Expecting the Unexpected: Scenario Planning and Human Behaviour are Two Fundamental Components of Robust Infrastructure Strategy

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Abstract

Local government bodies in New Zealand are required to produce infrastructure strategies. The approaches we have seen to date are largely extended renewals plans. They have little to no interrelationship to growth strategies, or plans that are designed to influence, implement and manage growth in towns and cities. But true strategies, if well developed and implemented, can prevent ‘unexpected outcomes’ that happen all too often in both the private and public sectors.

In this paper we propose that a good strategy is based on the following elements:

- Scenario planning, to set the vision and a general approach to meeting it,
- Spatial planning, to demonstrate where infrastructure (new and upgrades) will be required to meet the vision,
- Consultation, to inform likely responses to future scenarios, acceptability of management approaches, likely spatial developments, and willingness to pay for future services,
- Behavioural analysis, to test assumptions and stated responses from consultation, and
- Lifecycle and renewals cost estimates to estimate the costs and affordability of proposed development plans

Scenario planning, a technique originally developed in the military field, involves describing a handful of extreme but possible scenarios, and then proposing a handful of approaches for managing the world, regardless of the scenario. The analyst(s) then overlay each of the management approaches over each of the possible scenarios, and choose the management approach that either they are least likely to regret, or that is most likely to result in the scenario they are aiming at. Scenario planning propelled Royal Dutch Shell from 7th to 2nd largest petroleum company in the world, and the most profitable, while the rest of the world struggled through the energy crisis of the 1970s.

Spatial planning has also been successfully used by local government in the United Kingdom and other parts of Europe to articulate future growth strategies, and achieve community acceptance and buy-in to the future growth direction of their towns and cities.

Once the organisation has decided on their overall management approach, in the realm of public infrastructure, they must then decide where and how they want their cities and towns to develop. City and town development require the appropriate infrastructure, and fiscally responsible development requires that the infrastructure is not only affordable, but is also useful.

In the realm of public infrastructure, demand for infrastructure services depends entirely on people’s perception of their current (or expected) situation compared to their desired situation. Will they use it if we build it? Are they willing to act as environmentally friendly as they say they
will? And most importantly, if we invest in it, will they perceive benefit from commitments made to pay for it? If we get this wrong, we can build entirely the wrong thing, tying communities to long-term costs with no benefit. If we get it right, then we can improve the public’s trust, satisfaction, and overall wellbeing. ‘Getting it right’ relies on an understanding of the gap between what people say they want and what they will actually use.

Our methodology strengthens the current concept of infrastructure strategies by incorporating scenario planning, spatial planning, and human behaviour, as well as estimates of infrastructure renewals.

We are not forecasting tomorrow; we are making better decisions. Much better decisions.

Key Words
Spatial Planning, Scenario Planning, Consultation, Behavioural Analysis, Infrastructure Strategy, customer Behaviour, Local Government

Introduction

Local government bodies in New Zealand are under fire from all directions currently – they are seen as levying excessive rates for services, and for using their powers under the Resource Management Act 1991 to introduce excessive red tape, which is stymying development.

In January 2015 news headlines resonated across New Zealand with the results of a Demographia report, which showed Auckland to be less affordable than cities like New York and Los Angeles. The report cites the sky-rocketing cost of property as the key reason stoking this cost. At the same time, the government released further research into the costs created by the Resource Management Act to building in New Zealand. This has led the government to the conclusion that the Resource Management Act is making housing too expensive, hampering job and export growth and stymying much needed infrastructure. It is doing all of this whole not doing a particularly good job of managing vital resources like freshwater and the coastal environment. Oh dear.

Fast forward to February 2015 and the news headlines are resonating with the results of a Local Government New Zealand funding review, which notes a growing gap between the need to provide new and replace existing infrastructure, and the funding available to bridge that gap. The implication was that in order to close the funding gap, rates would need to be increased, or more money provided from central government. At the suggestion of rates increases, the comments sections of news websites went viral, with the unanimous view that rates are already excessive and unjustified, and are being spent on ‘bureaucracy’, and ‘a job for life’, rather than on the value of the infrastructure and its place in developing and delivering sustainable communities.

