcome
 - Begin a conversation on whether we all see the same gaps (or not)
 - Discuss what gaps should be a focus area for us as the NZ SE community

Inter-island Resilient Connection (iReX) Project

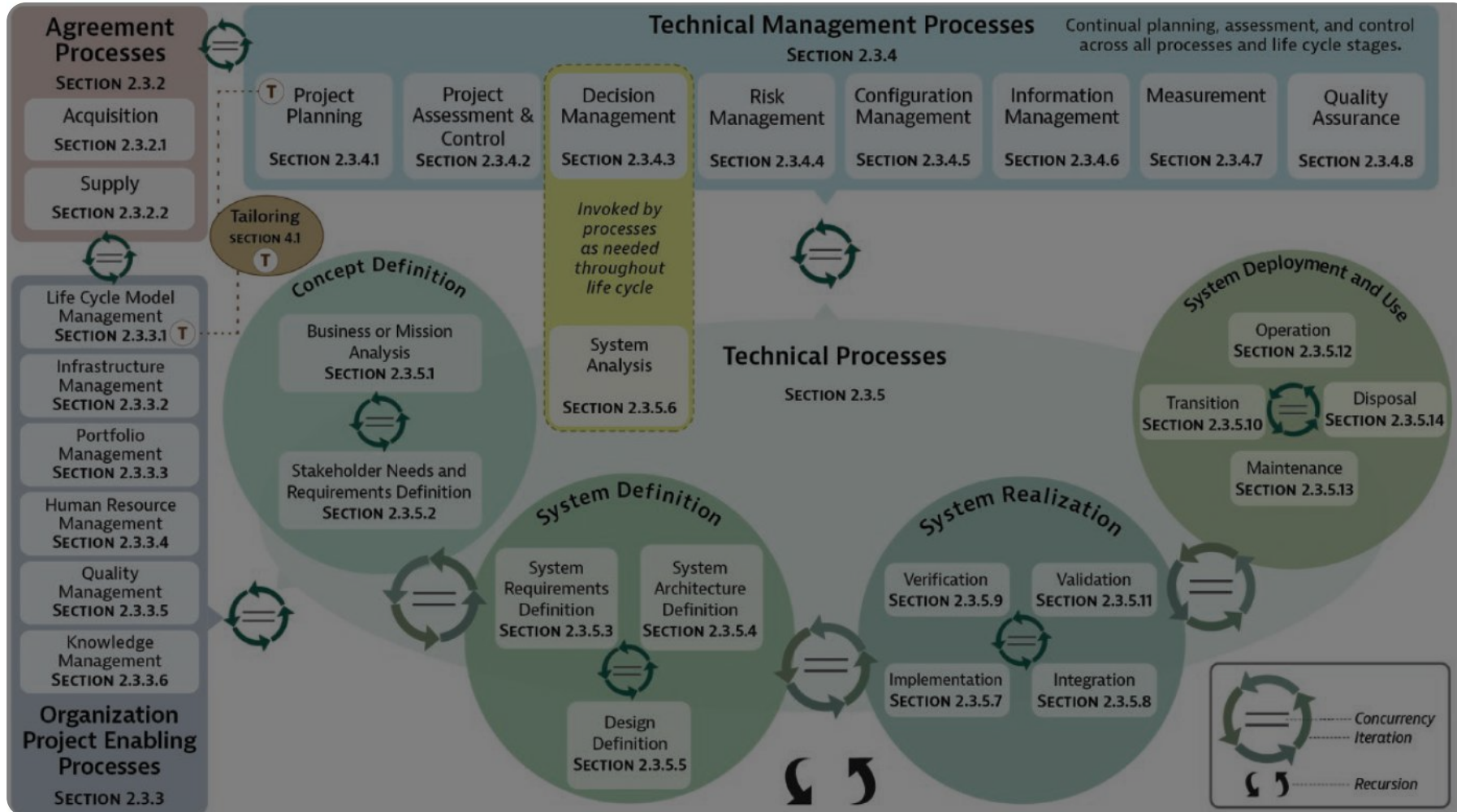


ISO/IEEE 15288 System Lifecycle Processes



