

SUMMARY OF PROCEEDINGS

Introduction

Purpose and status of this paper

This paper summarises the presentations given by six eminent speakers at a symposium on 24 June 2015, co-sponsored by Engineers Australia Queensland and The Royal Society of Queensland and hosted by the Institute for Future Environments, Queensland University of Technology, at its Kindler Theatre.

Background

“Infrastructure” as a destination for public expenditure is squarely on the contemporary policy agenda of the Queensland and national governments. The Prime Minister for example has described himself as an “Infrastructure Prime Minister” (media release 19.9.2013) and the previous Queensland Premier referred to cranes on the horizon as an indication of the health of the Queensland economy (media release 14.8.2014).

Engineers Australia Queensland and The Royal Society of Queensland share an interest in advocating for adequate investment in all forms of infrastructure. They are both concerned that procedures for planning infrastructure and evaluating proposed projects should offer investment certainty and be rigorous, transparent, non-politicised and consultative.

“Infrastructure” is normally defined as facilities, shared by a community, that are necessary preconditions for economic activity. Public debate commonly uses the term to refer just to the “hard” infrastructure of roads and railways, ports and airports, pipes, poles and wires. However economic activity also requires “soft infrastructure – social institutions such as research, education, libraries, governance, human capital; and “green infrastructure – a reliable flow of natural resources such as fuel, minerals, food, oxygen and water. Maintenance of these systems also needs adequate public funding.

Rationale for a fresh vision of infrastructure

The two non-government professional bodies consider that contemporary public debate about the need for new public infrastructure raises several issues of concern, including :

- the need for a transparent process, independent of political campaigns, by which project proposals are conceived, aligned with planning objectives and assessed;
- the need to include sustainability and energy security considerations in benefit-cost analyses for infrastructure projects;
- the need to evaluate competing demands on public funds objectively so that the broader foundations of economic activity – infrastructure defined broadly – are adequately resourced.

Presentations

Engineering requires a pipeline of projects

Industry requires a pipeline planned pipeline of predictable pipeline of projects if it is to invest in the people needed to bring them about, said Mr Chris Warnock, President of Engineers Australia Queensland Division in opening the symposium. Engineers' accreditation must be refreshed periodically and they cannot simply go and do something else waiting for an upturn. The boom-bust cycle corrodes the capacity of the profession to serve industry and the community.

Recent dramatic underinvestment in construction projects means that large numbers of graduates are now without jobs. It takes some 11 years or more to educate and train an experienced engineer, so planning at the scale of decades is required to avoid this waste.

Mr Warnock also paid respects to the traditional custodians of the land and thanked Engineers Australia Queensland's sponsors.

Use benefit-cost analysis comparatively

"Not just concrete and cranes" declared Dr Geoff Edwards in arguing that if governments were to seek the maximum economic value for fiscal outlays, they would invest heavily in research and education as forms of infrastructure. He differentiated "hard" or "economic" infrastructure such as roads and ports – mostly entrenching consumption of fossil fuels – from "soft" infrastructure such as scientific research, information systems and education; and "green" infrastructure such as the natural resources and open space on which all economic activity ultimately depends.

Current public commentary tends to confine the term to hard infrastructure. But published benefit cost ratios for some major recent transport projects (typically less than 2:1) are in contrast with the economic value added by scientific research (typically 40:1, according to a robust estimate by the Productivity Commission). Scientific research by companies adds to GDP but public good science appears in government budgets as a cost without readily identifiable downstream economic benefit.

To divert infrastructure funds towards research is not contrary to the interests of the engineering profession, as the implementation of research findings, in almost any field, necessarily requires engineering skills.

Use benefit-cost analysis honestly

Dr Richard Denniss explained that benefit cost analysis, an orthodox economic tool, is a valid method of assessing the economic value generated by a project relative to its financial costs, but that the tool is widely misused to justify decisions already taken on non-economic grounds.

Dr Denniss drew attention to some cases in which mining companies when touting new projects had published inflated predictions of employment shown by more honest economic analysis to be false.