At the same time, further news articles are citing that housing became 14 percent less affordable last year, and New Zealand’s average house prices increased by 5.7% during 2014. All of this is being referred to as the ‘Auckland effect’. The ‘Auckland effect’ is easily defined – demand for housing is currently outstripping supply by a large extent.

So we have a major national economic problem. The two obvious solutions to the Auckland housing affordability problem are:

1. Build more houses in Auckland
2. Direct population growth elsewhere in New Zealand

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Both solutions require an understanding of the type and location of housing that people will accept, and the second solution relies even more heavily on an understanding of the types of development that will be required to incentivise people and businesses to move away from Auckland into other areas. Part of this negotiation process relies on an ability to understand what people value, to accurately describe alternatives, to understand the difference between what people say they will do and what they actually do, and to estimate the costs of these alternatives.

**Local government bodies in New Zealand are required to produce infrastructure strategies.**

The problem of national affordability and efficiency of New Zealand infrastructure is not new, and it is not restricted to Auckland. In March 2012 the New Zealand Government announced an eight-point reform programme for local government. This programme was part of the Government’s broader programme for building a more productive, competitive economy and better public services. The Local Government Act 2002 Amendment Bill (No 3) passed its second reading on 27 May 2014. The Bill amends the Local Government Act 2002 to, among other things, introduce new requirements for infrastructure strategies and asset management planning.

The Bill specifies that the strategy must outline the “most likely scenario” for the management of a council’s infrastructure assets, and is to include “indicative estimates” of the projected capital and operating expenditure associated with those assets. As a result of these specific requirements, the approaches we have seen to date are largely extended renewals plans rather than strategies. This is likely to be as a consequence of the very tight timeframes imposed on local government to produce the infrastructure strategies, but there are significant opportunities to adopt a more strategic approach in the second generation of infrastructure strategies.

**Strategies, if well developed, well researched, and well implemented, have immense value; they can prevent ‘unexpected outcomes’ that happen all too often in both the private and public sectors.**

All too often, strategies in both public and private sectors fail. In two-thirds to three-quarters of large organisations, strategies are not successful (Donald Sull, 2015). In the public sector, there are numerous examples of failed efforts to produce (and have uptake of) affordable housing (Forrester, 1991; Schwartz, 2010), to reduce congestion by diverting business development or restricting development (Robin Hogarth, 1980) or building roads (Sterman, 2006), or to control flooding by building levees when existing natural assets were superior (Sterman, 2006). These failures were largely due to a lack of understanding of people’s behaviours and values.

When is strategy most important, and what are its most important elements? In a manufacturing context at least, Dean & Sharfman (1996) found that strategies that were most likely to result in the organisation meeting its objectives were when:

1. The procedure is more rational, supported by robust information gathering and analysis,
2. Individuals’ behaviours align with the decision’s main objectives (‘political behaviour’),
3. The environment is favourable; and,
4. The strategy is well implemented

These findings suggest that strategies are indeed important – particularly when the future is uncertain, as is the case of a 30-year time horizon for our infrastructure. The National Infrastructure Unit, for example, notes major infrastructural issues such as an ageing population, shifting from rural to urban areas, climate change, and changes in resource availability (National Infrastructure Unit, 2015).

To ensure the procedure is more rational, we propose the following steps:

1. Scenario planning
   a. Decide on the drivers and other ‘forces’,
   b. Identify the uncertainties,
   c. Develop a series of ‘plausible’ worlds,
d. Select possible overall approaches to managing infrastructure services,
e. Assess the resilience of each approach to each world collectively,
f. Determine which approach will result in the least regrets (or other decision criterion may be used); and,
g. Consult.

2. Behavioural test #1 (of people’s responses to scenarios and to management)
a. Test whether underlying assumptions about people’s behaviours are valid. For example, to what extent will we really be able to incentivise people to reduce resource use?

3. Spatial planning #1
a. Where are the geospatial growth (and shrinkage) areas? What are the plans for development?
b. Consult.

4. Behavioural test #2 (of people’s likely use of these areas)
a. Test whether underlying assumptions about people’s likely demand for services in identified areas, and to the extent assumed.

