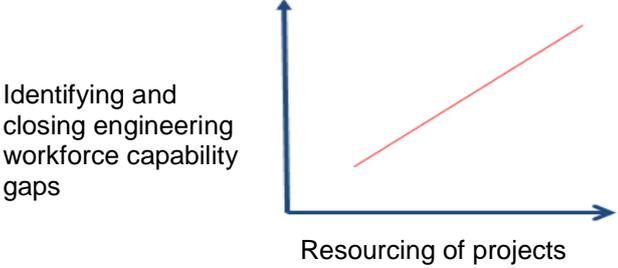


Problem Description

Question	Response
Description of the problem and purpose of the proposed research	<p>Transport for NSW (TfNSW) is committed to delivering transport infrastructure projects to achieve improved outcomes for the people of NSW. The forward projection for the next 5 years shows the total capital expenditure is estimated to total \$57 billion.</p> <p>All major states (NSW, VIC, QLD and WA) are predicted to have strong concurrent transport investment programs over the next 8 years. Organisations delivering engineering services for TfNSW have to be authorised by the Asset Standards Authority to become an Authorised Engineering Organisation (AEO). The organisations are authorised for a scope of engineering services to potentially deliver to TfNSW.</p> <p>TfNSW currently does not consolidate its demand profile as a single proposition to the market, nor does it have any measure of whether the industry has the capability or capacity to deliver the volume of projects it has planned. Related to this problem is that no analysis has been undertaken to determine if sufficient organisations have been authorised in the different engineering services, in order to guide decision-making based on skills distribution.</p> <p>The purpose of the proposed research project is to address this problem by evaluating the demand profile and supply chain capacity, and subsequently identifying the gaps and necessary response strategies.</p>

Hypothesis & Variables

Question	Response
<p>For explanatory research, please describe a clear hypothesis with variables for testing</p> <p>For exploratory research, please describe how the proposed research will contribute to future explanatory research</p>	<p>This is a Program of Research, focused on how to measure and determine the extent of the problem, with four modular stages:</p> <ol style="list-style-type: none">1. Demand profile2. Supply chain capacity3. Gap analysis4. Response strategies <p>Subsequent research may be hypothesis-based with a focus on developing and testing particular response strategies to address the problem and the gaps.</p> <p>It is anticipated that a strong causative and positive relationship exists between quantifying and addressing capability gaps in the engineering workforce and improved resourcing and delivery of projects, as measured by variation from agreed delivery date or agreed cost. That is, identifying and closing engineering workforce capability gaps, including the generation of new or modified skills and competencies that reflect the requirements of new or emerging technologies, influences the sustainable resourcing of projects and the successful delivery of projects (see figure below).</p> <div><p>The graph illustrates a positive relationship between 'Resourcing of projects' (x-axis) and 'Identifying and closing engineering workforce capability gaps' (y-axis). A red line starts at a low point on the x-axis and rises steeply towards the top right of the graph, indicating that as resourcing increases, the ability to identify and close capability gaps also increases.</p></div> <p>This project can be conducted as a large Program of Research, or as a series of four modular projects with an integrated plan to govern the sequence of activities and inter-relationships across phases. Phase 1 (Demand Profile/Definition) should be preserved as a single deliverable as it is a complex data consolidation phase.</p> <p>Methodological tools and techniques will be fairly standard, including a literature review, interviews and data analytics. This work is being sponsored by the TfNSW Asset Standard Authority (ASA), and is based in part on a report by L.E.K. Involvement by academics/universities is being sought to increase rigor. The ASA will liaise with the selected proponents to determine the appropriate methodology, and will share the internal research that has already been undertaken regarding Phases 1 and 2 of the program.</p>

Strategic Criteria & Alignment

Question	Response
<p>Alignment with strategic theme</p>	<p>This problem statement is aligned with the Strategic Research theme of 'Future Transport Workforce'. This theme is focussed on exploring the supply and demand for skills and workforce capabilities across the transport sector at the local, national and global scale.</p> <p>The Future Transport 2056 Strategy focuses on delivering a more efficient transport network, allowing businesses to reach new markets, attract new investment, and catalysing new job and training opportunities for our people. This proposed research project will help to ensure that we understand and can mobilise, prioritise and engage the necessary capabilities to deliver this improved transport network.</p>

Question

External driver of change analysis

Outline how the research will better position TfNSW to respond proactively to macro drivers of change

Response

This Problem Statement is made up of a number of external drivers of change that present challenges and opportunities for TfNSW.

Political

The delivery of transport projects, including the Sydney Metro and Light Rail (Sydney, Newcastle, Parramatta), are major political commitments for the current Government. 'Delivering Infrastructure' is one of the Premier's 12 Priorities in NSW. These projects reflect the political and public value expectations of TfNSW's Vision of making NSW a better place to live, visit and do business, and are central to supporting the public value proposition for the NSW Government.

