Procurement Decision Tool: A Case Study of the Toowoomba Second Range Crossing

31 July 2020

Austroads

Research Webinar

Today’s moderator

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Austroads acknowledges the Australian Aboriginal and Torres Strait Islander peoples as the first inhabitants of the nation and the traditional custodians of the lands where we live, learn and work. We pay our respects to Elders past, present and emerging for they hold the memories, traditions, culture and hopes of Aboriginal and Torres Strait Islander peoples of Australia.

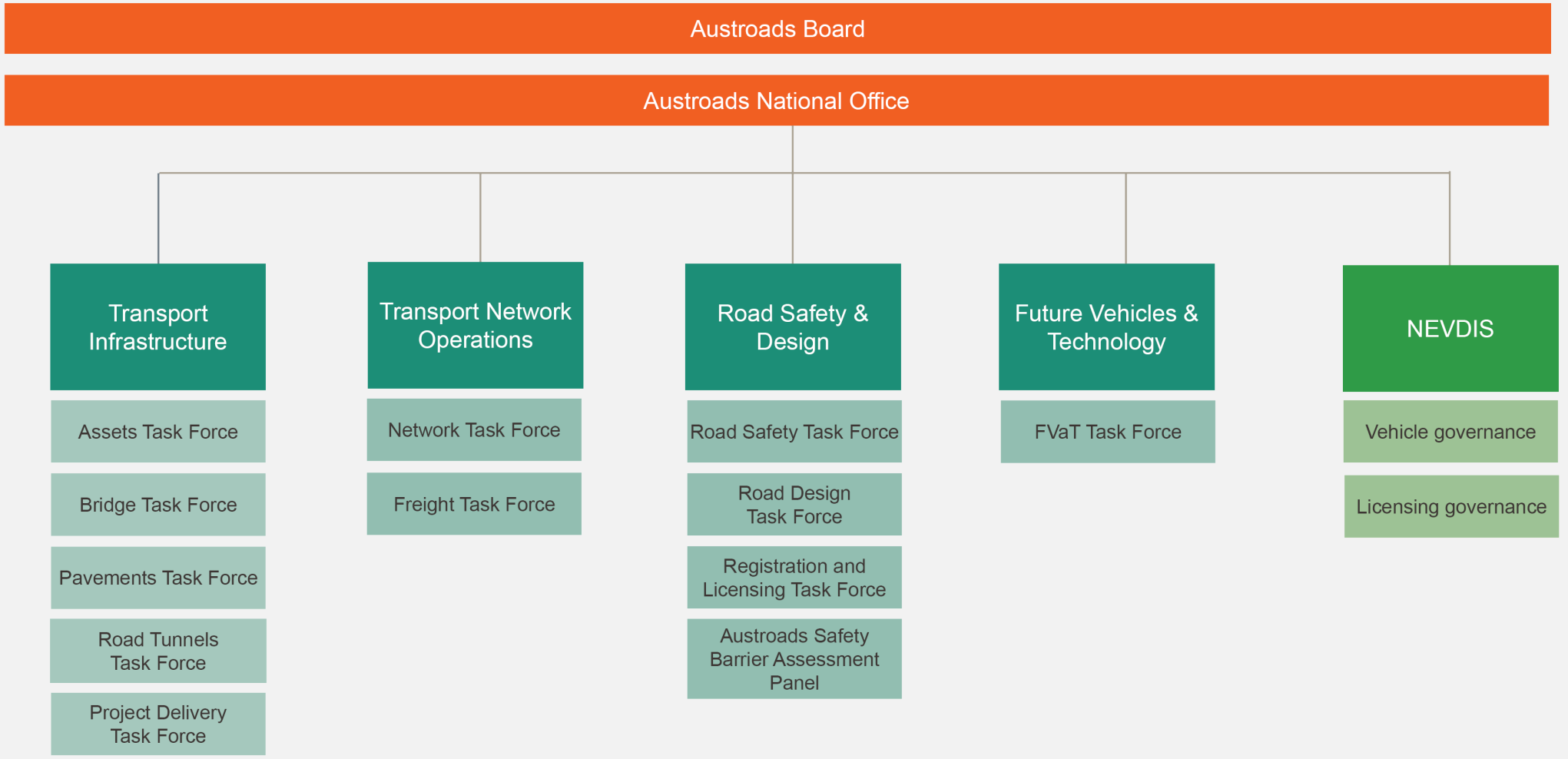
Austroads acknowledges and respects the Treaty of Waitangi and Maori as the original people of New Zealand.

About Austroads

The collective of Australasian transport and traffic agencies

- Transport for NSW
- Department of Transport Victoria
- Department of Transport and Main Roads Queensland
- Main Roads Western Australia
- Department of Planning, Transport and Infrastructure South Australia
- Department of State Growth Tasmania
- Department Infrastructure, Transport, Regional Development and Communications Northern Territory
- Transport Canberra and City Services Directorate, Australian Capital Territory
- Department of Infrastructure, Transport, Regional Development and Communications
- Australian Local Government Association
- New Zealand Transport Agency