At its core, economics arose through a desire to understand trade-offs. Now, economic modelling is used to argue that there is no need for trade-offs: "We can have it all". Input output modelling is based on the assumption that there is no scarcity, no shortage of anything – whether engineers, steel, cement – and therefore no trade-offs are necessary.

Australia's GDP indicates that we are a wealthy country, but "despite supporting a huge financial sector, we still can't seem to be able to afford the infrastructure we need – schools, hospitals, roads".

Green infrastructure has multiple economic values

'Green infrastructure' consists of "Planned and managed natural and semi-natural systems that can provide, enhance or replace the functionality required for human well being", said Dr Adrian Volders.

He presented estimates for the value of "ecosystem services" produced by Australia's National Reserve System, using orthodox economic methods, from \$250-660 billion per year, yet the investment by all governments in its growth is only \$0.07 billion per year and in maintenance only \$1.21 billion per year. It cost the Melbourne & Metropolitan Board of Works \$18 per megalitre to produce water from its closed catchments, but \$700 per megalitre to produce recycled water in Queensland. The Productivity Commission estimated that the community spent 10,000 times as much on flood remediation as on prevention.

Dr Volders also presented a case study on catchment management and water treatment in South East Queensland. The cost of comprehensive catchment restoration by SEQ Water (\$70 m) can be shown to be approximately recouped by the authority in terms of lower costs for water treatment (~\$30 m alone), reduced sediment load, less risk of pathogens, fewer algal blooms and weed outbreaks and improved storage capacity (less sedimentation). When the multiple benefits to the region including landholders are factored in, the benefits more than double for no additional investment cost.

Green infrastructure such as 'soft' treatment of stormwater can be shown to have numerous beneficiaries in the community with high ability to self-regenerate indefinitely. Value for money can be very high compared with traditional construction methods. However, it requires customised engineering rather than standardised and it may take decades to mature (10-50 years for riparian vegetation to reach maturity). There is more risk involved as the specifications must be matched to the unique site characteristics. Every reach of a river requires separate treatment.

Common barriers to adoption of green methods include fragmented ownership of the subject lands (the riparian zone is the most disputed area of ownership), governmental bias towards funding of capital projects rather than maintenance (built infrastructure adds to asset base so can justify increased charges), the intergenerational nature and dispersed nature of the beneficiaries – no funding authority can demonstrate the benefits back into its own accounts. We don't ask all the beneficiaries of public roads to share their cost, so should not expect the beneficiaries of environmental repair to do so.

Natural assets can create value –if accounting methods allow

'Infrastructure' was defined by Simon Warner as the basic "capital equipment, systems and services, such as transport and power supplies, that a country or organisation uses in order to work effectively". The definition of community infrastructure in the *Sustainable Planning Regulation* includes "facilities for parks and recreation" and "water cycle management infrastructure" but not green infrastructure in its environmental sense. The concept of green infrastructure has been known for a long time but is still inadequately recognised in investment programmes.

Mr Warner quoted Minister Jackie Trad in establishing Building Queensland as “seeking experts in the infrastructure and major projects, finance and public private partnerships, urban planning and design, engineering and construction, economics and transport and logistics” arenas – but no scientists or natural resource managers.

There is a view that our natural capital is infinite, so it both can and must be exploited – this proposition is observable in many predictions of growth and population.

Mr. Warner presented a case study of the Beaudesert Waste Treatment Plant that was not meeting its licence conditions. A traditional upgrade was estimated to require an investment of \$9 m with \$500,000 per annum running costs. The alternative green approach through managing the Logan River catchment would cost only \$1 m and would achieve three times the performance required in reduction of nutrients. However, to gain acceptance of this more cost-effective approach, it was necessary to capitalise the value of a piece of paper representing the natural asset on the authority’s books.

In 1997 a report identified that the greatest threat to Brisbane’s water supply was sediment in the middle Brisbane River. In 2011 sediment clogged the intake to the Mount Crosby plant (the main source for Brisbane). The cost of replacing the Brisbane River connection between Wivenhoe Dam and Mt Crosby with a pipe would be upwards of \$1 bn. It is arguable therefore that an amount of money equivalent to the annual maintenance of a pipe (say 5% or \$50 m) should be invested in maintaining the health of the Brisbane River connection (it is now ~\$5 m).