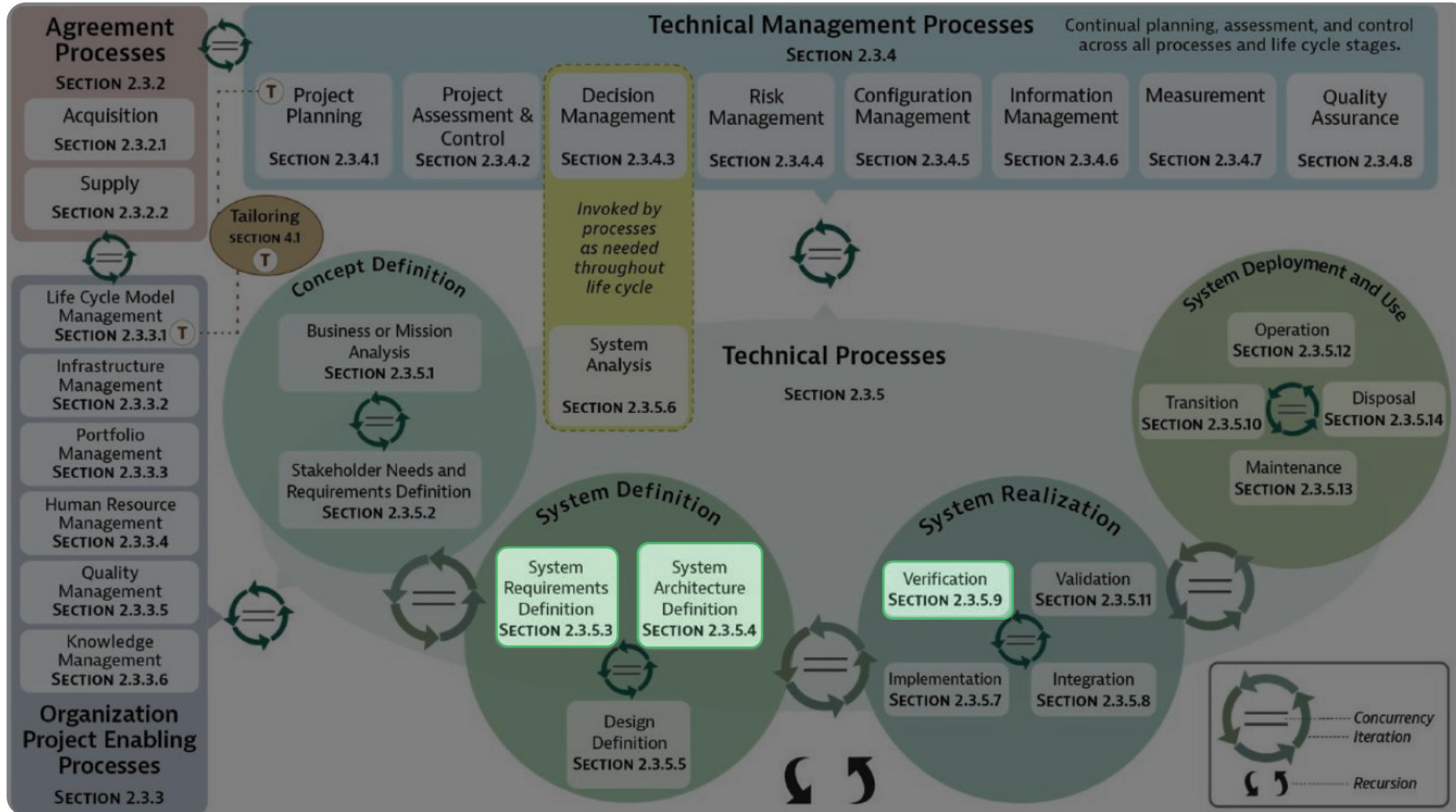
ISO/IEEE 15288 System Lifecycle Processes

- Accountable / Responsible
- Consulted
- Informed (at best)



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The 'Green' processes – What's been done well?