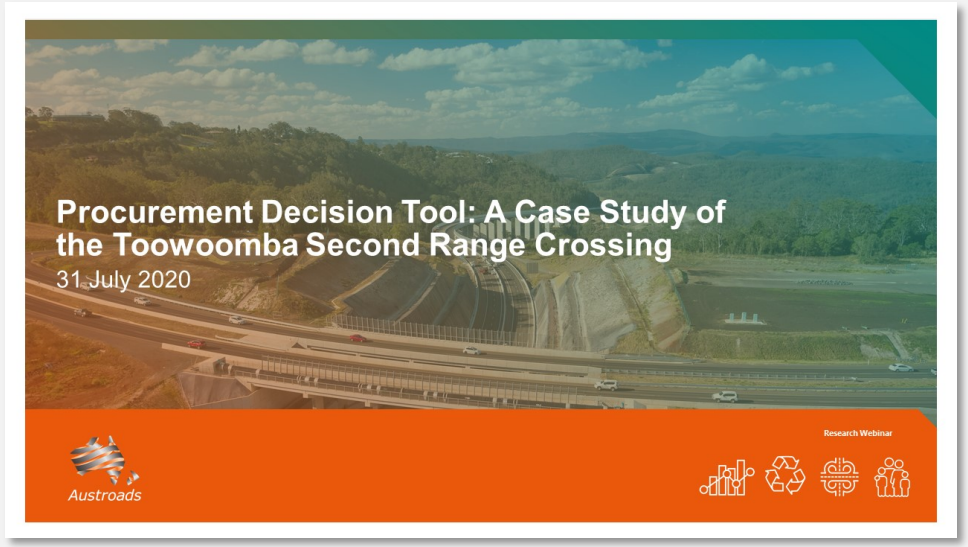
Our structure

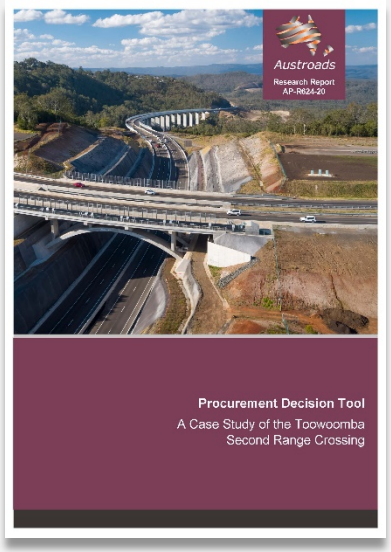


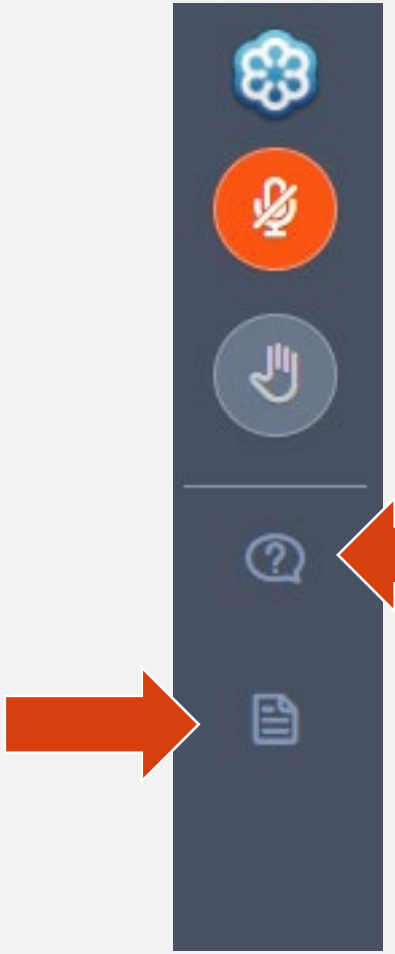
Housekeeping

Presentation = 40 mins

Question time = 15 mins







Type questions here

Let us know the slide number your question relates to

Today's presenter and agenda

Procurement Decision Tool ("the Tool")	The Toowoomba Second Range Crossing (TSRC) Case Study
Introduction to the team	Expression of Interest document for TSRC
Summary of the project	Steps in the Tool applied to TSRC
Why we urgently need the Tool	Conclusion and recommendations
Key differences between the Tool and current practice	
High level view of the Tool	
Q+A	

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Introduction to the team

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Introduction to the team

Project Team

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Dr. Farshad Rezvani
Nora Kinnunen
Linda Carroli

Review Team

Austroads
Project Delivery Task Force

Austroads Board

Summary of the project

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Summary of the project

Refer to Summary

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- **Value-for-Money**
- Bundling (or **contract packaging**) and nature of contracting (i.e. from **collaborative to competitive contracting**)
- **Guide future procurement decisions**; and/or **review** an actual procurement decision
- Case study successful application and validation of the Tool (**in review mode**) on Toowoomba Second Range Crossing (TSRC)
- **Credentials:** The Tool is developed, empirically tested and successfully trialled (in an Australian Research Council/**ARC grant**); cited by **Australia's Productivity Commission**; cited by **ITF/OECD** as key part of "way forward"; and highlighted in forthcoming book by **NBER**, USA

Why we urgently need the Tool

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Why we urgently need the Tool

Refer to Section 1

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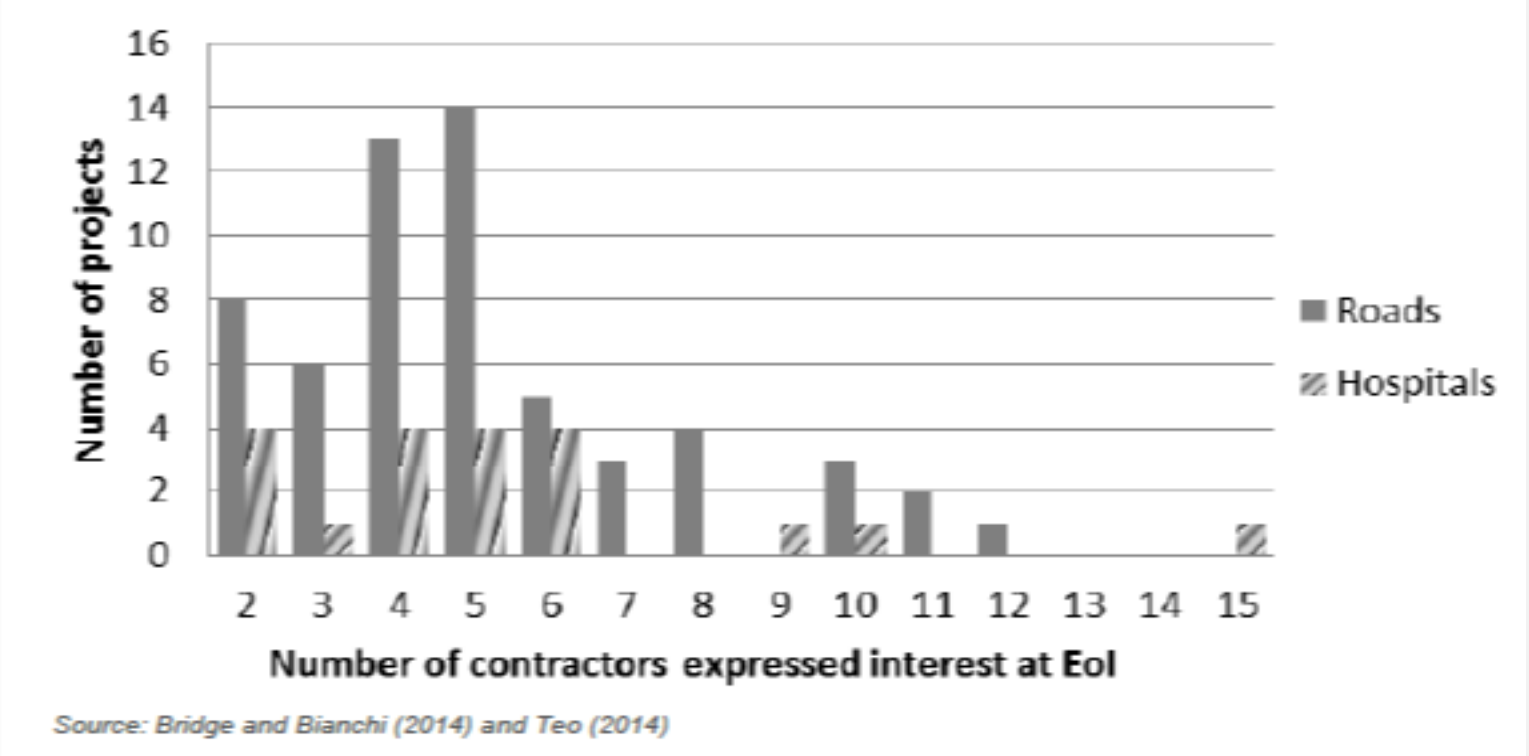
Evidence of market failure