Redlands City Council has valued the water bodies within its area, regarding them now as assets and therefore deserving of maintenance and appreciation. We cannot continue to regard natural assets as only a threat to other forms of infrastructure. We need accounting and management systems to support them just as we do with hard infrastructure. Mr. Warner also called upon the engineering profession to match ‘hard’ construction projects to the landscape of which they are a part.

‘Innovative financing’ cannot create infrastructure funds for nothing

The core problem in infrastructure policy, said Prof John Quiggin, is that governments and the public want infrastructure but don’t wish to pay for it.

Physical assets such as roads, schools and hospitals have traditionally been funded from tax revenue, while network utilities have typically been funded by user charges. Current expenditure can only be funded from tax revenue. One of the major mistakes of recent public policy has been to replace statutory authorities, “a great Australian invention” with a social purpose under which a wide range of assets were constructed, with government business corporations expected to return a dividend. Innovative financing blurs these categories and gives the appearance of free infrastructure, but the reality is that the public must always pay.

Prof Quiggin itemised a number of “tricks of the trade” that give false promises: site redevelopment such as 100 George Street (incentives like development rights are packaged in); sale and leaseback (=finance leases, equivalent to debt); BOOTs in which governments guarantee the revenue (“the high point of something-for-nothing-ism” – if the asset is better off in public hands after say 25 years, then the justification for its being private initially was false); public-private partnerships and capital recycling.

PPPs are a way of getting the expenditure off the fiscal books and of transferring risk. Some make sense, but the private sector cannot manage risk as well as government which holds all control over usage. Governments have made some incredibly bad decisions: some recent projects would never have been built under the traditional model. 'Capital recycling' which involves selling income-generating government businesses to replace with non-income-generating constructions provides no additional scope for capital investment by general government.

Any kind of bundling is some sort of a mistake. Government is large enough to take on projects of any scale. Either a project is justifiable on its own terms or it is not.

Investment in infrastructure must be funded by the public either through user charges or tax revenue. This is not a message that governments want to hear, but voters recognise its truth.

Systemic shortcomings in infrastructure planning remain

Transport planning and investment in Australia have several serious problems: lack of consistency in funding, lack of bipartisan support and focus on individual projects, with inadequate attention to systemic issues, as outlined by Drs Scott Elaurant and Jennie Louise. Governments have invested heavily on increasing supply but very little on managing demand.

Their paper summarised an investigation of major transport projects costing more than \$1 billion each since 1990. They found an average error of 50% in forecasts of demand for road projects that required tunnels. Tunnels were often seen to be required because surface corridors had not been reserved.

Many public-private partnerships have been signed for 30 years or more, whereas the private sector looks at viability on a five year horizon. There is no evidence that a longer period of concession is required.

They explained that at the macro scale, Australia has spent significant sums on transport projects but has achieved a comparatively poor outcome in terms of the quality of the transport system. Then at the scale of individual projects, planning and assessment processes have been inadequate to prevent projects that did not represent good value for money for taxpayers or investors, and economically should not have been built as scoped.

Systemic reform is required both in project planning and delivery, and also in planning of transport networks. Six shortcomings were explained.

1. Australia's transport analytical capability has atrophied, due to agency budget cuts. Funding is focused on building, with very little focus on capability to know what should be built. The total budget for infrastructure data acquisition, modelling and strategic analysis is less than 1% of the infrastructure capital budget in every mainland State.
2. Transport agencies should fund the development and regular updating of transport models of major urban areas. Models and calibration reports should be publically accessible, to inform public debate and to improve land use planning.
3. Data acquisition should be systematically budgeted and carried out. Currently Australia has no regular freight or transport survey at national level.
4. Transport and land use agencies should be required to identify and preserve corridors that will be required for future transport infrastructure at the time of development. This was normal practice up to the 1970s.