5. Spatial planning #2
a. What infrastructure would be required to service these developments?

6. Lifecycle costing
a. What new assets, upgrades, or disposals would be required?
b. Estimate the lifecycle costs of the asset investments

7. Consult to determine affordability and willingness to pay (and feedback into the process if necessary).

Scenario planning helps set a vision by overlaying possible futures against possible responses, helping asset owners to identify the building blocks towards the preferred outcome.

Scenario Planning is ‘the study of possible future events in society, an industry, the economy, etc., and how they might affect an organisation, and the action of planning to prepare for them’4.

Scenario Planning has started to become more commonplace across the business environment and, used effectively, it helps to encourage asset managers to develop ‘low or no regrets’ strategies. As a result, it also helps improve current operational practices, through encouraging the breakdown of silos, shared learning and open communication across organisations on how best to achieve current outcomes and improve on these into the future to maintain customer satisfaction levels high through improving performance particularly in areas where interdependencies exist with other asset service providers.

Assets can last 100 or more years. As such, asset managers have to consider, to some extent, the myriad of uncertainties that the future will bring and how these could influence the assets. All too often asset managers ‘play safe’ with their future assumptions using the known past to derive the likely future. This is compounded by denying the full range of plausible futures and as such, consider many alternative scenarios as being largely out of their control. Consequently, these asset managers tend to react slowly when ‘unexpected’ (unplanned-for) events occur.

Scenario planning can help managers question their usual assumptions around their investment strategies. The end result is not an accurate forecast of the world tomorrow, but enables better decisions through uncertainty. It helps managers to plot a path for infrastructure provision into the future accounting for a range of great uncertainties as well as determining the key action points in the future to help adapt to the changes better.

4 Cambridge Dictionaries Online – dictionary.cambridge.org
Scenario planning has several main uses across organisations which include enabling a review of specific decisions to understand the risks associated and determine how the decision may affect future performance, setting new strategies or evaluating existing strategies.

This tool can be implemented across any scale of organisation and is particularly useful to encourage collaboration across the organisation to perform currently and understand a common shared vision for the future of the organisation as well as to help position the organisation when the external environment is so uncertain.

This is even more crucial when the impacts of outside forces will have a dramatic impact on the viability and success of the organisation. Think how Apple and Samsung are now the most common personal device compared to ten years previously where Nokia and Blackberry were the market leaders. The shift in the fortunes of these companies is largely down to how the organisations have forecasted how the public would respond to their visions of how the technology could adapt the lives of their customers.

To commence, the organisation must consider a range of equally plausible futures, based on specific potential business ‘surprises’. These futures are identified by enabling and encouraging conversations within management teams to help uncover the prevailing assumptions. The process is made up of a structured approach, asking the questions below:

1. Setting the context:
   o What is your vision and what are you looking to achieve from providing the service?
   o Review available information of past changes to identify the ongoing forces.
   o Identify potential future changes and the underlying forces that encourage them to occur.

2. Develop ‘four worlds’:
   o What is uncertain that could lead to a different future?

3. Develop responses
   o Create a structured manner to face the critical uncertainties.
   o Develop stories around each of the four worlds (see A-D on Figure 3), which relate to how the world could plausibly turn out to be at the end of your planning period. Effectively what are the drivers that are present and could affect the performance and hence financial viability of your organisation. For example, what regulatory structure would be present in 2050, how available is capital and energy, what are the customer expectations around environmental performance and levels of service.

4. Test the effect of each response on each world:
   o Undertake a stress test workshop to discuss and identify the implications of the four worlds on the organisation and the developing strategy.

5. Plan:
   o Derive an action plan to support the strategy implementation and for highlighting the key signals to watch for.

Figure 1 shows an example of how Severn Trent Water identified present and future challenges and forces. These challenges were grouped into two main elements, or critical uncertainties, and for each element, the minimum and maximum extremes were identified. It is generally simplest to tackle critical uncertainties two at a time and develop a larger matrix of contributing forces that cover the four worlds, as shown in the matrix in Figure 2.
In public organisations one element (or axis) might be population growth (or decline); while another might be extreme drought (or floods, or both). Others could relate to technology and resource availability. Figure 3 identifies how the sets of matrices for the key issues (forces) can be combined up to identify the building blocks to help narrate to stakeholders what each of the plausible worlds looks like to help underpin the evaluation of the strategies against.
The UK economy has been in and out of recession, driving a societal backlash against consumerism and a growing culture of reuse and recycling wherever possible. Though bills are still heavily cost-driven, customers have a newfound appreciation of the water and waste services they receive from virtual monopoly regional companies. Climate change related events are coped with on a reactive basis, with communities coming together to overcome their difficulties and lead regeneration projects. Though river water quality is in a slow decline, industry practitioners take pride in achieving good outcomes from limited resources.