- Sample of **87 Australian public sector major roads and health projects worth $32bn** (in the ARC grant in which the Tool developed)



Source: Bridge and Bianchi (2014) and Teo (2014)

Why we urgently need the Tool

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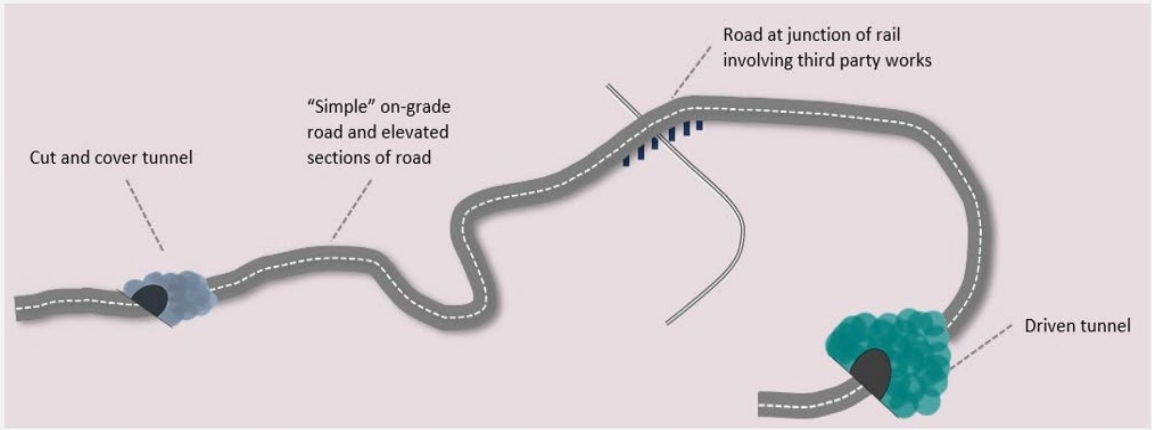
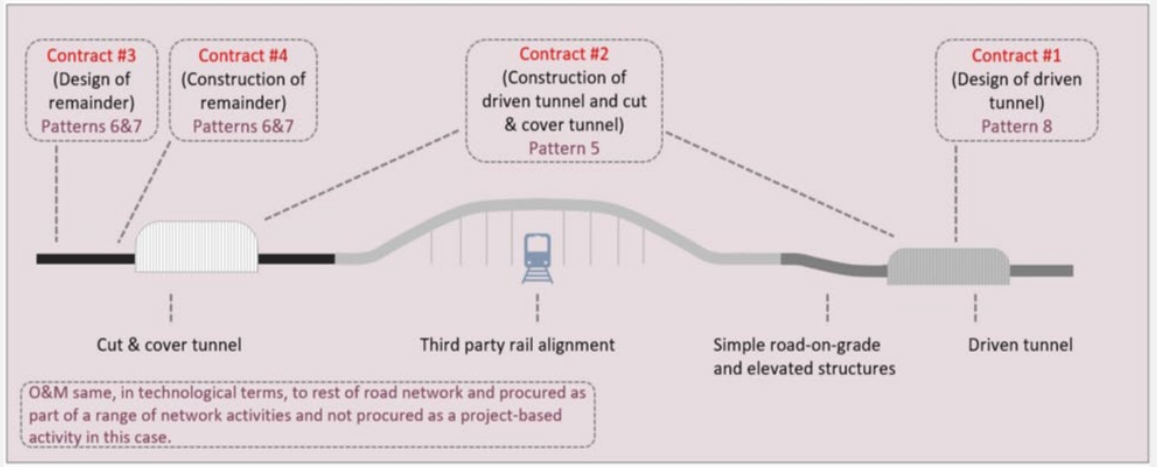
Evidence of market failure

- Sample of 87 Australian major projects
- Larger projects dominated by **single contracts** and Design and Construct; Early Contractor Involvement (ECI); Managing Contractor (MC); and Alliance-based models of procurement
- Stereotypical contracts and mistaken “collaboration”.
  - One-size-fits-all
  - Red herrings
  - Asymmetry
  - Government constraints

A major public sector road deliver as a single Alliance with two expressions of interest





Why we urgently need the Tool

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The Tool guides the user to:

- Avoid bundles (and contracts) that are either **too large** or **too small;** and develop most efficient size & number of bundles (and contracts).

- Avoid **mistaken collaboration** or **mistaken competition**; and develop the most efficient nature of contracting associated with each bundle (and contract).