- System Architecture
 - Development of an asset breakdown structure
 - Interface management ([INCOSE IS 23](#))
- Requirements
 - Decomposition & allocation
 - Strong traceability using Requirements Management Tools
 - Requirements analysis using Report Builder
- Verification
 - Work Package verification registers – DOORS & Excel alignment
 - Verification Register evolution to support design gates

Paper / Slides:



Presentation:

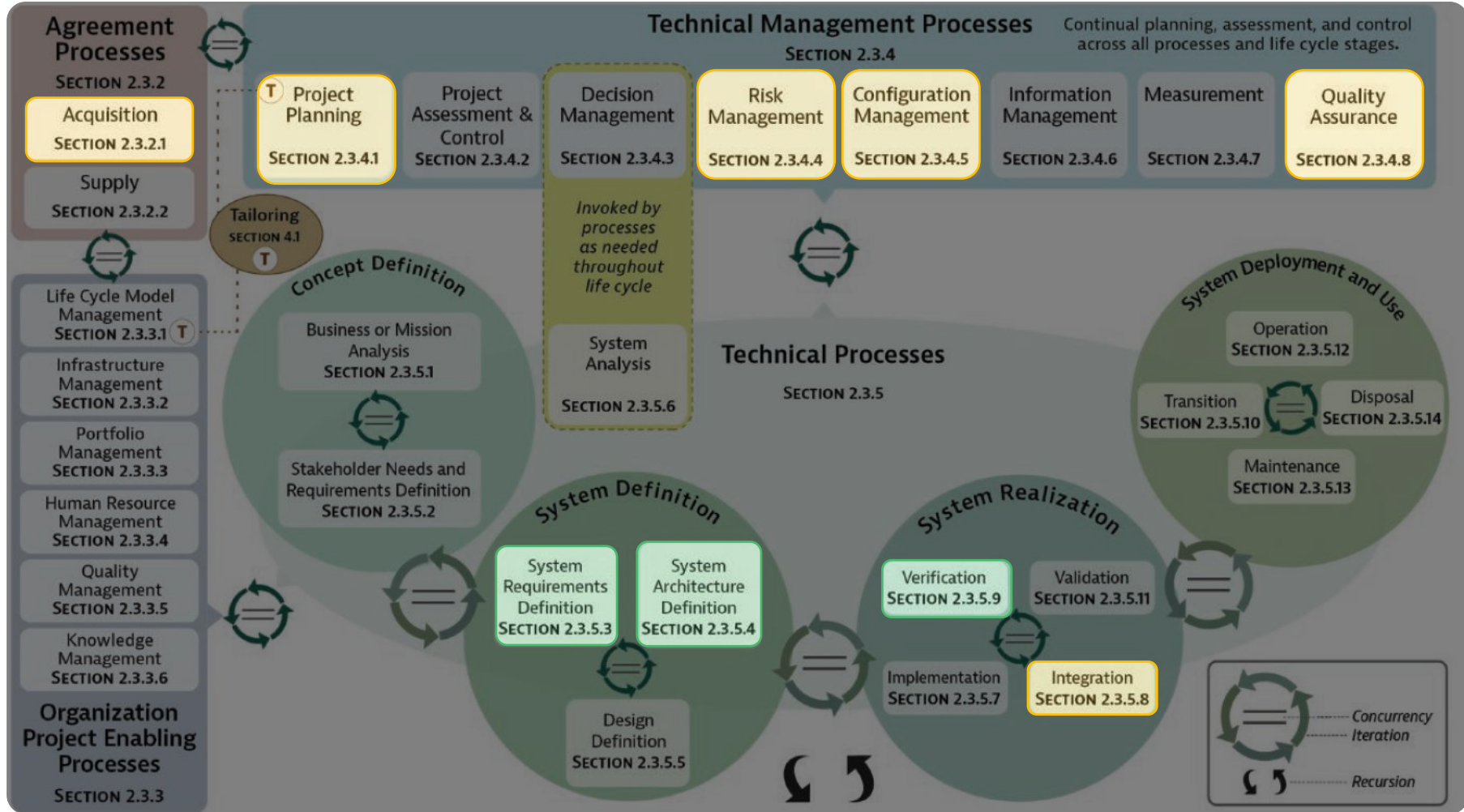


The 'Green' processes – Areas for Improvement

- System Architecture
 - Do we apply different efforts to System Architecture/SE to different specialist design areas
 - Different architecture fidelity/focus across lifecycle stages
 - Interfacing with parties that have a less rigorous interface management process
 - Focussing on physical without fully considering behaviour
- Requirements
 - Should we be requesting more visibility of contract requirements traces to higher level requirements?
 - How to write Minimum Requirements at a level that is useful without constraining and solution specific or too vague?
 - How should we align SE with other specialist areas such as safety assurance, HF, RAM etc?