The water and waste industry has seen consolidation and the set up of a private company to co-ordinate national water trading. Climate change events and a volatile economy have driven increased public interest in climate change and a move to invest in long term sustainable industries. Trust in water and waste companies is high, when funds are available they are often channelled to longer term WASC investment programmes. Some Industry players diversify to become “eco-utilities” specialising in product recovery or provision of wider environmental services. There is a prestige value associated with working in the environmental sector.

We’ve seen considerable Industry change. First retail competition was introduced, before cost cutting pressure and the Euro breakdown put companies in financial difficulties. Then a series of disastrous service failures prompted the UK government to take the opportunity to re-purchase WASC assets. Ofwat granted initial operating contracts to incumbents before regional council-based contract tender processes were established, known in the industry as “competition plan B”. Though this has led to inconsistent standards and climate change response, innovation is high as companies seek to differentiate and reduce their contract bid pricing.

Through the disruption caused by climate change and energy crises, the UK’s natural resources have become highly valued by society. We have a centrally managed water network, though asset ownership is still private. The UK has left the EU and enjoys growth in the economy. There are numerous new entrants to the water and waste industry, each specialising and seeking advantage through innovations in technology. With market forces really taking over, regulation is significantly reduced and focused mainly on water trading. The private investment of “water barons” has seen commercial pipelines commissioned.

Figure 3 High level summary narrative of the four ‘plausible’ worlds (STWL, 2013).

Figure 4 shows conceptually how the present situation in 2014 could take four very different directions by 2050.

Figure 3 – The 3D cone of uncertainty – showing the range of plausible futures represented by the four world scenarios (A-D) – after Shoemaker (2002)

The next step was to identify a handful of strategic approaches. STW developed four possible approaches, which covered a range of technology led, catchment led or adaptive approaches to managing the network and the infrastructure requirements.

Each strategic approach was then tested against each possible future and the outcome was assessed. As an example, Figure 5 shows the outcomes expected from an approach known to be that of ‘Network Experts’, a predominantly technology-focused strategic approach which should prevail across any of the four ‘plausible’ worlds.
Figure 5 – What a technology-focused strategy could mean for the infrastructure network, workforce, environment and customers (from STWL 2013).

The outcomes of each strategic option / scenario combination were based on a combination of financial, performance and customer service ratings. Ratings for each element were based on a qualitative evaluation using a 1-5 score.

Finally, for the stress test, participants were asked, if looking back from 2050, would we regret our investment decisions during the period 2015 – 2020 should the world end up as one of the four identified worlds?

For STW, the winning approach was the one that was the most robust across the four worlds – the least regrets scenario. It also provided flexibility to adapt to changing markets, incentives and fluctuating energy prices.

A mistake that is common to all types of organisations when predicting the future, however, is a miscalculation of how customers will react firstly to the situation itself, and secondly to the organisation’s response. That means that both the organisation’s imagined scenario and the success of their proposed response may be highly inaccurate – and may not be the best response at all.

The literature contains numerous cases in which people’s reactions to scenarios and decisions had not been considered, resulting in unintended consequences. The People’s Express case, for example, is a famous Harvard Business School study of an airline with a pricing policy that led to its own demise (Whitestone, 1983). The airline chose a low pricing policy and did not consider that other airlines might follow suit. The result was that People’s Express could not sustain the low prices and collapsed.

In an example from urban planning, a town in France was highly congested in the central business district (CBD) (Robin Hogarth, 1980). The town planners decided to create two new industrial areas to which businesses could move from the CBD. Business owners, however, had never previously faced a relocation decision and had no support to make this decision. As a result, their decisions took much longer than anticipated, frustrating planners and taking a significant amount of time to ease congestion.