Why we urgently need the Tool

Refer to Section 1

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- Delivering stimulus in COVID-times in Australia → danger pendulum might swing ***too far and for too long*** towards unbundling.
- The Tool employs a structured and tried/empirically tested microeconomic principles.
- At very least the Tool provides **efficient baseline/benchmark.**
- If near term inefficient unbundling and contracting, then assume that we will **need the pendulum to swing again.**
- Not back at too much bundling, rather to a more **sustainable position** of efficient bundling and efficient contracting.

Key differences between the Tool and current practice

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Key differences between the Tool and current practice

Refer to Section 2

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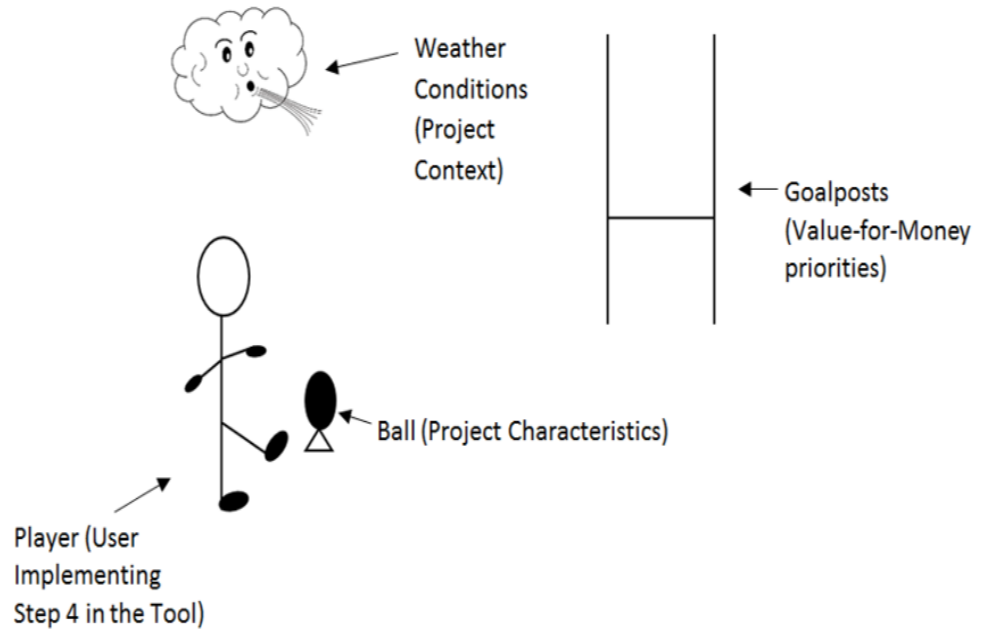
Current practice is typically reliant on some variant of the Multi-Attribute Utility Approach, often termed **"Procurement Options Analysis" (POA).**

In POA, typically revolves around one or **few short-term targets** (as opposed to the longer-term goal comprising the Value-for-Money priorities in the Tool).



Key differences between the Tool and current practice

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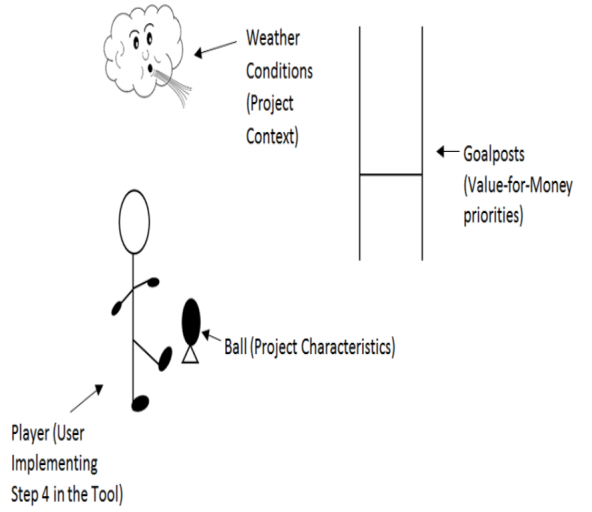
- The Tool sees **no one approach** to contract packaging is universally advantageous.
- Guides users to configure contracts to align the project characteristics and context with **Value-for-Money priorities** (key performance attributes).
- Contract packaging will vary dependent on project characteristics and its context.
- **Different** kinds of **risks** across the project's activities are **treated differently.**



Time Start/Finish (Minimum)	Time Compliance (Certainty)	Capital Cost (Minimum)	Lifecycle Cost (Minimum)	Whole-Life Cost (Minimum)	Cost Compliance (Certainty)	Quality Innovations (Maximum)	Quality Compliance (Certainty)
3	2	3	3	1	2	1	2

Note: 1 = Highest Priority; 2 = Moderate Priority; 3 = Least Priority

High level view of the Tool

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High level view of the Tool

Refer to sections 1 & 2

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The Tool combines various schools of economic thought → procurement strategy → **the efficient management of microeconomic risk** in the externalisation of key project-specific DCOM activities arising from the project schematic, or reference design.

Expression of Interest document for TSRC

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Expression of Interest document for TSRC

Refer to Section 3

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Extracts concerning reference design in **TSRC's EOI document** (Projects Queensland, ***2014; & pre-Covid***)

Overview of the Project and Opportunity

"The Toowoomba Second Range Crossing (TSRC) is a proposed bypass route to the north of Toowoomba, approximately 41 km in length.