5. Project assessment including demand modelling should be undertaken by an agency independent of the proponent, to avoid the potential for conflict of interest and bias.
6. Assessment (benefit cost) guidelines should be revised to match international practice, such as by including health and environmental impacts, adopting discount rates that are not biased towards projects with short-term benefits and adopting a benefit-cost hurdle of at least 1.5 to ensure that actual project benefits are likely to exceed actual project costs.

Cheap oil has ended, globally our response is very late

Depletion of reserves of crude oil (petroleum) is upon us, worsened by wastage and excess, warned Wally Wight. A signpost to future scarcity is that oil discovery peaked in the 1960s. Global annual oil production has exceeded discoveries since the mid-1980s and the gap is increasing.

Australia's transport is more than 90% oil dependent. The proportion of freight transported by trucks is growing, reflecting our dispersed population. Investment in transport infrastructure is facilitating increased truck transport. 'Just-in-time' delivery practices and dependence on remote sources for goods including food reduces resilience.

Global production of conventional oil peaked in November 2005 and has been declining at 6% p.a. since then. More risky unconventional and deep sea oil have kept up supplies. US tight oil is a "blip": estimates of its production are being revised downwards dramatically with experience. Oil depletion is reflected in volatile price fluctuations, diminishing margins for suppliers and increased retention of their reserves by exporting countries.

In the past 10 years, Australia has lost 50% of its refining capacity. We now import 90% of refined product, which deteriorates in transit. This traffic is dependent on vulnerable shipping lanes. There is an international requirement to hold 90 days' supply in reserve; our reserve is as low as 12 days in some localities. Australia's crude oil imports come from a number of developing countries with requirements of their own. There is also a shortfall in investment in new sources: productivity of global capital expenditure has fallen by a factor of five since 2000. Aggressive technologies are unlikely to be affordable. These factors are most likely to lead to 'peak investment', upsetting the reliance on progressively riskier and more expensive 'unconventional' sources.

If a crash program to reduce the use of oil or to switch to renewable energy had begun 20 years before peak, it may have been possible to avoid the disruptive economic consequences of a global shortfall. Also, climate change is "moving the goal posts". Mr Wight also drew attention to the phenomenon of "peak car", with statistics that vehicle miles peaked in the USA in 2005, as did departures of USA commercial airlines.

"We cannot build our way out of vulnerability to oil depletion" with transport projects. Mr Wight advocated "urban transformation": place-based planning to minimise travel, to localise production of employment, production and supply chains and to maximise "human exchange" as distinct from "goods exchange". "Transport vulnerability is addressed by non-transport solutions".

Compilation by Geoff Edwards 24 July 2015.

Sponsors

Engineers Australia (Queensland)

Engineers Australia is the national forum for the advancement of engineering and the professional development of our members. With over 100,000 members embracing all disciplines of the engineering team, Engineers Australia is the largest and most diverse professional body for engineers in Australia. Further information is available online at www.engineersaustralia.org.au

The Royal Society of Queensland

The Royal Society of Queensland, founded in 1884, is the State's oldest scientific institution. The Society seeks to increase awareness of science in Queensland. It encourages original research and the publication of research findings. Its *Proceedings* have been issued mostly annually since 1884.

As a non-specialist learned society, the Royal Society of Queensland is also keen to ensure that public policy formulation is adequately informed by contemporary science and it is keen to facilitate dialogue between separate scientific and applied disciplines. Further information on the Society is available online at www.royalsocietyqld.org.au .

The Institute for Future Environments

This entity of the Queensland University of Technology studies how our natural, built and virtual environments interact, change and converge, to find ways to make them more sustainable, secure and resilient. It is based in the Science and Engineering Centre, a pioneering research, education and community hub for science, technology, engineering and mathematics.

Further information on the Institute is available online at <https://www.qut.edu.au/institute-for-future-environments>

Publication

Presentations have been posted on the website:

http://www.royalsocietyqld.org.au/events/events_2015.htm . The Elaurant and Louise paper has been accepted for print publication in the annual *Proceedings of the Royal Society of Queensland*, vol. 120.