Finally, in an example in which human behaviour was considered and had a positive influence on the outcome, Northumberland County Council, like many councils in the UK and around the world had previously held a ‘lowest tenderer’ policy for any works undertaken on behalf of the council (nef, 2007). They noticed, however, that this policy resulted in money being taken out of the
community, as larger businesses based in larger cities were more able to offer lower prices. In response, the Council chose to reserve 10% of its annual budget for local companies. The result was an injection of 34m GBP to the local economy annually.

In the case of STW, the developing PR14 Business Plan had the largest degree of customer scrutiny of any of the previous five AMP cycles, through the formation of Customer Challenge Groups. These groups were tasked with challenging the developing Business Plans and in the instance of the particular organisation to ensure that it listens to its customers (through high quality research and engagement), and that its plan responds to their expectations and priorities.

The selection of the preferred strategic option was largely focussed on how to improve the service experience that customers across the region feel and as such the path was unlikely to have been significantly different to that selected. The development of the programmes of work that result from this overall strategic direction, would benefit from understanding how customers view the services provided from the water company.

This is particularly true around where customers are as likely to be the cause of issues around the network as the current state of the network. For example, messages around what individual customers can do to minimise sewer blockages by not misusing the sewerage system (such as pouring Fats, Oils and Grease into the network or disposing of wet wipes) are always hard to land where they don’t physically feel or experience the impact of the activities. Disposing of these items within the sewerage network has become a convenience item that is exponentially impacting the ability of the water company to safely remove wastewater from a drainage network without impacting people (e.g. flooding of properties) or the environment (e.g. discharges to watercourses through overflows).

This behavioural trend has the greatest potential to throw the preferred strategy for becoming network experts off track as resources are targeted towards targeting customer education programmes, sewer rehabilitation and enforcement activities (where applicable) as opposed to delivering a proactive renewals/rehabilitation programme to help maintain the system performance at the expected levels of service against the backdrop of ageing infrastructure and greater demands on the network.

**But the devil is in the detail they say; scenario planning, in an infrastructure context, needs spatial planning to really test it**

The term Spatial Planning is relatively new in New Zealand, but Master Planning is a much more familiar context and up until the advent of the Resource Management Act 1991 was fairly commonplace as part of traditional town planning. It has quickly gained traction however, owing to the governance reforms for Auckland, and also in other areas that are contemplating amalgamation or shared service delivery.

Approaches taken to date in New Zealand are a good start, but could definitely go further across local government functions, assets and funding. There are numerous definitions of spatial planning, with one of the earliest coming from the European Regional/Spatial Planning Charter (often referred to as the **Torremolinos Charter**), adopted in 1983 by the European Conference of Ministers responsible for Regional Planning (CEMAT):

*Spatial planning gives geographical expression to the economic, social, cultural and economic policies of society. It is at the same time a scientific discipline, an administrative technique and comprehensive approach directed towards a balanced regional development and the physical organisation of space according to an overall strategy*

A spatial plan provides a co-ordinated document for the effective management of growth of an area, and the integration of land use planning and infrastructure investment.
Spatial planning has existed in a variety of forms in Europe for a number of years. In the UK, spatial planning was made mandatory in 2004. Spatial plans need input from not only planners, but also engineers, asset managers and accountants to make it truly work. The key benefits expected to emerge from developing spatial plans, are that:

- It is **long term** (provides a 20-30 year vision for an area).
- It is **local**, but reflects the wider regional and national context.
- It is **visual**, illustrating how an area may develop in the future with sequencing of growth and infrastructure.
- It is **collaborative**, enabling parties to work together and participate in its preparation.
- It is **informative**, identifying critical infrastructure and services and highlighting areas for investment.
- It is **aspirational**, identifying the future location and mix of housing, businesses and industrial activities.
- It is **environmental**, identifying significant resources and areas that should be protected from development.
- It is **co-ordinated**, enabling interlinkages between implementation, regulatory and funding plans to be drawn.

In addition to the above, spatial planning also enables the integration of policy goals that could otherwise be competing and provides opportunities for coherent and combined investment and regulation.