 - Refer to ISO 29148 presentation for more...
- Verification
 - Verification against requirements, not (just) standards
 - Is it worth verifying against requirements if the requirements haven't been validated?

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The 'Amber' processes – What's been done well?

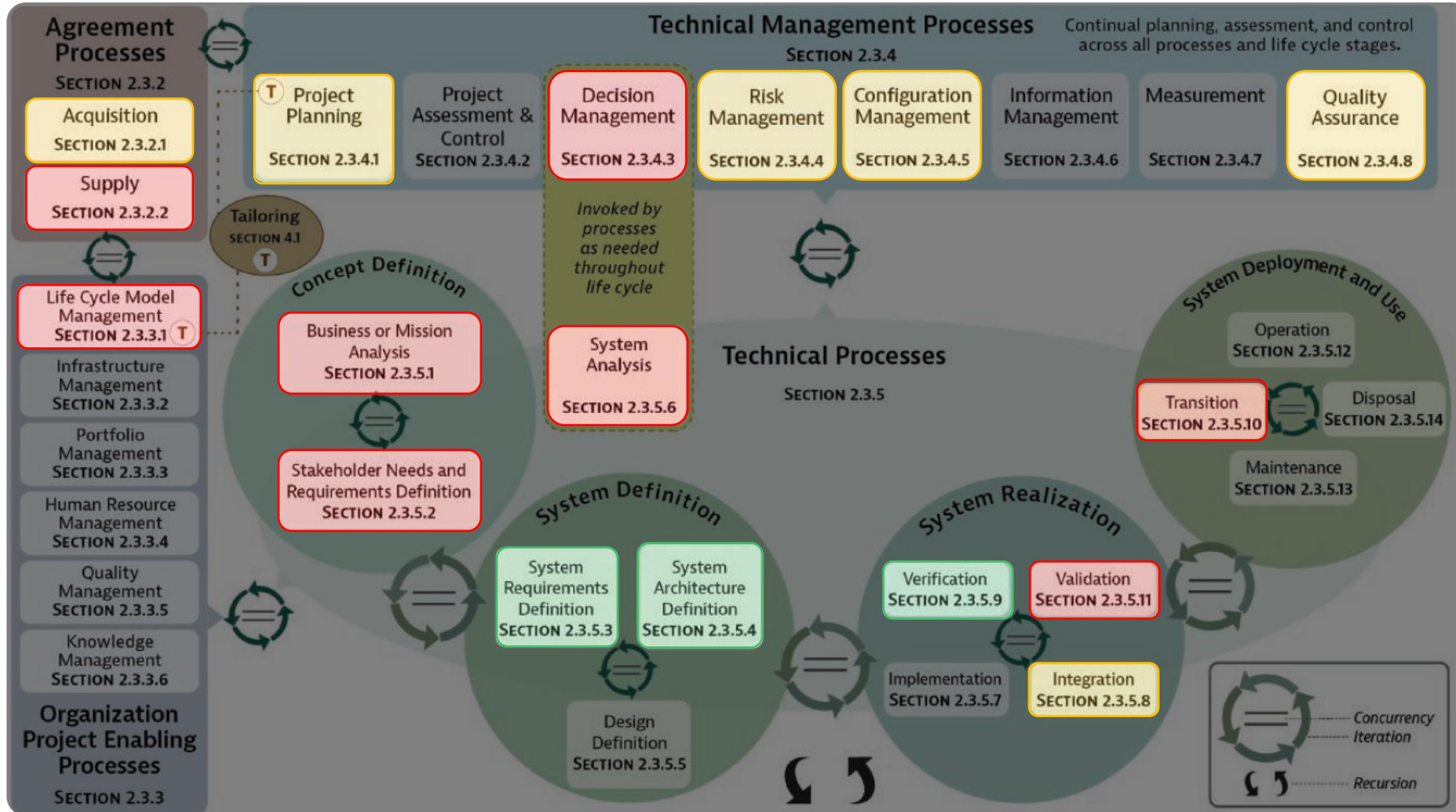
- Integration
 - City Rail Link (CRL) is currently in this phase and has Systems Engineers heavily involved (but perhaps not directly driving the process?)
- Configuration Management
 - Requirement changes drive a Change Control Process to support variation agreements
- Risk Management
 - The interface management process highlighted the interfaces that were considered the highest risk
 - Management of technical risk sometimes occurs separately to project risk, but not always
- Acquisition
 - Requirements used for subcontractor scope definition and verification
- Project Planning
 - Systems Engineering Management Plans (SEMPs) increasingly a contracted requirement
- Quality Assurance
 - Development and allocation of HF & RAM requirements to Work Packages