Reference Design

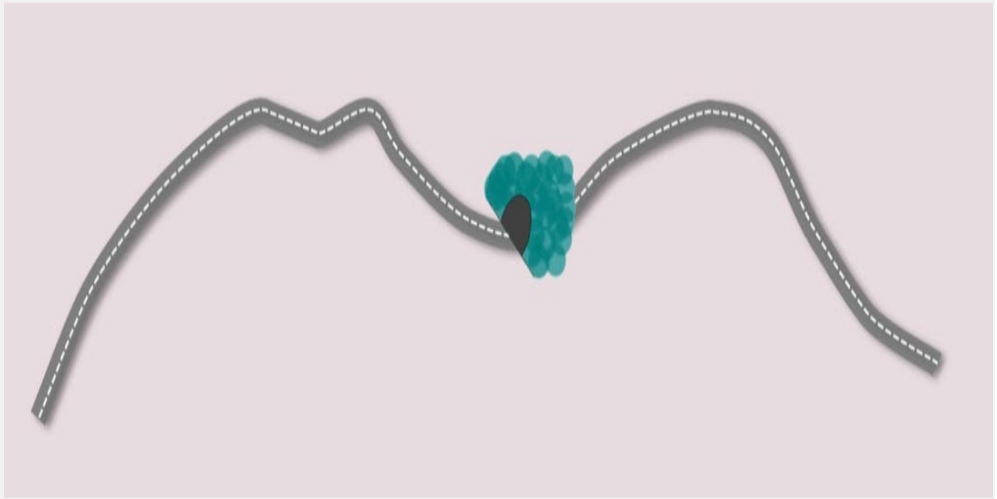
"The reference design forming the basis of the statutory planning and environmental approval process features: five intersections/interchanges…; two lane carriageway for a posted speed of 100kph; three lane divided carriageway; four lane divided carriageway including dual two lane tunnels (approximately 700 metres in length) for a posted speed of 100kph; maximum gradient of 6.5%; and service roads and auxiliary lanes."

Key Considerations

"It is expected that the TSRC will be tolled. However, at this stage, the Project scope will not include the provision of toll collection systems or associated toll collection services as this is intended to be procured separately."

Pilot Tunnel

"A pilot tunnel was constructed between August and December 2007 using drill and blast methods. The pilot tunnel project enabled the collection of geological data, sampling of rock mechanics and cuttability tests, estimation of ground water inflows, insitu stress and convergence measurements, monitoring and measurement of drill and blast induced vibration levels."



Steps in the Tool applied to TSRC

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Steps in the Tool applied to TSRC

Refer to sections 2 & 3

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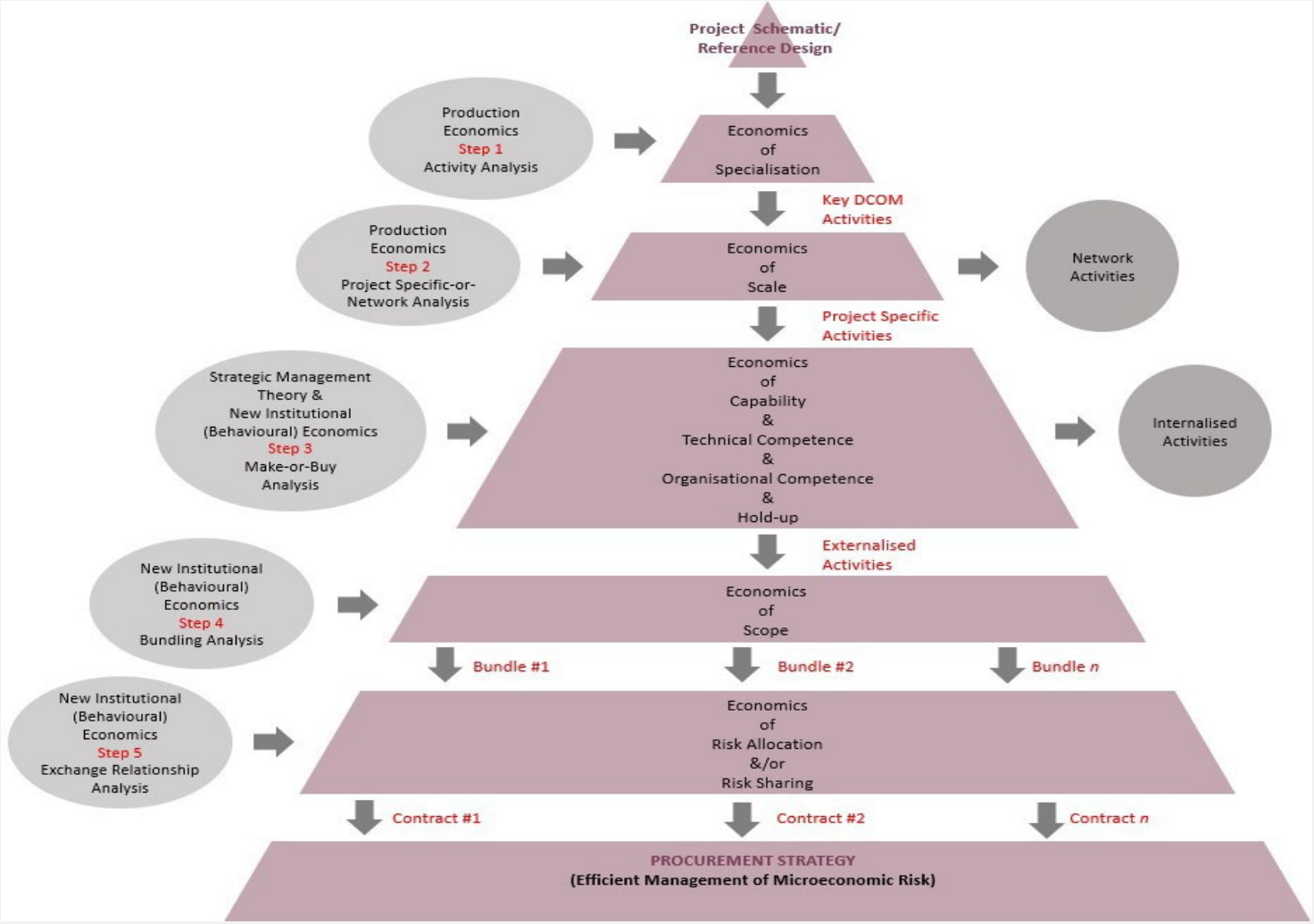
State-of-the art microeconomics underpin the steps of the Tool's procurement strategy.