**Is there a wrong way of consulting infrastructure service users?**

In late 2012, Hawke’s Bay Regional Council produced a discussion document to present choices and opportunities for land and water management in the Tukituki River catchment. It was a pre-cursor public engagement document produced to obtain feedback prior to the advancement of the controversial Ruataniwha Water Storage Scheme project, which is still the subject of consideration by a Board of Inquiry appointed by the Environmental Protection Agency. Public engagement was promulgated by the use of a range of scenarios or ‘choices’.

The scenarios were all presented as a narrative of ‘A Sunday Drive in 10 years’ time’, described through the eyes of Mark, a 70 year old farmer and his passenger. Mark is of Ngati Kahungungu descent and he’s a keen trout fisher. He drives from his home in Ongaonga, past his old farm on SH 50 before heading down the river valley. Each choice is described using environmental, economic, social and cultural outcomes as a guide.

The document received strong criticism from its time of release as being ‘a fatally flawed and biased piece of work written by the Hawke’s Bay Regional Council’. This criticism was three-fold, firstly that the choices were presented from a biased viewpoint, that they were based on flawed science, and that they were presented to the public for feedback after the decision has been made.

All of these criticisms highlight the potential for flaws with scenario-based planning, and point to the need to make sure that scenarios are articulated in a clear manner with a lack of bias, and in a timely manner.

**So how do we provide balanced scenarios?**

5 ‘Tukituki options fire up the critics’ Hawke’s Bay Today 8 September 2012.
Perspective is a key element that can be provided in scenarios, by examining scenarios in interactive sessions, whether this is using focus groups through to Delphi methods with experts (e.g. Linstone & Turoff, 2002). Interactive sessions allow multiple perspectives on an issue to be presented, followed by elaboration and discussion that allows individuals to revise their views in relation to others perspectives and potential “blind spots” and gain informed consensus. These interactive sessions can be a great way to ensure the scenarios put forward are realistic, robust, and reduce uncertainty.

A more recent trend is to use Participatory Action Research (PAR), where a goal is also to achieve positive change using community-based or local knowledge, resources and solutions (Reason, 1998). Often scenarios are very well polished before they get to the community level, because at this stage they come under close scrutiny and criticism. This process instead adopts a more inclusive philosophy where community stakeholders are brought in early to better understand the scenarios at a point where they can influence the options being presented.

An understanding of human behaviour is required in order to produce good strategies.

Why is public buy-in important and how do we get there?

Public acceptance of the final strategic decisions around infrastructure is paramount. Public acceptance is increased when the decision is defensible, based on plausible scenarios, has real input from members of the public, and the decisions offer fit-for-purpose solutions that take into account different user needs and the local context.

The public do not always trust expert opinion, so developing scenarios in consultation with stakeholders and taking people on the journey in developing scenarios is important. So why doesn’t this always occur in reality? The challenges here are how much to bring different groups in, what weight to place on conflicting opinion and how do we gain consensus? Also, limited knowledge around the different options, and how to overcome different biases, such as “squeaky wheel” effects from those that are the most passionate. Calibration of public perception is one method to gain informed public input and mitigate key biases.

Overall, people are self-interested but actually very rational. Given the opportunity and the right information people do make intelligent decisions. The problem is that rational decisions are limited by the information people have, the concept of bounded rationality (Kahneman, 2003). Providing them with the right information and being able to calibrate public expectations is the trick. Scenarios can allow people to make realistic economic, environmental or social trade-offs, or simply use scenarios to educate or fill knowledge gaps.

Without calibration of public expectations, public pressure can cause unbalanced outcomes. For example, in post-earthquake settings in New Zealand, such as Christchurch, there was a strong public desire to keep the building height maximum at seven storeys, even though this would make the relative cost of rebuild more expensive and the city less compact. Similarly, without constraints, about 50% of people in Christchurch responded they would be happy to live in the central city after the rebuild. However, this overestimate did not take into account the idea that people were still thinking they were moving their large house and large back yard into the central city, without downsizing or transitioning to a realistic inner city house footprint or lifestyle.