Economic

As populations increase, there is an increased demand on the transport network, with subsequent congestion. The delivery of capital projects assists in the management of congestion and mitigating the negative economic impact that it causes. There are also many wider economic benefits generated from transport projects, as they act as a catalyst for regenerating or repurposing precincts and areas.

Social

The on-time delivery of safe, accessible, reliable and high-quality transport networks and nodes is likely to influence the behaviour of the citizenry and stakeholders of NSW in favour of utilising the transport network. The social contract benefits of effective public transport and the wider economic benefits of efficient freight and passenger transit are well-established globally.

Technological

New engineering capabilities will be needed to deliver emerging technologies and innovations to improve customer journeys in the transport network. New technologies include enabling autonomous cars and an intelligent transport network through data sharing. Transport projects are both a user of technology and an integrator and generator of technology for customers and citizenry.

Forward looking

This Problem Statement is forward looking in that the development of solutions to any capability shortages may require a longer timeframe, rather than more immediate solutions. The focus on capacity and capability in a future context also provides a strategic response to technological change in that the future workforce is not simply 'more of the same', but rather 'more of different', reflecting the acknowledged changing face of work and the divergent skill sets required in the future.

Once capabilities have been identified that require additional supply, examination will be able to be made of which of these skills gaps can be filled through transferability of skilled labour from other sectors, such as mining.

Potential research impact

The successful delivery of TfNSW's projected \$57 billion of transport infrastructure over the next 5 years can be significantly impacted by a lack of capability and capacity in engineering services in the workforce. The scale of this expenditure highlights the major significance of this research.

With approximately 1000 different and distinct skills and capabilities in engineering services required by TfNSW, as identified by the AEO Engineering Services Matrix, the risk of loss through inefficiency and delivery constraints linked to the absence of the right skills is significant. This research project will help to target TfNSW's responses and interventions in building capability and/or workforce capacity in the industry.

Technical Criteria

Question	Response
Innovation Outline how the proposed research will result in new knowledge	<p>Previous research has been broad in its nature of engineering capability gaps which has limited the specificity of applying any interventions. The proposed research will allow the identification of specific engineering service capability gaps and the subsequent development of targeted interventions. The scope of this research will include a wide range of technical and assurance skills and capabilities that have not been the subject of previous studies, but are essential to successful infrastructure build and commissioning. These include systems engineering, integration, safety assurance and risk management, human factors, environment and sustainability and stakeholder management.</p>
Basis in completed research and/or observed practice	<p>L.E.K. Consulting was appointed by TfNSW in November 2016 to undertake a contractor and project-related professional services market study. Their study found that the market already perceived a shortage of qualified staff, but there wasn't great consistency in the roles nominated as the greatest concern. Their research suggested that the supply of geotechnical engineers was most commonly referenced as an area of concern. The L.E.K. study was confined to technical roles, however the scope did extend cross-sector and explored the transferability and mobility of certain key skills. Our proposed research project would adopt a similar whole-of-asset-life and cross-sector perspective insofar as it is relevant to the transport industry.</p>
Feasible data requirements	<p>The data requirements for this program of research will be largely quantitative and will be gained through an examination of TfNSW project requirements, interviews with engineering organisations and an analysis of the AEO's capabilities. The research may commission additional investigative and data generation activity and will also make use of the best available data to make key projections and assumptions on the composition of the engineering workforce both now and in the future relative to demand on a local/national/global scale.</p>

Level of Collaboration & Resource Requirements

Question	Response
Level of collaboration Please select the level of collaboration required to complete the proposed research	<p>1. 'Quick-Fire' Research <input type="checkbox"/></p> <p>Intense bursts of research activity (e.g. under 8 weeks). Intended to make use of 'hackathon'-type environments, where students/researchers work collaboratively and intensely on particular problems involving data interrogation and visualisation.</p>
	<p>2. Undergraduate Final-Year Research <input type="checkbox"/></p> <p>Suitable for final-year undergraduate students (e.g. capstone, Honours) as part of the research requirements for their undergraduate degree (i.e. 1 to 2 semesters).</p>
	<p>3. Higher Degree Research <input checked="" type="checkbox"/></p> <p>Project may form whole or part of a postgraduate research degree (i.e. Masters, PhD), and contribute to new knowledge (i.e. 1 to 3 years).</p>
	<p>4. Major Collaborations and Funded Research <input type="checkbox"/></p> <p>Project may form the basis for a significant collaboration agreement between TfNSW and the relevant research institution, including major competitive grant funding (e.g. Australian Research Council funding with TfNSW as an industry partner).</p>
Comments	<p>One-year research project suitable for final year or Honours thesis. This project could form all or part of a PhD or Master of Research.</p>
Supporting TfNSW resources	<p>TfNSW will facilitate access to subject matter experts and project support (up to 4 hours per week each).</p>