Step 1. Activity analysis

Refer to sections 2 & 3

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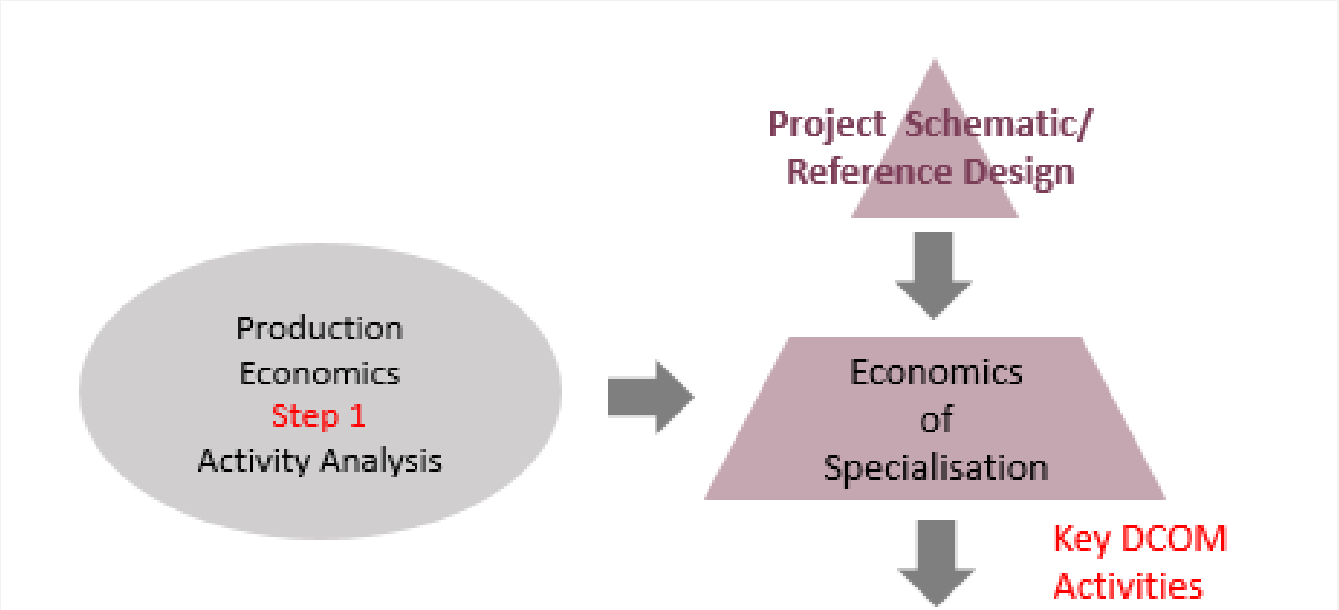
- Key DCOM activities
- Distinct knowledge and skills
- Each key activity initially grouped across project.



Step 1. Activity analysis

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Design activities in TSRC

Design of Road (Interchanges, Overpasses, Underpasses, Carriage ways, Bridges)	Design of Driven Tunnel
Design of construction of road 1. Geometric design 2. Road design 3. Pavement design 4. Landscaping design 5. Road lighting design 6. Bridge and retaining wall design 7. Noise mitigation design 8. Drainage design. Design of performance specification of maintenance to road 9. Plan for routine maintenance, programmed maintenance and rehabilitation of road pavement, road furniture, drainage maintenance & ITS	Design of construction of tunnel 10. Space proofing 11. Geometric design 12. Structural design 13. Ventilation design 14. Electrical design 15. Drainage design 16. Rock mechanics/structural design Design of performance specification of maintenance to tunnel 17. Plan for routine and programmed maintenance to specialist linings, mechanical and electrical and fire elements in driven tunnel

Step 1. Activity analysis

Refer to sections 2 & 3

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Construction activities in TSRC

Construction of Road (Interchanges, Overpasses, Underpasses, Carriage Ways, Bridges)	Construction of Driven Tunnel
18. Site preparation 19. Drainage 20. Earthworks 21. Paving (base and sub-base) 22. Asphalt surface 23. Lining and marking 24. Lighting 25. Traffic signs and furniture 26. Guardrail 27. Landscaping 28. Concrete barrier 29. Kerbs and traffic islands 30. Traffic management 31. Bridge works including piling 32. Retaining walls.	33. Excavation 34. Roof support 35. Insitu concrete works 36. Formwork 37. Reinforcement 38. Drainage 39. Mechanical fit-out 40. Electrical fit-out 41. Pavement

Step 1. Activity analysis

Refer to sections 2 & 3

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Operations and maintenance activities in TSRC

Operations	Maintenance
42. Intelligent Transport Systems 43. Traffic operations 44. Incident response services	45. Inspections and data collection, implementation of routine, programmed and reactive (emergency) maintenance to: a. Drainage; b. Paving (base and sub-base); c. Asphalt surface; d. Lining and marking; e. Lighting; f. Traffic signs and furniture; g. Guardrail; h. Landscaping; i. Concrete barrier; j. Kerbs and traffic islands; k. Traffic management; l. Bridge works including piling; m. Retaining walls; and n. Tunnel M&E systems.

Step 2: Project specific-or-network analysis

Refer to sections 2 & 3

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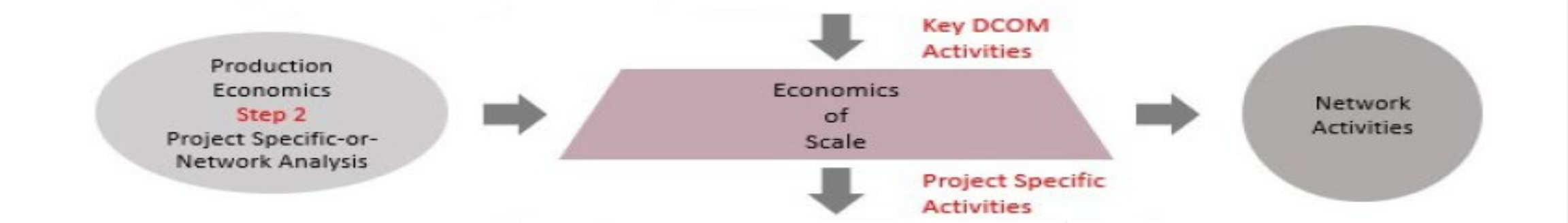

Project specific activities (≠ recurrent activities in existing network)	Network activities (= recurrent activities in existing network)
Design activities in road	Operations activities
Design activities in tunnel	Maintenance activities
Construction activities in road	
Construction activities in road	