Communication and information are key to calibration. Keeping with the earthquake safety theme, only 4% of Wellington city dwellers say they will tolerate a building that is the existing New Zealand minimum seismic standard and about one in five people are genuinely anxious about their buildings safety (Thomas & Mora, 2014). However, 86% underestimate the actual strength of new building standards (Thomas & Mora, 2014). People do not understand that seismic loading standards for new buildings in New Zealand have actually been altered six times over the last 75
years (Bothara & Sharpe, 2009), and there is evidence that advances in seismic standards have halved the likelihood of fatalities (Wyss, & Trendafiloski, 2009). People also underestimate the benefit of strengthening buildings, with a bias that strengthening an older building is like patching up old clothes, a new one is better (Beca Prota, 2005).

**If you build it will they come?**

An ultimate test of the success of infrastructure strategies is to examine public demand. Understanding questions like if we build it will they come, and who is they. However, simply forecasting demand based on existing behaviour will only enable examination of small change, not the step change that a truly successful infrastructure strategy could provide. A common transport analogy here is testing the demand for a bridge based on how often people swim across the river. Anchoring to the limitations of the existing infrastructure does not allow you to truly understand the latent demand that will inform what to build, where to build it, and who to build it for.

Infrastructure implementation scenarios allow us to present a snapshot of the future and when done well allow users to report how they would behave under different futures. Realistic scenarios, that are that are meaningful to the customers and sympathetic to the local context, will deliver a more realistic picture of future use. Perceived future use is also a measure of relative desirability of the different options. You can use techniques such as willingness to pay or willingness to use to quantify different options.

A challenge to overcome here is that even with trade-off scenarios there are still known biases in what people say they will do and what they will actually do. However, innovative techniques can be used to mitigate some of these biases, as behavioural scientists have been examining the gap between intention and behaviour for many years (e.g. Ajzen & Fishbein, 1977; Bamberg, 2000; Prochaska & DiClemente, 1986). For example, understanding how people have behaved in the past, their existing willingness to change, and the difficulty of the change, allows weighting of different user responses to future scenarios based on their existing demand or proximity to key infrastructure.

Scenario testing, combined with techniques for overcoming biases not only provides a more realistic response, but a quantitative success measure to help inform infrastructure strategy. The cost of getting it right using scenario planning is a lot less than the cost of getting it wrong.

**Discussion**

Scenario planning helps to test the waters ahead so that the consequences of today’s decisions can be played out, evaluated and tested against the uncertainty of the future. Both the scenarios and the likely effectiveness of management approaches to address them should be informed by the natural, engineering and behavioural sciences.

Scenario planning helps managers make strategic decisions that will be resilient across the range of potential likely futures\(^6\). The objective is to increase the usual range of thinking about the future world that the organisation will operate in. As such, the process of developing the scenarios is in itself beneficial as it allows:

- An opportunity to explore future scenarios and the implications of them for the organisations, and stakeholders internally and externally,
- Organisations to increase communication and shared learning,
- Strategic thinking capacity to grow within the organisation across all participants,
- A medium for sharing views from around the organisation,
- Commitment and buy in to a shared future to be developed by the participants; and,

\(^6\) For more guidance on developing scenarios, refer [http://www.mckinsey.com/insights/strategy/the_use_and_abuse_of_scenarios](http://www.mckinsey.com/insights/strategy/the_use_and_abuse_of_scenarios) and [https://hbr.org/2013/05/living-in-the-futures](https://hbr.org/2013/05/living-in-the-futures)
A forum for non-standard ‘wild card’ ideas to be raised and discussed.

The tasks we have presented form the backbone for a strong infrastructure strategy, and can be summarised as follows:

1. Determine most resilient approach across the four worlds.
2. Consult.
3. Test people’s responses to scenarios and to proposed management approach.
4. Determine the development plans.
5. Consult.
6. Test / validate people’s likely use of these areas.
7. Identify the infrastructure required to service these developments.
8. Identify changes required to existing (or new) infrastructure
9. Estimate the lifecycle costs of the asset investments
10. Consult to determine affordability and willingness to pay

Successful strategies are developed based on a rational procedure, supported by robust information gathering and analysis. The approach we have proposed in this paper offers a highly robust approach, and also overcomes many of the frequently-neglected behavioural issues that stymie many strategies and their implementation.

Conclusion
To be robust and defensible, and not a mere extension of business as usual, infrastructure strategies should be based on scenario planning, spatial planning, consultation, behavioural science and lifecycle costing.

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