The 'Amber' processes – Areas for Improvement

- Integration
 - Aligning SE concepts to support existing infrastructure integration processes
- Configuration Management
 - Aligning SE tools/outputs with digital engineering outputs of infrastructure design (BIM, geospatial, etc.)
- Risk Management
 - Further using SE to support the definition and management of technical risks on the project
- Acquisition
 - Anecdotes of requirements being ignored even through they form part of the contract
- Project Planning
 - Greater alignment/embedding of SEMP in overarching project plans
- Quality Assurance
 - Greater alignment of System Safety, HF and RAM teams

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The 'Red' processes – areas to consider

- Business/Mission Analysis & Stakeholder Needs Definition
 - Refer to INCOSE NZ Business Case presentation for more...
- Validation & Transition
 - No ongoing activities to validate proposed changes to requirements
 - Formal processes for client/stakeholder validation are organisation specific, not following an SE approach
 - Operational testing against operational concepts?
- Decision Management & System Analysis
 - How can SE assist more in managing decisions?
 - NZTA moving towards a decision led business case process - more we can offer in this space?
- Supply
 - Less visibility of SE on the supply side in NZ – how can we encourage adoption?
- Lifecycle Model Management
 - How can we support lifecycle modelling for NZ programmes?

Conclusion (of sorts)

- Application of SE in infrastructure projects has come a long way, and continues to evolve
- Challenges
 - The current Systems Engineering approach:
 - Is often fragmented
 - Doesn't support the end-to-end development, delivery and operations of a system
 - Is heavily dependent on what organisations are delivering each phase
 - Trust in the value of SE across some (often traditional) design teams is still not high
 - Work still to be done to align the SE approach to meet the needs of these teams
- This the start of conversations on this alignment
 - Do we agree on what the highest priority gaps are?
 - Do we agree what needs to be done to bridge these gaps?
 - How can INCOSE NZ best support this?

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Questions and Comments



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