Step 3: Risk (*make-or-buy*) analysis

Refer to sections 2 & 3

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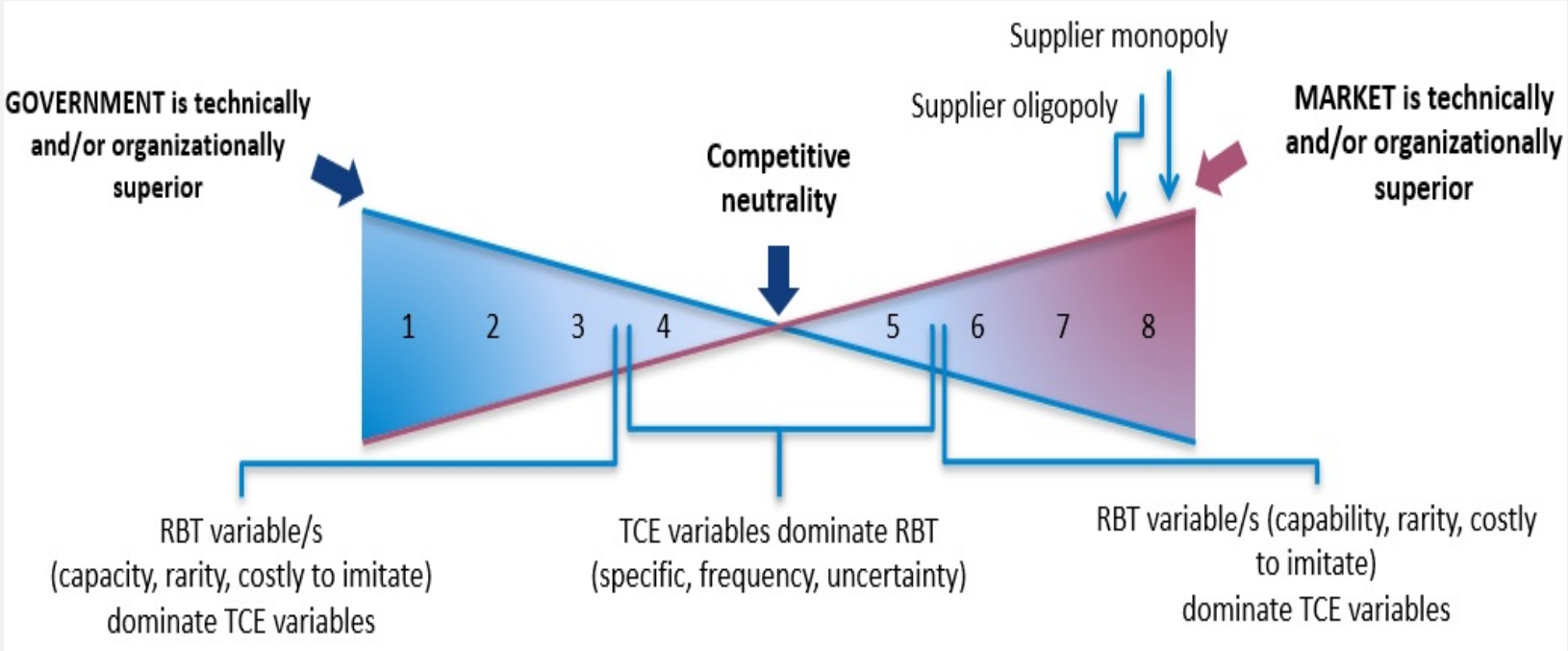

- Project Specific D & C Activities
- **4 kinds of risk** → 8 theoretical patterns (5 to 8 = outsource)
- TSRC Actual patterns 6 or 7 except 8s in tunnel (detailed design and installation of M&E) → all outsource.

Step 3: Risk (*make-or-buy*) analysis

Refer to sections 2 & 3

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Project Specific D & C Activities

Questions (concerning hold-up):

- Direct sunk/switching costs (i.e. disestablishment and re-establishment costs of supply)
- Indirect sunk/switching costs (costs of delay to buyer's business)

- **Third party interference during D&C**
- Environmental changes during O&M

- Buyer's demand for activity versus typical scale of activity in leadings suppliers
- Pipeline of activity.

Questions (concerning capability and competence/capacity):

- Buyer's capability (knowledge and skills) and capacity (sufficient resources) with and without temporary staff
- Supply of market firms capable of delivering the activity and likely to EOI
- Difficulty and cost to buyer to develop same or better capability as market firms in delivering activity.

Step 3: Risk (*make-or-buy*) analysis

Refer to sections 2 & 3

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Example of pattern 6 (Pavement Design)

Pattern	Logic	Asset Specificity	Uncertainty	Frequency	Value	Rarity	Costly to Imitate	Make-or-Buy
		TCE Question 1 A.2	TCE Question 2 A.3	TCE Question 3 A.4	RBT Question 4 A.5	RBT Question 5 A.6	RBT Question 6 A.7	
1	Capability (RBT)	+	0 or +	+	+	+	+	Internal
2	Production Competence (RBT)	0 or +	0 or +	+	+	+	0	Internal
3	Organisation Competence (Coase)	0 or +	0 or +	+	+	0	0	Internal
4	Hold-up (TCE)	+	+	0/+	-/+	0	0	Internal
5	Hold-up (TCE)	+	+	0	-/+	0	0	External
6	Organisation Competence	0 or +	0 or +	0	-	0	0	External
7	Production Competence (RBT)	0 or +	0 or +	0	-	+	0	External
8	Capability (RBT)	0 or +	0 or +	0	-	+	+	External

Step 4: Contract packaging (*bundling*) analysis

Refer to sections 2 & 3

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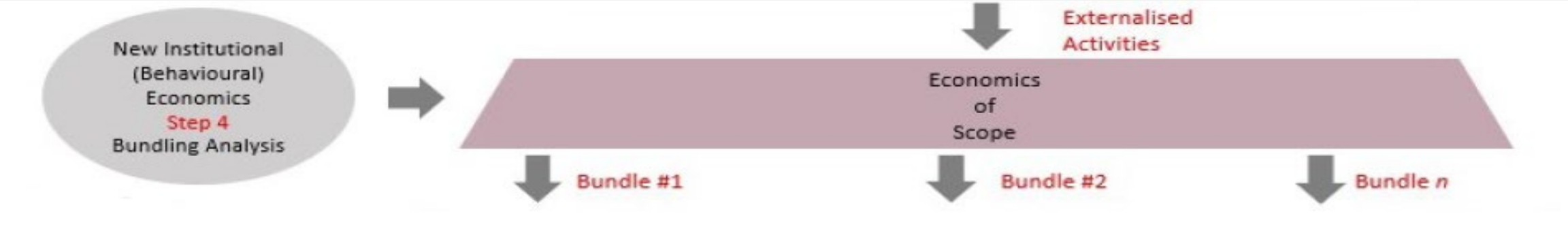

Opportunity costs/trade-off

- More bundling/less contracts (when low unpredictability)
  - Less compliance costs & more innovations (positive externalities) ☺

  ****
- More bundling/less contracts (when high unpredictability)
  - Less time to plan & design; & more hold-up ☹
- More bundling/less contracts (regardless of unpredictability)
  - Less competition ☹

Resolves less versus more contracts tension

- First, focus on the troublesome activities ☹ i.e. pattern 5 (hold-up – none in TSRC) and pattern 8 (thin supply – M&E in tunnel in TSRC); then leverage efficiencies of more bundling/less contracts ☺
  - **Bundle and Contract #2**. Detailed design and installation of the M&E activities in the tunnel.
  - Allowing pattern 6 & 7s to be bundled (while not creating a pattern 8) with less contracts; because of the ranking of key performance attributes (slide 19).
  - **Bundle and Contract #1**. D&C of all activities (except M&E activities in tunnel in Bundle/Contract #2).

Step 5: Competitive-or-collaborative analysis contracting (*exchange relationship*) analysis

Refer to sections 2 & 3

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Pattern	Logic	Asset Specificity	Uncertainty	Frequency	Value	Rarity	Costly to Imitate	Exchange Relationship
		TCE	TCE	TCE	RBT	RBT	RBT	
5	Hold-up (TCE)	+	+	0	-/+	0	0	Collaborative Contracting
6	Organisation Competence	0 or +	0 or +	0	-	0	0	Standard Competitive Contracting
7	Production Competence (RBT)	0 or +	0 or +	0	-	+	0	Standard Competitive Contracting
8	Capability (RBT)	0 or +	0 or +	0	-	+	+	Bespoke Competitive Contracting

Step 5: Competitive-or-collaborative analysis contracting (*exchange relationship*) analysis

Refer to sections 2 & 3

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Outcome-based contract terms (Pattern 8 and Pattern 6/7 Bundles)	Hybrid contract terms (Pattern 5 Bundles)	Behaviour-based contract terms (Pattern 5 Bundles)
• Fixed price • High power incentive • Agent's risk to completion • Agency costs – specification of outcomes – verification of outcomes – risk premium – suitability for information asymmetry – outcome certainty – better goal alignment	• Target out-turn costs or guaranteed construction sum linked with gain-share or pain-share regime • Risks balanced between agent and principal • Suitable for outcome uncertainty	• Cost-plus • Low power incentive • Principal's risk to completion • Agency cost – specification of behaviour – monitoring of behaviour – outcome uncertainty – high project complexity – less goal alignment

Validation and discussion

Refer to sections 2 & 3

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- Direct assessment of Value for Money problematic
- Indirect assessment using EOI
  - Established at early stage and close to the point in time **just after the procurement decision**
  - Captures **both** the potential for high bid prices, or pre-contract market failure, and the potential for hold-up, or post-contract market failure
  - Hypothesis
    - ***Actual competition*** *is expected to be within the optimum range of competition, i****.e. 5 to around 8 EOI inclusive****, in cases where* ***actual procurement*** *substantially* ***matches*** *the procurement strategy recommended by the* ***Tool****; and*
      - ***Actual competition*** *is expected to be* ***outside the optimum range*** *of competition i.e. 4 or less EOI, or 9 or more EOI, in cases where* ***actual procurement*** *substantially* ***mismatches*** *the procurement strategy recommended by the* ***Tool****.*

Validation and discussion

Refer to sections 2 & 3

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TSRC Actual Procurement	Tool's Recommended Procurement
Single contract	2 contracts (though cost substantially in Contract #1)
D&C&M bundled	D&C bundled in Contract #1 & M separated as network activity
Substantial government capital contributions for D&C, with Private finance mainly for M	All government finance

- Given the small cost of maintenance, relative to the much larger cost of design and constructing TSRC, the procurement strategy for this project recommended by the Tool mostly matches the actual approach.
- Anecdotally, there were 5 to 6 EOI.
- Also anecdotally, the absence of private finance may well have increased the number of firms expressing an interest, and closer to the optimum 8 EOI.

Conclusions and recommendations

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Conclusions

Refer to Section 4

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- Value-for-Money → efficient bundling (or **contract packaging**) and efficient contracting (i.e. from **collaborative to competitive contracting**).
- The single Alliance road project in the ARC grant (slide #14) and TSRC illustrates **significant improvements in Value-for-Money** that would have likely been delivered by the Tool.
- **All four cases** in the ARC grant **supported the hypothesis** developed to test the Tool.
- The Tool is expected to appreciably improve the chances (up to **double the chance**) that the procurement approach is successful in setting the project on a path to deliver superior VfM (in contrast to current practice).
- The Tool has now also been **supported by the results in its trialling in TSRC (funded by Austroads) and a major health project** (funded by Infrastructure Australia).

Conclusions

Refer to Section 4

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- Beyond significantly advancing Value-for-Money, the Tool will deliver **other microeconomic benefits**, including promoting:
  - Objectivity
  - Accountability and transparency
  - Reliability and consistency
  - More time for planning and design development
- Beyond microeconomic benefits **industry and macroeconomic benefits.**
- As COVID-times render the Tool **compelling to ensure that the best Value-for-Money** is delivered and demonstrated on each and every new infrastructure project.
- The trialling of the Tool on both TSRC and the major health project and forms the basis of the Tool's forthcoming **User Guide to be published by Infrastructure Australia.**

Recommendations

Refer to Section 4

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Two key recommendations:

- An agency **does <u>not</u> wait** for the publication of the User Guide by Infrastructure Australia.
- Austroads consider a proposal to develop the economics in the Tool into a further tool to be applied to the **procurement of <u>network activity</u>** including the operations and maintenance of roads.

Questions?

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Vehicles and Technology Future State 2030	6 August
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